

**Adolescent Social Skills Intervention: Theory, Design, and Implementation**

by

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## Abstract

This dissertation consists of three separate papers that contribute to the field of social skills intervention design and implementation with a specific focus on how to support adolescents with identified social skills difficulties. The first paper is a review paper of important topics related to this dissertation, namely social skills development, and current common intervention designs and strategies. The importance of underlying cognitive and socio-emotional abilities for social functioning are outlined, thereby emphasizing the importance of training these abilities in interventions focussed on improving social skills. In this first paper, I describe gaps noted in currently available social skills interventions and highlight specific concerns for the adolescent population due to limited availability of developmentally appropriate and engaging interventions for youth. I call for a new way of intervening for adolescents with social skills difficulties with an emphasis on training underlying abilities while employing innovative intervention delivery methods to increase engagement. As a result, I make a case for the use of video games as an intervention platform that can help offset some of the noted gaps.

In the second paper, I describe a two-fold process including the design and implementation phases of a newly developed social skills intervention for adolescents with identified social skills difficulties as well as a Fetal Alcohol Spectrum Disorder (FASD) diagnosis. First, in the design phase, I discuss the steps taken to create a video game-based intervention focussed on training underlying cognitive and socio-emotional abilities for social skills improvement. Furthermore, details about the development team, the chosen training constructs, the training progression, and the gamification process are provided. Second, in the implementation phase, I present and discuss data collected from an initial implementation of the video game based social skills intervention with three adolescent participants with an FASD

diagnosis. Several positive trends are found, including caregiver report of positive impacts on the youth's social skills and problem behaviors. Some inconsistent yet positive changes are also found for the cognitive scores, thereby providing some initial support for the concept of training cognitive abilities within a video game setting. This initial implementation is an important first step as it assesses feasibility and helps guide future refinements for the designed intervention.

In the third paper, I extend the exploration of the use of the designed and refined theory-driven video game based social skills intervention for a broad group of adolescents. A sample of 10 adolescents, with third party identified social skills difficulties, participated in the intervention. I conducted pre-and post-testing of social skills outcomes and collected change data on the participants cognitive and socio-emotional abilities. The results show some continued positive trends towards positive change in social skills and problem behaviors associated with social functioning. Furthermore, I collected data on the intervention engagement of the participants, and I present preliminary evidence of high adolescent engagement and low attrition within the video game intervention. Although exploratory in nature, I discuss the importance of these findings and the associated links to clinical practice and future research.

Overall, this dissertation is based on the premise that a video game grounded in theory can answer the call for a new way of supporting adolescents with social skills difficulties. Thus, all three papers are threaded together by a common focus on exploring this new intervention from theory to design, and implementation with an ultimate goal of improving the delivery and availability of social skills interventions for adolescents.

## **Preface**

This thesis is an original work by Rianne Elvira Spaans. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Social Skills Training: Use of Virtual Environments”, Pro00052027, March 17, 2015.

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## Chapter 1: Introduction

Humans are social beings who engage in approximately 12 social interactions each day (Zhaoyang et al., 2018). These interactions serve many different purposes as they can be used to obtain and transmit information or knowledge, support identity development, provide social connection, and offer emotional support or distress. Both the quantity and quality of daily social interactions have been linked to psychological and physiological well-being across the lifespan (Bernstein et al., 2018; Fiorillo & Sabatini, 2011) with individuals, who are engaged in regular positive social interactions, reporting higher levels of perceived happiness and motivation in addition to lower levels of stress, health concerns, and negative emotions (Bernstein et al., 2018; Fiorillo & Sabatini, 2011).

Individuals who engage in positive social interactions are typically viewed to be socially competent, meaning that they are perceived by others to complete social tasks successfully (Nangle et al., 2010; Rose-Krasnor, 1997). This *social competence* is dependent on the development and implementation of *social cognition* which refers to the mental processes that are used to perceive and process social cues, stimuli, and environments (Blakemore & Choudhury, 2006; Scourfield, et al., 1999). Included in social cognition are perceptual processes such as face processing and joint attention, as well as more complex cognitive processes including theory of mind and emotion recognition (Kilford et al., 2016).

In addition to social cognition, social competence also requires *social skills*, which are conceptualized as a specific class of behaviors that are used to complete a social task successfully (Beauchamp & Anderson, 2010; Gresham et al., 2010). Although these specific social skills are the subject of debate, researchers suggest the core social skills can be divided into three categories (Matson & Wilkins, 2007, 2009) including interpersonal (e.g. cooperation,

responsibility, engagement; Gresham & Elliot, 1990 and empathy; Crowley & Merrell, 2003; Gresham & Elliot, 1990; Matson et al., 2012), intrapersonal (self-management skills, Crowley & Merrell, 2003; self-control, Gresham & Elliot, 1990; assertion, Gresham & Elliot, 1990; Matson et al., 2012) and communication skills (expressive and receptive skills; Bellack et al., 2004). Taken together these three areas of behavioural skills (interpersonal, intrapersonal and communication) as well as social cognitive processes have been described as foundational to effective social functioning.

In addition to the general link between social competence deficits during childhood and difficulties in education, psychological and vocational settings later in life (Greene et al., 1999; Kupersmidt et al., 1990), researchers have also established specific links between social skills and long-term impacts. For example, kindergartners with good social skills tend to be more successful in developing positive attitudes about school and adjusting to school entry, in addition to receiving higher grades (Birch & Ladd, 1997; Jones et al., 2015; Rose, 2012). During mid-childhood, children with strong social skills are more likely to have stronger peer relationships which can serve as a protective factor for adversities (Demir et al., 2012; Parker et al., 2006; Segrin et al., 2016). Poor social skills; however, increase a child's risk of social adjustment problems, employment difficulties and mental health problems such as depression, anxiety, delinquency, and antisocial behavior (Davis et al., 2011; Erath et al., 2007; Feinberg et al., 2007; Gresham & Elliott, 2008; Gresham et al., 2012; Lugnegard et al., 2011; Segrin et al., 2016; Worley & Matson, 2011). Difficulties in educational settings have also been noted in terms of educational underachievement (Fleming et al., 2005; Woodward & Fergusson, 2000) and increased rates of school dropout (Lopez & DuBois, 2005). These significant long-term outcomes show the importance of social skills thereby highlighting the need to foster these skills



throughout all developmental stages to support healthy social outcomes. As a result of the known links between poor social skills and potential negative long-term outcomes, researchers have been exploring ways to support development of social skills for those who may experience difficulties in this area. A myriad of intervention programs has therefore been developed and evaluated across a variety of populations and settings over the past few decades. Examination of the overall effectiveness of these interventions suggests moderate effects for different groups of children and adolescents (Nangle et al., 2010). More specifically, researchers have been able to consistently show positive impacts associated with a variety of social skills interventions aimed to support individuals with Autism Spectrum Disorder (ASD) (Bellini et al. 2007; Gates et al. 2017; Matson et al. 2007; Reichow et al. 2012; White et al. 2007) and some evidence has been provided for effectiveness for individuals with emotional and/or behavioral disorder (Cook et al., 2008).

These intervention studies are important as they help practitioners decide on appropriate interventions for individuals identified with social skills deficits. However, the currently available interventions and associated research includes several gaps in how these programs are developed, who they target, and how effective and feasible they are across different populations and over time. Researchers have identified concerns with the generalizability of interventions, the availability of developmentally appropriate content for teenagers, and training materials applicable for individuals without ASD (e.g., Bishop et al., 2007; Lanovaz et al., 2017; Scandurra et al., 2019; Stevens et al., 2016). Furthermore, current interventions are described as resource intensive (Cappadocia & Weiss, 2011; Cividini-Motta et al., 2017; McMahon et al., 2013; Parson & Mitchell, 2002) and appear to show limited links to social skills development literature. Therefore, despite the large body of research dedicated to social skills development,

theory, and interventions, there is a need for continued research on how to best support those with deficits in this area.

### **Current Dissertation**

In this current dissertation I aim to extend existing literature on social skills and address gaps noted in the field. Specifically, in this work an argument will be made for the use of a theoretically driven video game based social skills intervention to help bridge these identified gaps. This will be done in three separate papers with a focus on intervention research from theory to design, and ultimately implementation. Intervention research can be defined as “the systematic study of purposive change strategies” (Fraser & Galinsky, 2010 p.325) and should not be confused with evaluation research which focusses on evaluating assessment processes and outcomes of existing programs. This current dissertation goes beyond the evaluative lens that is commonly associated with social skills programs and aims to also emphasize the design and theory-centered process associated with the evaluated intervention.

There are five steps typically outlined in intervention research including (a) development of the problem and program theories, (b) design of program materials and measures, (c) confirming and refining the program components in efficacy tests, (d) testing effectiveness in a variety of practice settings, and (e) disseminating the program findings and materials (Fraser & Galinsky, 2010). These steps are not always followed in a linear fashion and a corrective loop may be required. For example, after the initial efficacy tests a return to the design phase may be necessary prior to the continuation of effectiveness testing. This continued focus on design and development is said to allow for a greater link to evidence based practice for intervention research. There are often multiple elements that contribute to the potential effectiveness of a

program (Fraser & Galinsky, 2010) that may be missed when there is a sole focus on outcome evaluation.

The current dissertation will follow the outlined intervention research steps to discuss the design, development, and implementation of a new social skills intervention program. This information is presented in three separate papers (presented in chapters two, three, and four) that together aim to serve as a model for future intervention development purposes and to ultimately better support those who struggle with social skills.

### **Paper One: Social Skills: A Call for a New Way of Intervening**

In chapter two, arguments will be provided to support the call for a new way of designing and delivering social skills interventions. The paper will start with a thorough review of the theories associated with social skills development as this will help set the stage for a deeper understanding of the current gaps in the available interventions. Evidence suggesting the presence of gaps in the intervention delivery and design will then be provided including a review of concerns related to generalizability of the learned skills, access to interventions suited for individuals without ASD, and concerns related to the resources intensiveness currently found with intervention programs. Furthermore, a case will be made for a need to design and deliver interventions to the currently undersupported adolescent population. Interventions aimed at supporting adolescents with social skills deficits are scarce despite knowing that adolescence is characterized by significant social changes including increased social demands resulting in an increased importance on social skills (Andrews et al., 2021; Casey et al., 2000; Steinberg, 2014).

The last part of this paper will highlight how video games can mitigate these identified gaps and serve as an intervention platform for social skills development. This will be done by reviewing game-based learning theories and research on technology-based interventions.

## **Paper Two: Development and Initial Implementation of a Theory Driven Video Game Based Social Skills Intervention**

In the second paper, this call for a new way of intervening will be answered through the design and development of a theoretically based video game to support adolescents with social skills deficits. This paper will go beyond the current available literature on social skills interventions as detailed information will be provided regarding the design process of such an intervention. This is important information to disseminate to researchers and practitioners as much of the current research focusses on outcomes of interventions without providing information about how the intervention was designed or what theory it was based on. This lack of background information can limit a true understanding of what is deemed helpful to individuals with social skills deficits, which can slow down the development of appropriate and successful supports.

This second paper will also discuss data and findings from an initial implementation of this theory driven video game based social skills intervention. This implementation was performed with three adolescents with a FASD diagnosis and identified social skills difficulties. The goals of this small implementation were to show proof of concept for the game and the training constructs. This was done by ensuring playability of the game, assessing for any needs for changes to the intervention, and examining any potential trends for effectiveness based on outcome measures.

## **Paper Three: Adolescent Social Skills Intervention: Innovation, Engagement and Change**

The third and final paper included in this dissertation can be considered a natural extension on the previous two papers as it highlights data obtained from a secondary implementation of the developed video game intervention. This second round of data aimed to provide further evidence for the use of video games as a platform for social skills intervention in general, while also building

more support for the specifically designed intervention highlighted in the previous paper. Additional goals for the third paper were to explore the concepts of engagement and “goodness of fit” related to social skills interventions for adolescents with identified social difficulties. Concerns associated with attrition and engagement for adolescents in intervention research were highlighted in chapter two and are explored in more detail in this third paper. Engagement data collected as part of the second implementation of the video game intervention are examined and suggestions for future research are made. The concept of “goodness of fit” is also explored in this paper as a case is made for a focus on the alignment between identified social skills needs and intervention goals. This paper therefore adds to the field of social skills intervention by examining new concepts and methods and aims to increase understanding on how to support adolescents with social skills difficulties.

Taken together, the research presented in these three papers aims to respond to some of the current gaps in social skills intervention while serving as a model for future intervention design, development, and implementation. The increased knowledge about design and development of a theory informed video game based social skills intervention also aims to further link research to practice and result in increased supports for those who struggle with social skills.

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## **Chapter Two: Social Skills: A Call for a New Way of Intervening**

The importance of social connections and social functioning for children and adolescents has been well-established over the past few decades. Although connecting with peers may come easily to some, others struggle with social interactions and specifically social skills daily. An overall prevalence rate of people affected by social skills deficits is unknown; however, difficulties in social settings are often observed among several disability groups including individuals with neurodevelopmental disorders (e.g., Attention-Deficit/Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), and Cognitive Impairments; Cordier et al., 2015).

Researchers have consistently linked social competence to better educational, psychological; and vocational standings (Deming, 2017; Domitrovich et al, 2017; Greene et al., 1999; Kupersmidt et al.,1990). Social skills, a subcomponent of social competence, are said to be specifically important throughout development and children with strong social skills are more likely to have stronger peer relationships which can in turn serve as a protective factor against adversities (Demir et al., 2012; Parker et al., 2006; Segrin et al., 2016). As a result of these long-term impacts of social functioning, researchers and practitioners have focused efforts in the past few decades to develop intervention programs supporting social skills development. However, there are several gaps in how these programs are developed, who they target, and how effective and feasible they are.

Modern technology, such as video games, have been proposed as a potential delivery platform for these interventions that may help bridge these gaps. As a result, this paper aims to outline the gaps associated with the currently available social skills interventions in more detail and provide a guideline for researchers aiming to develop a new type of social skills intervention using video games. Part One will focus on theories related to social skills development and how

this informs intervention development. In Part Two, literature related to social skills deficits and gaps to current common interventions will be explored. Finally, in Part Three, the concept of video game-based intervention models will be discussed as an alternative delivery method with the capacity to address some of the current concerns in the field of social skills intervention. Overall, the information noted in this chapter will hope to serve as a model for future intervention development purposes and to ultimately better support those who struggle with social skills.

### **Part One: Development of Social Skills**

Social skills are important throughout childhood, adolescence, and into adulthood and are often conceptualized as a specific class of behaviors (including cognitive and interpersonal abilities) that are used to complete a social task successfully (Beauchamp & Anderson, 2010; Gresham et al., 2010). In order for individuals to engage in these specific behaviors, researchers propose the requirement of several underlying cognitive and socio-emotional abilities (Cordier et al., 2015). More specifically, attentional control, executive functions, and social cognition (e.g., facial and emotional perception, theory of mind, and empathy; Kilford et al., 2016) have been identified as crucial for social skills and social functioning. There are several neurological structures associated with these cognitive and socio-emotional abilities which can be impacted by both biological and social-cultural or environmental factors (e.g., maturation or trauma). As a result, social skills development occurs through a complex interaction of biological, cognitive, and environmental factors (Beauchamp & Anderson, 2010; Soto-Icasa et al., 2015). An examination of the interplay between these factors as well as an examination of the unique contributions of each of these factors can help guide intervention efforts.

## **Biological**

Social neuroscientists have found a wide network of brain areas that activates during social interactions including the frontal and temporal areas of the brain (Andrews et al., 2021; Beauchamp & Anderson, 2010; Soto-Icaza et al., 2015). This network is referred to as the *social brain*. Some of the structures involved in the *social brain* are already functional during the first year of development (e.g., areas involved in facial recognition and emotion perception); however, other structures (prefrontal and parietal cortex) develop and refine later in life through environmental stimulation (Beauchamp & Anderson, 2010; Blakemore & Choudhury, 2006). This continued refinement is possible as a result of synaptogenesis, synaptic pruning and myelination that occurs at several times throughout childhood and into adolescence and young adulthood.

The development of these social brain areas are linked to the development of executive functions (EF, e.g., working memory, planning, problem-solving, strategic behavior) and theory of mind (ToM) as they rely strongly on the activation of the frontal lobes (Beauchamp & Anderson, 2010). EF and ToM in turn are part of the identified cognitive and socio-emotional skills required for overall social skills development (Cordier et al., 2015). As a result, the biological model states that social skills development is therefore mediated by a functioning brain system which allows for the development of some of the foundational cognitive and socio-emotional abilities. These underlying abilities will develop as the associated brain structures mature and refine with age, ultimately resulting in good social skills.

## **Cognitive**

The biological model outlined above highlights the brain structures involved in social interactions; however, this does not explain the processes involved in accessing the required

skills. Over the past few decades, many researchers have developed cognitive models attempting to explain the social processes involved in social interactions (e.g., Beauchamp & Anderson, 2010; Dodge et al., 1986; Lemerise & Arsenio, 2000; Yeates et al., 2007). The most well-known cognitive model describing social processes is the social information processing (SIP) model. The SIP model outlines that individuals faced with social situations take five mental steps before engaging in the social interactions (Dodge et al., 1986). These steps include: (a) encoding of situational cues, (b) representation and interpretation of those cues, (c) mental search for possible responses to the situation, (d) selection of a response; and (e) enactment (Dodge et al., 1986). Social skills development therefore occurs as the interplay between a child and their environment, is encoded, interpreted, organized, and stored in memory, to be translated into mental models or schemas that inform subsequent exchanges (Burks et al., 1999). Over the years, the SIP model was expanded to include emotions, the relationship between self and others, and social experiences as factors that may impact how an individual reads and interprets cues (Crick & Dodge, 1994; Lemerise & Arsenio, 2000).

From a developmental perspective, the SIP model relies on prerequisite abilities such as attentional skills and an ability to read verbal and nonverbal cues which then leads into the development of cognitive schemas on how individuals can act in social situations. This means that the biological factors described above make it possible for children to further develop skills in social situations. The SIP model proposes that changes in these abilities will occur over time in a quantitative (children will develop more skills as they age) as well as a qualitative sense (the skills will evolve to include more complex and more competent methods). These changes are thought to be related to an increase in the child's experience with social stimuli as they mature as well as due to improvements in attentional abilities (Crick & Dodge, 1994). The attentional

changes lead to improvements in their ability to “detect subtle features of stimuli and to attend to relevant, rather than irrelevant, features of that stimuli” (Crick & Dodge, 1994, p. 80) resulting in greater accuracy, efficiency, and more complexity in the skills used by children. This further supports the idea of an interaction between biological and cognitive processes.

In addition to the SIP model, social learning theory (Bandura, 1971) provides another cognitive view of how individuals learn social skills. This theory proposes that learning, including learning social skills, takes place through direct experiences or observations of other’s behaviors. Social skills development is therefore the product of observational learning requiring an individual to pay attention to the modeled behavior, to retain the information in memory, to rehearse the skills, and lastly to reproduce the behavior when required (Olson & Hergenahn, 2013).

In summary, the SIP model and social learning theory are cognitive in nature as they describe cognitive processes involved in learning. They focus on the importance of underlying or foundational biological structures (e.g., attention and inhibition) to be present as the first step in social skills development as these skills allow for the creation of cognitive schema regarding social interactions. The literature on the development of the brain structures required for social skills development indicate that this process continues to develop and expand throughout childhood and adolescence. This suggests that the process of social skills development will follow a similar continuous development journey during which cognitive processes related to social interactions can improve and adapt as biological underpinnings grow and evolve. Taken together, this information highlights the interaction between biological and cognitive processes and helps explain how they are reliant upon each other.



Although the interaction between biological and cognitive processes provides the basis for social skills development, SIP and social learning theories in addition to research on brain development also highlight the impact environment such as social experiences and life circumstance.

### **Environmental**

Environmental or social-cultural impacts are said to be influential to the general development of social skills and in particular an individual's familial relationships are commonly thought to be important. First relationships are often with caregivers and this bond or attachment can influence later relationships as children internalize these connection experiences (Bowlby, 1973). Internal representations of self and others then form the basis for relationships in the future meaning that positive early relationships often result in positive future relationships and social interactions (Ainsworth, 1989). Harlow and Zimmerman (1958) were the first to assert that peer contact deprivation results in a failure to develop social skills and shows abnormal developmental trajectories. Since then, several researchers have shown that poor social skills or skills deficits are more common for children with non-secure attachment styles (Dwyer et al., 2010; Ladd, 1999; Stacks & Oshio, 2009).

In addition to attachment theory, the family environment can also impact social skills development through several other factors such as the extent to which parents encourage and foster peer relationships, the quality of the parent-child interactions, as well as any family conflict that may influence a child's exposure to more negative forms of communication and interaction (Guralnick, 1999). Adverse childhood experiences are known to impact the development of the brain across several areas including some related to the social brain which

can ultimately impact the development of social skills for individuals (McLaughlin et al., 2015; Teicher & Samson, 2016).

A last factor to consider is culture as it permeates child-rearing practices and dictates customs and social norms (Albert & Trommsdorff, 2014; Beauchamp & Anderson, 2010). This can influence attachment as well as the definition of social skills as cultures may differ on what is considered appropriate in social interactions (Keller et al., 2011). These cultural differences are likely to influence the development of these skills; however, limited research is available (Beauchamp & Anderson, 2010).

Taken together, these environmental experiences can have impacts on social skills development across biological and cognitive models and may help explain why some individuals develop deficits in these areas. Although environmental factors are not typical targets for intervention purposes (as opposed to preventative initiatives) it is an important influence to discuss in this paper as it highlights the potential impact of positive social experiences that may be created during an intervention. It is unlikely that positive experiences in the intervention will offset the neurological impacts of adverse childhood experiences; however, repeated exposures to positive social interactions may influence the creation of cognitive schemas thereby creating the potential for changes to social skills.

### **Part Two: Social Skills Interventions: Where are we at?**

Without interruptions to the biological, cognitive, and environmental correlates of social functioning, cognitive and socio-emotional abilities are said to develop typically resulting in “good” social skills. These skills are then linked to better educational, psychological, and vocational standings throughout an individual’s lifetime (e.g., Domitrovich et al., 2017). However, development of social skills does not always proceed as expected which can result in

social skills impairments and increases a child's risk of social adjustment problems, employment difficulties and mental health problems such as depression, anxiety, delinquency, and antisocial behavior (Davis et al., 2011; Erath et al., 2007; Feinberg et al., 2007; Gresham & Elliott, 2008; Gresham et al., 2012; Lugnégard et al., 2011; Segrin et al., 2016; Worley & Matson, 2011).

Difficulties in educational settings have also been noted in terms of educational underachievement (Fleming et al., 2005; Woodward & Fergusson, 2000) and increased rates of school dropout (Lopez & DuBois, 2005). These significant long-term outcomes show the importance of developing social skills throughout childhood and adolescence and highlight the need for interventions. The following section of this paper will outline the current conceptualization of social skills impairments, common interventions used to target these deficits, and the gaps in the existing interventions.

### **Social Skills Impairment**

Social skills impairment was first conceptualized in terms of acquisition versus performance deficits (Gresham, 1981). This position is now well accepted by several others (Elliott & Gresham, 2008; Gumpel, 2007; Maag, 2005; Walker et al., 2004; Lerner & White, 2015) and highlights the idea that social skills impairment is the result of one of the following deficits.

#### ***Acquisition Deficit***

Generally, this type of deficit results from a lack of knowledge on how to perform a social skill and characterizes individuals who have not acquired the necessary social skills (e.g., turn taking, perspective taking) to interact successfully with others (Elliot et al., 2008; Gresham, 2016). This lack of knowledge typically stems from impairments in social-cognitive abilities resulting in faulty or absent learning of required social behaviors (Gresham et al., 2010; Lerner

& Mikami, 2012). In addition, acquisition deficits also describe difficulties in knowing which social skills are appropriate in specific social situations or how to enact a fluent sequence of social behaviors. These deficits are referred to as a *can't do* problem (Gresham, 2016) or more recently known as a *social knowledge* deficit (Gates, et al., 2017; Lerner & Mikami, 2012; Wolstencroft et al., 2018).

### ***Performance Deficit***

This type of deficit results from a failure to perform a given social skill at an acceptable level despite the individual knowing how to do so (Gresham, 2016). This *won't do* problem or *social performance* deficit (Gates et al., 2017; Lerner & Mikami, 2012; Wolstencroft et al., 2018) characterizes individuals who have acquired appropriate social skills and know when to apply them; however, they show difficulty in applying this knowledge in real-life situations or show difficulty in applying them consistently (Lerner & Mikami, 2012). For example, a child may know what to do in a social situation but is too distracted by environmental stimuli to complete the required social action. Acquisition deficits were thought to be more common in the general population and were therefore targeted more frequently in interventions, however, social skills performance deficits appear to occur more often according to recent findings (Gresham et al., 2010).

### **Available Interventions and the Gaps**

According to the acquisition versus performance deficits theory, each child should receive an intervention to match their type of deficit. An individual with an acquisition deficit should receive a treatment focussing on direct instruction of social skills in a protected setting (Gresham, 2016). On the other hand, individuals with a performance deficit are more likely to benefit from manipulation of antecedents and consequences in a naturalistic setting (Gresham,

2016; Lerner & Mikami, 2012). Over the past few decades, several intervention methods have been developed and evaluated; however, there is currently no common, agreed upon approach for teaching social skills (Cappodocia & Weiss, 2011). Views on what is recommended also fluctuate thereby making it difficult for practitioners to decide on an appropriate intervention for individuals with social skills impairments. During this decision-making process, it is important to consider both the content (e.g., training objectives, theoretical orientation) as well as the method delivery (e.g., groups, one-on-one) of the training program and the efficacy and effectiveness associated with it (Milligan et al., 2017). This next section will therefore review common intervention features as well as gaps in the available programs as identified by the literature.

