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Evaluating The Efficacy Of Computer Social Skills Game In Improving The Social-Emotional Development Of Head Start Children

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™Running Head: Efficacy of Computer Game

EVALUATING THE EFFICACY OF COMPUTER SOCIAL SKILLS GAME IN IMPROVING THE SOCIAL-EMOTIONAL DEVELOPMENT OF HEAD START CHILDREN

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ABSTRACT

The preschool years are an important time for cognitive and social development. Children from lower socioeconomic backgrounds are often subject to difficulties in social-emotional competence. Head Start programs have a goal of improving social-emotional development of children from lower socioeconomic backgrounds. Social skills interventions teach fundamental social skills. FaceSay™, a computer-based intervention teaches skills such as eye gaze and face processing with a goal of improving face and emotion recognition. FaceSay™ performance was not predictive of post intervention face and emotion recognition. Based on the results, cognitive scores predicted increased face recognition scores post intervention; however, the assignment to FaceSay™ was the greatest predictor when compared to pre intervention scores and cognitive ability. Cognitive scores were the best predictor of emotion recognition, but game assignment was not a significant predictor of emotion recognition. Children playing FaceSay™ did not show a greater ability to draw the human face as compared to children playing the control games. However, children who performed better on FaceSay™ showed a greater ability to draw human faces.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Tables ***Page***

INTRODUCTION

Poverty is an important social issue that has far-reaching effects both on a local and national level. The poverty rate for children under the age of 18 increased from 17.4% to 18% in 2007, which equals to 13.3 million children in the United States living below the poverty line (DeNavas-Walt, Proctor & Smith, 2008). Poverty effects the environment in which the child lives, included in these affects are decreased resources, increased parental stress, and fewer opportunities for educational and social enrichment (NICHD Early Child Care Research Network, 2005). Social skills interventions are useful programs for children with or at risk for social deficits. Many of the programs focus on children with Autism Spectrum Disorders (ASD) or developmental disorders; however, many children are at risk for difficulties based on factors including socioeconomic status (SES). Previous studies have examined the efficacy of social skills interventions and demonstrated support for these programs. As children continue to demonstrate a need to improve social function, it necessitates the use of easily administered, low-cost programs. As technologies continue to advance, social skills interventions can be introduced to large populations of children through computers. Several studies have examined the efficacy of FaceSay- a computer-based social skills intervention (Gower, M., 2009; Hopkins, Gower, Perez, & Biasini,2011; Perez, T.A., 2008). The present study sought to further establish the efficacy of FaceSay™ in a population of preschool children enrolled in Head Start by examining the relationship between game performance and social skills outcome measures. In addition, the present study sought to determine if cognitive ability effects the children's intervention performance and outcomes on the social skills measures.

The study introduction outlines the components of preschool development, focusing primarily on the relationship between cognitive and social development and how the two combine to contribute to the child's social-emotional competence. The paper provides information on poverty in the United States and how the creation of Head Start has addressed the educational and social needs of preschool children from lower socioeconomic groups. Finally, the paper highlights social skills interventions that have been used to improve some of the social deficits preschool children from lower socioeconomic groups may face. The present study assessed the efficacy of one such intervention, investigating whether cognitive ability predicted performance in the intervention and performance on the social skills outcome measures.

Preschool cognitive, emotional, and social development

Human growth and development is a complex process involving the interplay of genes and environment, and children develop both cognitively and socially over the course of the early years of life (Feldman & Eidelman, 2009). The preschool years support the development of a myriad of skills ranging from personality development to cognitive and social development. Infant cognitive development begins as a primarily sensory event and gradually becomes more complex as infants mature in that they observe their surroundings and learn to modulate attention between novel and familiar stimuli. As the children grow and mature, they begin to manipulate their surroundings and interact with objects and individuals in their environments (Feldman & Eidelman, 2009). Social development, like cognitive development, is the result of the interaction of many different factors. Edwards (1999) noted that one of the first stages in a child's social development is his or her realization that he or she is a unique person, separate from the rest of the world. Social development progresses as this sense of self becomes more complex and the child describes him or herself as not only a physical being, including details such as height, hair color, skin color, but also incorporates character traits and other intangibles into the description (Edwards, 1999).

Relationship between cognitive abilities and social-emotional development

Social-emotional competence is defined as a person's ability to understand and act upon emotional experiences in his or her life in a manner that promotes successful social, academic, and interpersonal interactions. Social-emotional competence is highly influenced by the child's cognitive functioning. Cognitive ability directly relates to social-emotional development in that it affects the manner in which social-emotional skills develop and are expressed. Iarocci and colleagues (2007) discuss the importance of basic cognitive, sensory, and perceptual skills in the development of more complex, well-developed social abilities, including social-emotional skills. Social-emotional skills represent a higher order process and therefore develop over time as the more fundamental skills of temperament, early face recognition, emotion recognition, and theory of mind develop. Children begin to develop fundamental social skills from birth including the ability to recognize human faces and discern emotions. Over time, the child's cognitive and social skills develop, enabling him or her to understand and reflect on personal feelings and choices, as well as, the effect that one's choices have on others. The child learns to accurately label emotions in others and appropriately manage the situation given the intensity of the emotion. Cognitive skills help children to attend to activities, recall information that they have encountered before, and help them use problem-solving techniques in difficult social situations (Elias et al., 1997). Finally, the child develops the ability to critically analyze his or her behavior to determine if the outcome aligns with his or her personal goals. These higher-order skills continue to develop through adolescence, mirroring the development of the child's higher order brain functioning and frontal lobe development (Baudoin, Durand, & Gallay, 2008).

Cognitive ability contributes to social-emotional development, and there is evidence that social-emotional development affects cognitive development. Research indicates that emotional knowledge acts as a mediator between verbal ability and academic competence (Schultz, Izard, Fine, Ackerman, & Youngstrom, 2001). Social-emotional development cannot solely explain differences in cognitive development and school achievement of children from lower socioeconomic groups; however, difficulties in emotion knowledge can have an adverse effect on the child's learning environment. Specifically, poor social-emotional skills may lead to negative interactions with his or her teacher, resulting in isolation and a reduction in the teacher's interactions with the child. The decreased interactions may further result in decreased expectations for the child's academic performance (Schultz et al., 2001). Social psychological studies have shown that the self-fulfilling prophecy, or a false belief of a situation evokes a new behavior which makes the originally false conception come true, can actually have an effect on the child's performance in the classroom (Rosenthal, 1995). These difficulties could also have an effect on the quality of the child's peer relationships, affecting the child's morale, concentration, and motivation at school. Therefore, social-emotional development and cognitive development have a bidirectional relationship, contributing to the child's success in both social and academic settings.

During the preschool years, there are certain skills and milestones that the child should master in order to ensure developmentally appropriate social-emotional development (Edwards, 1999; Nuttall, Romero, & Kalesnik, 1999). Elias et al., (1997) offer a list of skills that preschoolers should begin to develop before they reach kindergarten and early school years, such as developing friendships and becoming a member of a group. In order to make friends and find social groups, children must first learn to appropriately label and express their emotions and develop the ability to discern positive and negative emotions in themselves and others (Denham, Blair, DeMulder, Levitas, Sawyer, Auerbach-Major, & Queenan, 2003; Schultz et al., 2001). In summary, social-emotional development involves the synthesis of several different component skills which are directly influenced by cognitive development. Although several component skills contribute to social-emotional development, the present study focused specifically on face recognition, emotion recognition, and theory of mind, as these skills undergo great developmental strides during the preschool years and are foundational skills for more complex social skills.

Face Recognition

Human beings, like other animals, are social creatures. Humans are hard-wired to interact with their environments, including the physical components and other individuals. Goldstein (1983) acknowledges the importance of the face as one of the most important human features, beginning at birth. The face is the medium through which humans understand their surroundings, gather information about others, and interact effectively. By the age of 3 months, infants prefer to look at meaningful shapes rather than blank canvases. Infants of this age also prefer to look at images of normal faces rather than scrambled faces (Fantz, 1966).

Face perception is the fundamental skill required to develop face recognition, as face perception requires the individual to observe the facial features but not recall or discriminate features from memory (Duchaine & Weidenfeld, 2003). There are two main theories of face recognition development (Crookes & McKone, 2009). The traditional theory, the face-specific perceptual development theory, posits that face processing begins to develop at birth and continues to mature during adolescence as the child is exposed to a greater number of faces. The theory highlights components including holistic and piecemeal processing. Holistic processing involves integrating all parts of the face and processing the face by examining the structure of the face and how each component comes together to form on structure. Piecemeal or configural processing involves using specific information on how the individual features are positioned and related to process the face (Carey, Diamond, & Woods, 1980). Piecemeal/configural processing tends to be less successful when determining face identity because it overlooks the manner in which the facial features are related to one another. The perceptual theory of face processing suggests that young children utilize piecemeal processing and that as the child matures and continues to develop perceptual and cognitive skills, face processing evolves from piecemeal to holistic processing. A newer theory offers an alternative explanation of face recognition development, known as the general cognitive development theory. The newer theory proposes that face perception is mature in early childhood and that the gains and improvements children make reflect improvements in cognition, including visual attention, attention to the task, and memory (Crookes & McKone, 2009). Crookes and McKone (2009) provide additional support for the newer general cognitive theory of face processing, noting that children are able to perceive and store unfamiliar faces much the same as adults. Additionally, children 5 years and older demonstrated holistic processing of faces equivalent to that of adults. The findings further corroborate the interplay between cognitive and social-emotional development, implying a positive correlation between cognitive development and face recognition.

Emotion Recognition

Emotion cognition involves appropriately perceiving, displaying, and adapting emotions to different situations (Schultz, Izard, Ackerman, & Youngstrom, 2001). Kats-Gold & Priel (2009) extend the definition somewhat by adding that emotion understanding requires both interpreting the emotional states of others as well as interpreting one's own emotional state. Emotion responses emerge at birth and continue to develop through the lifespan. Infants are likely to respond to a negative stimulus by crying, which is primarily a perceptual experience (Piek, Bradbury, Elsley, & Tate, 2008). As children develop and their cognitive abilities improve, the emotional responses become varied. In addition, children develop the ability to understand and anticipate the emotional responses of others (Schultz et al., 2001). These skills are important and facilitate the child's friendships, popularity, and overall social development.