### ***Content-based Intervention Considerations***

As with any intervention the content delivered to participants is of great importance as this provides the teaching of the intended skills. Social skills interventions are often referred to as social skills training (SST) programs as their main goal is to teach age-appropriate social skills and competencies, such communication, problem solving, decision making, self-management, as well as the ability to create and maintain friendships (Craig et al., 2015). The content for the intervention can differ based on the population it aims to target or based on the theoretical orientation used and are known to have benefits and drawbacks associated with it.

*Theoretical orientation.* Many of the social skills interventions currently developed are based on a theoretical orientation to help guide the content of the training program. Some of the content is based on general teaching strategies such as repetition and practice of a skill (Lerner & Mikami, 2012; Parsons & Mitchell, 2002; Wolstencroft et al., 2018) while others include strategies to fit a particular orientation. Early SST applications included a heavy focus on operant conditioning based on behavioral models and focussed on reinforcement and modeling. This was

determined to be effective for learning new behaviors but lacked in generalization of the skills (Parsons & Mitchell, 2002). Later, behavioral intervention also included teaching strategies such as prompting, chaining (by breaking complex tasks into smaller steps), and shaping (Spence, 2003).

Interventions anchored in social learning theory, on the other hand, include more cognitively oriented teaching strategies by borrowing certain components associated with Cognitive Behavioral Therapy and may include a focus on didactic instruction of social problem solving or emotion recognition skills (Beaumont et al., 2017; Koning et al., 2013). Modeling, either through in-vivo or video approaches are also frequently included teaching strategies as these align closely with the social learning theory and have shown some effectiveness in teaching skills (Bellini & Akulian, 2007). Depending on the setting of the modeling, some concerns have been noted regarding the limited generalizability of the learned skills (Bellini & Akulian, 2007). This lack of generalization is noted across many of the cognitive behavioral interventions (CBI) despite attempts to combat this through homework assignments (McMahon et al., 2013).

In general, cognitive-behavioral interventions (CBI) have shown improvements in social skills for children and adolescents with anxiety and/or behavioral problems (Othman et al., 2015). In addition, CBIs are the recommended intervention for individuals with schizophrenia as researchers have shown improvements in acquisition and durability of skills such as basic conversational skills, assertiveness, and daily living skills (Granholm et al., 2016). However, CBIs are often more resource intensive as they require more hours of total intervention time than other interventions making them costlier and perhaps less feasible to implement (Cappadocia & Weiss, 2011). Some concerns have also been raised about using CBIs for younger children as

they may not have the cognitive skills necessary to be impacted by the interventions (Cook et al., 2008).

As is shown above, many of the training strategies related to the specific theoretical orientations include benefits as well as disadvantages and it may therefore be beneficial for individuals to be exposed to a mix of teaching strategies within one intervention (Beaumont et al., 2017). Furthermore, examination of the interventions across different theoretical orientations reveals two main gaps that should be addressed. First, despite continuous efforts to improve generalization of the learned skills there remains to be a difficulty for participants to translate the skills learned in the interventions to outside settings (e.g., Matson, 2017). This is an important gap to address as generalization of the learned skill to settings outside of the intervention should be the overall training goal. Second, when examining the common content for available social skills interventions to also becomes evident that many of these teaching strategies across theoretical orientations focus on improving or acquiring specific social skills such as social problem solving, facial recognition, or communication skills. Based on the social skills development theory outlined above these skills are possible through underlying cognitive and socio-emotional abilities (e.g., Cordier et al., 2015; Ross et al., 2019; Soto-Icaza et al., 2015). The interventions available today; however, do not tend to focus on ensuring that these underlying skills are trained allowing for the acquisition of social skills but rather focus on directly teaching the impaired social skills.

*Targeted Population.* In addition to the development of content based on theoretical orientation, interventions are also influenced by the population they are designed to target. This occurs in two-fold. First, intervention content is presumed to be designed around the developmental needs of the targeted population (Milligan et al., 2017). The majority of the

programs available target younger children to provide early intervention (Ledford et al., 2018; Stevens et al., 2016; Storebø et al., 2019). The interventions available for children ages 10 and under focus the teaching of behavioral content including skills like sharing toys, starting conversations, and listening skills (Milligan et al., 2017). As participants age, interventions start to include a focus on emotional facets of social competence such as perspective taking and empathy (Milligan et al., 2017) as aligned with the developmental stage of the targeted participant group. During adolescence there is an increased focus on socio-emotional skills and self-reflective abilities. In addition to these changes to the teaching content there are also changes to the content in terms of the interests associated with different age groups. The examples and situations used in interventions for young children differ from those for adolescents.

Taken together, intervention content should be contextualized in development and maturity level of the participants, which may require case by case assessment. However, despite a myriad of research highlighting the importance of continued supports throughout adolescence there appears to be a gap in intervention development and engagement for this age group (Casey et al., 2000; Guthold et al., 2021; Steinberg, 2014). A limited number of interventions are targeted toward the adolescent age group and attrition rates tend to be higher for adolescents who enrolled in social skills interventions (e.g., Farris et al., 2019) which is suspected to be caused by a lack of engagement throughout the intervention.

Secondly, in addition to many of the interventions targeting younger children, most of the currently available programs are designed for individuals with ASD (Lanovaz et al., 2017). The social deficit profile associated with ASD is said to be distinctly different from the social deficits noted for individuals with other neurodevelopmental disorders such as ADHD, LD's, or FASD



(Bishop et al., 2007; Scandurra et al., 2019; Stevens et al., 2016). This is important to note as several researchers highlight the importance of providing interventions based on the type of deficit found for a particular individual. Based on the differing social skills profiles individuals with ASD should therefore receive an intervention different from those offered to individuals with different social profiles (e.g., ADHD) to optimize the potential for change in social competence.

### ***Method-based intervention considerations***

In addition to the importance of the content that is delivered through the training programs, it is also important to examine the method of delivery for these interventions (Milligan et al., 2017) as this can have an impact on the efficacy and effectiveness of the program. At the onset of the social skills intervention era, many of these trainings were conducted in one-on-one coaching environments (Cividini-Motta et al., 2017). As a result of the noted concerns related to generalization of learned skills, many of the interventions available today are delivered in group and/or classroom-wide settings with the intention of generalizing the skills to common settings for children (e.g., interactions with peers, and playground environments). Meta-analyses on the effects of these group based social skills interventions show moderate improvements to social competence ( $g = 0.51$ ; Gates et al., 2017 and  $g = 0.47$ ; Reichow et al., 2012) and have the added benefit of reducing stigmatization while encouraging individuals to practice the skills with each other during the intervention sessions (Mikami et al., 2017).

Furthermore, researchers also examined the effectiveness and efficacy of delivering social skills training using peers rather than intervention staff to close the gap to generalizability. These Peer Mediated Interventions (PMI) consist of typically developing peers who are taught strategies for interacting with individuals with social skills deficits (Walton & Ingersoll, 2013).

The peers therefore serve as the intervention agents as they become a model for appropriate social behavior. This is said to allow for naturalistic practice of the skills with the intent of increasing generalizability of the learned skills. However, despite these changes in intervention delivery format, generalization of the learned social skills remains to be problematic for the interventions available today (DuPaul & Weyandt, 2006; Matson, 2017; Pfiffner et al., 2000)

Another identified gap in the available delivery methods relates to the high resource intensiveness of many of the available programs. The peer mediated interventions require availability and willingness of peers to participate and be trained in the skills prior to the start of the intervention (Cividini-Motta et al., 2017). Even when peers are not required for the program, teaching of social skills often requires trained staff to provide modeling, reinforcement, and repetition in the same manner over the period of the intervention, placing an increased demand on intervention costs (Parson & Mitchell, 2002). The group and classroom delivery methods also require space in a school or community setting (McMahon et al., 2013). Resource and time intensive programs are not always feasible within small communities or due to limited finances thereby creating a gap for some individuals to obtain the intervention supports they require.

Lastly, the literature on social skills interventions also notes a gap to the availability of evidence-based programs in terms of long-term outcomes. Many of the research studies show little to sometimes no evidence of the maintenance of learned skills (Flynn & Healy, 2012; McMahon et al., 2013). This is likely due to the fact that the long-term outcomes are rarely measured when assessing the effectiveness of these programs. This is a problem related to the research and implementation of the programs; however, it may also speak to potential difficulties with the training methods themselves if long-term outcomes are found to be minimal.

## **Addressing the gaps**

Overall, when practitioners examine currently available interventions based on the teaching content, they may encounter difficulties with limited generalizability of the learned skills, limited available interventions appropriate for teenagers, and limited interventions suited for individuals whose social deficit profiles do not match that of individuals with ASD. This can result in the selection of an intervention that is not best suited for an individual thereby potentially impacting the efficacy of the treatment. These content related gaps are further compounded when examining the methods used to deliver the current interventions as these also highlight gaps in generalizability of the learned skills in addition to concerns related to resource intensiveness and limited evidence-based findings. Taken together, this literature review suggests a call for a new way of developing and delivering social skills interventions to those in need.

### **Part Three: Video Games as Social Skills Intervention Platforms**

Video game-based interventions are one viable alternative solution as they offer several advantages that may help offset the currently noted gaps in intervention development and delivery for improving social skills. Initially, technology was incorporated into interventions to help alleviate the concerns noted for generalizability of learned skills through the inclusion of video tapes showing modelling of desired social skills (DiGennaro et al., 2011). However, rapid advances in technology quickly made the use of video modeling appear outdated and modern technologies such as virtual environments, virtual realities, and specifically video games were included in social skills training delivery.

Despite the negative portrayal of video games in the media, there are several supporting theories to help explain how these new technologies can support general learning. Furthermore, it is important to highlight the reasons why videogames specifically can help bridge the gaps

identified for social skills interventions to continue to better support those individuals with social skills deficits.

### **Supporting Theories**

Several theories have been advanced to illustrate ways in which video games can be used as an intervention platform for social skills learning. Learning through games is not a new idea as influential theorists such as Piaget and Vygotsky mentioned the importance of play in cognitive development and learning long ago (Plass et al., 2015). More formally, the concept of Game-Based Learning (GBL) was applied in educational settings several decades ago as a method to increase learner engagement and motivation (Plass et al., 2015). Since then, the use of board and card games have mostly been replaced by educational or serious video games resulting in the concept of Digital Game Based Learning (DGBT) which started the belief that digital games could also be applied in the intervention realm. Researchers have since attempted to uncover the underlying learning principles and concepts associated with DGBT (Goh et al., 2008). Most commonly this can be explained through a cognitive, a motivational, an affective, and/or a socio-cultural approach.

#### ***Cognitive approach***

Games can activate cognitive processes in several ways which in turn facilitates learning (Plass et al., 2015). Bavelier and colleagues (2012) define learning as the transfer of skills from within the game to outside of the game. This transfer takes place through a concept referred to as *learning to learn* (Bavelier et al., 2012). Video games, and specifically action games, allow individuals to become better able to use evidence from repeated presentations of tasks to guide their decision-making and distribute their cognitive resources (Bavelier et al., 2012). Video games therefore do not teach a particular skill but rather increase an individual's ability to extract

patterns or regularities in the environment, and in essence are learning to learn (Bavelier et al., 2012). According to this explanation, enhancements in lower-level processing skills have been linked to video game play ranging from improvements in visual perception skills (peripheral vision, target discrimination, identification, and contrast) to different aspects of attention (selective and attentional blink) (Chisholm et al., 2010; Green & Bavelier, 2003, 2006a, b, 2007).

The *common demands hypothesis* was introduced by Oei and Patterson (2013) to more clearly explain the cognitive functions impacted. Video game play has been linked to isolated improvements in executive functions (Boot et al., 2008) showing that this type of learning might not extend to all skills and only facilitates learning for skills sharing a common demand with game tasks (Oei & Patterson, 2013). Video games therefore teach specific perceptual and cognitive skills, placing a higher demand on the certain neural regions involved. Repeated playing then refines and strengthens those skills and regions. Learning, or transfer of skills, can only be measured on tasks that are similar to those found within the game or for tasks that rely on the use of the neural regions sharing a common demand (Oei & Patterson, 2013).

Some general theories of learning also apply to video games including inquiry based learning or experiential learning. Inquiry-based learning refers to the process of making learning more meaningful and self-directed and the exploratory and discovery-based nature of video games allows for this freedom (Annetta & Bronack, 2011). Experiential learning states that learning occurs from experiences, actions, and reflections (Kolb, 1984). In video games, players must navigate the virtual environment, take actions, and make decisions with consequences attached to them. These experiences are then said to result in meaningful learning.

### ***Motivational approach***

Individuals are often engaged and motivated to play video games (Gee, 2003; Plass et al., 2015; Prensky, 2003). Motivation in turn is said to influence what we learn, how we learn, and when we choose to learn (Schunk et al., 2008). This is because a motivated learner is more likely to partake in challenging activities, to be actively engaged, and to adopt a deep approach to learning (Schunk et al., 2008). Several game elements linked to increased motivation include incentive systems, visual aesthetics, game mechanics, narrative or fantasy, challenges, and a level of mystery (e.g., Gee, 2003; Malone, 1981; Loftus & Loftus, 1983). These features are often present in games which explains the effectiveness of educational games over traditional forms of curriculum exposure (Prensky, 2003). The use of game features has been linked to enhanced student motivation, leading to greater attention to the curricular content, and eventually resulted in greater retention of the information (Ricci et al., 1996). Game features such as incentives (e.g., earning coins or medals) or engaging activities also enable individuals to stay engaged for longer (Plass et al., 2015).

### ***Affective Approach***

The emotions individuals experience while engaged in a game can either hinder or facilitate learning (Plass et al., 2015). According to Izard (2009) there is a dynamic interplay between emotion and cognition. For example, positive emotions have been linked to a broader scope of cognitive resources available to the individual leading to enhanced learning opportunities (Fredrickson & Branigan, 2005; Isen, 2002; Plass et al., 2014; Um et al., 2012). Others have shown that some emotions such as high levels of empathy may hinder learning (Huang & Tettegah, 2010). Playing video games can also lead to an increased release of dopamine in the brain (Craig et al., 2013; Koeppe et al., 1998) which is linked to feelings of

pleasure and well-being, as well as learning and reinforcement of behaviors (Koepp et al., 1998). The act of playing a game might therefore improve an individual's mood resulting in an increase of potential learning. Due to the adaptive nature of video games, it is possible to induce certain emotions for players through game designs of music, visual aspects, narrative, or game mechanics (Plass & Kaplan, 2015). The goal for game design is therefore to find a balance of emotional regulation that will allow for optimal learning opportunities.

### ***Socio-Cultural Approach***

Popular videogames such as Massively Multiplayer Online Games (MMO) require social interactions between players. The concept of social learning theory described above therefore applies here as well as players serve as each other's models (Bandura, 1971). Learning can therefore occur as a result of the social interactions within the game.

Cultural pieces often come into play when examining game design; a role-playing game (RPG) in one country might for example look different in another depending on cultural values and norms (Stenstrom & Bjork, 2013). This can influence the type of learning that occurs within the game setting. Other researchers indicate that socio-cultural factors can facilitate or hinder learning, but they do not result in learning on their own (Plass et al., 2015; Turkay et al., 2014). They hypothesize that social and cultural aspects of learning cannot be separated from cognitive, motivational, and affective constructs. For example, a gamer might be motivated to play a certain game to interact with others which will in turn lead to positive emotions such as joy which can then lead to an increase in cognitive processing (Plass et al., 2015). Either way, learning is said to be influenced by socio-cultural factors.

## **Responding to Common Criticisms of Video Games**

Video games have been in the homes and lives of children, teens, and adults since the 1970s and have received much criticism over the years. Once researchers showed that learning took place within these games, a focus was placed on the potential negative learning resulting from this recreational activity. Although many changes have taken place in terms of the appearance and the format of these games, much of the criticism has remained the same and continues to focus on the potential negative impact on the behavior and socialization of children and adolescents who engage in video game play. This criticism often comes in threefold and includes concerns regarding increases in: (a) aggressive behavior due to the aggressive nature of the games played, (b) potential addictions to video gaming and internet use; and (c) social competence deficits in children and youth (Adachi & Willoughby, 2017; Copenhaver et al., 2017). These concerns have received increased attention in research studies and are well published in mainstream media reports and may therefore impact practitioners' and caregivers' views on using videogames for intervention purposes. A closer look at the true effects of video games is therefore warranted.

### ***Aggression and Video Games***

One of the prominent concerns noted against video games states that aggressive behavior is expected to be higher for individuals who play video games as compared to non-gamers. This statement is often generalized in the media; however, it should be noted that this concern is specifically targeted toward violent video games only. The concern stems from principles of social learning theory and the notion that individuals will be desensitized to violent content over the course of their play (Laczniak et al., 2017). Many research studies have been conducted over the past decade to determine the true impact of these violent games and some meta-analysis



show concerning reports of increases in violent behaviors for those engaged in violent games (e.g., Anderson et al., 2010) while others show minimal to no concerns on the impact of behavior for gamers (e.g., Ferguson, 2015; Verheijen et al., 2017). These discrepancies in findings may be influenced by difference in the content of the game played by the participants (e.g., Grand Theft Auto vs. Angry Birds), the frequency of game play (e.g., short period of exposure vs long term), and the age of the participants. The combination of the age and content of the game played are important to consider as a rating system was put in place for video games by the Entertainment Software Rating Board (ESRB) to help protect children and youth in North America from gaming content deemed not appropriate for their age level (e.g., violence, sexual content). When these rating guidelines are followed, children are less likely to play violent video games and are less likely to exhibit negative behaviors outside game play as a result (e.g., violence or aggression; Lacznia et al., 2017). While there may or may not be a concrete link between aggressive behavior and violent video game play, it appears that this potential impact can be greatly reduced by following the provided guidelines. Furthermore, the games described in the research studies above are not comparable to those used for intervention purposes. Instead, serious video games, which are games designed with a purpose other than entertainment (Whyte et al., 2015) are often employed without any violent or aggressive material present. These games have a focus on education or training through three specific goals: 1) knowledge transfer; 2) skills acquisition or development and/or; 3) attitudinal/behavioral changes (Girard et al., 2013; Stewart et al., 2013) and are therefore an appropriate fit for intervention purposes.

### ***Addiction and Video Games***

The next concern commonly noted in the media relates to the frequency of game play as many parents, caregivers, and educators, report a fear that children and teens who are exposed to

technology including video games are more likely to develop an addiction or dependency on technology with adverse associated consequences to their mental and physical well-being (e.g., depression, sleep disturbances; Lissak, 2018). Internet Gaming Disorder (IGD) has been included in the most recent publication of the *Diagnostic Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) as a possible diagnosis and children and adolescents are noted as a susceptible population due to their underdeveloped cognitive control (Sugaya et al., 2019). A review of studies completed for this young population shows that developing an addiction or a dependency on video games is possible while often mediated by family environments and higher amounts of game play (Sugaya et al., 2019). Adolescents, who meet criteria for IGD, are more likely to report higher levels of family conflict, poorer relationships with their family, and lower levels of parental video game monitoring (Sugaya et al., 2019). Although the Canadian Pediatric Society has not yet provided guidelines for video game play frequency for children over the age of five, caregivers are recommended to monitor their child's gaming frequency, to encourage meaningful screen use, and to model appropriate screen time (Canadian Pediatric Society, 2019).

### ***Socialization and Video Games***

The last common concern related to the use of video games for children and adolescents is linked to both above noted concerns and posits that children and adolescents who engage in video games are likely to experience negative changes to their social competencies as children no longer practice their social skills in “real life” (Adachi & Willoughby, 2017). In contrast to the common perception of the “loner gamer” most children and teens play video games together with peers (Verheijen et al., 2017) and social interaction is often included and required for game play. Players are therefore able to initiate and maintain friendships online (Adachi & Willoughby,

2017). On the other hand, however, for children who are identified as being “addicted” to gaming, the opposite is true as research has shown lower social skills abilities for those individuals as compared to children and teens with non-video game dependencies (Zamani et al., 2010). Again, the main take-away message from this criticism may be the increased need for video game play to be monitored and positively supported by adults to ensure that possible negative impacts on children and youth will not occur.

Taken together, it should be noted that there is no overarching evidence that shows a causal link between video game play and increases in negative behaviors for children and youth and that the methods of reporting on the findings from research studies and in social media may paint a skewed picture of the true impact (Copenhaver et al., 2017). On the other hand, it should also be noted that there is no consensus of evidence suggesting that there is no potential for negative influences from certain video games but that when guidelines and restrictions placed upon the use of video games in childhood and adolescence are followed, the risk of these potential negative concerns appears to dissipate.

### **Positive Impacts of Video Games**

While some researchers focused their studies on examining the potential negative effects of video games on children and adolescents, others looked at the potential for positive impacts. As a result, there is a large body of research examining the potential positive effects of video games across cognitive, behavioral, and socio-emotional outcomes for recreational as well as educational video games. Individuals playing video games designed with the main purpose of providing entertainment (e.g., action or first-person shooter games), consistently outperform non-video gamers on a number of cognitive abilities such as visual attention (Durlach et al., 2009; Feng et al., 2007; Green & Bavelier, 2006a, 2006b, 2007), aspects of cognitive control (Colzato

et al., 2010; Glass et al., 2013; Strobach et al., 2012), visual short-term memory (Blacker & Curby, 2013; McDermott et al., 2014; Wilms et al., 2013), spatial skills (Uttal et al., 2013), improved multitasking (Chiappe et al., 2013; Strobach et al., 2012) and general processing speed (Dye et al., 2009). In addition to these cognitive abilities, improvements are also commonly found in players' emotions such as an improved mood (Russoniello et al., 2009; Ryan et al., 2006) and prosocial behaviors (Ewoldsen et al., 2012; Gentile et al., 2009).

Serious games (SG), which have the main goal of teaching or training, have a larger scope of potential impact as they can be developed for a variety of different applications including educational, business, military, commercial, prevention and rehabilitation purposes (Dörner et al., 2016). The most found applications are educational or rehabilitative in nature (Kokol et al., 2020) and include many games targeting social skills. As a result, several SGs have been developed with the goal to teach social skills to specialized populations, and in particular individuals with ASD. In these games, the focus is often on teaching facial and emotional recognition skills as specific components of SST (Kokol et al., 2020). Some of the games include virtual avatars that help children develop these skills (e.g. *GameBook*; Carvalho et al., 2015; *FaceSay*; Hopkins et al., 2011; *JeStiMule*; Serret et al., 2014) whereas others employ the use of other players to practice with (e.g. González-González et al., 2013; *Guess Who?*; Ahmad et al., 2014). The games *REAL LIVES* (Bachen et al., 2012) and *Zoo U* (Craig et al., 2015) were created to help individuals with general social impairments as they take players into virtual worlds in which they make decisions for their characters with implications to their virtual lives. These tasks are social in nature and allow for the development of a variety of skills such as empathy for their characters (Bachen et al., 2012), impulse control, communication, cooperation, social initiation, empathy, and emotional regulation (Craig et al., 2015).

Overall, researchers have noted that the goal of social skills teaching was accomplished by many of these games. These successes were typically observed by positive changes in underlying skills such as affect recognition, mentalizing skills, (Hopkins et al., 2011; Rice et al., 2015), facial recognition (Tanaka et al., 2010), emotion recognition (Kokol et al., 2020; Serret et al., 2014), emotion expression (González-González et al., 2013), global empathy (a sense of individual and collective responsibility that extends beyond individuals who you know personally; Bachen et al., 2012), impulse control, emotion regulation, (Craig et al., 2015; DeRosier et al., 2012; Kokol et al., 2020) and overall communication skills (Ahmad et al., 2014; González-González et al., 2013; Hopkins et al., 2011; Rice et al., 2015; Sanchez et al., 2017).

### **The Use of Video Games to Bridge the Intervention Gaps**

As highlighted previously, there are several social skills interventions currently available to individuals faced with social skills deficits. However, the literature shows several gaps in the content and delivery of these interventions including concerns about: (a) the ability of these interventions to teach social skills that are generalizable to outside settings, (b) the feasibility and resource intensity of the programs, (c) the suitability and availability of interventions for the adolescent age population; and (d) the intervention's ability to match an individual's identified social skills profile according to social skills development theory. This section will highlight how video games are able to provide an intervention platform that can help bridge these identified gaps in intervention content and delivery.

Video games are considered an ideal delivery method for social skills intervention due to several reasons (Parson & Mitchell, 2002). First, the above-described theories explain why learning can take place within a video game setting and can be extended to explain how social skills learning in particular could occur. Specifically, the cognitive and socio-cultural approaches

align with social skills development. Secondly, the adaptable nature of video games allows for the implementation of social skills training (SST) goals through immediate reinforcement, repetition, scaffolding, modeling, and the potential for naturalistic settings (Parson & Mitchell, 2002). Lastly, video games have the potential to eliminate the limitations of traditional SST programs as video game applications are more cost-efficient (e.g., less travel, lower program implementation costs, greater flexibility), ensure high program fidelity through the elimination of human error, and allow for greater opportunity for generalization due to realistic settings (Craig et al., 2016; Ludlow, 2015; Parson & Mitchell, 2002; Standen & Brown, 2005).

Currently available social skills interventions using technology tend to focus on teaching social cognitive processes (e.g., face processing, joint attention, ToM, and emotion recognition). Some focused on direct social skills such as communication or initiation abilities and limited interventions currently available target underlying cognitive functions such as inhibition. This is surprising considering the widely published positive effects of regular video games on cognitive abilities (e.g., Green & Bavelier, 2006; Colzato et al., 2010). Even though this type of learning does not appear to be a focus of the currently available programs it does provide evidence for the potential of including content in technology-based interventions to help address deficits in underlying cognitive and socio-emotional as is highlighted in the literature on social skills development theory (Gresham, 2016).

Furthermore, despite the noted benefits, the use of technology in current social skills interventions appears to be limited to virtual environments (VE) and virtual realities (VR) without gaming components (Kandalaf et al., 2013; Mitchell et al., 2007; Stichter et al., 2014). These interventions will typically provide a traditional SST program in a virtual setting. Alternatively, the VE or VR provides a space for individuals to practice social skills by placing

individuals in a simulated social situation to remove any fear of failure. These applications still receive some of the benefits described above (e.g., reduce resources and limit barriers) however, the additional benefit of increased motivation as a result of game features is missed (Ninaus et al., 2019).

Increased motivation is a crucial benefit of video games as the platform for social skills interventions when closing the gap for adolescents. Current literature highlights the need for a different type of intervention for adolescents on two levels: (1) different training content more geared towards adolescent social needs (e.g., Ledford et al., 2018; Steinberg, 2014), and (2) interventions that increase motivation for teens thereby addressing noted concerns regarding high attrition rates for teenagers (Farris et al., 2019).

Limited interventions are currently available for adolescent age groups (Ledford et al., 2018; Stevens et al., 2016; Storebø et al., 2019) despite the known potential for growth during this developmental period (Casey et al., 2000; Steinberg, 2014). Brain development in the prefrontal cortex and executive functioning skills (Casey et al., 2000) which are important underlying cognitive abilities linked to social skills development, is said to ramp up during adolescence thereby creating an opportunity to provide interventions targeting skills associated to these brain areas. Virtual environments are said to be able to deliver this new type of intervention for this population as it allows for flexibility in the training content and the environments developed for the adolescents. This would result in social skills content that is more geared towards the adolescent's needs.

In addition, virtual environments also allow for the inclusion of game-based learning which is known to increase motivation for individuals (Ninaus et al., 2019). Video games specifically are popular among children and adolescents, and it is likely that teens will be

motivated to participate in a social skills intervention set within a video game. Overall, 37 percent of Canadians, old and young, consider themselves to be a “gamer” and will play video games for approximately 11 hours per week (NPD Group as cited in Entertainment Software Association of Canada [ESAC], 2017). 52 percent of Canadians has played a video game (any game on any mobile device e.g., phones, laptops) within the last four weeks (NPD Group as cited in ESAC, 2017) and 80 to 90 percent of teenagers state they play at least once a day (Coëffec et al., 2015; Le Heuzey & Mouren, 2012).

Taken together, the adolescent geared content in addition to the increased motivation are likely to lead to increases in participation adherence for adolescents enrolled in social skills interventions. In turn, higher treatment adherence is often linked to increased social validity of the intervention and increases the likelihood of generalizability of the learned skills and overall effectiveness of a social skills intervention (Hansen et al., 1998; Chen, 2006). Videogames therefore have the potential to target several of the identified gaps in social skills interventions and particularly as they pertain to the adolescent population.

### **Conclusion**

Social skills are often viewed as a class of specific behaviors required for social functioning (Beauchamp & Anderson, 2010; Gresham et al., 2010) and are thought to develop in an integrated fashion, with input from neurological structures, cognitive processes, and social-cultural constructs. These skills are often viewed as a protective factor against adversities; thus, researchers have worked hard to identify ways to support and promote positive social skills development particularly for those identified with deficits in this area. The literature reviewed in this chapter provides an overview of important concepts related to social skills interventions and identifies several gaps in the currently available training programs. Most notable are the gaps



associated with the apparent overlooked adolescent population. Adolescence consists of a sensitive period of brain development and increased social functioning demands (Steinberg, 2014), yet traditional interventions are failing this population. Adolescents, with identified social skills difficulties, need interventions that are developmentally appropriate, engaging, and grounded in social skills development theory. After examining the gaps associated with current intervention, the suggested call for a new way of developing and delivering social skills interventions to this age group appears to be warranted.

Next, the use of video games is discussed as the potential answer to this call. The increasing popularity of technology in every-day life and the known associated benefits of game play (e.g., motivation, learning potential) create the potential for video games to uniquely support adolescents with social skills deficits who would otherwise remain under supported. Theories supporting the use of video games as intervention platforms and emerging research showing evidence in favor of video game-based interventions are discussed. Though further research is needed to examine the specific use of video game based social skills interventions with adolescents, the research highlighted in this chapter suggests promising results in finding an alternative way to support adolescents.

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### **Chapter Three: Development and Initial Implementation of a Theory Driven Video Game Based Social Skills Intervention**

Individuals start to develop and practice social skills, defined as specific behaviors necessary for social interactions (e.g., interpersonal, intrapersonal and communication skills), from a young age. Some of these skills appear as early as during infancy thereby setting the stage for continued development throughout an individual's lifetime. A kindergartener relies on social skills for an easier adjustment and positive attitude to school (Birch & Ladd, 1997; Jones et al., 2015; Rabiner et al., 2016; Rose, 2012), while an adolescent depends on peer relationships for support, advice, companionship, and affirmation (Furman & Buhrmester, 1992; Ross et al., 2019; Steinberg, 2005). These skills are then linked to better educational, psychological, and vocational standings during adulthood (Deming, 2017; Domitrovich et al., 2017; Greene et al., 1999; Kuperschmidt et al., 1990).

As a result of this importance, researchers have worked hard to identify ways to support and promote positive social skills development. Different social skills training programs have been developed and implemented with the intent to support individuals identified with social skills difficulties. Although researchers identify the positive impacts of these interventions, they also note areas for future study. In particular, a need for interventions based on social skills development theory, interventions that target the overlooked adolescent population, and interventions that can improve the current level of generalizability of the learned skills, have been identified as priorities.

Video games have been proposed as a potential delivery platform to respond to these identified needs. Through the application of the Digital Game Based Learning Theory (DGBLT) researchers have provided evidence supporting the idea that learning is able to occur in a virtual

intervention setting through increases in motivation, engagement, and activation of cognitive processes that support learning (e.g., Prensky, 2003). Several researchers have shown improvements to cognitive and behavioral outcomes for individuals engaged in educational or serious video game play (e.g., Ewolsen et al., 2012; Föcker et al., 2019; Pardina-Torner et al., 2019; Villani et al., 2018) while others have provided evidence for the direct teaching of social skills in virtual environments (Craig et al., 2015; DeRosier et al., 2012; Hopkins et al., 2011; Serret et al., 2014;). Evidence of the effectiveness and efficacy of a combination of video games as an intervention for social skills improvement is also starting to emerge (Craig et al., 2016; DeRosier & Thomas, 2019;); however, further research is warranted.

Although video games are associated with some negative views, as portrayed in media reports, the myriad of benefits associated with serious video games may outweigh these concerns (Gee et al., 2003; Kokol et al., 2020; Whyte et al., 2015). Firstly, the adaptive nature of video games allows for the potential to eliminate the limitations of traditional social skills training programs as these applications are more cost-efficient (e.g., less travel, lower program implementation costs, greater flexibility), ensure high program fidelity through the elimination of human error, and allow for greater opportunity to reach a wider range of participants including those in rural locations or other barriers (Craig et al., 2016; Ludlow, 2015; Parson & Mitchell, 2002; Standen & Brown, 2005).

Secondly, this adaptive nature also means that the settings in which the game occurs as well as the teaching content delivered can be individualized and can allow for more realistic settings for participants to practice their social skills in without fear of failure (Craig et al., 2016; Ludlow, 2015). This level of customizability is linked to higher levels of generalizability of the



learned skills to outside settings which is a known gap in traditional training programs for social skills (Craig et al., 2016; Ludlow, 2015; Parson & Mitchell, 2002; Standen & Brown, 2005).

Third, video games appear specifically well-suited to support adolescents with social skills deficits. The increased levels of motivation and engagement as a result of in-game elements such as incentive systems, visual aesthetics, game mechanics, narratives or fantasy, challenges, and levels of mystery (e.g., Gee, 2003, Malone, 1981, Loftus & Loftus, 1983), can be used to increase intervention engagement and retainment for this difficult to reach age group (Farris et al., 2019; Plass et al., 2015). This is an important benefit to note as adolescents are currently overlooked in the existing interventions despite the clear need for training programs geared towards individuals in this sensitive period of brain development and increased social functioning demands (Steinberg, 2014).

Fourth, video games are well positioned to provide support to individuals with social skills deficits by allowing for the training of underlying cognitive and socio-emotional abilities that have been identified as foundational for the overall development of social skills (Cordier et al., 2015; Kilford et al., 2016). In the past, several researchers have identified positive changes to both cognitive and socio-emotional abilities are possible as a result of video game play (e.g., Bavelier et al., 2012; Craig et al., 2015; see also Kokol et al., 2020). This combined with the adaptive nature of video game development will allow for this platform to build and include game elements targeting these underlying skills. Furthermore, the flexibility associated with video game development and implementation also allows for the potential to address another concern raised in the literature on social skill as some researchers highlight the importance of tailoring interventions to the specific social skills deficits identified for an individual (Gresham, 2016).

In response to the call for a new way of intervening in social skills development, this chapter details the process of developing a video game based social skills intervention. This chapter is divided into two parts. In the first part, detailed information about the development process of a theory driven video game based social skills intervention will be discussed. This will include information about the development team and the decisions that were made throughout the development process. The second part of the chapter will focus on the initial implementation of this game as an intervention. Trends found in the data collected during this implementation round will be discussed and recommendations for subsequent implementations of the intervention will be highlighted. Overall, this chapter will add to the existing body of literature on social skills interventions and serious games by providing information on how to develop and implement theory driven interventions in the future.

### **Part One: Development Process**

#### **Development Team**

The development of the theory driven video game project was a collaboration between two research teams from the University of Alberta including the Alberta Clinical & Community-Based Evaluation Research Team (ACCERT), led by Dr. Pei, and the Technology and Learning Sciences Lab (TALS), led by Dr. Boechler.

The project originated from the identified need for an alternate method of intervention delivery for adolescents (specifically those with Fetal Alcohol Spectrum Disorder; FASD) based on previous research, conducted by the ACCERT team, on adolescent-based intervention highlighting difficulties with high attrition and limited intervention adherence (Spaans, 2014). A review of the available literature on adolescent intervention suggested the use of technology and

specifically for adolescents with social skills deficits (e.g., Gee, 2003; Mitchell et al., 2007; Plass et al., 2015; Prensky, 2003; Stichter et al., 2014).

As a result, a collaboration was formed with researchers from TALS who provided expertise in creating virtual learning environments (VLEs) and game-based learning theory. This team had previously created several serious games aimed at teaching specific skills to university aged students (e.g., Boechler et al., 2013; Dejong et al., 2011). Together the shared experiences and expertise of this team allowed for collaborative and evidence-based decision making throughout the different phases of this research project.

### **Intervention Constructs**

The development team first set out to outline the goal of the intervention as this has implications for the content included in the video game. Previous social skills interventions have shown effectiveness in targeting specific behavioral skills associated with social functioning such as general communication and emotional recognition skills (e.g., Craig et al., 2015; DeRosier et al., 2012; Kokol et al., 2020; Sanchez et al., 2017; Serret et al., 2014). The current intervention development, however, focussed on building content based on social skills development literature, specifically the Social Information Processing (SIP) model (Crick & Dodge, 1994), as well as recent studies exploring the importance of training underlying cognitive and socio-emotional abilities as a basis for developing overall success in social interactions (e.g., attentional control, executive functions, and social cognition; Cordier et al., 2015; Crick & Dodge, 1994; Kilford et al., 2016), rather than targeting specific behavioral outcomes. The video game intervention discussed in this paper was initially developed specifically for youth with FASD and the chosen constructs therefore reflect commonly identified difficulties for this population (Kully-Martens et al., 2012). However, these identified areas are also often noted as

areas of concern in individuals with other neurodevelopmental disorders (e.g., ADHD and ASD). Based on these literature reviews, a total of five constructs were selected to be the focus on training for the intervention: sustained attention, inhibition, metacognition, perspective taking, and emotion regulation. A brief overview will be provided regarding the relationship between these constructs and overall social skills development.

### ***Sustained Attention***

Researchers have examined the mediating and moderating factors associated with poor social functioning for decades and attentional abilities are commonly found to have negative short- and long-term effects on social relationships (Andrade et al., 2009; Mahmood et al., 2018). Attentional control is a complex cognitive construct that includes several types of attention including sustained attention. Attentional abilities in general are thought to be linked to social functioning (Andrade et al., 2009), however, sustained attention has been specifically linked to social skills development in several studies (Andrade et al., 2009). Sustained attention can be defined as the ability to maintain attention for an extended period of time and individuals who struggle with sustained attention may therefore appear to wax and wane in their attention (Corkum & Siegel, 1993). Sustained attention is thought to impact social functioning in several ways. First, sustained attention difficulties could impede an individual's ability to maintain focus during a conversation or social interaction. Secondly, individuals who struggle to maintain their attention during social interactions may miss social cues (Andrade et al., 2009). This can impact the reciprocity required for social functioning. Lastly, attention is also a signal of social interest. Individuals who show varied levels of attention during social interactions may appear as disinterested which can lead to perceived social incompetence (Dodge & Pettit, 2003).

Other forms of attentional control such as selective attention have also been found to be linked to social functioning, however, as mentioned above the video game was originally designed specifically for individuals with FASD and sustained attention is a known common deficit for this population (Kully-Martens et al., 2012) thereby making it a suitable training construct within the game environment. In addition, sustained attention is also a common difficulty for youth with other disorders such as ADHD (Kooistra et al., 2010) and anxiety related disorders (Forster et al., 2015).

### ***Inhibition***

Inhibition refers to the mental process of exercising restraint upon behavior (Barkley, 1997). Some definitions of inhibitory control further specify this process to include the ability to deliberately retain “an automatic response in order to activate a less predominant response” (Hubert et al., 2017 p. 59). In social situations, individuals must pay attention to the verbal and nonverbals included. They are then required to select and act on socially acceptable behaviors and inhibit irrelevant behavioral responses (Crick & Dodge, 1994; Lemerise & Arsenio, 2000). Individuals who struggle with inhibitory control may not consider all social cues and rules in these situations, and they can therefore appear more socially dysregulated which may interfere with the perceived level of social competence and future social inclusion (Crick & Dodge, 1994; Hay et al., 2004; Walcott & Landau, 2004). Inhibitory control deficits have been linked to several negative social behaviors such as increased aggressive and disruptive behaviors (for review, see Hubert et al., 2017). Higher levels of inhibitory control on the other hand have been linked to several positive outcomes such as improved academic performance as well as overall psychosocial well-being (Anzman-Frasca et al., 2015).

Inhibitory control is a cognitive process often impacted in individuals with FASD (e.g., Kooistra et al., 2010) and was therefore selected as a training construct. However, researchers have also found this deficit to be common for other populations as well including individuals with ADHD (Barkley, 1998), ASD (Geurts et al., 2014), Tourette's Disorder (Morand-Beaulieu et al., 2017), obsessive-compulsive disorder (OCD) (Harsanyi et al., 2014), Posttraumatic Stress Disorder (Falconer et al., 2008), anxiety (Wood et al., 2001), and depression (Richard-Devantoy et al., 2012).

### ***Metacognition***

Metacognition was originally referred to as the “knowledge or cognition about cognitive phenomena” (Flavell, 1979, p.906). Today, the term is more commonly known as thinking about thinking and consists of two components (1) knowledge of cognition, and (2) regulation of cognition (Van Overschelde, 2008). This means that the individual has knowledge about their cognitive processes, abilities, and strategies, and that the individual can regulate the application of these strategies, monitor and evaluate the performance and eventual adjust future responses based on feedback (Whetstone et al., 2015).

According to the Social Information Processing (SIP) model (Crick & Dodge, 1994), metacognition, is an important component of successful social interactions, as individuals need to monitor and evaluate their chosen social action to apply this learning to continue the social interaction. Metacognition has also been linked to an increased interpersonal sensitivity (e.g., ability to perceive what other people are thinking, wanting, and feeling) (Whetstone et al., 2015). Researchers have shown that individuals with deficits in metacognition are less likely to accurately interpret others' behaviors and feeling which increases the likelihood of inappropriate or undesired social behaviors (Ames & Kammrath, 2004). Several training programs for

metacognitive strategies programs have been developed over the past decade and have been linked to improvements in academic performance as well as social interactions (Ames & Kammrath, 2004; Whetstone et al., 2015). These training programs typically consist of modeling, direct instruction, and practice modules for the desired metacognitive strategies.

Deficits in metacognition are frequently found in the FASD population and some research studies have resulted in positive impacts of strategy training programs for these individuals (Kerns et al., 2017; Makela et al., 2019). Similar deficits are found in individuals' ability to use metacognitive processes within the ADHD population (Barkley, 1997) as well as for individuals diagnosed with generalized anxiety disorder (Wells, 1995), and schizophrenia (Arnon-Ribenfeld et al., 2017). Interventions for this deficit and these populations have been developed and evaluated and although the overall effectiveness of these programs remains dependent on the implementation, some review studies suggest that metacognitive interventions are likely to be effective (Philipp et al., 2019; Saenz et al., 2019).

### ***Perspective Taking***

Perspective taking is generally referred to as one's ability to put themselves in another person's shoes or to understand the mental state of others (Premack & Woodruff, 1978) and is considered important during social interactions as "it facilitates the anticipation of other people's thoughts" (Dixon & Moore, 1990 p.1502) making the social interaction more predictable for the individuals involved. This ability is connected to the concept of Theory of Mind (ToM) and is known to start developing during the preschool years and continues into the school age years (Premack & Woodruff, 1978). Once developed this skill allows individuals to interpret verbal and nonverbal cues during social interactions. Perspective taking should be differentiated from another social cognitive concept called empathy as this can be defined as one's affective

response to another person's emotional state (Eisenberg et al., 2006). Both perspective taking and empathy are related to social interactions and social skills but with perspective taking being the required basis for developing empathy. Deficits in Theory of Mind, or perspective taking are common for individuals with social skills difficulties and specifically individuals with ASD (Baron-Cohen et al., 1985); however, individuals with FASD are known to also struggle with perspective taking (Rasmussen & Bisanz, 2009; Stevens et al., 2015).

### ***Emotion Regulation***

In addition to knowing and understanding how other people feel it is also important to recognize and regulate one's own emotional state and respond accordingly during social situations (Eisenberg et al., 2010). Emotion regulation can be defined as the processes "used to manage and change, if, when, and how (e.g., how intensely) one experiences emotions and emotion-related motivational and physiological states, as well as how emotions are expressed behaviorally" (Eisenberg et al., 2010 p.497). These processes are thought to develop rapidly during the early years of life as children learn to regulate themselves rather than relying on others to calm them (Eisenberg et al., 2010). This development is said to be influenced by environmental (e.g., modeling, feedback) and biological (e.g., temperament, executive functions) factors and is shown to be linked to long term outcomes for individuals (Eisenberg et al., 2010).

The ability to regulate one's emotions and behaviors associated with this is highly linked to social interactions and associated social skills. Frick and Morris (2004) noted that emotion dysregulation can impair the development of social cognition as it may interfere with an individuals' ability to process social information due to the correlation between emotions and executive functions. Emotional arousal is said to sharpen and strengthen communication between different parts of the brain often highlighting executive functions including thinking abilities and



attentional control (Blair & Raver, 2015). However, when individuals experience high levels of emotional reactivity, cognitive control and resources can be disrupted. This “shutting-down” experience of the higher-order cognitive skills impacts social functioning as these are also the processes required for social skills (e.g., attentional control, inhibition). Furthermore, it is likely that difficulties with emotion regulation impact the quality of social interactions with peers and adults due to an established link between emotion dysregulation and externalizing behaviors such as reactive aggression (Eisenberg et al., 2010).

Due to the known importance of emotion regulation development, there is an increased interest in developing evidence-based interventions targeting dysregulation. Existing interventions usually include a focus on executive function training in addition to emotion identification and regulation skills and have shown some effectiveness for preschoolers and school-aged children. (Eisenberg et al., 2010).

These interventions have been targeting some specific population such as individuals with ADHD (Bunford et al., 2015). Bunford and colleagues indicate that there are several factors impacting emotion regulation abilities for this population as individuals with ADHD tend to struggle with 1) emotional inflexibility, 2) slow returns to an “emotion” baseline, 3) tend to have a low threshold for emotional excitability, impatience, and 4) show difficulty controlling the associated behaviors (2015). The same researchers also found links to these difficulties and individuals with depression (Bunford et al., 2015). Common deficits in regulation abilities are also found in individuals with FASD (Kable et al., 2016; Temple et al., 2019;).

### **Gamification of Intervention Constructs**

The five training constructs described above provided the development team with guidelines in terms of the content to include in the intervention. As this intervention aimed to

draw from benefits associated with virtual environments and game-based learning theory, additional steps were required to transform the intervention into a virtual gaming format. Previous interventions aimed at improving social skills using virtual environments provided standard social skills training programs to individuals in a virtual environment (e.g., the same program as in real-life applied in a virtual environment; Kandalaf et al., 2013; Stichter et al., 2014). However, the intervention discussed in this paper aimed to use game-based learning principals to impact cognitive and social-emotional constructs related to social functions. The chosen constructs described above therefore required to be gamified to be present in the video game. Gamification describes the process of taking something existing (e.g., ways to improve sustained attention skills) and integrating game mechanics into it to enhance motivation, participation, and engagement (Burke, 2014).

Motivation and engagement are one of the main benefits associated with game-based learning as a motivated learner is more likely to partake in challenging activities, to be actively engaged, and to adopt a deep approach to learning (Schunk et al., 2008). A narrative is a known game element that is linked to increased motivation (Gee, 2003; Sanford et al., 2015). An overall storyline was therefore constructed for the entire intervention to increase motivation while also providing a platform to include additional gamified training constructs.

### ***Storyline***

The overall storyline created matches popular video games as it requires a team of participants to work together as special agents to solve crimes. The storyline spans six intervention sessions, each referred to as a mission, and although participants are exposed to different activities in these six gaming sessions the overall goal and process remains similar. Sessions start off with “mission objectives”, followed by activities to be completed, and end with

a debriefing. The game activities were embedded into the storyline and require the participants to complete specific tasks requiring sustained attention, inhibition, metacognition, perspective taking, and/or emotion recognition (see Figure 3.1 for various screenshots of game locations and tasks).

**Figure 3.1a-d.**

*Various screenshots of game locations and tasks*



(a) Bird's-eye view of warehouse mission



(b) Mission objective screen



(c) De-activating alarm task



(d) Guard dog task

The storyline is introduced to the participants in their first mission and team introductions are completed using the participants chosen spy names rather than their real names. These introductions are facilitated by the “mission commander”, who is known to the participants as a member of the research team. The commander provides the participants with their mission goals, and they are told they will serve as his “eyes and ears” to gather information and report back at

the end of each mission. A research assistant also joins the game as an “undercover” participant to help facilitate some of the training objectives (see the progression of construct section for more details).

Due to the importance of the storyline and the game-tasks included in the intervention, an overview of the six missions will be provided below. At the onset of their first sessions, the participants are told that they are to investigate a carshop due to reports of ongoing illegal activity. The team is instructed to obtain evidence to link the carshop owner to the crimes. Game tasks related to this session include collaborating to escape guard dogs, opening a gate, disabling security cameras, and examining paperwork to locate incriminating evidence. The mission ends when the commander calls the team back and sends the collected evidence back to “headquarters”.

During the second mission, the team is told that the evidence was examined by agents at the headquarters, who were able to link the carshop owner to the crimes. The team’s new mission is therefore to apprehend the criminal and find out more about his potential partners. They must break into a building, disrupt the phone lines, deactivate alarms, and uncover more evidence.

The storyline continues in the third mission when the team is asked to investigate a warehouse owned by the same criminal from the previous mission, as it is suspected that this location is used to print and distribute counterfeit money. For this mission, the team needs to dust the warehouse for fingerprints and decipher the distribution plans found inside. According to the agents back at headquarters, the criminals found out that they are being investigated and have taken hostages. The team therefore needs to free the hostages and arrest those responsible during the fourth mission. This requires them to engage in some familiar activities such as deactivating

alarms in addition to new tasks including strategizing together to decide on which room to raid, completing a maze to go unnoticed, and assisting hostages.

For the fifth mission, the team is told that the criminals they arrested work for an even bigger criminal and that it is important to return to their earlier locations to gather more evidence. As a result, the team returns to carshop, and they must find a new way inside. They also need to work together to obtain access to hidden files that are send back to headquarters. In the sixth and last session the team is tasked with arresting the mastermind criminal who is hidden somewhere in the warehouse. No further details are provided, and the team must therefore work together to complete the mission successfully. They are required to interact with a non-playable character to obtain information, find a hidden basement room and solve a series of puzzles to open locks.

Some of the locations and tasks were repeated in the storyline to help simplify the development process. However, when locations or tasks were re-introduced to the participants small changes were made by the development team to prevent repetition. For example, when the team returns to the carshop, the storyline states that the criminals increased the security to protect their building resulting in a need for the team to find an alternative way of entering the building.

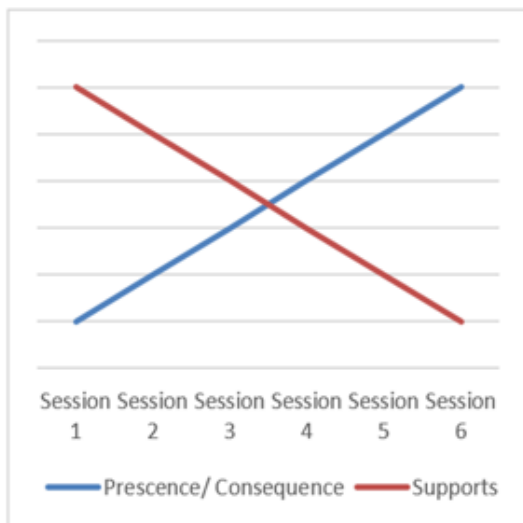
### **Progression of Training Constructs**

In addition to gamifying the constructs and the creation of a storyline, the development team also designed a progression for the training constructs meaning that as the intervention progresses, there is an increased presence of training activities or an increase in difficulty associated with the training activity. This progression allows for the participants to continue to practice the skills while building on previous learning. This approach is commonly used in virtual environments and allows for the scaffolding of the participants' learning which has shown

to be specifically beneficial when providing social skills training (Kerr et al., 2002). The designed progression also included a reduction in the amount of support provided to the participants to complete the required training activities. At the onset of the intervention, participants receive higher levels of supports and information to ensure that the skills are understood and trained as intended. As the intervention continues, this support is gradually reduced to allow for independent practice and solidification of the learned skill (see Figure 3.2 for a visual representation of the progression). This process was completed for each construct separately and specific gamified tasks were assigned (see Figure 3.3 for an overview).