Emotion recognition is an important skill for children as it directly correlates with children's ability to regulate their own emotions and behavior. Denham (1998) proposed that a preschool child's ability to recognize and label emotions is correlated with peer competence and prosocial behavior in low-income children and peer likeability in children of a middle class income. Trentacosta and Fine (2009) support the importance of emotion knowledge, noting that children with well-developed emotion knowledge skills tend to develop superior social skills and interpersonal relationships with peers. Studies have also examined parental and environmental factors that affect emotion recognition and regulation (Schultz, et al., 2001). Denham, Zoller and Couchoud (1994) conducted a study investigating children's individual characteristics and how these characteristics contributed to emotion recognition. Cognitive ability is a characteristic that has been shown to effect emotion recognition. Researchers have investigated cognitive ability by examining the child's verbal ability (Denham, Zoller, & Couchoud, 1994). In addition to cognitive ability, the study suggested behavioral characteristics, specifically attentional control and behavioral control, as possible determinants to the child's abilities to recognize, name, and understand emotions contextually. Specifically, the amount of time a child can maintain attention on a given task and modulate his or her behavior during the task is related to emotion skills. The study's findings suggest that cognitive ability, behavioral control, and attention influence the child's emotion knowledge development. In addition, a child who demonstrated difficulty with emotion recognition also had difficulty interacting with peers and withdrawing from other children (Schultz et al., 2001). Emotion recognition is therefore an important social skill component for children because it affects how well he or she controls emotions, interprets emotions in others, and reacts in social situations. Emotion recognition is therefore an important social skill that contributes to the child's social competency. Face and emotion recognition also form foundational skills for higher order social process such as theory of mind.

Theory of Mind

Theory of mind is an evolutionary psychology phenomenon in which a child understands that other people have knowledge, feelings, emotions, and desires that may be different from one's own (Bjorklund & Pellegrini, 2002). Emotion understanding is one of the foundational skills for higher order emotion processing such as theory of mind and social cognition (Piek et al., 2008). There are both individual characteristics of the child and environmental characteristics that contribute to the child's development of theory of mind. Collectively, these skills generally develop by the age of four. Individual characteristics that negatively impact the child's theory of mind development include a difficult temperament, inattention, and the presence of problem behaviors (Hughes & Ensor, 2007). The environmental characteristics that effect theory of mind development are the number of individuals that a preschooler interacts with, including the number of adults and the number of peers (Smith & Hart, 2002).

Furthermore, researchers suggest that theory of mind can be an accurate predictor of social maturity for typically developing preschool children (Peterson, Slaughter, & Paynter, 2007). Nelson, Adamson, and Bakeman (2008) expound upon these findings, connecting theory of mind development to attachment theory. The authors propose that interactions with caregivers are a necessary and provide a basis for the child's development of theory of mind skills. Nelson and collegues (2008) also describe specific behaviors that contribute to theory of mind development, including coordinated engagement with the caregiver and with the shared event during infancy and attention to nonverbal communication of the caregiver during preschool years. The findings suggest that there are precursors to adaptive theory of mind development and that children who develop these skills go on to demonstrate an understanding of false belief tasks, thus demonstrating theory of mind.

Social development of preschool children from low socioeconomic backgrounds

Preschool development involves many physical, cognitive, social, and motor changes for the child as he/she transitions from the guiding care of the parents to a more independent state. There are many factors that can enhance and/or hinder developmental gains, including individual characteristics of the child, parents, and environment in which the child is raised. Characteristics of the child that may enhance or encumber development include temperament, cognitive ability, and social-emotional development. Parental characteristics including parenting style, parental education, and parental stress may also have effects on development. Environmental characteristics such as family composition and socioeconomic status may also be important considerations. Family composition includes information about who lives in the home and who makes up the child's immediate and extended family, either by blood relation or not (Kalesnik, 1999). This information is important because it describes the home environment, possible caregivers, and the child's available playmates and family members who may contribute to the child's cognitive and social development.

Low SES

According to data released from United States Census Bureau, 13.2% of the U.S. population is living in poverty (DeNavas-Walt, Proctor & Smith, 2008). DeNavas-Walt et al. (2008) also provide data on the rates of poverty within different ethnic groups and regions of the country. Based on those data, 24.7% of African-Americans are living in poverty. Additionally, the data on regions of the country indicate that the southeast accounts for the greatest percentage of individuals living in poverty at 14.3% of the region's population.

Given the high rates of poverty in the United States, it is important to ensure that the secondary effects of socioeconomic status be addressed early to provide the most optimal environment possible for growth and development. Studies have found that children from lower socioeconomic backgrounds, such as children enrolled in Head Start programs, experience difficulties in social-emotional skills, which could lead to behavior and academic problems later in childhood (McLoyd, 1998). The research highlights, decreased parental supervision, lower quality childcare facilities, and an acceptance of aggression as a need for protection, as possible contributors to these difficulties. Often times the social and emotional needs are shadowed by an emphasis on cognitive development; however, the social skills deficits that are often inherent in low SES backgrounds can lead to problems with not only academic subjects, but also peer relationships and behavioral functioning. Furthermore, children from low SES backgrounds are more likely to develop juvenile delinquency (McLoyd, 1998). Interventions targeting a Head Start population could potentially improve social skills, reduce aggression, and help to prevent behavior and academic problems.

Research studies from the National Institute of Child Health (2005) suggest chronic poverty presents numerous secondary characteristics, including increased negative life events, increased number of stressors, decreased parent-child interactions, and decreased positive parent-child interactions. Kalesnik (1999) adds that the SES of a family provides information on resources and support networks available to the family. Furthermore, SES has been shown to be more important than early birth complications in predicting child outcomes later in life. Research findings indicate that the presence and timing of poverty are important factors to consider (NICHD Early Child Care Research Network, 2005). The young childhood years including the period from preschool to school age are a time of great growth and development. Poverty during this period may present additional difficulties for the child, unique to those evident than poverty during the later school-aged years given the child's dependence on the home environment and parental interaction for the acquisition and improvement of many social-emotional skills (NICHD Early Child Care Research Network, 2005). Children from lower socioeconomic groups are less likely to have access to computers in the home and have three times fewer books in the home than their higher SES peers. These differences yield a vocabulary that is less developed in the lower SES group than the higher SES group (Evans, 2004). The effects of decreased access to books, computers, and parental interactions are likely to have an adverse effect on all areas of development, including social-emotional development. Though many interventions focus on improving the cognitive functioning of children from lower socioeconomic backgrounds, it is vital to consider social-emotional development as well given its proven impact on cognitive development and overall development of the child. The NICHD recommends early interventions for children from lower socioeconomic groups, as it may be able to decrease disparities in social and behavioral development.

Preschool Programs for Underserved Populations

Though many factors, including SES, poverty, and family characteristics effect the development of the child, there have been many efforts to mediate these factors in the school setting to improve child outcomes later in life. Project Head Start is one such program. Project Head Start began in 1965 as an initiative of the Office of Economic Opportunity. At that time, the nation embarked on the “War on Poverty,” postulating that by instituting educational programs in under-served communities and with disadvantaged populations there would be mediating effects for the economic and social deficits that underserved groups face (U.S. Department of Health and Human Services, 2010; Zigler & Styfco, 1993). Head Start programs employ a holistic approach to improving the emotional, social, health, nutritional, and psychological needs of the children that it serves (U.S. Department of Health and Human Services, 2010). The program is designed to provide a nurturing, high quality, preschool environment for underserved groups that will ultimately prepare them for the upcoming school years (National Head Start Association, 2010). Oppenheim and Macgregor (2002) define high quality preschools as programs that offer opportunities for academic and social development, good nutrition, health screening, strong relationships with caregivers, a safe environment, and support for parents. One of the hallmark preschool programs is the Perry Preschool program, which was implemented between the years of 1962 and 1967. It was designed to provide high quality preschool for children from lower socioeconomic backgrounds. The curriculum for the classroom incorporated problem-solving and decision-making tasks. The children were active learners, planning and evaluating activities and their performance. In addition, parent and teacher communication was facilitated through weekly meetings. The program had far reaching educational and social outcomes for participants, evident still at 40 years of age, including increased years in school, decreased teenage pregnancy rates, higher incomes as adults, and decreased use of public assistance programs as compared to children who did not complete the preschool program (American Institutes for Research in the Behavioral Sciences, 1969). Schweinhart, Barnes and Weikart (1993) offer additional components based on The Perry Preschool, including developmentally appropriate learning, training for teachers and staff, regular modification of curricula, teacher-student ratios of no greater than one teacher for every 10 students, and administration that consistently monitor and evaluate the program's components. Federal guidelines mandate that at least 90% of the children in the program must come from households falling at or below the poverty line and 10% of the population must be comprised of children with developmental disabilities. Head Start programs provide the structure of preschool as well as an environment dedicated to promoting well-being.

High quality preschool programs are an invaluable experience for children because they provide an atmosphere for growth and development as well as socialization with same age peers. They are designed to prepare the child for elementary school and beyond, establishing a strong foundation with which the child can develop into a responsible adult (Zigler & Styfco, 1993). There is empirical support for the efficacy of Head Start programs in preparing preschool children for elementary school. There have been some criticisms that the effects of the program do not generalize to later school years; however, the governing body contends that the cognitive, social-emotional, and parental benefits provide greater opportunities for the children to establish effective practices in elementary school that will remain throughout their educational endeavors (U.S. Department of Health and Human Services, 2010; Zigler & Styfco, 1993; 2004). Additionally, there is support for the efficacy of Head Start programs employing features of the most elite high quality preschool programs (Schweinhart et al., 1993).

Attending high quality preschools show promising results in reducing disparities between children from lower SES and those from middle and upper SES by promoting positive social behavior and decreases in internalizing and externalizing behaviors. Of particular interest is the fact that the effects of childcare and quality were most notable for boys, suggesting that preschool boys and girls demonstrate differences in display of internalizing and externalizing behaviors (Piggott & Israel, 2005). Piggott and Isreal (2005) note Head Start children's higher reading and math scores as compared to peers of the same age and socioeconomic status. Research indicates that Head Start programs are beneficial for the graduates, at least to the early school years; however, some children require additional, individualized services to improve upon the deficits that could develop into academic and behavioral concerns later in life. Oppenheim and Macgregor (2002) provide evidence for far reaching effects of attending high quality preschools, including higher rates of high school graduates, reduction in crime, increased employment and lifetime earning potential, and decreased use of public service programs, and decreased healthcare costs due to increased safety procedures such as wearing a seatbelt and avoiding cigarettes.