**Figure 3.2**

*Progression of Constructs*



**Figure 3.3***Progression Overview per Construct*

Construct	Session 1	Session 3	Session 6
Sustained Attention	6 different tasks & 1 min DTC	3 different + 1 similar & 3 min DTC	2 similar tasks & 6 min DTC
Inhibition	1 passive distant distractor	1 passive distant & 1 passive near distractors	2 active near distractors
Metacognition	6 prescribed tasks	3 prescribed + 1 strategy related tasks	2 strategy related tasks
Perspective Taking	Immediate + Nonconsequential + Identification and Action	Delayed + Nonconsequential + Identification	(Extinct) + Consequential + Identification + Action
Emotion Regulation	Commander directs all to chill out room	RA models + Commander prompts	Monitor only

Socio-Emotional Abilities

Cognitive Abilities

***Sustained attention***

For this intervention, the cognitive construct of sustained attention was incorporated in the game by adjusting the level of exposure and intensity of the construct. The game was designed to start off relatively easy and to slowly become more difficult in terms of attentional requirements. This was done by slowly decreasing the number of tasks (first session is six activities and the last session comprises of two activities) the participants must complete thereby making them longer and inherently more attention intensive and requiring higher levels of sustained attention. In addition, the activities required to be completed by the participants, were designed to start off as all novel tasks which is known to increase engagement and attentional control. As the intervention and the storyline progress the tasks were designed to become more similar to previous tasks thereby putting a larger demand on sustained attention. Lastly, one mini game (Designed Time to Completion game, DTC) was built in per mission during which the

participants were required to sustain their attention to proceed with the following tasks. The mini games varied in the requirements but were generally designed to be simple tasks (e.g., pressing a series of buttons to unlock a tool). The time restriction linked to these mini games was also designed to increase throughout the intervention leading to the training of this specific skill. For example, during the first intervention session, the participants complete a mini game requiring one minute of sustained attention which was increased to a six-minute requirement by the end of the intervention. These mini games varied in the required tasks but were incorporated into the storyline. One of the mini games requires the participants to continuously select a series of buttons on their Xbox controller to hack the security system while another requires the selection of arrows to find a way through a maze.

### ***Inhibition***

Within the game, participants were trained on the concept of inhibitory control through a slow increase in exposure to the number of distractors. Distractors are known to be enticing to individuals particularly when they are active in nature (allow for interaction such as an object that can be pushed) and when they are nearby (DeRosier et al., 2012). The game therefore started off with passive (e.g., objects that do not allow for interaction) distractors that were placed far away from the participants. As the intervention progresses the type of distractor changes to be active, meaning that the participants are then able to interact with the object. In addition, as the intervention sessions progress, the distracting items are placed near the participants increasing the likelihood of distractibility. This increases the inhibitory control requirements as engagement with the objects will interfere with the game objectives (e.g., participants who are distracted by the objects may take longer to get to the end point). Furthermore, the number of distractors also increased to increase the attention demands placed on the participants. The inhibition construct is



therefore not linked to specific game tasks; however, the distractor items were designed to match the ongoing storyline and the locations of the missions (e.g., billboards, vending machines, computers).

### ***Metacognition***

For this specific construct, the progression takes place in terms of the type of tasks required. At the onset of the intervention, participants complete prescribed tasks only. During these tasks detailed instructions are provided to the participants on how to complete the game activities and how to work together to ensure success. As the intervention progresses these instructions lessen, and ultimately participants are required to engage in strategy related tasks. For these tasks, they are provided with vague instructions thereby requiring them to plan and evaluate their own game strategy as well as a team strategy. For example, during the first session, the participants are told to enter the carshop by first cutting the electricity to the gate. They are provided information on where they can find access to this. In the last mission, the only information provided to the team is to obtain access to the building.

As the development of the game progressed, another metacognitive training activity was added by including a debrief at the end of each intervention session. During this debrief, the commander guides the participants through an evaluation of the strategies used during the sessions.

### ***Perspective Taking***

Perspective taking is the first socio-emotional training construct included in the intervention and required additional thought transforming into gaming activities as it requires several steps. First, a person must have the recognition that someone else might have different thoughts or feelings than themselves. Secondly, they must then take action that corresponds to

that recognition. To effectively train this skill, the intervention started off with the modelling of both steps. Slowly, the amount of modelling is reduced and replaced by prompts on both how to recognize as well as act when there is a difference in perspectives. Next, the prompting was slowly removed by switching from immediate to delayed prompting. Ultimately, the goal was for participants to apply perspective taking approaches spontaneously when they were presented in the game format.

Opportunities for modelling of perspective taking skills were built into the game sessions through specific game activities. Initially the modelling was geared towards the “undercover” agent (played by a Research Assistant; RA) who would follow a script highlighting the steps of perspective taking. Certain tasks were also built into the storyline to create moments of perspective taking. For example, in one mission the undercover agent is provided with a photograph of the criminal the team is tasked to arrest. The undercover agent therefore has information unknown to the rest of the team.

Initially the modelling of the steps related to perspective taking is done immediately and had no consequence to the actual game play. Meaning that when the action associated with perspective taking was not completed by the participants it did not interfere with the continuation of the game. As the sessions progress, there is a change in how quickly the modelling or prompting of perspective taking skills is applied and there is an increased importance of the action to the completion of the game session. For example, noticing and acting on the perspective of someone else may provide a bonus to the team or it may allow them to continue to the next game activity thereby placing an increased importance on this skill.

Furthermore, the participants receive their instructions from their mission commander. This character was needed to provide information to the team and to serve as a potential

mediator in case of difficulties; however, the participants' interactions with the commander also serve as ongoing perspective taking training opportunities throughout all the missions. The team is told that the commander is located back at headquarters and is unable to see what occurs during their mission. For the investigation to go according to plan, they are told to act as the commander's "eyes and ears" and to report back to him throughout and at the end of each mission. Certain tasks were also included that require participants to report specific information back to the commander prior to being able to continue the game. For example, one of the missions requires the participants to share specific information about the cars seen on location to the commander before he can send them the help they need to continue to the next task.

### ***Emotion Regulation***

The idea of training a socio-emotional construct through modeling was also used for the last concept of emotion regulation. This was a more challenging construct to gamify as it requires emotional arousal from the participants which can be inherent to the concept of video games but is more challenging to control (Plass et al., 2015). The training activities were therefore designed to include role-modeling by the undercover agent as their actions were within the control of the development team. The undercover agent provides modeling of the steps required to move from emotional dysregulation/arousal to emotional regulation. This modelling was reduced over time with a progression from verbal to non-verbal modelling. For example, at the onset of the intervention, the undercover participant verbalizes frustration and receives prompts from the game commander on how to regulate including deep breathing and grounding exercises. In later sessions, the undercover participant shows frustration by running around or making noises and then engages in calming down activities on his own.

A second component of the emotion regulation training construct was the inclusion of a “chill out room”. This was a specially designed virtual space where participants could retreat to when feeling overwhelmed during game play. This room was accessible to the participants by a simple click on their controller. At the onset of the intervention, the purpose of this space was explained to the participants and suggestions were made for ways to regulate in this space (e.g., deep breathing, counting). Throughout the sessions, the commander also provided prompts to participants who appear emotionally dysregulated by reminding them of the option of the chill out room as well as the calm down strategies. During the first sessions the commander made these prompts immediately but delayed this response as the sessions progressed.

### **Materials Required**

The development and the playing of the intervention involved several requirements in terms of hardware and software.

#### ***Software***

The game was developed by the researchers at the University of Alberta using the Unreal Engine 4 game development platform. This platform was chosen as it allowed for the possibility of creating a private virtual space that would only be accessible to the participants while keeping the costs of development down. The research team had previous experience with virtual environment developments in the Second Life platform; however, it was decided that the Unreal Engine 4 provided graphics that were closer to the desired effect as the appearance of true immersion into the virtual environment is said to be linked to overall impact of the intervention (Gee, 2003).

Development of the game underwent several versions and test runs were first conducted with adult video game players in the university community prior to the initial implementation

phase of the intervention with participants. Researchers also worked on creating a secure server within the university's network to allow for the intervention to run on a provincial level. This allowed for a broader inclusion of participations around the province but required additional testing to ensure the security of the broader network capabilities.

Development difficulties were encountered throughout the process of the project, specifically regarding the interaction opportunities between all participants involved in the intervention. As the intervention had the goal of impacting social skills and social functioning, the research team focussed on increasing the opportunity for social interactions while maintaining the game-based learning principles such as the narrative. Ultimately, it was decided to include an external software program to allow participants to speak freely to each other. For the initial implementation of the intervention, participants were required to download TeamSpeak3, an online voice chat application. The opportunity for verbal communication was chosen over written (which is common in computer games) to reduce the participants' cognitive load while engaged in the game (Erlandson et al., 2010).

### ***Hardware***

Computer hardware was required for the development of the intervention but also for the playing of the intervention by the participants. Participants' computers were checked for a certain level of processing speed, graphics cards, memory, and internet connection and loaner laptops were provided when needed. In addition, each participant was provided with an Xbox One™ controller to standardize the controls for game play. This allowed the commander of the game to provide unified directions that were familiar to all players (e.g., "press the "x" button"). Lastly the game also included a headset that was provided by the researchers to limit potential difficulties with communication.

## **Part Two: Initial Implementation**

The initial implementation of the game was conducted on a small sample of participants to ensure proper functioning of the game and game mechanics in addition to testing the fit with the population and to establish a level of feasibility in intervention delivery.

As mentioned earlier, the game was initially developed for adolescents with Fetal Alcohol Spectrum Disorder (FASD). FASD is a diagnostic term that describes a range of significant cognitive, behavioral, and physical impairments resulting from prenatal alcohol exposure (Cook et al., 2016). Challenges with social functioning and social skills are also widely reported for this population (e.g., Coggins et al., 2007; Greenbaum et al., 2009; Kerns et al., 2016; Kjellmer et al., 2013; Lindinger et al., 2016; McGee et al., 2009; Quattlebaum & Connor, 2013; Rasmussen et al., 2011; Thomas et al., 1998; Whaley et al., 2001). As a result of these known impacts, some interventions targeting social functioning have been developed for this population; however, most of the research examining social interventions for individuals with FASD ranges from scarce for children to non-existent for the adolescent age group. The theory-driven video game based social skills intervention was geared to support this population and specifically the adolescent age group.

The use of technology or games in interventions for individuals with FASD is not a new idea. Previously, researchers have used video games with children with FASD to successfully improve attention abilities and executive functioning (Pei & Kerns, 2012), sustained and selective attention, spatial working memory, reading and math fluency (Kerns et al., 2010), and to teach fire and street safety (Coles et al., 2007; Padgett et al., 2006). In addition to these findings, Pei and Kerns (2012) also noted that the use of the video games resulted in high levels of engagement. The purpose of this current exploratory study was therefore to build upon this

emerging data and determine the potential impact of a video game-based intervention on the social skills and underlying cognitive abilities for adolescents with FASD using a case study design.

### **Participants**

Prior to starting the study, ethics approval for the project was obtained from the institutional review board at the University of Alberta. Recruitment of participants was based on snowball sampling in which the information was distributed to participating local and provincial organizations providing services to individuals and families with FASD. Three participants between the ages of 11 and 14 and with a FASD diagnosis then participated in the study. These participants were selected to participate based on having: (a) a diagnosis of FASD, (b) reported difficulties with social functioning (as reported by caregivers), and (c) a willingness to participate, in addition to the absence of significant brain injuries or a co-morbid diagnosis of Autism Spectrum Disorder (ASD). A description for each of the participants, referred to by their assigned pseudonym, can be found below and in Table 3.1.

#### ***Brandon***

Brandon was a 14-year-old African Canadian male with a diagnosis of Alcohol Related Neurodevelopmental Disorder (ARND) which falls under the FASD diagnostic umbrella, based on the Canadian 2005 diagnostic guidelines (Chudley et al., 2005), as reported by his caregiver. He was diagnosed at the age of six and was in foster care for a short period prior to his adoption. His adoptive mother indicated several social struggles for Brandon including a limited number of friends and social interactions.

### *Victoria*

Victoria was an 11-year-old female with a diagnosis of FASD, as reported by her caregiver, and of Caucasian and Metis background. She was diagnosed at the age of 9 and was previously in foster care. Victoria now lives with her parental grandmother and has occasional visits with her biological father. Her grandmother reported several difficulties for Victoria, including difficulties with appropriate social behaviors. No cognitive testing was completed for Victoria due to her geographical location in relation to the location of members of the research team.

### *Tyler*

Tyler was an 11-year-old Caucasian male with a diagnosis of FASD, based on the new Canadian 2016 diagnostic guidelines, as reported by his caregiver. He was diagnosed at the age of ten years old. He currently lives with his biological mother who reported Tyler's main difficulties to be related to not paying attention and not thinking before acting or speaking when interacting with peers or others.

**Table 3.1**

#### *Participant Characteristics*

Character Name	Ethnicity	Age	Diagnosis	Age at Diagnosis	Caregiver	Global IQ <sup>a</sup>	Verbal IQ <sup>a</sup>	Visual IQ <sup>a</sup>
Brandon	African American	14	ARND	6	Adoptive parent	75	69	89
Victoria	Caucasian /Metis	11	FASD	9	Biological grandparent	N/A	N/A	N/A
Tyler	Caucasian	11	FASD	10	Biological parent	73	77	75

<sup>a</sup>as measured by the WRIT (Glutting et al., 2000)



**Setting**

All three participants participated in the study from their own homes located in different areas throughout Alberta, Canada. Within their homes, they were asked to find a private space with limited distractors (e.g., home office or bedroom). As a result of limited opportunities for a quiet space in his house, one of the participants chose to participate in the game in the office setting of his caregiver.

**Materials*****Software***

Prior to the first intervention session, participants were required to download the game as well as TeamSpeak3, a free online communication system. For some, the caregivers of the participants aided with the downloads and where needed members of the research team were able to assist through verbal guidance or through a remote desktop connection during which they were able to download the required programs. This support was available for the participants regarding any technical difficulties associated with the intervention throughout all sessions (e.g., sounds not working, lags in the video game play).

***Hardware***

To run the video game, developed in the Unreal Engine 4, a computer or laptop with a certain level of processing speed, graphics cards, memory, and internet connection was required. Two out of three participants used their personal devices to participate in the study while the third youth was provided with a loaner laptop. In addition, the participants were provided with an Xbox One™ controller and a headset which allowed them to communicate to each other. All participants reported familiarity with both Xbox One controllers as well as headsets and no additional instructions were therefore provided.

## Measures

### *Demographic Questionnaire*

Caregivers completed a brief researcher-constructed demographic form to collect information about the participant's age, grade, diagnosis, prenatal history, placement history, and current living situation, as well as caregiver factors such as the relationship to the adolescent, marital status, level of education, occupation, and household income bracket.

### *Wide Range Intelligence Test (WRIT)*

The WRIT (Glutting et al., 2000) provides a brief and reliable measure of verbal and nonverbal cognitive abilities for individuals ages four to 85. A total score is provided for an estimate general IQ in addition to scores for verbal (crystallized) IQ and visual (fluid) IQ ( $M = 100$ ;  $SD = 15$ ). Internal consistency reliability (.84-.90 for main scales) test-retest reliability (>.90), and inter-rater reliability (.98 to .99) for the main WRIT scales is high. Examination of the psychometric properties also shows acceptable construct, concurrent, and predictive validity (WISC-III, 0.90 and WRAT; .36 to .64) (Glutting et al., 2000). This measure was only provided to participants during the pre-testing phase.

### *Social Skills Improvement System (SSIS) Rating System*

The SSIS-RS is a questionnaire that measures social skills in terms of frequency of occurrence (e.g., how often a child is helpful or polite) and behaviours relating to self-control, responsibility, cooperation, empathy, and assertion (Gresham & Elliott, 2008). For the purposes of this research both the parent and youth self-report versions (ages 8-12 and 13-18) were used, and the focus was placed on examining the two main scales of social skills and problem behaviors ( $M = 100$ ,  $SD = 15$ ). The SSIS rating scales are normed using a large representative US sample ( $N = 4700$ ) and overall high levels of internal consistency reliability are found across

the different scales and subscales (ranging between .75 and .98). Medium test-retest reliability was also found across both the parent and the self-report measure (ranging from .59 to .81) (Gresham & Elliot, 2008).

***Delis-Kaplan Executive Function System (DKEFS)***

The D-KEFS (Delis et al., 2001) is designed to measure a broad array of executive functions including problem-solving, planning, cognitive flexibility, and inhibition, and can be used with individuals ages eight to 89. The measure includes nine subtests and is co-normed using a large, non-clinical, representative US sample. For each subtest, raw scores are converted to scaled scores ( $M = 10$ ;  $SD = 3$ ), with lower scores indicating poorer performance. Moderate to high split-half reliability (0.62 - 0.86), and test-retest reliability have been determined for the CWIT (Homack et al., 2005). For the purposes of this study, the participants completed five D-KEFS subtests: trail-making test, design fluency test, color-word interference test, twenty questions test, and tower test.

***Conners Continuous Performance Test 3rd Edition (CPT-3)***

The Conners CPT-3 is a computerized assessment of attention-related difficulties in individuals ages eight years and older. Test administration requires participants to respond to letters displayed on a computer screen, except for the letter X, by pressing on the space bar which provides information about inattentiveness, impulsivity, sustained attention, and vigilance. Obtained raw scores are converted to t-scores based on a normative sample (Conners, 2014;  $M = 50$ ,  $SD = 10$ ). The third edition of this test is normed on representative US sample ( $N = 1400$ ). An examination of the psychometric properties shows high internal consistency (.92 - .94) and moderate test-retest reliability (.67) (Conners, 2014).

## **Procedures**

The initial implementation of the intervention served a very exploratory function to begin to assess both the feasibility and the potential impact of the developed game. As a result, a case study design was chosen to best represent this data collected to allow for an in-depth examination of the individual impact for the three participants while also helping to determine if future studies in this area are warranted.

Upon recruitment of the three participants, pre-testing occurred within three weeks of the intervention start date. During this period, the caregivers completed the demographics questionnaire and the parent version of the SSIS while the participants completed the SSIS-self report, the CPT-3, five subtests of the DKEFS, as well as the WRIT. The adolescents then participated in the video game twice a week for three weeks. The research team made the decision to run the intervention twice a week rather than once weekly due to the intervention taking place just prior to summer break. Running two sessions a week allowed for the intervention to be completed prior to the start of summer break with the intent not to impact attendance rates. The average length of game play per session was 28.5 minutes (range 25 to 33 minutes). Within two months of the last intervention session, post-testing took place during which the participants and the caregivers completed the same measures again except for the WRIT and the demographics questionnaire. All participants were provided with two \$10 iTunes gift cards and the caregivers received a \$25 Indigo gift card for their participation.

## **Results**

Analysis of the pre and post SSIS reports was conducted using clinically significant and reliable change index (RCI) calculations (Jacobson & Truax, 1991). To calculate the RCI, the standard error of measurement (SEM) found in the manuals for the CPT-3 and SSIS were used

(Conners, 2014; Gresham & Elliot, 2008). The SEM for the DKEFS scales were derived from the reliability coefficients and standard deviations based on the normative age group for this participant pool (Delis et al., 2001). Once the RCI was calculated, change scores greater than 1.96 were considered statistically significant and clinically meaningful.

### **Brandon**

An overview of Brandon's change scores can be found in Table 3.2.

**Social Findings.** Brandon started the intervention with self-perceived social skills in the *Above Average* range and maintained this view upon completion of the intervention. His perceived level of problem behaviors; however, significantly increased over the course of the intervention. It should be noted that this higher score still places him in the *Average* range. Next, Brandon's caregiver reported *Well-Below Average* social skills pre-intervention and the analysis showed a significant positive change after. Moreover, a positive significant reduction was also found for the reported problem behaviors.

**Cognitive Findings.** When examining Brandon's pre- and post-cognitive data on the DKEFS and the CPT-3 some reliable changes can be found; however, overall, his profile remains stable. Inconsistent findings were observed for the reliable changes noted in the CPT-3 administrations. Changes were observed in Brandon's error type on the CPT-3 indicating that he made significantly more omission errors post intervention which could point to increased inattention. However, improvement was noted in his response speed as this was observed to be more consistent during post testing which would indicate lower levels of inattention.

On the DKEFS only one reliable decrease was found on the number sequencing component of the Trail Making Task. Since Brandon obtained a score in the *Average* range for this task pre-intervention it is unlikely that this post-intervention score represents any difficulties

in math or number processing but rather points to other factors such as inconsistent effort or difficulties with inhibitory control.

**Table 3.2**

*Summary of Brandon's Results*

Measure	Scale	Pre-Score	Post Score	RCI	Reliable Change	
SSIS	<i>Social Skills – Self</i>	122	131	1.93	No	
	<i>Problem Behaviors – Self</i>	93	106	2.79	Yes*	
	<i>Social Skills – Caregiver</i>	69	79	2.36	Yes*	
	<i>Problem Behaviors – Caregiver</i>	139	130	-1.99	Yes*	
CPT 3	<i>Response Style (C)</i>	63	70	1.37	No	
	<i>Detectability (d')</i>	57	58	0.31	No	
	<i>Error Type %</i>	Omissions	69	81	3.54	Yes*
		Commissions	49	46	-0.88	No
		Perseverations	51	54	0.66	No
	<i>Reaction Time</i>	HRT	49	50	0.64	No
		HRT SD	60	54	-2.02	Yes*
		Variability	52	60	1.26	No
		HRT Block Change	49	53	0.88	No
		HRT ISI Change	48	43	-1.10	No
DKEFS	<i>Trail Making Test</i>	Condition 1 - Visual Scanning	1	1	0	No
		Condition 2 - Number Sequencing	9	1	-3.93	Yes*
		Condition 3- Letter Sequencing	4	1	-1.08	No
		Condition 4 - Number-Letter Switching	Invalid	1		
		Condition 5 - Motor Speed	7	8	0.56	No
	<i>Design Fluency</i>	Condition 1 - Filled Dots	7	6	-0.40	No
		Condition 2 - Empty Dots	7	5	-0.62	No
		Condition 3 – Switching	5	7	0.51	No
	<i>Color Word Test</i>	Condition 1- Color Naming	3	1	-1.03	No
		Condition 2 - Word Reading	1	1	0	No
		Condition 3 – Inhibition	2	1	-0.75	No
		Condition 4 -	1	4	1.58	No
	<i>Twenty</i>	Initial Abstraction Score	4	Invalid		
Total Weighted Achievement		9	Invalid			

<i>Tower Test</i>	Total Score	7	8	0.31	No
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Note. RCI = Reliable Change Index

\* reliable change detected

### **Victoria**

An overview of Victoria's findings can be found in Table 3.3. As stated previously, data was only collected on Victoria's social-emotional functioning due to her geographical location. Despite not being able to collect cognitive data for this participant, her participation in the intervention highlights an added value beyond data collected as this emphasizes increased accessibility to intervention participation for those in more remote locations.

**Social Findings.** Victoria started the intervention with *Below Average* perceived social skills and showed a significant change to *Average* social skills post intervention. Her caregiver also noted a change in her social skills improving from *Well-Below Average* to the *Below Average* category. Furthermore, her caregiver also indicated positive reliable change in her problem behaviors again moving her into a different indicator category and suggesting improvements in this area.

**Table 3.3**

*Summary of Victoria's Results*

Measure	Scale	Pre-Score	Post Score	RCI	Reliable Change
SSIS	<i>Social Skills – Self</i>	71	99	5.35	Yes*
	<i>Problem Behaviors – Self</i>	115	120	0.79	No
	<i>Social Skills – Caregiver</i>	65	74	2.12	Yes*
	<i>Problem Behaviors – Caregiver</i>	143	132	-2.16	Yes*

Note. RCI = Reliable Change Index

\* reliable change detected

## ***Tyler***

An overview of Tyler's findings can be found in Table 3.4.

**Social Findings.** Tyler started the intervention, believing to have *Well-Above Average* social skills and reported *Below-Average* skills post intervention. A significant change was also found in his reported level of problem behaviors with an increase noted post intervention.

Tyler's caregiver noted *Well-Below Average* social skills pre-intervention with a reliable increase post intervention (up to the *Below-Average* range). A small reduction in problem behaviors was also found; however, this did not meet the RCI criteria.

**Cognitive Findings.** When examining Tyler's pre and post cognitive data on the DKEFS and the CPT-3, several reliable changes can be found. Overall, the change findings on the CPT-3 represent a reduction in problems with decreased errors rates, increase speed, and more consistency in responding which could point to decreased impulsivity and increased attention. It should be noted that despite the reliable change in these scores, the identified difficulties remain at the clinically significant level. Furthermore, decreased information processing was also found which may suggest more difficulties with sustained attention.

On the DKEFS, reliable positive changes were also found three out of the four Color Word Test conditions suggesting potential improvement in inhibitory control. A reliable negative change was also found on the measure of Trail Making Test (Number Sequencing) which similarly to this change found for Brandon likely represents some difficulty with inconsistent effort or inhibitory control.