Social Skills Interventions Used in Preschool Populations

The preschool years are important developmentally, signifying a time of great cognitive and social-emotional gains. High quality preschools provide an environment in which these skills can be learned and improved; however, there are times when children require specific interventions in addition to the instruction provided in the classroom each day. Children from lower socioeconomic backgrounds are at risk of developing behavioral and academic problems later in life because of environmental influences and are therefore good candidates for programs offering to minimize some of these risk factors. Furthermore, children with behavioral and emotional disturbances have greater difficulty achieving gains in traditional social skills interventions and prevention programs (Gresham, Sugai, & Horner, 2001). Gresham and collegues (2001) also noted that not all social skills interventions are equally effective for all groups. Therefore, it is imperative that education officials select programs that will meet the unique needs of the population and are efficacious for the greatest number of individuals. When possible, an effective technique may be to identify the child's specific needs and select interventions that will meet those needs given the array of interventions available to children (Denham, Hatfield, Smethurst, Tan, & Tribe, 2006). There are several types of social skills interventions targeting different areas of social-emotional functioning. Among the programs available are those targeting prosocial interactions, problem-solving, and emotional intelligence. Denham and colleagues (2006) describe social inclusion programs implemented in an elementary school setting for a population of children who have demonstrated difficulties interacting effectively with peers.

Social Skills Training in Group Settings

The social skills training program developed by Denham and colleagues (2006) was primarily facilitated by adults and taught the children skills including communication, managing emotions, turn-taking, and role-playing. The children assigned to the intervention demonstrated difficulties interacting with others and often lacked confidence in social settings, but they did not exhibit challenging behaviors such as opposition, defiance, and bullying. The parents, teachers, and students completed social skills questionnaires pre and post intervention. The students and teachers participated in a post intervention interview to assess perceptions of the effectiveness of the social skills intervention. The teachers reported improvement in social inclusion following the intervention; however, parents did not report significant improvements in their children's social skills following the intervention. Conversely, the students reported feeling better able to manage emotions and solve problems when they occurred. Qualitative reports from the children indicated the children had improved confidence and made better friendships following the intervention.

Denham and collegues (2006) also describe the effects of social inclusion/problem-solving interventions in school-aged children. The intervention was designed to aid children who are more likely to have difficulties in social interactions, challenging behaviors, and difficulty acting appropriately, when issues occur. The program focused on skills such as resisting peer pressure, effective communication skills, and perspective-taking using cognitive problem-solving techniques. The social inclusion intervention differed from the previous social skills group in that it was facilitated by the student members rather than adult leaders. The peer-mentoring model encouraged children to take an active role in the problem solving; thus, the children participated in and led group discussions. In the study, the children assigned to this condition were more likely to demonstrate problem behaviors following the intervention. Teachers reported improved social skills and inclusion following the peer mentoring. Parents did not report significant improvements in social skills following the intervention. Qualitative reports from the children indicated that the children felt better equipped to deal with problems, learned better ways to manage peer pressure, control anger, and ignore others following the intervention.

Izard, Trentacosta, King, and Mostow (2004) cite empirical evidence that poor emotion knowledge and regulation are associated with increased risk for psychopathology. The authors evaluated The Emotion Course, an emotion-based social skills intervention implemented by teachers in Head Start programs. The goal of the program was to increase the children's social communication, including their empathy and prosocial behaviors. This model differed from other social skills training and prevention programs in that the primary focus was on emotion understanding, expression, and regulation rather than cognitive and behavioral principals. The Emotion Course program was intended to increase emotion awareness and expression in order to increase positive emotional interactions and decrease negative emotional interactions, with the hope that the emotional knowledge would generalize to other skills and behavior. Study results indicated that children enrolled in the Emotion Course showed increases in emotion knowledge as compared to children in the control group. Additionally, the children in the Emotion Course showed improvements in the number of negative emotional expressions exhibited in the classroom environment (Izard, Trentacosta, King, & Mostow, 2004).

The Incredible Years training series is curriculum designed to increase social competence in children while decreasing maladaptive behaviors and emotional difficulties. The program targets the four predictors for childhood delinquency: (a) promoting parent involvement by helping parents learn to be more positive and nurture their children, using less harsh or abusive words in their discipline approaches; (b) promoting stronger ties between home and school by improving the relationship and communication of parents and teachers; (c) increasing children's social competence; and (d) promoting children's self-regulation skills by teaching teachers and parents to help children learn anger management strategies, problem-solving skills, appropriate social behaviors, and friendly communication (Webster-Stratton & Reid, 2007). The Incredible Years program differs from the other interventions in that it offers training and curricula for teachers, parents, and children.

Outcomes of the Incredible Years training programs have suggested increased social and emotional competence and emotion regulation in children, as well as increased parental involvement. The authors noted that these areas of improvement contribute to the child's school readiness. The children were also better able to resolve conflicts with peers and demonstrated fewer maladaptive behaviors following the intervention. Results of the parent training curriculum included increased nurturing, implementation of more positive discipline techniques, and more involvement in the child's education. The parents also noted decreased problem behaviors in the children following the parent training. After completing the teacher curriculum, the teachers demonstrated more positive classroom management and discipline techniques, in addition to increased support of the children's social and emotional development. The teachers reported that the children responded to the teachers' modifications with increased attention and cooperation in class and decreased maladaptive behaviors. The results of the Incredible Years program provide support for interventions that meet the needs of the populations served. All three curricula demonstrated efficacy for the target group; however, the outcomes in the target group elicited improvements in the other groups (Webster-Stratton & Reid, 2007).

The aforementioned social skills interventions have all demonstrated efficacy in improving the social skills and social competence of preschool children. It is important to note that the programs discussed were all group interventions. One study highlights some of the possible reasons for the generalizability, effectiveness, and acceptance of group social skills models (Taylor, Webster-Stratton, Feil, Broadbent, Widdop, & Severson, 2008). Group settings provide curricula that focus on improving the group as a whole, rather than targeting the specific challenges and problem behaviors experienced by each member. The authors note that group settings may be more comfortable for participants, and the groups remove the stigma associated with attending one-on-one therapy. The group environment also provides a supportive learning environment in which the participants can both learn and share experiences. Though all of the programs described have demonstrated efficacy and effectiveness, there are some drawbacks to the group social skills interventions, including the difficulty in forming and maintaining groups given scheduling conflicts. In addition, Taylor et al., (2008) noted that some therapists may not have specific training in group therapy models and manualized interventions, which could adversely affect the intervention outcomes.

Furthermore, children are likely to benefit from interventions that meet their individual needs, regardless of whether the intervention is implemented in an individual or group setting. Many of the interventions raised the issue of measuring individual progress and outcomes in addition to group efficacy (e.g., Denham et al., 2006), highlighting the importance of individual outcomes. Each child may benefit from some components of an intervention and less from others. Thus, individualized interventions or interventions that first establish a baseline then adapt to meet the specific needs of the client would be invaluable. Therefore, Taylor and colleagues (2008) support adaptation of group social skills interventions into various media forms, including individual therapy, computer, and web-based interventions.

Computer Interventions

Computers have become an important part of our society and have recreational, educational, and rehabilitative services, and computers are used more and more during everyday life. Taylor and colleagues (2008) highlight the potential benefits of using computers as a medium for psychological interventions, as computers provide an avenue to disseminate manualized treatments. With computers, it is possible to provide clients with intervention materials, such as handouts, videos, and audio recordings in a systematic, low-cost manner. However, there are also drawbacks to computer use, including the lack of interactions with trained professionals. Of particular interest in the present study is preschool and young children's computer use. Computers are ubiquitous in today's society and provide access to countless resources and information. Computers can provide recreational activities, access to the internet, and enhance academic environments. The use of virtual reality and computers immerses the user in a computer-based world full of graphics and features. For many children, the computer-based world is somewhat less intimidating than the outside world in which they live. Thus, computers have emerged as tools for social skills interventions in order to reduce some of the anxiety associated with peer interactions and evaluation (Muscott & Gifford, 1994). Kutnick and Marshall (1993) corroborate this finding, suggesting that learning takes place in a collaborative fashion in classrooms; however, interactions of more than two students may lead to competition and criticism. Computers offer a context in which children can learn in a safe, yet supportive environment alone or with peers. Computer interventions provide some advantages on group-based curricula in that they offer the opportunity for individualizing the program to meet the specific needs and level of the participant. Thus computers are able to provide an avenue for individualized programs, while removing the stigma associated with attending one-on-one therapy with a therapist. Computers also offer an easily implemented, lower cost alternative to many other treatment options.

FaceSay™ is an interactive computer game that utilizes avatars made from human faces to teach children social skill components, including eye gaze, joint attention, and recognizing facial expressions. The game was designed to teach children with autism spectrum disorders, who often have deficits in these areas by virtue of their diagnosis, component social skills. FaceSay™ has two different forms, one designed for school age children and adolescents and a modified game designed for preschool children. In the school age/adolescent version, there are three games: The “Amazing Gazing” game, The” Band-Aid Clinic”, and Follow the Face. “Amazing Gazing” shows a human face in the middle of the screen. The face looks at different numbers and shapes dispersed in a clock pattern, and the child is asked to follow the person's eyes to the different stimuli on the screen. "Band-Aid Clinic" involves a human face with the eye, nose, or mouth region missing. The child is asked to complete the face by correctly selecting the missing region from several pictures (Band-Aids) presented. "Follow the Face" presents a target face and a second face that can be manipulated. When the target face shows a facial expression, the participant is asked to match the second face to the target face by manipulating the eye region, nose region, and mouth region of the face. The preschool version of FaceSay™ only includes "Amazing Gazing" and "Band-Aid Clinic," as "Follow the Face" was deemed too difficult for a preschool population. Over the past four years, there have been three studies completed analyzing the efficacy of FaceSay™ in both clinical and nonclinical populations, at a wide range of ages from preschool to adolescence, and with varying degrees of cognitive functioning. Face recognition and emotion recognition assessments were used as outcome measures.