**Table 3.4***Summary of Tyler's Results*

Measure	Scale	Pre-Score	Post-Score	RCI	Reliable Change	
SSIS	<i>Social Skills – Self</i>	126	83	-8.22	Yes*	
	<i>Problem Behaviors – Self</i>	108	129	3.30	Yes*	
	<i>Social Skills – Caregiver</i>	57	72	3.54	Yes*	
	<i>Problem Behaviors – Caregiver</i>	150	145	-0.98	No	
CPT 3	<i>Response Style (C)</i>	52	49	-0.59	No	
	<i>Detectability (d')</i>	67	64	-0.92	No	
	<i>Error Type %</i>	Omissions	64	59	-1.47	No
		Commissions	63	63	0	No
		Perseverations	89	72	-3.76	Yes*
	<i>Reaction Time</i>	HRT	59	51	-5.14	Yes*
		HRT SD	90	78	-4.04	Yes*
		Variability	72	66	-0.94	No
		HRT Block Change	24	68	9.72	Yes*
		HRT ISI Change	58	48	-2.21	Yes*
DKEFS	<i>Trail Making Test</i>	Condition 1 - Visual Scanning	5	9	1.33	No
		Condition 2 - Number Sequencing	10	6	-1.97	Yes*
		Condition 3- Letter Sequencing	1	2	0.36	No
		Condition 4 - Number-Letter Switching	1	4	0.79	No
		Condition 5 - Motor Speed	7	10	1.66	No
	<i>Design Fluency</i>	Condition 1 - Filled Dots	6	10	1.62	No
		Condition 2 - Empty Dots	6	10	1.25	No
		Condition 3 – Switching	8	4	-1.01	No
	<i>Color Word Test</i>	Condition 1- Color Naming	1	7	3.09	Yes*
		Condition 2 - Word Reading	3	1	-0.98	No
		Condition 3 – Inhibition	5	9	2.98	Yes*
		Condition 4 - Inhibition/Switching	1	5	2.11	Yes*
	<i>Twenty Questions</i>	Initial Abstraction Score	8	11	1.59	No
		Total Weighted Achievement	9	9	0	No

<i>Tower Test</i>	Total Score	6	8	0.76	No
<i>Note.</i> RCI = Reliable Change Index					
* reliable change detected					

### **Discussion for Initial Implementation**

The purpose of this exploratory study was to test the theory-driven video game based social skills intervention for adolescents with FASD. The initial implementation phase was conducted to ensure proper working of the video game and game mechanics in addition to testing the game with the adolescent FASD population. Lastly, this phase also set out to provide preliminary evidence for feasibility and potential impact of this video game as a delivery platform for a social skills intervention. Data from this project will add to the limited existing literature for this population.

The results were presented in a case study format to highlight the unique outcomes for each adolescent. FASD presents with diverse patterns of brain injury, and it is therefore not surprising that the improvements are different for the individuals who took part in this study. Furthermore, the case study approach also allowed for consideration of the intra-individual variability that is often present for this population (Ali et al., 2018). Despite the expected diversity, three overall significant trends can be identified in this study that will aid further research in this area.

First, for all three adolescents, the caregivers reported reliable positive change for the adolescent's overall social skills. Furthermore, although not all change met the level of RCI, a positive trend was also found for caregiver reports in reductions of problem behaviors. Decreases in problem behaviors have previously been linked to increases in observed prosocial behaviors and overall social skills (Gresham & Elliot, 2008). Taken together, these trends suggest a potentially positive impact of the intervention on the youth's social skills and problem behaviors.

Second, the self-report results differed from the caregiver reports which is consistent with previous research on multiple informant discrepancies (de Los Reyes & Kazdin, 2005) as well as previous findings on the discrepancies between caregiver and adolescent dyads within the FASD population (Mariasine et al., 2014). This may represent a tendency for individuals with FASD to present themselves in a favourable light or a tendency for caregivers to focus on the difficulties experienced by the participants. Additionally, this discrepancy in reports may also represent limited self-awareness for the participants in terms of their social functioning and potential difficulties associated with this. Among the three adolescent reports, negative trends in problem behaviors were also found suggesting that these behaviors increased after the intervention. This may represent an increase in self-awareness as a result of the intervention. Some research has linked the concepts of perspective taking and metacognition to the development of self-awareness (Bach & David, 2006; Weil et al., 2013) which may potentially explain the negative trends found in this study. As both perspective taking and metacognition were trained constructs it could be that this led to increases in self-awareness for the participants and particularly to their understanding of their perceived difficulties.

Third, the cognitive scores obtained for two of the three participants, show some reliable changes, supporting the idea of training cognitive abilities within a video game setting. However, these changes were not consistent across participants despite the consistent positive caregiver social skills findings. FASD is a diverse brain injury which can result in different presentations of individuals' cognitive functioning as well as intra-individual variability (Ali et al., 2018). Social skills are also commonly said to be a composite of several cognitive and socio-emotional abilities and perhaps the fact that this current intervention targeted a broad number of functions may help explain the positive social skills results. It is also possible that the game impacted

social functioning for reasons other than the cognitive skills highlighted and examining these relationships will help to further hone intervention efforts going forward. At this time, it is therefore difficult to discern the impact on cognitive constructs and further research is therefore needed to help clarify the potential link between cognitive training and positive changes in social skills.

Findings outside of the outcome measures also add to the research regarding the use of video games as interventions. The three participants were observed to be engaged and motivated as they expressed enjoyment on several occasions and only one session was missed by one participant due to an emergency. Additionally, participation demands were lowered as the adolescents were all able to play the game from the comfort of their home. The initial implementation of the game included some technical difficulties with regards to the download of the game and the running of the required programs. Some of the difficulties encountered were corrected through immediate technical support offered by the research team which allowed for smooth continuation of the game. There were no lags in game play as a result of difficulties with the game; however, several temporary glitches were noted for future improvement. Other difficulties highlighted the need for some targeted adaptations to allow the game to run more smoothly for future use. As this initial implementation intended on testing the feasibility of the developed game, these pieces of information are considered extremely valuable as it will likely lead to improvements in feasibility for subsequent implementations of the intervention. Overall, these observations provide initial positive feedback for using video games as a platform for social skills intervention.

## **Limitations and Recommendations for Future Research**

Some limitations of the study exist and highlight the need for further research. First, the sample size is small as was intended for this initial implementation phase. This allowed for an in-depth examination of the intervention impact on three participants across their different social profiles. This approach also allowed for considerations for adaptations to the game itself as it highlighted areas to improve on feasibility. The small sample size and the case study approach limits the generalizability of the findings but highlights the need for a larger scale examination to better understand the impacts identified, keeping generalization in mind as the ultimate goal. The findings from this initial implementation are promising and suggest the need for future implementation with a larger pilot group.

Second, due to the nature of the intervention platform, recruitment of participants was limited to those who had access to laptops or computers compatible with the gaming software. One of the participants was provided with a loaner laptop; however, this requirement should be considered as a potential barrier in future work in this area. Furthermore, this requirement may have also led to recruitment of participants of somewhat higher SES thereby potential further hindering generalizability of findings. The potential impact of this bias should therefore be considered during future implementations of this study and an effort should be made to include participants from a variety of SES backgrounds.

Third, from a feasibility perspective it may be difficult for participants to consistently find access to a quiet and private area in their homes. For this current implementation one of the participants noted this as a difficulty ahead of the intervention and was able to find an alternate solution. However, the other participants encountered some minor disruptions during some of the sessions as a result of the intervention taking place in their home environment. Despite the

benefits associated with participation from home (e.g., less resource intensive, no travel required) it may be beneficial to examine alternate locations that can offer quiet and private spaces (e.g., schools or libraries).

Fourth, the data collected to assess social skills changes is subject to the mono-method bias as only the use of behavior rating scales (SSIS) are included. It should be noted that both naturalistic behavioral observation and behavior rating scales are the primary choice of social skills assessment (Merrell, 2001). With observations being time and resource intensive, the SSIS questionnaires were the more feasible option for this study. In addition, input from multiple sources is included using both self- and caregiver reports. This is beneficial as it is unclear whether youth with social behavior problems can report accurately and reliably on their own social skills (Merrell, 2001). The only well-researched instrument of self-report assessment is the SSIS, showing strong levels of divergence between self-reported social skills and more direct measures of these abilities through observations and other behavior rating scales (Merrell, 2001).

Lastly, the data collected for this research project consisted only of quantitative data (e.g., cognitive change data, participant attendance). Inclusion of qualitative data on participant enjoyment, caregiver observations, and ease of participation from home could further guide research on the feasibility and effectiveness of the developed game. Specifically, qualitative input from the participants regarding their perceptions, experiences, and expectations of the game can help guide development changes that may increase enjoyment as well as learning potential for the adolescents (Sanford et al., 2015).

### **Conclusion**

Within the realm of social skills interventions, a call for a new way of developing and delivering these interventions has become more pronounced over the past few years. The idea of

using video game technology and relying more heavily on theory driven intervention development was proposed as a way of answering this call and this paper set out to provide a preliminary scan of the feasibility and potential effects of such an intervention. Though the data presented in this current paper is limited, it does call attention to three important take-home messages that will add to the existing literature on social skills and its intervention methods.

First, the development phase as described in this paper highlights the ability for video games to serve as a highly adjustable platform through which an intervention can be securely grounded in theory and evidence-based research. The chosen training constructs were based on social skills development theory and although the true impact of training underlying abilities to instill change in overall social skills could not be established through the initial implementation, it shows promising preliminary results that support the need for subsequent implementations.

The trends found based on the initial implementation of this intervention also suggest promising results for an intervention tailored to the needs of a specific population or in this case adolescents with FASD. This is an important finding as researchers have suggested that interventions for social skills improvements should be designed specifically based on the social deficits noted for an individual (Gresham, 2016). As this approach would be resource and time intensive, the current study focused on targeting training constructs commonly found to be impacted for a specific population (e.g., sustained attention, perspective taking). Although the data collected on these cognitive constructs was limited, some positive changes were noted in overall reported social skills therefore suggesting that this approach should be evaluated further. Further evaluations may include examining the impact of this video game with other disability populations known to show deficits in similar areas of cognitive and socio-emotional abilities such as ADHD.

Second, the case study data presented in this paper shows promising early results for the potential impact of the intervention for the participants in terms of reported decreases in problem behaviors associated with social interactions. Based on the current available data, the mechanisms of change resulting in these findings cannot be linked back to any specifics yet, but further implementations of the intervention are expected to shed more light on this. Any future implementations would benefit from some adjustments to the game as were highlighted during this initial phase and future outcome studies could result in even more successful trends as a result.

Third, by capitalizing on the adjustable and motivational nature of video games, the development team was able to create an intervention targeting adolescents specifically from both urban and rural settings in Alberta. The positive feedback from participants, the high attendance rate, and overall engagement seen in the participants all speak to the importance of matching youth's interests to intervention development. Furthermore, the ability for participants to participate from the comfort of their own home can be viewed as a great asset for individuals struggling with anxiety regarding their social skills as well as for those in geographically challenging areas as supports are often limited there. Further investigation on the observed levels of engagement and participation should therefore help to strengthen the call for inclusion of modern technology to support teens.

Currently many of the social skills programs available are run within the school system, as this limits the demands placed on caregivers and allows for a greater number of individuals to be supported simultaneously. It may therefore be prudent to examine the potential for this video game-based intervention to be delivered in school systems as well as the home environment.



In conclusion, the findings presented in this paper highlight some promising early results for a video game based social skills intervention which was initially tested on a small group of adolescents diagnosed with FASD. The promising results provide strong evidence for the need for subsequent implementations of this game with a higher number of participants from a more diverse background to examine the potential impact more thoroughly. Despite the need for further research, the current information presented already adds to the existing literature by highlighting the blueprints of the development process for a social skills intervention that is securely grounded in theory and technology while showing great potential for continued success.

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#### **Chapter 4: Adolescent Social Skills Intervention: Innovation, Engagement and Change**

Social skills, defined as specific behaviors necessary for social interactions (e.g., interpersonal and communication skills), are important during childhood and adolescence as these skills are linked to greater social competence which in turn has been linked to increased positive long-term outcomes (educational, psychological and vocational; e.g., Deming, 2017; Domitrovich et al., 2017) as well as decreased negative outcomes (e.g., mental health concerns, delinquency, and anti-social behavior; Davis et al., 2011; Erath et al., 2007; Feinberg et al., 2007; Gresham & Elliott, 2008; Gresham et al., 2012; Lugnegard et al., 2011; Segrin et al., 2016; Worley & Matson, 2011). Although social skills are considered important throughout the developmental span, their importance increases during adolescence. This developmental period, which is defined to include individuals between 10 to 24 years of age, involves significant biological and social changes (Sawyer et al., 2018). As children transition into adolescence, increased importance is typically placed on friendships and peer socialization resulting in an increase in the amount of time spent with peers rather than family (Andrews et al., 2020; Steinberg, 2014). Social skills are required to support adolescents during these additional social interactions. Furthermore, adolescence is typically characterized as a period of increased independence and autonomy in preparation of adulthood, skills development during the adolescent years can therefore be viewed as important for social interactions and social success later in life (Andrews et al., 2020; Steinberg, 2014).

In conjunction with observed changes in social demands, adolescence is also characterized as a period of *social brain* development. The term *social brain* describes a “circumscribed set of brain regions that are dedicated to social cognition” (Frith, 2007 p.671) including the frontal and temporal areas of the brain. These regions are linked to the

development of executive functions (EF; e.g., working memory, planning, problem-solving, strategic behavior) and theory of mind (ToM) as they rely strongly on the activation of the frontal lobes (Beauchamp & Anderson, 2010). EF and ToM in turn are cognitive and socio-emotional skills required for overall social skills development (Cordier et al., 2015). During the adolescent years, several brain areas, such as those involved in the *social brain*, undergo continued structural and functional maturation as a result of synaptogenesis, synaptic pruning, and myelination (Andrews et al., 2020; Beauchamp & Anderson, 2010). This period of growth and maturation is therefore thought to positively impact underlying cognitive and socio-emotional abilities thereby ultimately positively impacting overall social skills (Andrews et al., 2020).

Typically, a period of increased brain development as described above, or a sensitive period, is considered an optimal time for intervention due to the associated malleability of the brain and opportunity for change (Steinberg, 2014). This combined with the known increase in social demands during adolescence highlights the importance of offering social skills interventions specifically to the adolescent age group to promote skills development that will support these youth throughout their adolescence and into adulthood. Unfortunately, few social skills interventions geared towards youth are available as many of the training programs are aimed at school aged children (Ledford et al., 2018; Stevens et al., 2016; Storebø et al., 2019). In addition to overall scarcity of the adolescent geared interventions, a review of the available research also notes some concerns in terms of intervention design and implementation. First, high attrition rates have been noted for adolescents enrolled in these interventions (Lopata et al., 2019), which is suspected to be due to the adolescents not being engaged by the intervention (Farris et al., 2019). Second, there is limited research available on interventions aimed at training

underlying cognitive and socio-emotional abilities despite evidence showing the importance of this approach with adolescents. Third, many social skills interventions are geared toward specific diagnostic populations which may cause misalignment between identified individual needs and training goals (Maag, 2006), and/or may preclude some individuals from receiving supports based on their diagnosis. Research aimed at exploring and examining ways to address these concerns is therefore needed to ensure appropriate interventions are available to adolescents with social skills difficulties.

In response, the purpose of this research study is to examine the potential impact of a newly developed video game based social skills intervention for adolescents with social skills difficulties. Video games are known to be highly popular with youth across the world and due to this popularity, the use of technology and particularly video games have been proposed as a strategy for increasing engagement for mental health related services for adolescents (Georgeson et al., 2020; Plass et al., 2015). This format also creates opportunities to respond to the call for interventions to target underlying cognitive and socio-emotional needs due to its versatility and potential as a teaching platform (Bavelier et al., 2012). Finally, the use of video game-based interventions has been applied across several specialized populations and for a variety of different concerns such as depression (Stasiak et al., 2014), ADHD (Wegrzyn et al., 2012), and anxiety (Hopkins et al., 2011; Serret et al., 2014; Wols et al., 2018). A successful extension of this approach to a group of individuals presenting with shared identified social skills needs rather than a shared diagnosis is therefore expected and would examine the importance of alignment between participant needs and intervention goals or assess for a goodness of fit. Taken together, this research study aims to contribute to the current understanding of social skills intervention supports for adolescents with social skills difficulties.

## **Background**

### **Engagement in Interventions**

An intervention can be defined as a “purposeful action by a human agent to create change” (Midgley, 2000, p.113) and many different interventions exist to support people in a variety of ways or settings including therapeutic treatments such as pharmacological or psychological therapies, surgical procedures, medical devices, or behavioral treatments (Hughes-Morley, 2017). Within the field of psychology, interventions are typically developed to modify behavior, emotional states, or cognitive processes (Hughes-Morley, 2017) and include social skills training programs. Much of the research published on interventions focusses on the effectiveness, impact, or outcomes of the programs; however, the role of participant engagement has received an increasing amount of attention in recent years (Lindsey et al., 2013; O’Keeffe et al., 2019). Intervention engagement refers to the participants’ involvement and interaction with the intervention (Baltierra et al., 2016) and is typically measured through quantitative findings such as time spent in the intervention, completion of intervention goals, attendance, and/or adherence (Georgeson et al., 2020; Perski et al., 2016). At times, subjective measures are used through self-report questionnaires or interviews about the individual’s perceived experience of engagement, satisfaction, or useability of the intervention (Perski et al., 2016). Research on participant engagement has linked higher levels of engagement to increased effectiveness of the intervention (McKay et al., 2001; Strecher et al., 2008) as well as lower attrition rates (Couper et al., 2010). As a result, it is important to ensure that participants are engaged with the intervention as this may impact their continued attendance and overall success in the program.

### ***Engaging Adolescents***

Despite increased interest in examining the role of engagement in interventions, the current available literature is limited and specifically for adolescent geared interventions. Research conducted to date notes high attrition rates for youth (Farris et al., 2020) across different intervention settings (e.g., family-, school-, and community-based; Stattin & Kerr, 2009) including social skills related interventions (Lopata et al., 2019). Information about engagement in related fields such as psychotherapy suggests that between 28 to 75 percent of adolescents drop out of mental health services prematurely (deHaan et al., 2013). A similar trend is also observed for adolescent engagement in education as high school drop out rates are estimated to be as high as 9.3% for American youth and 9.8% for Canadian youth (Archambault et al., 2009). These numbers have been linked to decreases in the experienced engagement with school (Archambault et al., 2009) and several strategies have therefore been developed to help promote adolescent engagement in the school systems including a focus on inquiry-based learning as well as the inclusion of technology in the classroom (Taylor & Parson, 2011).

### ***Leveraging Technology***

The use of technology has also been proposed as a strategy for increasing engagement for mental health related services for adolescents (Georgeson et al., 2020). More specifically the use of video games has been suggested and evaluated to help support teens with behavioral concerns (Chacko et al., 2016), depression (Stasiak et al., 2014), ADHD (Wegrzyn et al., 2012), and anxiety (Wols et al., 2018; Wuthrich et al., 2012). Video games are thought to be a particularly well-suited platform for interventions to adolescents due to their already existing popularity among this age group (NPD Group as cited in Entertainment Software Association of Canada, 2017) as well as the possibility for video games to have built in narratives, incentive systems,

and visual aesthetics further enhancing the participants' motivation and engagement (Gee, 2003, Malone, 1981, Plass et al., 2015).

The use of video games as an intervention platform has also been applied to the field of social skills and specifically for the adolescent population (e.g., Hopkins et al., 2011; Serret et al., 2014). In addition to the overall benefits associated with this type of platform (e.g., increased engagement for youth, adaptable nature, more cost-effective, high program fidelity, learning potential; see Chapter 2 for review), video games appear to specifically align well with social skills training approaches. An examination of traditional social skills training (SST) programs suggests that modeling is an important training component, although concerns have been noted regarding the limited generalizability associated with traditional types of modeling (Bellini & Akulian, 2007). Within a video-game setting, the virtual environment is adaptable and can include modeling of social skills in more realistic settings with opportunities to practice, which is thought to enhance generalizability (Parson & Mitchell, 2002). Furthermore, video games often take place in a group setting with peers, thereby creating another naturalistic setting for the participants to practice and model skills. Despite these potential advantages, the body of literature examining the impact of video game based social skills interventions is limited and particularly concerning the level of engagement that is experienced by the participants as a result of the technology-based delivery platform (Georegeson et al., 2020). Further research in this area would likely aid a better underlying on how to support adolescents and engage them in interventions.

### **Social Skills Change**

The goal of participant engagement in social skills interventions is to positively change social skills abilities and in turn improve participants' overall social functioning. There are

several ways in which these programs aim to do this. Many interventions focus on teaching specific behavioral social skills such as communication skills, eye contact, or conflict resolutions skills (see Andrews et al., 2020b). These types of interventions tend to use direct teaching and modeling as the main teaching method and some have shown to be effective in positively impacting individuals' social skills (e.g., Leaf et al., 2016; Stichter et al., 2010). However, reviews indicate mixed reports on the effectiveness and generalizability of these programs (e.g., Gates et al., 2017; Wolfenstan et al., 2018). A change to the methods through which social skills change is expected to occur may lead to stronger efficacy and effectiveness results and should therefore be examined.

### ***Focus on Underlying Abilities***

Over the past few years, research on social skills interventions has increased and the importance of underlying abilities required for social functioning has been highlighted through increased knowledge on the social brain (Soto-Icasa et al., 2015). This thinking also aligns with the Social Information Processing (SIP) Model (Dodge et al., 1986), a well-known social skills development theory which states that abilities such as attention and memory are required in order for an individual to respond and interpret to social situations. Training of the underlying cognitive and social emotional abilities is believed to lead to improvements in social skills and overall social functioning (e.g., Cordier et al., 2015; Ross et al., 2019; Soto-Icaza et al., 2015) and interventions have therefore been designed to focus on these areas rather than historical approaches on teaching specific behavioral skills. Despite some interventions showing success targeting social problem solving (Bell & D'Zurilla, 2009), perspective taking (Radley et al., 2014), and emotion regulation (Thomson et al., 2015), more research is needed to further explore the impact of training these and similar constructs and its impact on overall social skills change.

The complexity of social skills and continued disagreements on uniform classification of the behaviors included in the term social skills (Matson & Wilkins, 2007, 2009), can lead to some challenges determining which underlying cognitive and socio-emotional abilities are important to social skills development and should therefore be considered training goals for intervention purposes. However, researchers have established links between several cognitive and socio-emotional constructs and social skills abilities specifically for individuals with developmental disabilities and/or mental health concerns as these individuals are more likely to struggle with social functioning (Cordier et al., 2015). Some of the prominently identified underlying abilities in this research include sustained attention (e.g., Andrade et al., 2009), inhibition (e.g., Hubert et al., 2017), metacognition (e.g., Ames & Kammrath, 2004; Whetstone et al., 2015), perspective taking (Dixon et al., 1990; Eisenberg et al., 2006), and emotion regulation (Eisenberg et al., 2010; Frick & Morris, 2004; see chapter 3 for a review). Although additional abilities are at times also discussed in their relation to social functioning, the research on training cognitive and socio-emotional constructs and the evidence for their potential link to social skills appears most strong for sustained attention, inhibition, metacognition, perspective taking, and emotion regulation (Beauchamp & Anderson, 2010; Kully-Martens et al., 2012). Furthermore, the selection of these five underlying abilities was informed by and aligns with Social Information Processing (SIP) model (Dodge et al., 1986) highlighting the need for foundational skills that allow for the enactment of social skills.

A social skills intervention aimed at training these identified five important underlying constructs is therefore thought to lead to positive changes in overall social skills. This type of intervention is particularly well suited to the adolescent age group due to the known structural and functional maturation that takes place in certain brain areas during this sensitive



developmental period (Andrews et al., 2020a; Beauchamp & Anderson, 2010). The brain regions commonly impacted by this maturation process include several of the cognitive and socio-emotional abilities mentioned above. As a result, an intervention aimed at training these abilities during a period of expected brain maturation is likely to be beneficial to social skills and ultimately social functioning. There is limited research available examining the impact of video game interventions targeting underlying cognitive and socio-emotional abilities with the overall goal to improve social skills. As a result, exploratory research is needed to examine if evidence of intended change would be found for a video game based social skills intervention for adolescents. This preliminary work would be foundational to future research examining the potential impact this intervention approach could have on enhancing efficacy.

### **Goodness of Fit**

In addition to the idea of potentially enhancing efficacy for social skills intervention by targeting underlying abilities, these training programs may also benefit from a goodness of fit approach when it comes to intervention design and intervention selection. Currently there is an apparent trend for social skills interventions to be designed and evaluated for specific diagnostic populations (e.g., ADHD, ASD, LDs, FASD). This is often done based on the assumption that these populations will “require modifications to assessment and treatment” (Matson et al., 2017, p.7) and appears to be in opposition to the call made by several researchers for interventions to be selected and informed by knowledge of functional needs of the individual requiring supports (assessment to inform intervention on an individual level) (e.g., Gresham, 1981, see also Cordier et al., 2015; Elliott & Gresham, 2008; Gumpel, 2007; Lerner & White, 2015; Maag, 2005; Walker et al., 2004) thereby calling for a “goodness of fit” between the chosen intervention and the participant. On the surface, social skills interventions targeting specific diagnostic

populations may be viewed as beneficial as it can help streamline intervention selection (e.g., all individuals with social skills difficulties and ADHD receive intervention X). However, this approach does not guarantee alignment between an individual's functional needs and intervention goals, as diagnostic groups (e.g., ASD, FASD, ADHD) are known to display high levels of heterogeneity as well as comorbidity (e.g., Aduen et al., 2018; Dajani et al., 2016). Designing and selecting interventions based on an individual's diagnosis may therefore lead to a misalignment between their identified needs and the intervention goals which has been identified as a common problem for social skills interventions (e.g., Bellini et al 2007; Kilgus et al 2015; Maag, 2006; Schoenfeld et al., 2008). This is important to consider as misalignment is said to impact the overall effectiveness and generalizability of the intervention (Maag, 2006).