In the first study, Hopkins (2011) evaluated the efficacy of the school age/adolescent version of FaceSay™ in improving the face and emotion recognition of school-aged children with both autism and Asperger's Syndrome. The study findings supported the use of the game with these populations and demonstrated improvements in emotional skills in both the autism and Asperger's group. The children with Asperger's Syndrome demonstrated improved facial recognition scores, while the children with autism did not. Following this study Perez (2008) replicated the study, using the preschool version of FaceSay™, in a population of preschoolers enrolled in Head Start programs to determine if the same skill improvements would be evident in a younger, typically developing population who may also be at risk for social difficulties given environmental factors. Results from the study indicated that preschool children showed significant improvements in total facial recognition, but not emotion recognition following the study, similarly to the Autism population in the previous study. Though the children did not demonstrate improvements in recognizing all emotions, they demonstrated improvements in recognizing sadness, happiness, and fear. Gower (2009) completed an additional study to demonstrate the efficacy of the preschool version of FaceSay™ in a population of preschoolers with and without autism spectrum disorders. The results indicated that the children with autism spectrum disorders showed significant improvements in face recognition, but not emotion recognition and that the children with autism spectrum disorders showed the greatest improvement in game performance from pre intervention to post intervention. Given the findings of these studies, it is important to determine factors that may be associated with social skills improvements after playing FaceSay™. In addition, it is important to determine if performance on FaceSay™ is in agreement with other empirically supported social skills measures to further validate its use as a social skills intervention.

Taylor and colleagues (2008) implemented the Incredible Years Parent program in a computer format. The study participants reported high achievement of their self-determined goals and were highly satisfied with the intervention. The study combined features of the Incredible Years intervention in a computer facilitated program. As an added benefit, professionals provided assistance and consultation to study participants. During the intervention, parents watch videos of parents demonstrating the target social skill. Following the video, the facilitator asked questions and provided topics for discussion. In addition, professionally trained coaches provided home visits before, during, and following the intervention to review material, role-play skills, set goals for the intervention, and address individual concerns. In addition, coaches had access to the computer data describing the parent's use of the program, including the last log in date and time, the session last viewed, and the participants use of web materials, including links, handouts, and message boards. Following the intervention, all participants noted improvements in at least one of the treat goals, and 67% of the families reported improvement in half of the treatment goals. Moreover, 87% of the families stated that the computer-based version of Incredible Years was a positive program. The results of the study provide support for the use of computer-based interventions to teach social skills (Taylor et al., 2008). Taken together, the computer interventions presented offer additional support for the use of computers as a medium for providing social skills interventions.

The Present Study

The preschool years mark an important developmental period in a child's life, full of rapid cognitive and social growth. The growth and development takes place on an individual level and as a part of an external environment, making the child susceptible to both positive and negative influences. Given the data about poverty rates in the United States, many preschoolers are at risk of growing up in environments where they may be lacking in social experiences and enriching educational activity. It is also common for the home environments of impoverished families to be stressful for the child, parent, or both. The early home environments can have detrimental effects on the child's academic, social, and emotional development (Vortruba-Drzal, Coley & Chase-Lansdale, 2004). Programs such as Head Start were implemented in order to remediate some of the difficulties associated with impoverished environments. The goals of Head Start programs are to provide an enriched preschool program for children and families from low socioeconomic backgrounds in order to prepare the child for kindergarten and beyond (National Head Start Association, 2010; U.S. Department of Health and Human Services, 2010). The Head Start programs focus on the educational, social, nutritional, and health needs of the children and families (U.S. Department of Health and Human Services, 2010). Vortruba-Drzal, Coley & Chase-Lansdale (2004) propose that high quality preschool programs, such as Head Start, may serve as protective factors for children from lower socioeconomic backgrounds. In addition to providing services for all children enrolled, Head Start programs seek to identify children who may require additional services to achieve their greatest academic and social potential (Zigler & Styfco, 1993; 2004).

Given the bidirectional relationship between cognitive and social-emotional functioning, it is important to provide interventions that target not only cognitive delays but social deficits as well. Social skills interventions have proven effective in improving children's face and emotion recognition skills, which in turn improve their theory of mind and overall social-emotional functioning. Computer interventions provide a low cost, easily implemented means by which to provide social skills interventions, and there have been several studies to support the use of computers and avatars in impaired populations. The goal of the present study was to further evaluate the use of a computer-based social skills game on a low SES group of Head Start children. Specifically, the study sought to determine if cognitive ability affected the children's performance on social measures and the social skills intervention. Based on the findings in the literature, it was postulated that children with higher cognitive functioning would demonstrate greater performance on the games. However, Gower (2009) and Hopkins (2011) provide evidence that some of the gains in the intervention were also related to autism spectrum-specific social deficits. Furthermore, the study sought to explore the relationship between performance on the game and outcomes on empirically supported measures of component social skills, including face recognition, emotion recognition, theory of mind, and overall cognitive ability measured by the child's ability to create features of the human anatomy. Previous studies have found that children demonstrated improvements in the ability to distinguish unfamiliar faces and recognize emotions based on the participant's results on the face and emotion outcome measures; however, the previous studies have not measured the children's ability to extend recognition skills to actual production-drawings of the human anatomy. In addition, previous studies have yet to examine how game performance (FaceSay™ accuracy scores) relates to face recognition and emotion recognition outcome measures. If the games were targeting the component skills of interest, one would expect that children who performed well on the intervention game would have also demonstrated greater improvements than children who did not perform well on the intervention game. Finally, it is important to determine individual factors that affect success on the games. For the purpose of the current study, cognitive ability will be assessed to determine if children with higher cognitive functioning demonstrated better outcomes on face and emotion recognition measures, given the relationship between cognitive functioning and social emotional competence.

Positive findings from the present study would provide additional support for using social skills interventions in typically developing populations. Additionally, findings would support the positive effects of social skills intervention for children from low SES groups. The computer social skills interventions introduced social skills in a comfortable, non-competitive, yet interactive environment. With the growing use of computers in society, it is important that children from lower socioeconomic groups have access to computers, thus the computer-based social skills interventions were invaluable for the children, as they exposed them to computers and provide opportunities for them to improve upon social skills that will aid in their cognitive and social development. The computer-based social skills interventions also fit the mission of Head Start in improving the educational and social needs of preschoolers from lower SES groups in order to prepare them for kindergarten. Positive findings from the present study could offer an additional program to be implemented in Head Start programs across the country that could bolster the stated goals of the programs in a low cost, easily implanted manner.

OBJECTIVES

The overall purpose of the study was to determine the efficacy of avatars in improving the social-emotional functioning of a preschool population and to evaluate the utility of using early screening measures to identify children who may benefit from a social skills intervention.

Specific Aim 1

The study aimed to determine the effect of FaceSay™ on children's face and emotion recognition scores. It was hypothesized that game performance on FaceSay™ (as defined by their cumulative accuracy score on ten sessions) would predict post intervention face recognition, with children scoring higher in accuracy scoring higher on the post intervention Benton Facial Recognition Test. It was also hypothesized that game performance on FaceSay™ would predict post intervention emotion recognition, with children scoring higher in accuracy scoring higher on the post intervention Sullivan Emotion Recognition Test.

Specific Aim 2

The present study sought to determine if children with high cognitive functioning benefit more from the interventions, as demonstrated by their scores on the face and emotion recognition outcome measures, compared to children with lower cognitive functioning. Specifically, it was hypothesized that children scoring higher on the cognitive measure of the AGS Early Screening Profile would demonstrate higher scores on the post intervention Benton Facial Recognition Test regardless of intervention type. In addition, it was hypothesized that children scoring higher on the cognitive measure of the AGS Early Screening Profile would demonstrate higher scores on the post intervention Sullivan Emotion Recognition Test regardless of intervention type.

Specific Aim 3

The study aimed to determine if the use of avatars improved preschooler's abilities to recall facial features in a drawing assessment. It was predicted that children playing FaceSay™ and Early Flyers™ (avatar interventions) would identify more facial features on the post scores of the Goodenough Harris Draw-A-Man Test than children playing Tux Paint™ (no avatars).

RESEARCH METHOD AND DESIGN

Participants

Seventy-seven children between the ages of 3 and 5 were recruited from two Head Start centers in the southeast. African-American children comprised the majority of this population (N = 72; 94%), and the population included primarily low-income families. Approval to recruit participants and conduct the present study was obtained from the University of Alabama at Birmingham Institutional Review Board. Participants were recruited from the centers during parent meetings, before school, and after dismissal. Parental consent was obtained from the parents through signing the consent form for the study. Each child with a signed consent form was randomly assigned to one of the three intervention groups. The mean age of the participants was 4 years, 0 months (SD = 0.58). There were 44 males (57%) and 33 females (43%).

Design

The present study was a 3 X 2 mixed (between and within) subject design in which each participant was randomly assigned to one of three intervention groups with the use of a random number generator. The children completed face recognition, emotion recognition, and drawing assessments both pre and post intervention. The participants then played the computer games twice per week for 12 weeks. In addition, each child completed a comprehensive assessment for the Head Start program that included both cognitive and social measures. The independent variables in the study were intervention or game assignment, FaceSay™ accuracy scores, cognitive scores on the AGS Early

Screening Profiles, and the pre intervention GoodEnough Harris Draw-A-Man Test. The three games utilized in the study were FaceSay™, a social skills intervention designed to improve face and emotion recognition skills, Early Flyers™, an early spelling intervention designed to increase the number of sight words children spell, and Tux Paint™, a painting game. Early Flyers™ and Tux Paint™ were included in the study as computer-based controls to account for the interactive features of FaceSay™ and the interaction between the participants and the research assistants, respectively. Game accuracy refers to the total points earned while playing the FaceSay™ or Early Flyers™ during the 12-week intervention. The AGS Early Screening Profile includes both a cognitive measure, comprised of verbal and nonverbal scores, as well as a social profile, which includes parent report information about the child's communication, socialization, self-care skills, and motor skills. The GoodEnough Harris Draw-A-Man test was also a measure of cognitive ability as measured by the child's ability to reproduce an anatomically accurate man. The dependent variables in the present study were face recognition scores, emotion recognition scores, and the total number of features produced in the post intervention Draw-A-Man assessment. The dependent measures were collected as a part of data collection for the intervention study (Perez, 2008).

Intervention Condition Descriptions

FaceSay™

Face Say™ is a computer-based game with interactive features designed to teach children two main component social skills: joint attention and eye gaze that will aid in their ability to interact effectively with others in social situations. The game was designed by the Symbionica Corporation in an effort to provide a computer-based social skills intervention for children with autism spectrum disorders. The children played the Preschool version of FaceSay™ in the present study. After the introduction, the participants were asked to respond to questions and statements by touching a variety of choices that are presented on the screen. The first game, “Amazing Gazing,” taught the children to orient to the eyes. The child was asked to distinguish faces from other objects on the screen and got progressively more difficult as the child answered correctly. In the highest level of the “Amazing Gazing” game, the child determined the specific face that the target individual is looking at, discriminating from twelve possible faces on the screen. This game encouraged the children to focus on the eyes and follow the gaze of the avatars and thus focuses on improved eye contact and joint attention over time. The second game, “Band Aid Clinic,” was designed to further teach facial recognition by having the child understand the holistic and configural pieces of the human face. In the game, the avatar encouraged the child to focus on various parts of the face, including the eye region, the nose region, and the mouth region by selecting the appropriate Band-Aid that completed the missing portion of the face. The child received verbal encouragement during each question, and immediately following his or her response, the avatar either congratulated the child or encouraged him or her to select another option. In addition, there were graphic changes associated with correct responses, including spinning and flashing numbers, verbal praise from the avatar and animals on the screen, and the opportunity to participate in computer games after the completion of a session. The child received one point for each accurate response, and the cumulative total for all sessions was visible at the bottom of the screen. The FaceSay™ accuracy score was the cumulative total for ten sessions. Children completing 10 or more sessions were included in analyses. Children completing fewer than 10 sessions were not included.

Early Flyers™

The children played a computer game modeled after the Symbionica Spell First program called Early Flyers™. The game incorporated interactive animals and other graphic features, including blinking numbers and letters, and thought bubbles. In addition, the child received verbal praise and encouragement from the avatars when he or she provided correct answers and encouragement when incorrect answers were given. It was used as an avatar computer game control in the present study, controlling for the interactive features of FaceSay™. First, the target word flashed on the screen. The animal character then used the target word in a sentence. The participants were instructed to choose from the alphabet letters on the screen and touch the letters that correctly spelled the target word. The developers of the program provided evidence for the selection of the words used in the game, stating that mastering the top 100 sight words aids in early reading (Wimsatt, 2006). The words used in the program make up nearly 50% of the words most frequently used in English language; however, they tend to be difficult for young children to learn. The animals in the game assisted the children in recognizing words by pronouncing each word for the child. They also helped the child spell the words by providing facial expressions corresponding to the letters selected. For example, if the child selected a letter that belonged in the word, the animal smiled. However, if the child selected a letter that was not in the word, the animal would make a surprised face. In addition, the animals provided verbal praise to the participant and facial expressions denoting the animals' feelings with respect to the child's incorrect or correct answer. The child received one point for each word spelled correctly, and there was a running point tally for each session.

Tux Paint™

Tux Paint™ is a computer painting game created by the Microsoft Corporation that incorporates a variety of colors, shapes, line types, tools, backgrounds, and graphics. The game has sound effects and many graphics but lacks the interactive features of the avatars used in FaceSay™ and Early Flyers™. The children in the Tux Paint™ group played the painting computer painting game for the same amount of time as the children in the two intervention groups. Tux Paint™ was used as a computerized control and accounted for computer time and interaction with research assistants in the absence of avatar-directed activity. There were no scores given for children playing Tux Paint™.

Measures

AGS Early Screening Profile

The AGS Early Screening Profile (ESP) is nationally normed measure of preschool functioning designed to identify children at risk for developmental delays, behavioral problems, learning disabilities, and those children that may qualify for gifted services (McIntosh, Gibney, Quinn, & Kundert, 2000). Lenkarski, Singer, Peters, and McIntosh (2001) report the utility of the ESP in screening children at risk for developmental and cognitive delays. The ESP is designed for children between 2 years 0 months of age and 6 years 11 months of age. The ESP is comprised of individual subtests measuring skills such as cognitive abilities, language abilities, motor development, social-emotional skills, and adaptive functioning. The tests produce three major profiles: the Cognitive/Language Profile, the Motor Profile, and the Self-Help/Social Profile. The ESP demonstrates good test-retest reliability (Smith, Lasee, Hasted, & Ouradnick, 1991). Specifically, the Cognitive/Language Profile had test-retest reliability of 0.90, and the Self-Help/Social Profile had a test-retest reliability of 0.81 (Smith, 1990). The test-retest reliability Total Screening test-retest reliability measures range from .78 to .89. The AGS Early Screening Profiles also demonstrate concurrent validity with empirically supported measures of cognitive functioning including the Stanford-Binet and Differential Ability Scales (Genteman, 1992). The AGS Early Screening Profiles were administered by trained professionals hired by the Head Start programs. Copies of the completed measures were provided by the Head Start administration. For the present study, the Cognitive/Language Profile standard scores were used.

Goodenough Harris Draw-A-Man Assessment

The Goodenough Harris Drawing Test is a nationally normed test designed to assess preschool through school-aged children's general abilities in order to identify those children that are in need of additional attention and possibly services (Goodenough, 1975; Simner, 1985). Specifically, the test is used for children between the ages of 3 and 15. Most notably the results of the test give an estimate of the child's intellectual maturity (Goodenough, 1975). The test can be administered with limited verbal abilities and individuals from different cultural backgrounds because it does not rely on well-developed verbal skills (Goodenough, 1975). The child is allowed to erase, start over if needed, and talk to the examiner about his or her drawings. The test is scored based on 73 criteria, with separate norms for males and females. Measures of internal consistency were estimated as being in the high .80s. The average test-retest reliability coefficient was .74. For the current study, the following features were coded as either present or absent: head, upper region of the face (eyes), middle region of the face (nose), and lower region of the face (mouth). The children received one point for the presence of each feature, and the scores were then added to obtain the cumulative number of facial features drawn with a possible total of 4 points.

Benton Facial Recognition Test.

The Benton Facial Recognition Test is a nationally normed test designed to measure one's ability to discriminate and distinguish unfamiliar faces. It was developed to detect brain damage in patients, identifying such conditions as facial agnosia and prosopagnosia (Benton, Sivan, deS. Hamsher, Varney, & Otfried, 1994). A person's performance on the task can also provide some suggestion of the location and type of brain damage. The Benton Facial Recognition Test contains a long form consisting of 54 items and a short form consisting of 27 items. There are four different types of stimuli presented in the test: matching identical front view photographs, matching front-view, three quarter view photographs, and matching front view photographs under varying lighting conditions. The test has norms available for individuals ages 6 to 74 years of age (Benton et al., 1994). In addition, Levin and Benton (1977) examined possible cultural and ethnic artifacts and it was determined that African-Americans scored slightly lower than Caucasians on the Facial Recognition Test, which may affect the generalizability of some of the results of the present study. The tests demonstrate good reliability with an internal consistency of 0.71 and test-retest reliability of 0.66 (Benton, 1980). In the present study, the children completed the 27-item short form and received one point for each face correctly identified. The points were added to produce a total face recognition score with a possible total of 27 points.

Sullivan Emotion Recognition Test.

The Sullivan Emotion Recognition task is a test measuring the child's ability to verbally identify the emotions of schematic line drawings and photographs adapted from Ekman and Friesen's (1975) and Sullivan (1996) emotion recognition tasks. The version used in the present study was further adapted from Hopkins (2011) and Sullivan (1998). The Ekman and Friesen faces have demonstrated strong reliability 0.89-0.91 (Ekman & Friesen, 1975) and validity 0.71-0.86 (Ekman & Friesen, 1975).

Schematic Drawings. Sullivan (1995;1997) used the theoretical frameworks of Ekman and Friesen's (1975) drawings of facial expressions to compile a set of schematic drawings of emotions including happiness, sadness, anger, fear, surprise, and disgust. The pictures utilize the three areas of the face considered to be important for emotion perception, as supported by the literature on emotion recognition. Some emotions require only the mouth for recognition, while other emotions use the eyebrows/eyes, nose, and mouth. In the drawing condition, each child was presented with the six pictures, the examiner read an emotion label and then the child was asked to choose the target emotion amongst the other five distracters. If the child picked up the picture from amongst the other five pictures, it was replaced before he or she was asked to identify the next emotion. The placement of pictures was counterbalanced, using a Latin square in order to ensure that each picture is in each position in an equal number of trials (Hopkins 2011; Sullivan, 1996). The child earned one point for each correct emotion identified. A Drawing Total was obtained by adding all correct responses.

Photographs. Six black and white photographs of a woman making six emotions (anger, sadness, happiness, surprise, fear, and disgust) were selected from Ekman and Friesen's (1976) faces, and a subset of six faces were chosen for this study. Models were trained for each of the photographs and specific muscles were targeted in each emotion. As with the drawings, the pictures utilize the portions of the face deemed necessary in emotion recognition. The child was asked to select the target emotion amongst the other five-distracter emotions after the examiner had read the emotion label. The photographs were counterbalanced like the schematic drawings using a Latin square (Hopkins 2011; Sullivan, 1996). The child earned one point for each correct emotion labeled. The correct responses were added together to comprise a Picture Total.

Emotion Labels. The labels for the six emotions used in the study were read to the participants. The labels for the emotions were given as follows happy, sad, and surprised; alternate words for some of the emotions will be given as necessary, including anger (mad), disgust (yucky), afraid (scared). For the current study a child received one point for each of the six emotions he or she labeled correctly in both the Drawing and Picture categories. The points from the Drawing and Picture categories were added to produce an emotion recognition score with a possible total of 12 points.

Procedure

Before beginning the study and prior to interacting with the children, all graduate students completed FBI background checks. The participants were recruited from four Head Start classrooms in Birmingham, Alabama. The parents were given information about the study and the procedures at a monthly parents' meeting. Parents desiring to participate in the study were then asked to sign a consent form. Upon receiving consent from the parent, each child was randomly assigned to one of the three games: the social skills game (Face Say™), the early spelling game (Early Flyers™), or the painting game (Tux Paint™). The children were then administered the Benton Facial Recognition Test and the Sullivan Emotion Recognition Test prior to and immediately following completion of the 12-week intervention. Trained graduate and undergraduate research assistants administered the Benton Facial Recognition Test and the Sullivan Emotion Recognition Test in a classroom in the Head Start building, during Head Start hours. Before beginning the paper and pencil measures, the research assistants explained the study procedures to each participant. Each child was told that he or she would see some pictures of a woman and a cartoon face and would have to point to the picture that showed the emotion, the same emotion that the examiner was labeling. The examiner also explained the procedures for the facial recognition test, stating that pictures would be shown in a book and he or she would have to select the cut out picture(s) that matched the target picture in the booklet.

The research assistants also supervised the children while playing the computer games. The children participated in the study for 12 weeks, completing on average one to two sessions per week for the duration of study. Each session lasted approximately 15 minutes, depending on the attentiveness of the child. Post intervention assessments included: The Benton Facial Recognition Test and Sullivan Emotion Recognition Test. In addition, the children completed the Goodenough Harris Draw-A-Man Test as a part of AGS Early Screening Profile testing at the beginning of the school year and following completion of the intervention.