Furthermore, intervention specification based on diagnosis may also limit the intervention options available for teens even further as many of the interventions available are geared towards and evaluated for individuals with an ASD diagnosis (Lanovaz et al., 2017). An intervention for adolescents with ASD may also be beneficial for an individual with an alternate diagnosis depending on their identified needs and the intervention goals. There is limited research available examining the potential impact of a goodness of fit approach to intervention selection. First steps in examining this approach would be to explore the use of a social skills intervention with a group of participants with identified social skills difficulties (rather than recruit based on diagnosis) and to learn about potential commonalities and differences in social skills profiles for these participants. Further research on whether a single social skills intervention can support adolescents with social skills needs regardless of a shared diagnosis is therefore warranted.

## **Research Questions**

In response to these identified challenges, this current research aims to explore the concepts of engagement, underlying cognitive and socio-emotional abilities, and “goodness of fit” for social skills interventions with adolescents with identified social skills difficulty. This was done by analyzing data collected from 10 adolescents with third party identified social skills difficulties who participated in a video game based social skills intervention. Three specific research questions are examined with the intent of providing further information to support adolescents with social skills difficulties.

### **Research Question 1**

What is the level of engagement measured for adolescents who participated in the video game intervention? Based on previous research advocating for the use of video games as intervention platforms due to expected increases in engagement (e.g., Georgeson et al., 2020), high levels of engagement for the participants in this study (as measured by their attendance levels, intervention completion, and participation in tasks) are expected.

### **Research Question 2**

What are the characteristics of the group of participants who engaged in the intervention? The participants enrolled in this research study were selected based on third party identified social skills difficulties (by caregiver or school personnel) regardless of diagnosis. As a result, the participant group is not as homogeneous as is often seen for social skills interventions. Typically, social skills interventions are provided to participants from the same diagnostic populations and some commonalities in strengths and weaknesses can be assumed. The same can not be assumed for the group of participants in this study and it is therefore important to understand the social skills strengths and needs (or social skills profile) of this

group. This recruitment approach was chosen with the aim to improve information about the use of a social skills intervention based on an individual's identified needs rather than based on diagnosis alone. As a result, it is important to examine and explore the participants' pre-intervention profiles to establish commonalities and potential differences in their overall profiles.

It is hypothesized, based on the selection criteria for this study, that all participants will show deficits in social skills as measured by the SSIS. Furthermore, based on the research emphasizing the link between underlying cognitive and socio-emotional abilities and the development of social skills, it is hypothesized that the participants in this study will show deficits in at least one measured cognitive and/or socio-emotional ability. This will thereby provide some evidence for the role of these underlying abilities and the need to target them as training constructs in intervention programs. No further a priori hypotheses were made due to the exploratory nature of the research question.

### **Research Question 3**

Is there evidence of change after participation in the intervention? More specifically, (a) is there evidence of change in social skills and/or problem behaviors post-intervention, (b) is there evidence of change in sustained attention, inhibition, perspective taking, or emotion regulation (as measured in this study) after participation in the intervention, and (c) are there differences between participant baseline profiles (compiled by information obtained from social skills and underlying cognitive and socio-emotional assessments) and if so, are these differences associated with changes post-intervention?

Engagement is critical for interventions; however, the overall goal is to instill change in social skills. Based on the research linking cognitive and socio-emotional abilities to social skills (e.g. Cordier et al., 2015; Soto-Icasa et al., 2015; Ross et al., 2018), in addition to the research

showing evidence for the use of video games as an intervention platform (e.g., Hopkins et al., 2011; Stasiak et al., 2014; Wegrzyn et al., 2012; Wols et al., 2018), it was hypothesized that evidence of change would be found for participants in overall social skills as measured by the SSIS self and caregiver reports. Specifically, social behaviors (including communication, cooperation, assertion, responsibility, empathy, engagement, and self-control) were expected to increase post intervention while problem behaviors (bullying, externalizing, internalizing, hyperactivity/inattention), which are said to interfere with acceptable social behaviors, were hypothesized to decrease. Furthermore, evidence of change was expected for all measured underlying cognitive and socio-emotional abilities as these were targeted in the intervention. This included expected improvements in measured sustained attention, inhibition, perspective taking, and emotion regulation.

### **Study Design**

This study is exploratory in nature and aims to answer three related yet distinct research questions. Within intervention research it is common for exploratory studies to adopt a formal evaluative design (using an RCT design) (Hallingberg et al., 2018). The goal of these exploratory studies is typically to investigate the concepts of feasibility, intervention refinement, and to ultimately provide evidence and guidance for a full evaluation of the intervention. As a result, several research questions are often asked and answered in these studies, requiring a potential variety of research approaches.

For this current study, descriptive research is used to help define the characteristics of the participant group which is important for future implementations of the intervention. Descriptive statistics are also used to study the concept of participant engagement within the new intervention design. Furthermore, a pre-post design is used to examine the participant data

collected before and after the completion of the intervention. Due to the early stages of this exploratory work, no control is included for this current study.

## **Method**

### **Procedure**

This study is a continuation of a previous study through the University of Alberta for which ethics approval was sought and granted by the institutional review board. The recruitment phase for this study continued from the recruitment efforts made during the initial implementation of the study (see Chapter 3). This included the research information being distributed to participating local and provincial organizations providing services to individuals and families with FASD and participants being recruited through this snowball sample. Participants who enrolled in the study based on these recruitment efforts completed the intervention sessions from their home.

The recruitment process for this current study was broadened to expand beyond adolescents with an FASD diagnosis. To do so, a research request application was submitted to a local school district in Alberta. Once the proposal was accepted, a team of school administrative staff was provided with criteria to select potential participants. These criteria included the age of the participants to be between 11 and 18 years, observed social skills deficits by the school staff, as well as any diagnosis (e.g., FASD, ADHD, depression). Exclusionary criteria were provided as individuals with ASD as well as youth with significant traumatic brain injuries were not allowed to participate in the study. Participants who enrolled in the study based on these recruitment efforts completed the intervention sessions at school during class time.

Prior to the start of the intervention the participants completed pre-testing and caregivers were asked to complete a demographics questionnaire as well as one rating scale. Upon

completing the pre-testing, the adolescents received a \$10 iTunes gift cards. The school participants then completed the intervention by playing one session per week. The participants who played from home completed the intervention in a condensed format and engaged in two sessions per week. After the intervention, caregivers were asked to complete the rating scale again and they were provided with a \$25 gift card to Indigo. Post-testing was also completed for the participants, and they received another \$10 iTunes gift card upon completing this second round of testing.

### **Participants**

Eight participants were originally selected by the school administrators through the recruitment process in the school system. One of the participants did not meet the inclusionary criteria and pre-testing was only therefore completed for the remaining seven participants, between the ages of 11 and 14, and their caregivers.

After the school participants completed the intervention, three participants between the ages of 11 and 16 and with a FASD diagnosis were recruited using the snowball sample efforts described above. This method allowed interested caregivers to contact the research team and the participants were recruited into the intervention based on having a diagnosis of FASD in addition to difficulties with social functioning as reported by their caregiver (see Table 4.1 for a breakdown).

### **Setting**

The intervention was provided to participants in two different settings (see Table 4.1). The first two groups were recruited through the school system and engaged in the study on school property. The school group was comprised of seven participants, split up in a group of four and a group of three. This was done as the capacity of game play allowed up to four

participants in the intervention at a time. The composition of the two groups was created in collaboration with school personnel as they made suggestions for groupings based on assumptions about potential group dynamics and participant availability.

Within the school, the participants were spread out across different empty offices and classrooms to create a private space for them to participate in the intervention without outside distraction.

**Table 4.1**

*Participant Characteristics*

Participant	Setting	Gender	Ethnicity	Age	Diagnosis	Caregiver	Global IQ <sup>a</sup>
104	School – Group 1	Male	Caucasian	12	ADD/ADHD, Anxiety, Tourette’s Syndrome, ODD	Biological Parent	105
105	School – Group 1	Male	Caucasian	13	ADD/ADHD, Anxiety	Biological Parent	129
106	School – Group 1	Male	Caucasian	12	ADD/ADHD, Anxiety, PTSD	Biological Parent	90
107	School – Group 1	Male	Caucasian	11	Depression, Anxiety	Biological Parent	117
108	School – Group 2	Female	Caucasian/ Metis	11	ADD/ADHD, ODD	Biological Parent	110
109	School – Group 2	Male	Caucasian	11	ADD/ADHD, Depression, Anxiety	Biological Parent	124
110	School – Group 2	Male	Caucasian	11	Mild Cognitive Learning Disorder	Biological Parent	72
111	Home	Male	Caucasian	12	FASD, ADD/ADHD, Depression, Anxiety, Bi-Polar	Adoptive Grandparent	97
112	Home	Female	First Nation	16	FASD	Foster Parent	87
113	Home	Female	Caucasian	16	FAS, ADD/ADHD	Adoptive Relative	86

<sup>a</sup>as measured by the WRIT (Glutting et al., 2000)



In addition to the school participants, the three participants, who played the video game in their own homes, were in different areas throughout Alberta, Canada. Within their homes, they were asked to find a private space with limited distractors (e.g., home office or bedroom). As these three individuals participated in the intervention during summer break, two of the participants completed some of the intervention sessions while being away from their home and played the game in a tent or trailer.

### **Intervention**

The participants were asked to partake in a video game based social skills intervention. This intervention was initially designed for adolescents with FASD and aimed to train five underlying cognitive and socio-emotional abilities including sustained attention, inhibition, metacognition, perspective taking, and emotion regulation, as these are commonly impacted abilities within the FASD population. However, after a detailed examination of the available literature and the gaps in available social skills interventions, the decision was made to apply the specifically designed intervention to the general population of adolescents with social skills difficulties and to test its efficacy with this group. This generalization in the use of the intervention is thought possible due to the overlap in commonly identified underlying cognitive and socio-emotional abilities across a variety of diagnoses commonly found in adolescents (e.g., ADHD, FASD, Anxiety, Depression; see Chapter 3).

The videogame itself was developed using the Unreal Engine 4 and requires the participants to work together as secret agents to solve crimes and apprehend criminals. To do so, the participants must engage in gamified tasks that expose the players to one or more of the underlying abilities mentioned above. The intervention includes six sessions or what are referred to as “missions” for the team to complete. Each of the missions is designed to build on the

previous one in terms of storyline and difficulty level. At the onset of the mission, the team of participants receives their mission objectives from the commander, who is a member of the research team virtually present to moderate and monitor the game play. At the end of the mission, the commander also provides feedback to the team about their completed mission and provides reminders for the upcoming session.

### **Measures**

The measures included in this study were chosen based on careful examination of the available literature on social skills development and assessment and aim to provide a comprehensive overview of the participants social skills in addition to the underlying cognitive and socioemotional abilities included in this study. Additional measures were included due to the exploratory nature of the study, to help provide more background information about the participants specifically regarding factors that could be important to social skills functioning (e.g., language development; Beauchamp & Anderson, 2010; Kully-Martens et al., 2012). Furthermore, resources and costs were also considered a factor when deciding on the measures to allow for increased feasibility and replications in non-research settings.

### ***Demographic Questionnaire***

Caregivers completed a brief researcher-constructed demographic form to collect background information about the participant's as well as the caregiver, marital status, level of education, occupation, and household income bracket. In addition to general participant information, this questionnaire also included six questions related to early language development and current language abilities adapted from the Alberta Language and Development Questionnaire (ALDeQ; Paradis et al., 2010).

### ***Wide Range Intelligence Test (WRIT)***

The WRIT (Glutting et al., 2000) provides a brief and reliable measure of verbal and nonverbal cognitive abilities for individuals ages four to 85. A total score is provided for an estimate general IQ in addition to scores for verbal (crystallized) IQ and visual (fluid) IQ ( $M = 100$ ;  $SD = 15$ ). Internal consistency reliability (.84-.90 for main scales) test-retest reliability (>.90), and inter-rater reliability (.98 to .99) for the main WRIT scales is high. Examination of the psychometric properties also shows acceptable construct, concurrent, and predictive validity (WISC-III, 0.90 and WRAT; .36 to .64) (Glutting et al., 2000). This measure was only provided to participants during the pre-testing phase.

### ***Social Skills Improvement System (SSIS) Rating System***

The SSIS is one of the most used social skills assessments and can be utilized with individuals ages three to 18 (Gresham & Elliot, 2008). Separate rating scales exist for self-report, teacher, and caregiver report and all three aim to collect information regarding an individual's social skills and associated problem behaviors. The Social Skills Scale consists of seven social behaviors including self-control, responsibility, cooperation, communication, empathy, and assertion (Gresham & Elliot, 2008). The Problem Behavior Scale examines the areas of externalizing, internalizing, bullying, and hyperactivity/inattention. The caregiver report includes an additional subscale assessing for autism spectrum behaviors. To complete the SSIS, the informant rates both the frequency with which a social behavior has been exhibited (never, seldom, often, or almost always) as well as the perceived importance of each of these behaviors (not important, important, critical) (Gresham & Elliot, 2008).

For this study, the multiple informant approach was applied using both self-report and caregiver report. Included in the analyses are the Social Skills ( $M = 100$ ,  $SD = 15$ ) and Problem

Behavior Scales which are composite scores ( $M = 100$ ,  $SD = 15$ ) based on a large representative US sample ( $N = 4700$ ; Gresham & Elliot, 2008). Furthermore, raw score data obtained from the associated subscales are also used in some of the analyses and standard deviations and means were obtained for each of these scales from the SSIS manual (Gresham & Elliot, 2008). Overall, research indicates overall high levels of internal consistency reliability are found across the different scales and subscales (ranging between .75 and .98). Medium test-retest reliability was also found across both the parent and the self-report measure (ranging from .59 to .81) (Demaray et al., 1995; Gresham & Elliott, 2008).

### ***Delis-Kaplan Executive Function System (DKEFS)***

The D-KEFS (Delis et al., 2001) is a normed measure of executive functions such as problem-solving, planning, cognitive flexibility, and inhibition, and can be used with individuals ages eight to 89. The DKEFS is normed on a large, non-clinical, and representative US sample and provides scaled scores for each subtest with lower scores signifying poorer performance ( $M = 10$ ,  $SD = 3$ ). For the purposes of this study, the Color-Word Interference Test (CWIT) was used to provide information about the participants' pre and post inhibition performance. The CWIT is a subtest of verbal inhibition and is comprised on four parts including color naming, word reading, inhibition, and inhibition/switching. Only the inhibition test was used for analyses in this study; however, it should be noted that a score can not be obtained for the inhibition component of the test if a participant has made several errors in previous parts that exceed a provided limit. Moderate to high split-half reliability (0.62-0.86), and test-retest reliability have been determined for the CWIT (Homack et al., 2005).

### ***Conners Continuous Performance Test 3<sup>rd</sup> Edition (CPT-3)***

The Conners CPT-3 is a computerised assessment of attention-related difficulties in individuals ages eight years and older. Test administration requires participants to respond to letters displayed on a computer screen, except for the letter X, by pressing on the space bar which provides information about inattentiveness, impulsivity, sustained attention, and vigilance. Obtained raw scores are converted to t-scores based on a normative sample (Conners, 2014;  $M = 50$ ,  $SD = 10$ ). The third edition of this test is normed on representative US sample ( $N = 1400$ ). An examination of the psychometric properties shows high internal consistency (.92 - .94) and moderate test-retest reliability (.67) (Conners, 2014).

The only score obtained from the CPT3 used in the analyses of this study is the Hit Reaction Time Block Change (HRT Block Change) which measures change in reaction time across the duration of the test (Conners, 2014). A low score on this measure suggests that responses became quicker as the test progressed which would suggest that the participant was able to sustain their attention. A high score on the other hand suggests a slowing of reaction time and is said to indicate difficulties with sustained attention (Conners, 2014).

### ***Difficulties in Emotion Regulation Scale – Short Form (DERS-SF)***

The DERS-SF (Kaufman et al., 2016) is a short version of the DERS (Gratz & Roemer, 2004), a widely used self-report measure for assessing emotion regulation problems among adolescents and adults. This shortened instrument maintains the excellent psychometric properties (ranging between .79 and .91) and retains the total and subscale scores of the original measure with 18 items (Kaufman et al., 2016). The shorter version was chosen over the original measure to limit the demands placed on participants. Participants were asked to rate their regulation abilities related to six subscales including 1) non-acceptance or negative reactions to

emotions, 2) engaging in goal-oriented behavior, 3) controlling impulsive behavior, 4) emotional awareness, 5) ability to cope with negative emotions (strategies), and 6) lack of clarity about one's emotions, using a 5-point likert scale (Kaufman et al., 2016). A score is provided for each of the subscales as well as a Total Score for overall emotion regulation with a high score indicating more difficulties.

The DERS-SF is not a normed measure; however, some psychometric properties have been reported in several validation studies specifically validating the DERS-SF for the adolescent population. Some difficulties have been noted for some of the subscales related to the original DERS as well as the DERS-SF and as a result only the Total Average Score was used for analyses in this current study following a recommendation made by Charak and colleagues (2019). Kaufman and colleagues reported a Cronbach's alpha and standard deviation of 0.91 and 0.79 respectively (2016) and a similar number was found in a recent validation study ( $\alpha = 0.90$ ; Skutch et al., 2019).

### ***Reading the Mind in the Eyes: Child (RMEC)***

The original RME was developed to assess theory of mind abilities in adults and was adapted for use with children in 2001 (Baron-Cohen et al., 2001). The measure consists of 28 photographs of individuals' eyes, participants are then asked to identify the inner affective and cognitive states of the portrayed people. A raw score is then comprised of the number of correctly identified emotions. Several researchers have published on the psychometric properties of the adult version of the RME (adequate levels of internal consistency and overall validity; Olderbak et al., 2015); however, limited information is available regarding the validity and reliability for the child version. A validity study for the use of the RME with children showed a mean correct score of 17.8 with a standard deviation of 3.5 (Müller et al., 2014). Internal

consistency was found to be low ( $\alpha = 0.53$ ), and results obtained in this study should therefore be considered with caution.

### **Planned analyses**

All data was entered into SPSS Version 27 and several analyses were planned to answer the three outlined research questions. Descriptive statistics were conducted to describe demographic variable and data of interest in this study.

In order to answer the first research question, descriptive statistics on time spent in the intervention, attendance rates, and task completion, were used.

For the second research question, pre-intervention characterization of the participants' social skills profile was completed using descriptive statistics of social skills, cognitive and socio-emotional abilities.

For the third research question, paired t-tests were conducted in SPSS version 27. Assumptions of normality were checked and met for most of the analyses ran using Shapiro-Wilk. However, the assumption of normality was not met for the subscale externalizing on the SSIS self-report ( $W(9) = 0.749, p = 0.005$ ) as well as the Bullying subscale for the SSIS Caregiver-report ( $W(7) = 0.710, p = 0.005$ ). Caution should therefore be paid when interpreting the results for these two subscales. Furthermore, a Bonferroni correction was applied to results obtained from the paired t-tests due to the multiple analyses made.

In addition to the paired t-tests, individual analyses of the change observed post intervention was also completed due to the small and heterogeneous population used for this study. These individual analyses aim to add information about potential clinically relevant change and was completed using the Jacobson and Truax's (1991) Reliable Change Index criteria. Therefore, a change score on the outcome measures was considered a reliable change if

it exceeded the standard error of the measure. Similarly, to the paired t-tests, this individual analysis approach was applied to all outcome measures collected in this study (social skills, problem behaviors, sustained attention, inhibition, perspective taking and emotion regulation). Lastly, examination of the change scores based on baseline profiles was conducted using independent t-tests on the change scores between groups.

## **Results**

**Research Question 1:** What is the level of engagement measured for adolescents who participated in the video game intervention?

To answer the first research question, descriptive data was collected on the adolescents' engagement with the intervention. This was done by measuring the time spent in the intervention, the attendance rates, and the number of intervention tasks completed by the participants. This information was gathered per group (school 1, school 2, and the participant group who played from home; see Table 4.2).

This analysis shows that all 10 participants completed the intervention with all of the intervention tasks being completed by all of the participants throughout all of the six intervention sessions. Furthermore, the data shows that the participants engaged in the intervention play for an average of 23 minutes per session (Range = 14 to 35 minutes). It should be noted that this refers only to the time engaged in actual game play. The participants often engaged with the intervention (talk to other participants and research staff) prior to the start of the mission to get the video game started and to sort out any technical difficulties. This time ahead of the intervention was not consistently measured as it was variable for the participants and at times included restarts of computers for participants and researchers to ensure optimal functioning of the game.



Lastly, attendance rates show an overall attendance of 91.67% and attendance was high across all three different groups. The attendance rate was higher for the two school-based groups as compared to the participants who completed the intervention from home.

**Table 4.2**

*Quantitative Engagement Data*

Setting	Average play time per session (in minutes)	Attendance rate (%)	Participation in Tasks (%)
School Group 1 ( $n = 4$ )	27 (range = 17-35)	95.83%	100%
School Group 2 ( $n = 3$ )	22 (range = 14-31)	94.44%	100%
Home ( $n = 3$ )	22 (range=19-28)	83.33 %	100%
Total ( $n = 10$ )	23 minutes	91.67%	100%

**Research Question 2:** What are the characteristics of the group of participants who engaged in the intervention?

To answer this research question, an exploration of the descriptive statistics related to the participants' social skills data was conducted (Table 4.3). This showed that 60% ( $n = 10$ ) of participants were identified either, through self- or caregiver report, to struggle with social skills (based on a standard score of  $< 85$ ). Agreement between self- and caregiver reported social skills deficit was found for only one participant. None of the participants were identified to show any social skill strengths as measured by the SSIS. The SSIS data also shows that Problem Behavior difficulties are noted for 100% ( $n = 10$ ) of the participants as reported through either self- or caregiver report (or both  $n = 3$ ) (see Table 4.3). An examination of the above average identified subscales included in the Problem Behavior showed that seven caregivers noted concerns related to internalizing behaviors, six identified hyperactivity/inattention as a concern, and five reported concerns for externalizing, bullying and autism spectrum behaviors. For the self report, the most frequently noted problem behavior was externalizing ( $n = 5$ ), followed by

hyperactivity/inattention ( $n = 4$ ) and internalizing ( $n = 4$ ) and only two participant self-disclosed bullying behaviors (see Table 4.4).

**Table 4.3**

*Overview of SSIS Self and Caregiver Report*

Participant	Social Skills Scale Score – Self	Problem Behavior Scale – Self	Social Skills Scale Score – Caregiver	Problem Behaviors Scale-Caregiver
104	107	99	103	126 <sup>a</sup>
105	92	124 <sup>a</sup>	-	-
106	83 <sup>a</sup>	111	90	130 <sup>a</sup>
107	90	130 <sup>a</sup>	92	122 <sup>a</sup>
108	67 <sup>a</sup>	126 <sup>a</sup>	67 <sup>a</sup>	139 <sup>a</sup>
109	88	141 <sup>a</sup>	64 <sup>a</sup>	154 <sup>a</sup>
110	110	142 <sup>a</sup>	-	-
111	-	-	74 <sup>a</sup>	149 <sup>a</sup>
112	89	96	76 <sup>a</sup>	129 <sup>a</sup>
113	93	96	73 <sup>a</sup>	160 <sup>a</sup>

<sup>a</sup> represents an area of difficulty as defined by the SSIS measure.

**Table 4.4**

*Number of Reports of Above Average rated Problem Behavior Subscales Pre-Intervention*

SSIS Subscale	Self-Report ( $n = 9$ )	Caregiver Report ( $n = 8$ )
Externalizing	5	5
Bullying	2	5
Hyperactivity/Inattention	4	6
Internalizing	7	4
Autism Spectrum	-	5

An examination of the data collected pre-intervention on the participants' sustained attention, inhibition, perspective taking, and emotion regulation abilities shows variability across the participant group (See Table 4.5). Despite this variability, 70% ( $n = 7$ ) of participants showed one or more deficits (as defined as 1 SD below Average) in at least one of the identified four underlying cognitive/socio-emotional areas of sustained attention, inhibition, perspective taking,

and emotion regulation. Two participants within this group of seven, showed a deficit across two underlying abilities. Emotion regulation difficulties were more frequently noted for the participants as 40% showed higher than average levels of dysregulation. For one participant, a score could not be computed for emotion regulation due to skipped items on the questionnaire. In addition, a CWIT score could not be computed for three participants due to high error rates in their completion of the task.

**Table 4.5**

*Overview of Cognitive and Socio-Emotional Abilities*

Participant	Sustained attention (HRT block Change)	Inhibition (CWIT)	Perspective Taking (Total RMEC score)	Emotion Regulation (Total DERS)
104	36	11	17	1.28
105	63 <sup>a</sup>	11	20	2.39
106	60 <sup>a</sup>	-	23	3.17 <sup>a</sup>
107	59	-	21	3.88 <sup>a</sup>
108	52	9	22	2.22
109	53	14	15	3.67 <sup>a</sup>
110	33	-	7 <sup>a</sup>	3.56 <sup>a</sup>
111	49	5 <sup>a</sup>	21	-
112	52	5 <sup>a</sup>	22	2.50
113	46	8	22	2.11

<sup>a</sup> represents an area of difficulty defined as 1 SD Below Average

Characterization of this group of participants therefore shows that the main difficulty identified appears to be related to problem behaviors (100%), followed by identified difficulties with social skills (60%), and emotion regulation concerns (40%).

**Research Question 3:** Is there evidence of change after participation in the intervention? More specifically, (a) is there evidence of change in social skills and/or problem behaviors post-intervention, (b) is there evidence of change in sustained attention, inhibition, perspective taking, or emotion regulation (as measured in this study) after participation in the intervention, and (c)

are there differences in participant baseline profiles and if so, are these differences associated with changes post-intervention?