DATA ANALYSIS AND RESULTS

Prior to completing the inferential statistics, all descriptive statistics were obtained to determine if the assumptions for regression and analysis of variance were met, thus reducing the chances of Type I or Type II errors. Specifically, the scatter plots of the variables were examined to determine the normality of the data. In addition, all dependent variables were compared to each independent variable using bivariate correlations. All outliers were examined and considered in the interpretation of the final results. In order to determine if the independent and dependent variables have a linear relationship, residual plots were inspected. The reliability measures of the subjective measures were assessed and determined to be at levels of 0.9 or higher, suggesting that the variables were measured with reliability. In order to test for homoscedacity, the residual plot of the standardized residuals was compared to the standardized predicted plot. The independent variables were tested for multicollinearity using bivariate correlations. Table 1 displays the correlations between all variables included in the analyses.

Table 1
Descriptive Statistics and Bivariate Correlations of All Variables

	M (SD)	1	2	3	4	5	6	7	8
1. AGS Cognitive	86.16 (12.30)	1.00							
2. Pre_Benton	13.66 (3.48)	0.06	1.00						
3. Pre_Emotion	4.43 (2.15)	0.45**	0.22	1.00					
4. FaceSay Accuracy score	148.25 (48.96)	0.42	0.20	0.46**	1.00				
5. Pre_Draw-A-Man Total	1.23 (1.55)	0.36**	0.32*	0.28*	0.34	1.00			
6. Post_Benton	15.90 (2.82)	0.29*	0.46**	0.53**	0.30	0.03	1.00		
7. Post_Emotion	5.06 (2.48)	0.51**	0.34**	0.67**	0.43*	0.45**	0.53**	1.00	
8. Post_Draw-A-Man Total	1.23 (1.55)	0.31*	0.32*	0.11	0.55**	0.51	0.26*	0.38**	1.00

N ranged from 54 to 73. Pre_Benton = Pre intervention Benton Face Recognition score. Pre_Emotion = Pre intervention Emotion Recognition score. Pre_Draw-A-Man Total = Pre intervention Draw_A-Man Total. Post_Draw-A-Man Total = Post intervention Draw-A-Man Total.
* $p < 0.05$
**$p < 0.0001$

Multiple Regression Analyses

Aim 1: Face Say™ game accuracy as a predictor of post intervention face and emotion recognition

The first aim of the study was to determine the effect of FaceSay™ performance on children's face and emotion recognition scores. The predictor variable was accuracy on FaceSay™, defined as the total points earned following the completion of 10, 15-minute sessions and the dependent variables were the post intervention Benton Facial Recognition Test scores for the first analysis and the post intervention Emotion Recognition Test for the second analysis. Two multiple regression analyses were conducted to test the hypotheses. Specifically, the first standard regression evaluated whether FaceSay™ game performance predicted Benton Face Recognition performance post intervention. Pre intervention Benton Face Recognition scores and FaceSay™ game accuracy scores were entered into the model simultaneously. A second multiple regression was conducted to determine the relationship between FaceSay™ accuracy and emotion recognition abilities as measured by the post intervention Emotion Recognition Test scores.

Results

Table 2 shows that 24% of the variance in post intervention Benton Face Recognition scores can be explained by pre intervention Benton Face Recognition scores and the FaceSay™ game accuracy score, $R^2 = 0.24$, F (2, 30) = 4.35, $p = 0.03$. The pre intervention Benton Face Recognition score made the greatest unique contribution to the model, explaining 15% of the variation in the post intervention Benton scores, and the FaceSay™ Accuracy scores uniquely explained 2% of the variance in the post intervention Benton scores. Thus, the final model indicated that only pre intervention Benton scores provided a statistically significant, unique contribution to the model.

Table 2

Multiple Regression Predicting Post Intervention Benton Face Recognition Scores Based on FaceSay™ Game Performance

Predictors	B	S.E.	df	p	R^2
Pre_Benton	0.54	0.23	2	0.03*	0.24
FaceSay_score	0.01	0.01	2	0.44	

N = 31. Pre_Benton = Pre intervention Benton Face Recognition score.
* $p < 0.05$

Based on the model, 43% of the variance in post intervention Emotion Recognition scores can be explained by pre intervention Emotion Recognition scores and the FaceSay™ game accuracy score, $R^2 = 0.43$, $F(2, 30) = 10.62$, $p = 0.00$. As depicted in Table 3, only the pre intervention emotion recognition scores significantly contributed to the model, explaining 25% of the variation in the Benton Post scores. The FaceSay™ Accuracy scores did not uniquely contribute to the model and only explained 2% percent of the variance in the Benton Post scores. Thus, the final model indicated that only pre intervention Emotion recognition scores provided a statistically significant, unique contribution to the model.

Table 3
Multiple Regression Predicting Post Intervention Emotion Recognition Scores Based on FaceSay™ Game Performance

Predictors	*B*	*S.E.*	*df*	*p*	R^2
Pre_Emotion	0.91	0.26	2	0.00**	0.43
FaceSay Accuracy score	0.01	0.01	2	0.32	

N = 31. Pre_Emotion = Pre intervention Emotion Recognition Score
$^*p < 0.05$
$^{**}p < 0.001$

Aim 2: Cognitive ability as a predictor of post intervention face and emotion recognition

The second aim of the study was to determine if children with high cognitive functioning benefit more from the avatar interventions, as demonstrated by their scores on the face and emotion recognition outcome measures. The independent variables were cognitive functioning, obtained using the standard scores on the AGS Early Screening Profiles, game assignment (FaceSay™, Early Flyers™, Tux Paint™), and baseline performance on the Benton Facial Recognition Test for the first analysis and baseline performance on the Sullivan Emotion Recognition Test for the second analysis. Two orthogonal contrasts were used as predictors comparing FaceSay™ and Early Flyers™ vs. Control (Tux Paint™) and an additional contrast comparing FaceSay™ vs. Control (Early Flyers™ and TuxPaint™). The dependent variables were the post intervention scores on the Benton Facial Recognition Test for the first analysis and post intervention scores on the Emotion Recognition Test for the second analysis. In order to test the hypotheses, multiple regressions were used to predict post intervention facial recognition and emotion recognition scores. AGS Cognitive scores, pre intervention Benton Face Recognition scores, and orthogonally coded conditions were entered into the model simultaneously. For the second set of regressions AGS Cognitive scores, pre intervention Sullivan Emotion Recognition scores, and orthogonally coded conditions were entered into the model simultaneously.

Results

Table 4 indicated that 37% of the variance in post intervention Benton Face Recognition scores were explained by AGS Cognitive scores, pre intervention Benton Face Recognition scores, and game assignment to the FaceSay™ versus assignment to the control game, Tux Paint™, $R^2 = 0.37$, $F\ (4, 54) = 7.23$, $p = 0.00$. The pre intervention Benton Face Recognition score made the greatest unique contribution to the model, explaining 14% of the variation in the post intervention Benton scores, followed by the assignment to the FaceSay™ condition which explained 10% of the variation in post intervention Benton Face Recognition scores. The AGS Cognitive scores explained 6%

of the variation, and the assignment to Tux Paint™ explained less than 1% of the variation in post intervention Benton scores. Based on the results, the Benton pre intervention scores, assignment to the FaceSay™ game compared to Tux Paint™, and AGS Cognitive scores were all statistically significant unique contributions to the model.

Table 4

Multiple Regression Predicting Post Intervention Benton Face Recognition Scores from AGS Cognitive Scores

Predictors	*B*	*S.E.*	*df*	*p*	R^2
AGS Cognitive Score	0.06	0.03	4	0.04*	0.37
Pre_Benton	0.31	0.09	4	0.00**	
FaceSay	2.13	0.76	4	0.02*	
EarlyFlyers	0.15	0.84	4	0.18	

N = 55. Pre_Benton = Pre intervention Benton Face Recognition Test
* $p < 0.05$
**$p < 0.0001$

An additional multiple regression was conducted comparing the effects of assignment to the FaceSay™ game versus assignment to Early Flyers™. The results indicated that the model, including the AGS Cognitive scores, pre intervention Benton scores, and game assignment to FaceSay™ versus control games, explains 37% of the variation in post intervention Benton scores. In terms of unique contributions, shown in Table 5, assignment to the FaceSay™ game accounted for 8% of the variance in post intervention Benton scores, while assignment to Early Flyers™ accounted for less than 1% of the variance in post intervention Benton Face Recognition scores.

Table 5
Multiple Regression Predicting Post Intervention Benton Face Recognition Scores from AGS Cognitive Scores

Predictors	*B*	*S.E.*	*df*	*p*	R^2
AGS Cognitive Score	0.06	0.03	4	0.03*	0.37
Pre_Benton	0.31	0.09	4	0.00**	
FaceSay	1.98	0.76	4	0.01*	
Tux Paint	-0.16	0.84	4	0.85	

N = 55. Pre_Benton = Pre intervention Benton Face Recognition Test
* $p < 0.05$
** $p < 0.0001$

Multiple regressions were run to determine if AGS cognitive scores were predictive of post intervention emotion recognition scores for children playing FaceSay™ as compared to those playing Tux Paint™. Based on the model, $R^2 = 0.57$, $F(4, 73) = 15.71$, $p = 0.00$, 57% of the variance in post intervention emotion recognition scores can be explained by the model including the AGS cognitive score, pre intervention emotion recognition scores, and game assignment to either FaceSay™ or Control. Based on the results depicted in Table 6, only pre intervention emotion recognition scores and AGS cognitive scores were significant, unique predictors. Pre intervention emotion scores uniquely account for 9% of the variance in post intervention scores, while the AGS cognitive scores uniquely account for 21% of the variance in post intervention emotion recognition scores. Assignment to the FaceSay™ condition uniquely accounts for less than 1% of the variance in post intervention emotion recognition scores. Assignment to the Tux Paint™ uniquely accounted for 1% of the variance in post intervention, though game assignment was not a significant predictor.

Table 6
Multiple Regression Predicting Post Intervention Emotion Recognition Scores from AGS Cognitive Scores

Predictors	*B*	*S.E.*	*df*	*p*	R^2
AGS Cognitive Score	0.07	0.02	4	0.00**	0.57
Pre_Emotion	0.59	0.13	4	0.00**	
FaceSay	0.00	0.57	4	0.99	
Tux Paint	0.79	0.63	4	0.22	

N = 74. Pre_Emotion = Pre intervention Emotion Recognition Score.
** $p < 0.0001$

An additional standard regression was performed to determine if cognitive ability predicted outcomes on the emotion recognition test following the intervention for children playing FaceSay™ as compared to those playing Early Flyers™. Based on the model, 57% of the variance in post intervention emotion recognition scores can be explained by the model including the AGS cognitive score, pre intervention emotion recognition scores, and game assignment to either FaceSay™ or Early Flyers™. Based on the results depicted in Table 7, only pre intervention emotion recognition scores and AGS cognitive scores were significant, unique predictors. Pre intervention emotion scores uniquely account for 9% of the variance in post intervention scores, while the AGS cognitive scores uniquely account for 21% of the variance in post intervention emotion recognition scores. Assignment to the FaceSay™ condition uniquely accounts for less than 1% of the variance in post intervention emotion recognition scores.

Assignment to Early Flyers™ uniquely accounted for 1% of the variance in post intervention, though game assignment was not a significant predictor.

Table 7
Multiple Regression Predicting Post Intervention Emotion Recognition Scores from AGS Cognitive Scores

Predictors	*B*	*S.E.*	*df*	*p*	R^2
AGS Cognitive score	0.07	0.02	4	0.00**	0.57
Pre_Emotion	0.59	0.13	4	0.00**	
FaceSay	-0.79	0.58	4	0.18	
Early Flyers	-0.80	0.63	4	0.21	

N = 74. Pre_Emotion = Pre intervention Emotion Recognition score.
**p < 0.0001

Aim 3: Improvements in line drawings of facial features following intervention

The third aim of the study was to determine if the use of avatars improved preschoolers' abilities to recall facial features in a drawing assessment. The independent variables were game assignment (FaceSay™, Earl Flyers™, and Tux Paint™), accuracy on FaceSay™, defined as the total points earned following the completion of 10, 15-minute sessions, and standard scores obtained on the AGS Early Screening Profiles. The dependent variable was the total number of features produced on the Goodenough Harris Draw-A-Man Assessment. In order to test the third hypothesis, an analysis of covariance was conducted comparing the number of facial features recalled on the Goodenough Harris Draw-A-Man Assessment following the intervention. The pre intervention Goodenough Harris Draw-A-Man Assessment scores were used as a covariate.

Results

Preliminary analyses were conducted to confirm the reliability of the covariate, linearity, and homogeneity of regression slopes. After controlling for the pre intervention Draw-A-Man total score, there was no significant difference between the children based on game assignment, $F\ (2,60) = 0.49$, p = n.s., $\eta = .02$. The results in Table 8 indicated that there was a strong relationship between the pre intervention and post intervention Draw-A-Man total scores, $F\ (2,60) = 16.59$, $p = 0.00$, $\eta = 0.25$.

Table 8
Analysis of Covariance Measuring Group Differences in Drawings Post Intervention

Source		*M(SD)*	*df*	*F*	*p*
Pre_Draw-A-Man Total		1.25(1.56)	1	18.38	0.00**
Game Assignment			2	0.49	0.61
	FaceSay	2.55(1.22)			
	Early Flyers	2.73(1.03)			
	Tux Paint	2.95(0.97)			

N = 61. Pre_Draw-A-Man Total = Pre intervention cumulative score of all facial features drawn.
** $p < 0.0001$

In addition, a multiple regression was conducted to determine if FaceSay™ accuracy scores were predictive of post intervention drawings. $F\ (2, 21) = 5.58$, $p = 0.01$. As depicted in Table 9, the full model containing pre intervention Draw-A-Man Total scores and FaceSay™ accuracy scores explains 37% of the variance in post intervention Draw-A-Man Total scores. The FaceSay™ accuracy score was the only significant predictor of post intervention drawings, uniquely explaining 17% of the variance in post intervention drawing scores.

Table 9
Multiple Regression Predicting Post Intervention Draw-A-Man Total Scores Based on FaceSay™ Game Performance

Predictors	*B*	*S.E.*	*df*	*p*	R^2
Pre_Draw-A-Man Total	0.26	0.18	2	0.17	0.37
FaceSay_score	0.01	0.01	2	0.04*	

Note: *N*=22. DAMpre_Total = cumulative score of all facial features drawn. Pre_Draw A-Man Total.
* $p < 0.05$

Supplementary Analyses

Aim 1

Given the significant finding that AGS scores were significant predictors of outcomes on both face recognition and emotion recognition, it was hypothesized that cognitive ability may also have had an effect on the FaceSay™ accuracy scores analyzed in Aim 1. Therefore, the effect of the interaction between FaceSay™ game accuracy and AGS Cognitive scores was evaluated. The full model containing the $F(3, 18) = 2.31$, $p =$ n.s. However, the results were not significant, suggesting that there are other factors affecting the efficacy of FaceSay™.

In order to account for differences in performance at the beginning and end of the intervention more accurately predicted face and emotion recognition following the intervention, an additional measure of accuracy on FaceSay™ was computed. The predictor variable was accuracy on FaceSay™, defined as the mean score on the first three, 10-minute sessions of FaceSay™ compared to the mean score on the last three sessions of FaceSay™. Change scores were computed and used in the model. The dependent variables were the post intervention Benton Facial Recognition Test scores for the first analysis and the post intervention Emotion Recognition Test for the second analysis. Two multiple regression analyses were conducted to test the hypotheses. Specifically, the first standard regression evaluated whether FaceSay™ game performance predicted Benton Face Recognition performance post intervention. Pre intervention Benton Face Recognition scores and FaceSay™ game accuracy scores were entered into the model simultaneously. A second multiple regression was conducted to determine the relationship between FaceSay™ accuracy and emotion recognition abilities as measured by the post intervention Emotion Recognition Test scores.

Results

Table 10 shows that 13% of the variance in post intervention Benton Face Recognition scores can be explained by pre intervention Benton Face Recognition scores and the FaceSay™ game accuracy score, $R^2 = 0.13$, $F\ (2, 20) = 1.36$, $p = 0.28$. The FaceSay™ game accuracy scores made the greatest unique contribution to the model, explaining 12% of the variation in the post intervention. Pre intervention Benton Face Recognition scores uniquely explained 4% of the variance in the post intervention Benton Face Recognition scores. However, neither pre intervention Benton Face Recognition scores, nor FaceSay™ game accuracy scores provided a statistically significant, unique contribution to the model.

Table 10

Multiple Regression Predicting Post Intervention Benton Face Recognition Scores Based on FaceSay™ Game Performance

Predictors	*B*	*S.E.*	*df*	*p*	R^2
Pre_Benton	0.18	0.18	2	0.34	0.13
FaceSay Accuracy score	0.13	0.09	2	0.15	

Note: N=21. Pre_Benton = Pre intervention Benton Face Recognition Test.

$p < 0.05$

Table 11 shows that 34% of the variance in post intervention Emotion Recognition scores can be explained by pre intervention Emotion Recognition scores and the FaceSay™ game accuracy score, $R^2 = 0.34$, F (2, 20) = 4.64, $p = 0.02$. The pre intervention Emotion Recognition score made the greatest unique contribution to the model, explaining 34% of the variation in the post intervention Emotion Recognition scores, and the FaceSay™ Accuracy scores uniquely explained 0.6% of the variance in the post intervention Emotion Recognition scores. Thus, the final model indicated that only pre intervention Emotion Recognition scores provided a statistically significant, unique contribution to the model.

Table 11

Multiple Regression Predicting Post Intervention Emotion Recognition Scores Based on FaceSay™ Game Performance

Predictors	*B*	*S.E.*	*df*	*p*	R^2
Pre_Emotion	0.99	0.33	2	0.01*	0.34
FaceSay_score	0.02	0.06	2	0.67	

Note: N=21. Pre_Emotion = Pre intervention Emotion Recognition Score.

Aim 3

In order to determine whether there were differences in the portions of the face drawn by the children, logistic regression models were performed to examine if differences exist in the portions of the face recognized by the children post intervention depending on game assignment. Each model contained two independent variables game assignment (FaceSay™, Early Flyers™, and Tux Paint™) and face region (head, upper, middle, and lower face).The full model containing game assignment and the pre intervention drawings of the head region was not significant, χ^2 = (3, N = 57) = 5.623, p = n.s., indicating that the model was not unable to distinguish children who did and did not recognize the head post intervention. The current model explained between 9% (Cox & SnellR^2) and 24% (NagelkerkeR^2) of the variance in drawings of the head.

The model containing game assignment and the pre intervention middle face (nose) was significant, χ^2 = (3, N = 57) = 9.304, p = 0 .03, indicating that the model was able to distinguish between children who recalled the middle of the face and those who did not. The model correctly classified 72% of the cases and explained between 15% (Cox & Snell R^2) and 20% (Nagelkerke R square) of the variance in post intervention middle face drawings. Though the full model was significant, the results, as shown in Table 10 indicate that the pre intervention middle face drawings were the only significant predictors of post intervention middle face drawings. Thus, game assignment was not a significant, unique predictor of post intervention middle face drawings.

Table 12

Logistic Regression Predicting Post Intervention Middle Face Drawings from Pre Drawings and Game Assignment

Predictors	*B*	*S.E.*	*Wald*	*df*	*p*	*Odds Ratio*
P_Middle	2.16	0.88	6.00	1	0.01*	8.63
FaceSay	0.77	0.69	1.24	1	0.27	0.46
Early Flyers	0.45	0.48	0.89	1	0.35	0.48

Test	χ^2	*df*	*p*
Overall Model	9.3	3	0.03*

N = 61. P_Middle = Pre intervention drawing of the middle of the face (nose) region.
* $p < 0.05$

The full model containing game assignment and the pre intervention upper face (eyes) drawings was not significant, χ^2 = (3, *N* = 57) = 3.36, *p* = n.s., indicating that the model was not unable to distinguish children who did and did not recognize the upper face. The current model explained between 5% (Cox & Snell R^2) and 11% (Nagelkerke R^2) of the variance in drawings of the upper face. The full model containing game assignment and the pre intervention lower face (mouth) drawings was not significant, χ^2 = (3, N = 57) = 3.97, p = n.s., indicating that the model was not able to distinguish children who did and did not recognize the lower face. The current model explained between 7% (Cox & Snell R^2) and 9% (Nagelkerke R^2) of the variance in drawings of the lower face.