### ***Evidence of Change on the SSIS***

Paired sample *t*-tests were conducted to examine the pre- and post- data collected from all 10 participants for evidence of change in social behavior as measured by the Social Skills Scale and associated subscales (communication, cooperation, assertation, responsibility, empathy, engagement, and self-control) on the SSIS. In addition, a change in problem behavior was also assessed through the Problem Behavior Scale and associated subscales (externalizing, bullying, hyperactivity/inattention, internalizing, and autism spectrum disorder). Both self-report as well as caregiver report data was used. Due to the high number of comparisons and the small sample size (nine participants for the self-report and seven for caregiver report) a Bonferroni correction was applied. As a result, the level of significance is set at 0.0038 (0.05/13) for the self-report data and 0.0036 (0.05/14) for caregiver report. The exploration of change in social skills post intervention as reported by the participants themselves showed no significant change on either the social skills or problem behaviors scales (see Table 4.6). In addition, no significant change was detected on any of the subscales.

An examination of individual change scores was conducted to provide further information about the potential individual change for each of the participations. Using the Jacobson and Truax (1991) criteria for reliable change, eight participants remained unchanged in terms of their reported social skills and problem behaviors (see Table. 4.7). One participant reported a reliable improvement in their reported problem behaviors and another participant noted a deterioration of social skills post-intervention.

### **Table 4.6**

*Summary of Paired T-tests SSIS Self-Report N = 9*

Scale	Mean Pre-Test	Mean Post-Test	Significant change at 0.0038
Social Skills Scale Composite	91.00	87.33	No ( $p = .125$ )
Communication	12.56	11.67	No ( $p = .312$ )
Cooperation	12.44	12.33	No ( $p = .834$ )
Assertion	11.67	10.33	No ( $p = .257$ )
Responsibility	12.44	12.44	No ( $p = 1$ )
Empathy	13.11	12.44	No ( $p = .169$ )
Engagement	12.56	10.78	No ( $p = .028$ )
Self-Control	9.89	9.44	No ( $p = .498$ )
Problem Behavior Scale Composite	118.33	113.22	No ( $p = .166$ )
Externalizing	14.89	13.11	No ( $p = .280$ )
Bullying	4.33	3.11	No ( $p = .005$ )
Hyperactivity/Inattention	10.67	9.44	No ( $p = .367$ )
Internalizing	15.67	13.56	No ( $p = .169$ )

**Table 4.7**

*RCI Summary of SSIS Self-Report*

Participant	SSIS Social Skills Reliable Change at 1.96	SSIS Problem Behavior Reliable Change at 1.96
104	No (RCI = 0.38)	No (RCI = -1.1)
105	No (RCI = 0.86)	No (RCI = 0)
106	No (RCI = -0.76)	No (RCI = 1.26)
107	No (RCI = 0.76)	No (RCI = -1.57)
108	No (RCI = 0.19)	No (RCI = 0.16)
109	No (RCI = -1.34)	Yes (RCI = -3.93)
110	No (RCI = -0.57)	No (RCI = -1.89)
111	-	-
112	No (RCI = -0.86)	No (RCI = 1.07)
113	Yes (RCI = -3.86)	No (RCI = -1.29)

Similar to the self-report data, an exploration of the caregiver-report data collected pre- and post-intervention using paired t-tests also showed no significant change in either social skills or problem behaviors nor for any of the related subscales (see Table 4.8).

**Table 4.8***Summary of Paired T-tests of SSIS Caregiver Report N = 7*

Scale	Mean Pre-Test	Mean Post-Test	Significant change at 0.0038
Social Skills Scale Composite	78.43	74.57	No ( $p = .310$ )
Communication	13.29	11.29	No ( $p = .162$ )
Cooperation	9.00	9.14	No ( $p = .788$ )
Assertion	11.43	10.86	No ( $p = .457$ )
Responsibility	10.29	9.42	No ( $p = .270$ )
Empathy	11.14	10.57	No ( $p = .611$ )
Engagement	9.43	9.71	No ( $p = .805$ )
Self-Control	8.29	6.43	No ( $p = .102$ )
Problem Behavior Scale Composite	139.86	138.86	No ( $p = .787$ )
Externalizing	17.14	15.86	No ( $p = .336$ )
Bullying	4.14	4.14	No ( $p = 1.00$ )
Hyperactivity/Inattention	11.57	11.57	No ( $p = 1.00$ )
Internalizing	16.57	17.00	No ( $p = .800$ )
Autism Spectrum	19.57	20.00	No ( $p = .706$ )

An analysis of the individual change showed that five caregivers reported unchanged social skills for the participants and deterioration was noted for two participants (see Table 4.9). For the problem behaviors scale, four caregiver reports showed no change, while two caregivers noted deterioration, and one showed improvement through a reduction of the problem behaviors.

**Table 4.9***RCI Summary of SSIS Caregiver-Report*

Participant	SSIS Social Skills Reliable Change at 1.96	SSIS Problem Behavior Reliable Change at 1.96
104	Yes (RCI = -3.77)	No (RCI = -0.98)
105	-	-
106	-	-
107	No (RCI = 1.18)	No (RCI = -1.77)
108	No (RCI = 1.18)	Yes (RCI = 1.964)
109	No (RCI = -0.94)	No (RCI = 0.39)
110	-	-
111	Yes (RCI = -4.01)	Yes (RCI = 1.964)
112	No (RCI = 0.24)	No (RCI = 0.00)
113	No (RCI = -0.24)	Yes (RCI = -3.31)

***Evidence of Change in Underlying Abilities***

After the analyses for the social skills and problem behavior data was completed, the same process of analysis was applied to examine evidence of change in the underlying cognitive and socio-emotional abilities including sustained attention, inhibition, perspective taking, and emotion regulation after participation in the intervention. For the paired sample t-tests, a Bonferroni correction was applied and set at 0.0125 (0.05/4). Using this correction, the results of these paired t-tests, showed no significant change in sustained attention, inhibition, perspective taking, or emotion regulation (see Table 4.10).

**Table 4.10***Summary of paired T-tests for Cognitive and Socio-Emotional Abilities*

Underlying Abilities	Measure	N	Mean Pre-Test	Mean Post-Test	Significant change at 0.0125
Sustained Attention	CPT3 HRT Block Change	10	50.30	49.40	No ( $p = 0.924$ )
Inhibition	DKEFS CWIT	6	9.67	10.50	No ( $p = 0.042$ )
Perspective Taking	RMEC Total Correct	10	19	20	No ( $p = 0.252$ )
Emotion Regulation	DERS Total Average	9	2.75	2.57	No ( $p = 0.304$ )

An examination of individual change scores was conducted to provide further information about the potential individual change for each participant (see Table 4.11). All participants remained unchanged on the measures of perspective taking and inhibition according to the Jacobson and Truax criteria (1991). Seven participants remained unchanged for emotion regulation while one participant deteriorated and one improved post intervention. Lastly, on the measure of sustained attention, three participants remained unchanged, three participants deteriorated, and four participants improved.

**Table 4.11**

*RCI Summary of Underlying Cognitive and Socio-Emotional Abilities (RCI  $\geq$  1.96)*

Participant	Sustained Attention CPT3 HRT Block Change	Inhibition DKEFS CWIT	Perspective Taking RMEC Total Correct	Emotion Regulation DERS Total Average
104	Yes (RCI = 7.95)	No (RCI = 0.75)	No (RCI = -1.47)	No (RCI = 0.99)
105	Yes (RCI = -10.16)	No (RCI = 0.75)	No (RCI = 0.88)	Yes (RCI = 1.99)
106	Yes (RCI = -4.42)	-	No (RCI = 0.59)	No (RCI = -1.66)
107	Yes (RCI = -4.64)	-	No (RCI = 0.29)	No (RCI = -1.66)
108	Yes (RCI = 4.20)	No (RCI = 0.75)	No (RCI = 0.59)	No (RCI = 0.166)
109	Yes (RCI = -4.20)	No (RCI = 0.00)	No (RCI = 1.18)	No (RCI = -0.50)
110	Yes (RCI = 11.27)	-	No (RCI = 0.88)	Yes (RCI = -2.32)
111	No (RCI = -1.10)	-	No (RCI = -0.29)	-
112	No (RCI = -1.10)	No (RCI = 0.00)	No (RCI = 0.29)	No (RCI = -0.83)
113	No (RCI = 0.22)	No (RCI = 1.49)	No (RCI = 0.00)	No (RCI = -0.33)

### *Evidence of Change based on Participant Profiles*

The descriptive statistics examined in research question 2 showed several differences in the baseline profiles obtained for the participants. Notable was the difference in reported social skills difficulties as only six out of the ten participants were identified either through self report or caregiver report to show difficulties with overall social skills (SSIS Social Skills Scale <85).



The other four participants showed no overall social skills difficulties as measured by the SSIS self- or caregiver-report.

Independent sample t-tests were therefore conducted to determine if there was a significant intervention effect when comparing the social skills difficulties group to the no social skills difficulties group on the outcome measures assessing for social behaviors, problem behaviors, sustained attention, inhibition, perspective taking, and emotion regulation (see Table 4.12). No significant differences were found between the social skills difficulties group ( $n = 6$ ) and the no social skills difficulties group ( $n = 4$ ) on the social skills or problem behavior scale nor on any of the underlying cognitive and socio-emotional measures.

**Table 4.12**

*Independent T-test Results*

Variable	Mean Change (SD)	Significance difference at 0.05
SSIS Social Skills Scale- Self		No ( $p = 0.166$ )
SSD group	-6.40 (7.09)	
No SSD group	-0.25 (3.86)	
SSIS Social Skills Scale- Caregiver		No ( $p = 0.795$ )
SSD group	-3.20 (8.38)	
No SSD group	-5.50 (14.85)	
SSIS Problem Behavior Scale – Self		No ( $p = 0.603$ )
SSD Group	-3.40 (13.16)	
No SSD Group	-7.25 (5.25)	
SSIS Problem Behavior Scale – Caregiver		No ( $p = 0.327$ )
SSD Group	1.40 (10.24)	
No SSD Group	-7.00 (2.83)	
CPT-3 HRT Block		No ( $p = 0.704$ )
SSD group	-4.83 (14.37)	
No SSD group	5.00 (46.02)	
D-KEFS CWIT		No ( $p = 0.745$ )
SSD group	0.75 (0.96)	
No SSD group	1.00 (0.00)	
RMEC Total Correct		No ( $p = 0.859$ )
SSD group	1.33 (1.75)	
No SSD group	0.50 (3.79)	
DERS Total Average		No ( $p = 0.645$ )
SSD group	-0.21 (0.23)	

No SSD group

-0.14 (0.75)

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## Discussion

This study explored the concepts of engagement and social skills change for adolescents with social skills difficulties using a video game based social skills intervention. More specifically three goals of the study were outlined at the onset. First, the goal was to learn about the impact of the video game intervention on engagement for adolescents. Second, this study aimed to provide information about an implementation of a single social skills intervention, aimed at training underlying cognitive and socio-emotional abilities, with a group of adolescent participants with potentially different social skills needs and to learn about the potential commonalities and differences in social skills needs for these participants. Lastly, preliminary evidence was sought for indications of change as a result of training underlying cognitive and socio-emotional abilities within the intervention. Despite the limitation faced in this study due to the exploratory nature, there are some valuable lessons learned that will add to the field of social skills literature.

### Engagement

The quantitative engagement data collected and analyzed as part of this study provided some preliminary evidence in support of using video games to help engage adolescents in intervention work. All participants enrolled in the study completed the six intervention sessions and showed high levels of engagement throughout (as measured by the number of tasks completed). This finding is important to consider based on previous research estimating intervention drop out rates for adolescents to be as high as 28 to 75 percent (deHaan et al., 2013).

Overall high attendance was also found across all three groups of participants; however, slightly lower attendance was recorded for the participants who engaged in the intervention from

home. This could potentially be attributed to the fact that this group of participants was enrolled in the intervention over summer vacation, and this led to some participants being unavailable during scheduled intervention sessions. Furthermore, this may also speak to the benefit of providing interventions to adolescents in a school setting. Known benefits of school-based interventions also include reduced costs and time commitments for families, as well as increased potential for student engagement (Paulus et al., 2016). However, when interventions occur in the school system, it may be more difficult to engage caregivers and it is often difficult to secure a physical space within the school (Paulus et al., 2016). The research presented in this study showed preliminary evidence for the use of a video game based social skills intervention in the school system. Despite some identified difficulties in terms of finding appropriate spaces to run the intervention, the study showed that the video game intervention was run during school hours with the support of school administrators and engagement of students. These promising results suggest that further research on feasibility of using video game-based interventions from the home and the school environment is needed.

The overall high quantitative engagement results are hypothesized to be due to the engaging nature of video games as well as the shared experience of a group or team-based intervention. Video games are proposed as a potential platform for interventions based on previous research providing evidence for increased engagement and participant motivation for video-game based learning compared to traditional educational methods (e.g., Huizenga et al., 2009; Khan et al., 2017). The findings presented in this paper provide preliminary evidence that a similar trend may be applicable to social skills interventions and further research is therefore warranted.

Furthermore, engagement is said to be high for video games that include a social component or a multiplayer component (e.g., Kang et al., 2019; Siu et al., 2017). As the intervention used for this study relies on teamwork and cooperation for the game narrative but also for task completion it is likely that this aided the observed level of engagement for the participants. As a next step, researchers may want to further explore if observed levels of engagements for video game-based interventions differs for multiplayer versus single player games.

### **Participant Social Skills Characteristics**

An analysis of the baseline profiles shows mixed results in terms of identified areas of need and strengths. All ten participants were identified with problem behaviors higher than average. However, 60 percent of participants were identified with social skills difficulties and 70 percent showed a deficit in one or more cognitive and socio-emotional abilities. Forty percent also noted difficulties with emotion regulation. These findings show that there was high diversity based on identified needs for the participants. Several participants shared one or more diagnoses, yet the overall baseline profile does not necessarily represent this. Taken together this provides preliminary evidence against the current methods of intervention selection and suggests that further research should be completed on best practices for this selection process.

Another important finding from this section includes the fact that despite social skills difficulties being a requirement for enrollment, 40 percent of the participants were not identified to have social skills difficulties through either self or caregiver report. However, this 40 percent was identified as having problem behaviors. This finding could suggest that difficulties with externalizing or internalizing behaviors can be mistaken for social skills difficulties by caregivers and/or teachers and highlights the need for more rigorous pre-testing prior to enrollment in an

intervention. The overlap between social competence and behavioral problems has been highlighted by previous research as children and adolescents with lower levels of social competence are known to display higher levels of problem behaviors and vice versa (e.g., Hukkelberg et al., 2019). Due to limited research in this area, the directionality and strength of this correlation is unknown. However, a meta-analysis on the topic does show that higher levels of inconsistencies in reporting of social skills difficulties versus problem behaviors are found when both caregiver and teacher reports are used (Hukkelberg et al., 2019). This is explained by the fact that caregivers tend to provide reports based on individual evaluations whereas teachers complete normative assessments (Hukkelberg et al., 2019). This may help explain some of the variance found in the current study as informal teacher report was used for recruitment purposes and caregiver report for assessment purposes. Furthermore, social skills are behaviors that are not guaranteed to be equal across context, suggesting that it is possible for an individual to show positive uses of social skills in one setting but not in another such as home versus school settings (Hukkelberg et al., 2019). Despite several unknowns surrounding the relation between social competence and behavioral problems, the meta-analysis completed by Hukkelberg and colleagues (2019) suggests that interventions aimed at either problem behaviors or social competence or social skills can have a positive impact on both constructs with the ultimate goal of improving the well-being of children and adolescents. Taken together these findings provide some potential explanations for the results in this current study while also highlighting the need for more research on how to best capture the overlap and differentiation between social skills difficulties and problem behaviors in intervention research.

## **Evidence of Change**

An analysis of individual change using the Reliable Change Index showed mixed results as some participants remained unchanged, while others showed improvement and some deteriorated with no noticeable consistent pattern to analyse further. Notable are the four participants who improved on the measure of sustained attention as this is the largest group of improvements observed. Research in the field of recreational video games has shown a link between game play and visual attention skills with improvements noted for frequent “gamers” (e.g., Green & Bavelier, 2012; Spence & Feng, 2010). Although the relationship between video games and sustained attention specifically is not yet fully understood similar outcomes are expected (Trisolini et al., 2018). Therefore, the preliminary findings presented in this paper may provide potential evidence that sustained attention can improve after video game training.

In addition to the preliminary positive findings, it is also important to discuss the fact that deterioration was found for several participants on some of the outcome measures. Specifically, those found on the social skills self report may represent an important finding as the worsening of these behaviors could be corresponding to a response-shift bias (Drennan & Hyde, 2008). Response shift bias occurs when the reporters’ internal frame of reference of the abilities measured changes between the pre- and post-tests due to influences associated with the intervention (Aiken & West, 1990; Drennan & Hyde, 2008). For this study this could mean that the participants’ beliefs or awareness of their social skills changed as a result of participation in an intervention focussed on social skills improvements. Further investigations should include retrospective pre-testing to control for this type of bias (Drennan & Hyde, 2008).

## **Limitations and Future Research**

Even though technology has been around for several decades and appears to have permeated much of daily life, the use of video games as intervention platforms continues to be viewed as a relatively novel idea. The current study does not only deviate from common social skills intervention based on the delivery platform but also in the chosen focus of training constructs. Rather than teaching direct social behaviors, underlying cognitive and socio-emotional abilities were the focus of the intervention discussed in this study. This approach is supported by theory (e.g., Cordier et al., 2015; Soto-Icasa et al., 2015); however, limited research has been completed to date to show evidence. Furthermore, delivering a social skills intervention to a general group of adolescents with social difficulties rather than with a common shared diagnosis can also be viewed as uncommon. As a result of these novel concepts tested, the study presented here should be viewed as preliminary and exploratory. This limits the potential for generalizability of the current findings but provides rich information for future directions.

Future studies may want to explore additional method of assessing for intervention engagement through the collection of subjective data or what is referred to as attitudinal engagement (the participants' emotional investment in and commitment to the intervention; Lindsey et al., 2014; Perski et al., 2016). For this study, no information was collected on participants' commitment or interest in the intervention nor their attention level during game play. This means that while they appeared to be engaged in the intervention they could have been engaged in several other online activities or distracted by things in their environment, thereby lowering their attention to and ultimately engagement with the intervention.

Next, one of the goals of this study was to provide information about delivering the intervention to a general group of adolescents with social difficulties rather than a specific

diagnostic population and to learn about social skills needs for this more heterogeneous group. Despite the limitations associated with the current study, the work presented here should be considered critical to any future research conducted examining the use of a goodness of fit approach to intervention design and selection. The findings presented here show shared common deficits in not only social skills or problem behaviors but also in cognitive and socio-emotional abilities across different diagnoses thereby highlighting the importance of a fit between intervention goals and identified needs. Any future research done in this area would benefit from more sensitive and normed measures to provide a more comprehensive individual profile of needs and strengths.

Another goal outlined at the onset of this study was to provide preliminary evidence for indications of change as a result of training underlying abilities rather than employing direct training methods to teach specific social behaviors. Uncovering information about potential change as a result of this new approach to social skills training was thought to be foundational to future research in this area. Although the data presented in this research is limited there were some identified trends of possible impact and more importantly there was no significant decline in abilities or skills post-intervention. The limited evidence of change found in this study could be due to the small sample size, the measures used, or the short duration of the intervention. As a result, further research is needed using a larger sample size, more sensitive measures, a randomized control design, and an exploration of the ideal length of an intervention should be completed.

The preliminary work done in this study show the necessary first steps to test and examine the novel ideas presented in the areas of video game interventions, engagement, as well as efficacy enhancements by changing training modalities and intervention selection criteria.



Future research should build on this promising work with a continued aim of improving the supports available to adolescents with social skills difficulties.

### **Conclusion**

This study focused on the importance of engagement, underlying abilities, and participant profiles, related to social skills interventions for adolescents. The study was exploratory in nature as several new concepts were trialed including the use of a video game as the intervention platform, a focus on training underlying cognitive and socio-emotional abilities rather than directly training specific social behaviors, as well as the inclusion of a heterogeneous pool of participants with common perceived difficulty with social functioning. The study included an analysis of quantitative information gathered on the adolescent participants' levels of engagement, an examination of participant profiles which showed some commonalities in social skills needs, and an exploration of change observed for the participants in terms of social skills, problem behaviors, sustained attention, inhibition, perspective taking, and emotion regulation.

Overall, the positive trends discovered and absence of negative statistically significant findings, suggest that these novel ideas to changing the field of social skills interventions for adolescents warrant further attention from researchers in the field. Continued explorations on how to better support adolescents with social skills difficulties is critical and the research presented in this paper hopes to guide this future research while promoting change and innovation.

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## Chapter 5: Conclusion

The importance of social skills has been highlighted throughout years of research emphasizing the link between good social skills and long-term benefits to the psychological well-being for individuals across the lifespan (e.g., Deming, 2017; Domitrovich et al., 2017). Despite the breadth of knowledge regarding this identified importance, current literature shows several gaps in the supports available to those who struggle in social situations. Although many interventions have been developed over the years, concerns are noted regarding the lack of theory driven interventions as well as the primary focus being on younger children (e.g., Ledford et al., 2018; Stevens et al., 2016; Storebø et al., 2019), thereby leaving adolescents with social skills difficulties under supported. Yet adolescence is a period of opportunity for intervention as a result of increased brain development (e.g., Andrews et al., 2021; Soto-Icaza et al., 2015) and an increase in social demands (Steinberg, 2014). Taken together, this highlights a need for more developmentally appropriate supports for this age group.

In response to this need, the overall goal of the dissertation was to increase understanding on how to support adolescents with social skills difficulties and discuss the use of an intervention grounded in theory and innovation to provide increased appropriate supports to this age group. Research on interventions can be multifaceted and researchers such as Fraser and Galinsky (2010) have identified five steps when conducting intervention research to ensure the development of theory informed and effective interventions. These steps include: (a) development of the problem and program theories, (b) design of program materials and measures, (c) confirming and refining the program components in efficacy tests, (d) testing effectiveness in a variety of practice settings, and (e) disseminating the program findings and

materials (Fraser & Galinsky, 2010). Informed by this framework, I engaged in exploratory research, enacting the first three steps of this process.

In addition to the intervention research framework, the work presented in this dissertation was also informed by my training in the scientist-practitioner model (Frank, 1984). This model emphasizes the importance of the integration of science and practice during the training years for clinical psychologists. This training allowed me to combine the scientific knowledge about social skills and development with my practical experiences in providing interventions to adolescents. Furthermore, this training also helped guide the research as I moved through the intervention research steps as outlined above.

### **Step One: Identifying the Problem**

An important first step in intervention research is to complete a thorough review of the applicable literature to help identify and define the problem thereby guiding the intervention design and implementation steps. I therefore examined related theories to social skills development and intervention principles in Chapter Two of this dissertation. The importance of underlying cognitive and socio-emotional abilities in overall social skills development was highlighted (e.g., Cordier et al., 2015) and a critical analysis of the available supports for children and adolescents with social skills showed several gaps. These gaps included concerns about the ability of these interventions to teach social skills that are generalizable to outside settings as well as the feasibility and resource intensity of the programs. Furthermore, two specific concerns were highlighted and discussed in more detail. First, many of the social skills interventions historically focused on direct teaching of behavioral skills, despite the increasing support for training underlying cognitive and socio-emotional abilities to instill change in the observable social behaviors and ultimately social functioning (e.g., Cordier et al., 2015; Ross et

al., 2019; Soto-Icaza et al, 2015). Secondly, a gap was noted in the populations targeted as many of the interventions are designed to support children and limited developmentally appropriate, engaging, and evidence-based social skills interventions are available for adolescents (e.g., Ledford et al., 2018; Stevens et al., 2016; Storebø et al., 2019). Taken together, the review and critical analysis highlighted the need for a new way of developing and delivering social skills interventions for adolescents.

To move beyond a problem focused approach and keeping in line with the scientist-practitioner model, I also presented a possible solution to find appropriate supports for adolescents with social skills difficulties. The review highlighted the importance of engagement in the clinical practice of supporting adolescents (see Chapter 4 for a review) and with this in mind, I chose to explore the possibilities of finding a solution to the gaps presented for suitable interventions for adolescents. Through this exploration, the potential for the use of technology and specifically video games as an intervention platform for adolescents was striking. Video games have been proposed as a new way of delivering interventions to individuals due to the benefits associated with digital game-based learning including cognitive, motivational, affective, and social benefits (e.g., Georgeson et al., 2020; Plass et al., 2015). This approach may also be well suited to mitigate some of the other gaps identified in the literature including the concerns related to resource intensity and generalizability of the learned skills. Although the concept of using video games as a platform for intervention delivery is relatively novel, some evidence for this approach was highlighted in the review chapter (e.g., Craig et al., 2015; DeRosier et al., 2012; Kokol et al., 2020) and suggests that further research is warranted.

## **Step Two: Designing the Intervention**

Informed by research in the area, the next step of my process was focused on development. Thus, Chapter Three of my dissertation describes the design process of a theoretically driven video game based social skills intervention for adolescents to address the concerns outlined in the review chapter. Much of the research conducted on social skills interventions focuses on outcomes such as efficacy and effectiveness and although these are crucial components of intervention research, attention should also be paid to the intervention used and how it was designed as this often links to outcome findings (Maag, 2006).

Understanding the development process of an intervention allows for a potential deeper understanding of the potential change that may occur as a result of the intervention (Wight et al., 2016). Furthermore, documenting the steps involved in the design process allows for future improvements and refinements as the intervention moves through efficacy and effectiveness studies. Much of the research published on interventions focuses on their evaluations, while there is little research to guide the design and development process (Wight et al., 2016). Presenting the details of the design steps therefore also adds important information to the field of intervention literature.

As a result, the design process was discussed in detail in Chapter Three and outlines information about the decisions made by the development team throughout each step of the design process. This included an analysis of the training constructs selected, the gamification process, as well as the measures chosen to assess potential impact. The concept of a video game as the intervention platform for social skills training continues to be relatively new and as the popularity of this approach continues to grow, future interventions will likely be designed. The

design process outlined in this dissertation can therefore serve as a preliminary blueprint for considerations to be included in future interventions.

The design stage of this dissertation work was highly fluid in nature and drew upon my unique training as a scientist-practitioner linking both research on social skills and adolescent development to practical components of intervention principles such as engagement and playability. The integration of science and practical experience helped guide much of the design process ranging from deciding on the length of the intervention to the storyline for the intervention sessions. The scientist-practitioner model is often linked to evidence-based practice or treatments (Navab et al., 2016) and grounding intervention design in this approach helps establish the base for an evidence and practice informed support for adolescents with social skills difficulties.

### **Step Three: Efficacy Implementations and Refinements**

Once developed, the game needed to be trialed and tested. This proceeded is a three-step process, that increasingly advances towards a full implementation. Typically, the implementation step includes an initial implementation testing for feasibility as well as further implementations to refine the intervention and test for use in a variety of settings (Fraser & Galinsky, 2010). The first step was tied closely to the game development, as it aimed to determine the actual workability of the gaming platform. Thus, the game was first trialed with a small group of adult volunteers to ensure preliminary playability. This allowed the team to address technical concerns and further the ease of playability prior to adolescent participation. Once the changes were made an initial implementation took place with a small group of three participants with FASD and identified social difficulties, representative of a pilot study. These initial implementation steps were described in Chapter Three, and the results were promising. First, participants were

engaged in the game. This was determined based on high attendance rates as well as observed participation in the intervention tasks. Second, limited difficulties were observed administering the game from a distance, within participants' home environments, providing evidence for feasibility. Third, I found that the youth involved experienced some positive trends towards positive change to social skills and problem behaviors associated with social functioning. Although this does not provide clear evidence for the potential impact of this intervention, it does clearly establish that it is viable, that youth are willing to engage in the activities and do not experience any evident harm.

Before building on this promising start, it was important to examine the intervention for a need for refinement and changes. Consequently, some changes to the gamified tasks and software bugs were highlighted and applied. Furthermore, in keeping with the call for interventions to be geared towards social skills needs rather than diagnosis (e.g., FASD; e.g., Cordier et al., 2015; Gresham & Elliot, 2008; Gumpel, 2007; Maag, 2005; Walker et al., 2004; Lerner & White, 2015) and in response for calls to increase the number of widely available adolescent social skills supports (Casey et al., 2000; Lanovaz et al., 2017; Steinberg, 2014), the participant inclusion criteria were extended. Specifically, recruitment was opened to all adolescents between the ages of 11 to 18 with any diagnosis and identified social skills difficulty. Lastly, the intervention research approach described by Fraser and Galinsky (2010) also highlights the importance of testing an intervention in a variety of practice settings. Typically, this applies to the effectiveness testing stage; however, due to some experienced difficulties with recruitment in the initial implementation stage and the common use of social skills interventions in school settings, the decision was made to test for feasibility of the intervention with participants in schools for the next implementation.

The third step of the early implementation plan was therefore an expanded pilot intervention, described in Chapter Four. In this study I aimed to examine the efficacy of the intervention concept while also allowing for a deeper exploration on how to best support adolescents with social skills difficulties in general. This was accomplished by making changes to improve playability (e.g. software bugs, downloading changes). Changes were also made to the outcome measures to track individual changes more accurately, and specific data was collected to further assess levels of engagement experienced. These changes were made based on research highlighting the importance of engagement in adolescent interventions, engagement research, as well as literature on social skills assessments. The inclusion of these changes required additional time and resources from the research team; however, it highlights the evolution and continued refinement that is required for intervention development.

The results obtained from the expanded pilot study, showed high levels of engagement for the participants thereby providing preliminary evidence of the use for video games as an intervention platform to help limit attrition for adolescents. Furthermore, some preliminary evidence for change was found for the use of a social skills intervention for adolescents with identified social skills difficulties. Although this concept requires further research, the foundation has been laid and this current dissertation can be used to inform future studies to investigate efficacy of video game-based interventions. The research presented shows the use of an intervention research approach (Fraser & Galinsky, 2010) to guide intervention design through to implementation while also highlighting the value of a scientist-practitioner model for intervention research. The links to theory and research were emphasized throughout the steps and the examination of the data collected from the testing and implementation stages was used as feedback to guide future work, thereby solidify both input from science and practice. In



summary, the design and testing processes described in Chapters Three and Four, combined with the theoretical review of Chapter Two, show the steps that should be considered in intervention research. Furthermore, the work presented highlights the importance of integrating science and clinical practice throughout all stages of design and implementation and supports the idea of a necessary feedback loop (Wight et al., 2016) between professionals involved in research versus clinical settings. Lastly, the process helped me as a researcher and clinician develop a more holistic view on what it means to take a scientist-practitioner approach to supporting individuals.

### **Contributions and Implications**

Intervention development is a significant undertaking. To develop effective interventions, there are several required steps including theory reviews, development stages, initial implementations, and refinements. Without these foundational steps, effectiveness studies, such as randomized control studies, would not be possible. Through my dissertation research, and preliminary findings, this work is now poised for the next steps. Moreover, the process of conducting this work has revealed many core considerations for working with adolescents, in both scientist and practitioner capacities.

### ***Research Contributions***

Each of the intervention research steps covered in this dissertation contributes to the existing body of literature on social skills development and intervention in unique ways. First, the literature review and associated critical analysis presented highlights the overall gaps in social skills interventions while specifically focussing in on several gaps related to adolescent interventions. The importance of engagement and its relation to intervention completion was also underscored. This review will contribute to the overall literature by informing and stimulating change in the field of social skills interventions with an overarching goal of better supporting

adolescents with social skills difficulties. The emphasized importance of supporting adolescents and focussing on engagement to impact attendance also extends beyond the social skills intervention realm as this can be applied to the broader field of adolescent supports. Difficulties with adolescent attrition rates have been noted across a variety of interventions despite growing evidence highlighting adolescence as a period of opportunity for intervening (Andrews et al., 2021). Although the focus of the research presented in this dissertation was social skills based, the underlying message highlighting the importance of offering developmentally appropriate and engaging supports to adolescents can be applied across many areas.

Next, the design process covered in Chapter Three, contributes to the existing literature as it highlights a unique process in intervention design. This process shows the collaboration between researchers from different background and combines the knowledge on social skills and adolescent development with the technical expertise required to build the video game intervention. For interventions using digital technology, the content design (e.g., training constructs) commonly occurs in isolation of the technology development (e.g., programming) (Lyon et al., 2020). This is suspected to result in interventions that are suboptimal as they may lack overall effectiveness or fail to take full advantage of the benefits that digital technologies have to offer (Lyon et al., 2020). The collaborative development process highlighted in this work therefore highlights a potential way to eliminate potential threats to effectiveness.

Futhermore, the implementation steps discussed in this paper contribute the literature by providing preliminary support for the use of a theory driven video game based social skills intervention for adolescents with varying diagnosis but shared social skills needs. More specifically, the intervention designed and applied in this dissertation explored several novel ways to support adolescents with social skills difficulties and showed preliminary evidence that

1) an intervention can be delivered to adolescents through a video game, 2) adolescents can remain engaged in a social skills intervention that is engaging and developmentally appropriate, and that 3) one intervention can be potentially effective for adolescents based on alignment between their needs and the intervention goals. The implementation step also highlights the need for future research to be conducted to further assess the relatively novel ideas presented in this paper.

Lastly, the research presented in this dissertation also highlighted the overlap between behavioral problems and social skills difficulties. Although the study did not aim to focus on this known correlation it is important to consider the impact that this may have on the findings of this current as well as future studies in the field of social skills intervention. As the research on this relation is currently limited, the findings from this current study showing support for the perceived overlap can be considered an important contribution specifically when considering the ages of the participants in this dissertation. A meta-analysis conducted by Hukkelberg and colleagues (2019) examining the correlation between social competence and behavioral problems shows that many of the studies to date focus on individuals ages 3 to thirteen. This dissertation shows that the phenomenon of overlap is likely to continue into adolescence and highlights the need for future research on the relation and the impact of the current conceptualization of both social skills difficulties and problem behaviors in children and adolescents.

**Future Research.** In addition to the contributions to the current available research this dissertation makes, there are also several learnings that can be drawn from this to inspire future research. First, the preliminary work completed in this dissertation highlights the first three steps of the intervention research approach. The preliminary positive trends discussed as a result of the initial implementations suggest that further research is warranted which may include further

efficacy studies or potentially studies examining potential effectiveness associated with the intervention.

Second, the research presented in this paper adds to the scarce literature on integrating the use of technology with social skills interventions and more specifically the impact this platform can have on adolescent engagement. The high levels of engagement noticed during the two rounds of implementation for this dissertation suggest that the use of technology should be explored further. This can include a continuation of the research started in this dissertation using video games; however, other options may also include the use of Virtual Reality (VR). VR is expected to further engage participants due to the immersion level associated with this type of technology and has specifically been proposed to align well with social skills interventions as allows for repeated, safe, and realistic practice of social interactions (Yuan & Ip, 2018). Recent advances in this technology have also made this a more financially feasible alternative to consider and should therefore be explored further.

Third, the literature on social skills interventions discusses the importance and benefits of including parents in the intervention as some researchers have reported higher levels of effectiveness of interventions that include parent supports (Gresham, 2016). Parental or caregiver involvement is thought to bridge the gap between intervention and real-world environments and is therefore said to help increase generalizability of the learned social skills. The addition of a parent component has also been linked to decreases in attrition (Grimes, 2008; Laugeson et al., 2009). However, many social skills interventions that include a parent component are aimed at younger participants and parent participation is expected to be different for adolescents. As adolescent interventions often take place within the school system (Plavnick et al., 2015), an alternative may be to include school staff to help link the intervention impacts to the real-world settings, instead

of a parent or caregiver. Further research should therefore be conducted to examine the use of caregiver or school staff support and its impact on generalizability and adolescent attrition rates.

### ***Clinical Implications***

The research presented in this dissertation provides important information that can help inform best practices for supporting adolescents with social skills difficulties. Practitioners and clinicians can serve many different roles when supporting adolescents with social skills difficulties ranging from identification of the difficulty through assessments to finding and selecting appropriate interventions and supports for them. As a result, the information presented in this dissertation, aims to help inform clinicians in both the realms of assessment and intervention selection.

First, the research presented in this dissertation highlighted the importance of goodness of fit between the participant's social skills needs and the goals of the intervention. A case was made for this through an exploration of relevant literature which showed that the call for a goodness of fit approach to intervention design and selection was supported by several researchers (e.g., Gresham, 1981, see also Cordier et al., 2015; Gresham & Elliot, 2008; Gumpel, 2007; Maag, 2005; Walker et al., 2004; Lerner & White, 2015). However, this goodness of fit approach can only be applied when an individual's social skills profile is known, requiring a full assessment of the participant's social skills strengths and needs. Typically, social skills assessments include behavioral observations, sociometric assessments, and/or behavior rating scales (Matson, 2017) and best practice is to use a multimethod, multisource, multi-setting assessment design (Merrell, 2001). However, this approach is often not feasible and more commonly the sole assessment used by researchers and practitioners to inform intervention is a rating scale completed by either the caregivers and/or teachers. A thorough assessment of the

underlying cognitive and socio-emotional abilities is often not included, despite the identified importance to overall social skills functioning. The information presented in this research therefore serves to remind practitioners of the valuable information that can be drawn from assessments and how this can help inform intervention selection.

Second, in addition to the importance of goodness of fit, engagement with the intervention should also be considered as crucial. Participants who are not engaged with the intervention and the training content are more likely to drop out and show limited lasting impacts from the intervention program (Couper et al., 2010; McKay et al., 2001; Strecher et al., 2008). Due to the importance, intervention engagement should be considered at the design stages of intervention research. However, practitioners/clinicians can also play a role in this as engagement and motivation for intervention are subjective to the individuals and in this case adolescents. Practitioners and clinicians are therefore encouraged to examine potential intervention options for the engagement level offered and its match to the individual requiring support.

Taken together, the two clinical implications drawn from this dissertation highlight the need for an individualized approach for intervention selection for adolescents with social skills difficulties. Assessing the needs of the individual and considering their individual motivations and levels of engagement is thought to be beneficial for their overall experience in the intervention and ultimately lead to increased effectiveness and an increased sense of support offered to the youth.

### **Summary**

In this dissertation, I have contributed to the understanding of social skills intervention development. I also added to the current knowledge on the importance of engagement in adolescent interventions and I explored a way to help better support youth with social skills

difficulties through innovation and guided by my training in the scientist-practitioner model. In addition, the work presented shows evidence for future research to further assess the potential effectiveness of the designed intervention.

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## Appendix A

### Ethics Approval Letter

#### Approval Form

Date: March 17, 2015  
 Study ID: Pro00052027  
 Principal Investigator: [Jacqueline Pei](#)  
 Study Title: Social Skills Training in FASD: Use of Virtual Environments  
 Approval Expiry Date: March-15-16  
 Sponsor/Funding Agency: Scholarship and Awards Committee Faculty of Education

	Project ID	Project Title	Speed Code	Other Information
RSO-Managed Funding:	<a href="#">View</a> RES0003521	ACCFCR IDSRG 09SM Pei		
	<a href="#">View</a> RES0005063	UV 20070254 (33884- 58400) Pei		
	<a href="#">View</a> RES0008657	University of Victoria/NeuroDevNet		

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel . Your application, including revisions received February 20 & March 16, 2015, has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health Services approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health should be directed to (780) 735-2274.

Sincerely,

Anthony S. Joyce, Ph.D.  
 Chair, Health Research Ethics Board - Health Panel

*Note: This correspondence includes an electronic signature (validation and approval via an online system).*

## Appendix B

### Information Letters

1/2

#### PARENTAL/GUARDIAN INFORMATION FOR CHILD TO BE INVOLVED IN AN INTERVENTION STUDY

- Project:** *Social Skills Training: Use of Virtual Environments*
- Researchers:** Jacqueline Pei PhD, Educational Psychology; Patricia Boechler PhD, Educational Psychology
- Information:** Please call Dr. Pei (780) 248-1167.
- Aims:** In this study, we want to see if adolescents with complex needs (e.g. a FASD, suspected FASD or other diagnoses) can improve their social skills through playing a video game. If you agree to have your child do this study, you will be asked to answer some questions about your child. Then your child will be asked to play a computer game at home or at one of the participating organizations' offices, once a week for 6 weeks. We will also do three sets of tests, each 6 weeks apart.
- Background:** Adolescents with complex needs such as FASD or other diagnoses often have challenges with social skills, but there is little research on how to improve this. This project is trying to improve your child's social skills.
- Trials:** Testing will take approximately 2 hours, measuring attention, concentration, social skills, thinking and reasoning abilities. Subsequent testing will last approximately 60 minutes each. When possible, testing will take place at one of the participating community organizations. At three times during the study, you will be asked to fill out a form about your child's behavior. The form will take approximately 20 to 30 minutes of your time and will be given to you about 6 weeks apart. Prior to starting the intervention, you will also be asked to complete a background questionnaire about your child.
- Your child will be asked to play an online computer game for approximately an hour long once a week for 6 weeks. In this game your child will interact with other adolescents online. The game will be monitored by the researchers to ensure that proper play occurs.
- Possible benefits:** Children will have fun playing in a team format. Your child may also enjoy using the new skills they learn to help them interact with others. In addition, your child will receive a \$10 iTunes gift card (or equivalent) each time they complete one of the 3 sets of tests. You will also receive a onetime \$25 Indigo gift card upon completion of the questionnaires at the beginning of the study.



- Possible risks:** There are no known risks to participating in this study. You and your child will not experience any negative results if you choose not to participate.
- Confidentiality:** Only the people involved with the study will see the information collected. Your child's name will be replaced by a number and will not be shared with anyone outside the study. In addition, the name will not be used in any publications and the information collected during the study will be kept in a locked filing cabinet at the University of Alberta for at least of five years.
- Withdrawal:** Your child may choose to leave the study at any time while participating in the study, without having to give a reason. If they choose to leave, they will have the option of having all of their data destroyed. Once all the above identified data has been collected withdrawal is no longer possible (approximately 12 weeks from start date). When deciding to withdraw your child will receive the promised gift cards up to the number of sets of testing that they completed. For example, if they decide to withdraw after the second set of testing they will receive 2 gift cards.
- Concerns:** If you have concerns with this study, please contact the University of Alberta Health Research Ethics Board at 780-492-2615. This office has no affiliation with the study investigators.

### INFORMATION FOR ADOLESCENTS ABOUT INTERVENTION STUDY

- Project:** *Social Skills Training: Use of Virtual Environments*
- Investigators:** Jacqueline Pei PhD, Educational Psychology; Patricia Boechler PhD, Educational Psychology
- This study is to find out if playing a special computer game can help youth with their social skills.
- What is it?:** Talking with other people, making friends, or knowing what to do or say when around others may be hard sometimes. Learning how to do this may make it easier. We will play a computer game in a team to see if it helps kids get better social skills.
- What will you have to do?:** The game will take place at your house or at one of the organizations' offices and will last an hour, one time per week for 6 weeks. Before you start, after you finish the 6 weeks, and at one other point you will work on some tasks that will tell us what your social skills are like. It may take around 2 hours the first time and then 60 minutes the next two times, to do these parts.
- Will it help?:** Most kids and youth like playing this game and working together with others to complete the game. You will also receive a \$10 iTunes gift card (or Indigo) each time that you complete a set of tests. In total, you will be able to get up to \$30 in gift cards.
- Will it hurt?:** We do not think it will hurt you to do this research.
- Who will know?:** Only the researchers will know that you are doing this study and they will be the only ones to look at the test results.
- Can you quit?:** You can quit the study at any time. You do not have to give a reason if you want to quit. You can ask the researchers about the study at any time. Also know that if you decide to quit you will still receive the gift cards for the number of set of tests that you completed. For example, if you stop participating in the study after you have completed 2 sets of testing then you will receive a total of 2 gift cards.
- Do you have more questions?:** You can ask your caregivers about anything you don't understand. You can also ask Dr. Pei, her phone number is 780-248-1167.

## Appendix C

### Consent and Assent Forms

#### PARENTAL/GUARDIAN CONSENT FOR CHILD TO BE INVOLVED IN INTERVENTION STUDY

**Project:** *Social Skills Training: Use of Virtual Environments*

**Investigators:** Jacqueline Pei PhD, Educational Psychology; Patricia Boechler PhD, Educational Psychology

**Information:** Please call Dr. Pei (780)-248-1167.

#### DEMOGRAPHIC/HEALTH INFORMATION

Child's Name: \_\_\_\_\_ Birth Date: (M/D/Y) \_\_\_\_/\_\_\_\_/\_\_\_\_ Weight: \_\_\_\_\_ Sex: M/F

Caregiver's Name: \_\_\_\_\_ Phone Number (daytime): \_\_\_\_\_

Address: \_\_\_\_\_ City/Province: \_\_\_\_\_/\_\_\_\_ Postal Code: \_\_\_\_\_

Are you the child's **legal guardian**?  YES  NO

Relationship to child (circle): Biological Parent / Adoptive Parent / Foster Parent / Relative\* / Other\*

\*If relative or other please specify: \_\_\_\_\_

If you are not the child's **legal guardian**, please have the legal guardian review and sign this consent or provide a name and phone number where we can contact them for consent: \_\_\_\_\_

\_\_\_\_\_

Is the child taking any medications? YES / NO If yes, please list: \_\_\_\_\_

Please indicate any diagnoses and when this diagnosis was made: \_\_\_\_\_

\_\_\_\_\_

**CONSENT TO PARTICIPATE**

	YES	NO
Do you understand that you and your child are being asked to be in a research study?	_____	_____
Do you understand that you are consenting to participate in this study through your role in completing the forms?	_____	_____
Have you received and read the attached information sheet?	_____	_____
Do you understand the benefits and risks in participating in this research study?	_____	_____
Have you had an opportunity to ask questions and discuss this study?	_____	_____
Do you understand that you and your child are free to leave the study at any time without having to give a reason and without affecting you/their future medical care?	_____	_____
Has the issue of confidentiality been explained to you?	_____	_____
Do you understand who will have access to your child's records, including personally identifiable health information?	_____	_____

I agree for my child and myself to take part in this study:  YES  NO

\_\_\_\_\_  
Printed Name of Parent/ Legal Guardian Completing Form      Signature      Date

\_\_\_\_\_  
Signature of Witness      Date

For Investigator Only:

I have explained this study to the participant signing this form. They appear to understand what is involved in the study and voluntarily agree to let their child participate.

\_\_\_\_\_  
Signature of Investigator or Designee      Date





Health History

1. Has your child ever experienced or been diagnosed with any of the following? (check all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> ADD/ADHD            | <input type="checkbox"/> Manic/Bipolar                       |
| <input type="checkbox"/> Depression          | <input type="checkbox"/> Oppositional Defiant Disorder (ODD) |
| <input type="checkbox"/> Anxiety             | <input type="checkbox"/> Autism/Asperger's Syndrome          |
| <input type="checkbox"/> Tourette's Syndrome | <input type="checkbox"/> Schizophrenia                       |
| <input type="checkbox"/> Epilepsy/Seizures   | <input type="checkbox"/> Other (specify): _____              |

2. Has your child been involved in any interventions (research related or not) before? If so when and what for?

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3. Some women drink alcohol before they know they are pregnant. Did you drink any alcohol while you were pregnant, including before you knew?  Yes  No

4. Some women smoke before they know they are pregnant. Did you smoke while you were pregnant, including before you knew?  Yes  No

5. Were there any complications or did anything unusual happen during your pregnancy? (please describe)

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6. Were there any complications or did anything unusual happen during the birth of your child? (please describe)

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Language Development

1. How old was your child when he/she first spoke a word? \_\_\_\_\_

2. How old was your child when he/she began to put words together to make short sentences (=2 words e.g. 'more milk')? \_\_\_\_\_

3. Is there any other language spoken at home (apart from English)? If yes, what language?

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a. Does your child understand and/or speak this language? \_\_\_\_\_

4. Compared to other children of the same age, how do you think your child expresses him/herself?

not very well  a little less well  the same  very good/better/one of the best

ID # \_\_\_\_\_  
Date (MM/DD/YY) \_\_\_\_\_

5. Compared to other children of the same age, how do you think your child pronounces words?  
 \_\_\_\_ not very clearly    \_\_\_\_ sometimes not clear    \_\_\_\_ same    \_\_\_\_ very good/better/one of the best
6. Is it easy for your family or friends to have a conversation with your child?  
 \_\_\_\_ very easy    \_\_\_\_ easy enough    \_\_\_\_ sometimes not easy    \_\_\_\_ no, very hard

#### Demographic Questions

1. What is the marital status of the child's primary caregiver?

- Single, never married       Married       Widow or Widower  
 Divorced, single       Divorced, remarried

**If divorced/separated**, how often does the child see his/her mother/father?

- Weekly       Yearly       Never  
 Monthly       Other: \_\_\_\_\_

2. Please indicate the primary caregiver's (e.g. biological/foster/adoptive parent, guardian, etc):  
 highest level of education

- Less than 7<sup>th</sup> grade       Partial university/specialized training (e.g., trade school)  
 Junior high school       University graduate (Bachelor's degree)  
 Partial high school       Graduate degree  
 High school graduate

Type of employment: \_\_\_\_\_

Relationship to the child (e.g. mother/father/grandmother): \_\_\_\_\_

3. Please indicate the primary caregiver's spouse/partner's (if applicable):

Highest level of education

- Less than 7<sup>th</sup> grade       Partial university/specialized training (e.g., trade school)  
 Junior high school       University graduate (Bachelor's degree)  
 Partial high school       Graduate degree  
 High school graduate

Type of employment: \_\_\_\_\_

Relationship to the child: \_\_\_\_\_

4. What is the annual income of the household in which the child lives?

- Less than \$25,000       \$101,000 to \$150,000  
 \$25,000 to \$50,000       \$151,000 to \$200,000  
 \$51,000 to \$75,000       \$201,000 to \$250,000  
 \$76,000 to \$100,000       More than \$251,000



## Appendix E

### Difficulties in Emotion Regulation Scale-Short-Form (DERS-SF)

**Please indicate how often the following apply to you.**

	Almost Never (0–10%)	Some- times (11–35%)	About Half Of the Time (36–65%)	Most of the Time (66–90%)	Almost Always (91–100%)
1. I pay attention to how I feel	1	2	3	4	5
2. I have no idea how I am feeling	1	2	3	4	5
3. I have difficulty making sense out of my feelings	1	2	3	4	5
4. I care about what I am feeling	1	2	3	4	5
5. I am confused about how I feel	1	2	3	4	5
6. When I'm upset, I acknowledge my emotions	1	2	3	4	5
7. When I'm upset, I become embarrassed for feeling that way	1	2	3	4	5
8. When I'm upset, I have difficulty getting work done	1	2	3	4	5
9. When I'm upset, I become out of control	1	2	3	4	5
10. When I'm upset, I believe that I will end up feeling very depressed	1	2	3	4	5
11. When I'm upset, I have difficulty focusing on other things	1	2	3	4	5
12. When I'm upset, I feel guilty for feeling that way	1	2	3	4	5
13. When I'm upset, I have difficulty concentrating	1	2	3	4	5
14. When I'm upset, I have difficulty controlling my behaviors	1	2	3	4	5
15. When I'm upset, I believe there is nothing I can do to make myself feel better	1	2	3	4	5
16. When I'm upset, I become irritated with myself for feeling that way	1	2	3	4	5
17. When I'm upset, I lose control over my behavior	1	2	3	4	5
18. When I'm upset, it takes me a long time to feel better	1	2	3	4	5