In order to account for differences in performance at the beginning and end of the intervention more accurately predicted post intervention drawings, an additional measure of accuracy on FaceSay™ was computed. The predictor variable was accuracy on FaceSay™, defined as the mean score on the first three, 10-minute sessions of FaceSay™ compared to the mean score on the last three sessions of FaceSay™. Change scores were computed and used in the model. A multiple regression analysis was conducted to test the hypothesis. Specifically, the regression evaluated whether FaceSay™ game performance predicted post intervention drawings. Pre intervention Draw-A-Man scores and FaceSay™ game accuracy scores were entered into the model simultaneously.

Table 13 shows that 19% of the variance in post intervention Draw-A-Man scores can be explained by pre intervention Draw-A-Man scores and the FaceSay™ game accuracy score, $R^2 = 0.19$, F (2, 19) = 4.64, p = 0.17. The pre intervention Draw-A-Man score made the greatest unique contribution to the model, explaining 18% of the variation in the post intervention Draw-A-Man scores, and the FaceSay™ Accuracy scores uniquely explained 0.00% of the variance in the post intervention Draw-A-Man scores.

The final model indicated that neither pre intervention Draw-A-Man scores, nor FaceSay ™ accuracy scores provided a statistically significant, unique contribution to the model.

Table 13
Multiple Regression Predicting Post Intervention Draw-A-Man Total Scores Based on FaceSay™ Game Performance

Predictors	*B*	*S.E.*	*df*	*p*	R^2
Pre_Draw-A-Man Total	0.41	0.04	2	0.07	0.19
FaceSay_score	0.00	0.21	2	0.92	

Note: *N*=20. DAMpre_Total = cumulative score of all facial features drawn. Pre_Draw A-Man Total.
* $p < 0.05$

DISCUSSION

The present study sought to evaluate the efficacy of an avatar intervention in improving the social-emotional functioning of a preschool population, as well as, evaluate the efficacy of early screening in identifying children who may benefit from the avatar intervention. The study had the added feature of assessing an underrepresented cultural and socioeconomic group in order to contribute to the literature on computer-based social skills interventions.

The first aim of the study was to investigate the relationship between game performance and the face and emotion recognition outcome measures. The study's results indicated that the children's performance on FaceSay™ was not predictive of face and emotion recognition scores following the intervention. It was hypothesized the game accuracy on FaceSay™ would predict higher scores on the post intervention Benton Face Recognition Test. The children's performance on the pre intervention Benton Face Recognition Test was the best predictor of post intervention performance, indicating that children with better face recognition pre intervention continued to demonstrate better face recognition regardless of how well they performed on FaceSay™. It was hypothesized that game performance on FaceSay™ would predict post intervention emotion recognition, with higher accuracy scores predicting higher scores on the post intervention Sullivan Emotion Recognition Test. However, FaceSay™ accuracy scores were not significant predictors of post intervention emotion recognition scores. Hopkins

(2011), Perez (2008), and Gower (2009) provide support for improvements in face recognition after playing FaceSay™, as compared to control games. However, the current study's results could not substantiate a link between game performance and the outcome measures. The findings suggest that there are other variables contributing to the children's improvements following the intervention. Based on the results of supplementary analyses, children's cognitive ability could not explain the relationship between FaceSay™ accuracy and face and emotion recognition abilities. Therefore, it is likely that there are other underlying characteristics that contribute to children's success on the FaceSay™ game. Thus, it is important to further investigate FaceSay™ to determine the specific constructs targeted by the game, as compared to those assessed in the face and emotion outcome measures.

Another goal of the study was to determine if children with higher cognitive functioning benefit more from the avatar interventions, as demonstrated by their scores on the face and emotion recognition outcome measures. It was hypothesized that children scoring higher on the AGS Early Screening Profile would demonstrate higher scores on the post intervention Benton Face Recognition test and Sullivan Emotion Recognition Test. The findings indicated that cognitive scores were in fact an important predictor of success on the games. Furthermore, cognitive scores were especially predictive of face recognition outcomes for children playing FaceSay™. Thus, having higher cognitive functioning and being assigned to FaceSay™ yielded the most favorable outcomes in face recognition. However, the results of the present study differed some from other studies. Researchers provided support for the general cognitive development theory, stating that face perception is mature in early childhood and gains made are a result of improvements in cognition, attention, and memory (Bjorklund & Douglas, 1997;Crookes and McKone, 2009). The present study findings indicated that the children's pre intervention face recognition was the best predictor of post intervention results, followed by assignment to FaceSay™, and then cognitive ability. The results indicate that though children may have developed skills in face recognition, the FaceSay™ intervention resulted in higher post intervention face recognition scores. Though cognitive ability was a significant predictor, it was the least powerful predictor for the current population. However, it is important to note that there were several methodological differences between the studies. Crookes and McKone (2009) had a slightly higher sample size; in addition, the current sample was comprised solely of preschoolers, while the previous study incorporated a range of ages. The youngest group was also older (mean age = 5.97 years) in the Crookes and McKone (2009) study than that of the present study (mean age = 4 years). The age difference could have contributed to differences in cognitive ability. Crookes and McKone (2009) also focused primarily on discriminating human faces from animal faces, and the same faces were used in the pre and post assessments. The present study investigated children's ability to discriminate unfamiliar faces after having participated in the intervention, and the intervention faces differed from the faces used in the outcome measures.

While the present study demonstrated positive results in face recognition following the intervention, there are still several areas that remain to be evaluated. First, the stimuli used in the present study were unfamiliar adult faces, all of Caucasian descent, while the population was mostly comprised of children of African-American descent. Future studies may seek to assess the differences in performance when ethnicity is considered. It would also be beneficial to consider the effects of familiar as well as unfamiliar faces. The current findings provide additional support for the utility of FaceSay™ in teaching face recognition, one of the foundational skills for social-emotional development.

The results for the Sullivan Emotion Recognition Test demonstrated that cognitive scores were the best predictor of emotion recognition post intervention, regardless of intervention. These results provided possible explanations for outcomes in previous studies. Perez (2008) and Gower (2009) failed to demonstrate post intervention group differences in emotion recognition ability for children playing FaceSay™, as compared to those playing control games. Elias et al. (1997) highlighted the importance of the preschool years in the developmental trajectory of social-emotional skills. Among the skills mentioned were the improvement in attention that enables the synthesis of small bits of information and the improvement in the ability to label emotions and discern both positive and negative emotions. The ability to label emotions and distinguish positive and negative emotions build the foundation for theory of mind and friendship-building, contributing to one's overall social-emotional development. Denham, Zoller, and Couchoud (1994) also noted the importance of cognitive ability and behavioral characteristics in emotion recognition skills. The present study provided support for the importance of cognitive ability in emotion recognition, as cognitive ability was the best predictor of post intervention outcomes, to a greater extent even than pre intervention scores. However, the present study did not investigate the effects of behavioral characteristics in the development of emotion recognition skills. Future studies should investigate the importance of behavioral characteristics, such as attention and temperament, in emotion recognition improvements following the social skills intervention. In addition, memory may play a role in the children's ability to identify emotions and future studies may investigate the importance of memory. Furthermore, given the findings of Perez (2008) and Gower (2009), there is reason to believe that in its current form, FaceSay™ is not designed to specifically teach emotions. Improvements to the game may seek to incorporate age appropriate games explicitly teaching children to identify emotions and distinguish positive emotions from negative emotions. Hopkins (2011) utilized the school age/adolescent version of FaceSay,™ incorporating the "Follow the Face" game and reported improvements in emotion recognition. Therefore, the utility of "Follow the Face" is supported; however, it is also likely that cognitive ability and behavioral characteristics may have aided the older children in improving these skills.

The third aim of the study was to determine if the use of avatars improved preschooler's abilities to recall facial features in a drawing assessment. It was predicted that children playing FaceSay™ and Early Flyers™ (avatar interventions) would identify more facial features on the post intervention Goodenough Harris Draw-A-Man Test than children playing Tux Paint™ (no avatars). It was also predicted that children with higher accuracy scores on FaceSay™ (avatar intervention) would identify a greater number of facial features post intervention. The results of the study indicated that there were no differences in drawing ability based on the game assignment; rather, the number of facial features produced pre intervention was the best predictor of the number of facial features produced post intervention. Supplementary analyses were conducted to determine whether there were differences in the regions of the face recognized. The results indicated that children who were able to correctly draw the middle (nose) region of the face pre intervention were most likely to produce it again post intervention. However, game assignment was not a significant predictor of the ability to produce the middle region of the face. The results indicated that neither pre intervention drawings, nor game assignment, were significant predictors of children's ability to produce the eye region and the mouth region. Goodenough (1975) designed the test to measure intellectual maturity and help to identify children who may be at risk for developmental delays. As evidenced by the data, there was a moderate relationship between cognitive ability and drawing ability. However, assignment to FaceSay™ was not predictive of improved post intervention drawing abilities. It is possible that the children's variable performance on the FaceSay™ confounded the analysis. Future studies may seek to evaluate the children's ability to produce drawings of the human anatomy as well as emotions.

In addition, FaceSay™ accuracy scores were used to predict the number of features produced following the intervention. It was hypothesized that children performing better on FaceSay™ would have gained ample information about the structure of the human face, which could then be used to produce line drawings of faces. Results indicated that children who performed better on FaceSay™ also produced more complex line drawings. Thus, FaceSay™ accuracy was predictive of the post intervention drawings. This information provides additional support for the benefits of FaceSay™, suggesting that playing games with avatars may increase children's awareness of facial features and may improve their understanding of the organization and orientation of the human face.

General Discussion

The present study sought to examine the utility of a computer-based social skills intervention utilizing avatars in helping preschool children improve component social skills. Specifically, the study investigated the relationship between game performance and performance on the outcome measures, cognitive ability and game performance, and children's ability to produce line drawings of the human face following the 12-week intervention. Results from the study indicate that children with higher cognitive functioning showed the greatest improvements following the intervention, and children playing FaceSay™ had the greatest post intervention face recognition. These results support the use of FaceSay™ in improving children's face recognition. Children's accuracy scores on FaceSay™ did not predict post intervention face and emotion recognition. The FaceSay;™ nonetheless, FaceSay™ accuracy scores predicted post intervention drawings. However, there was no significant effect for game assignment. Taken together, there is support for the use of FaceSay™ in improving social-emotional skills, namely face and emotion recognition skills, for preschoolers enrolled in Head Start programs. Future studies should further examine the constructs targeted by FaceSay™. Given the findings that FaceSay™ is more effective for children with higher cognitive functioning, it may be helpful to modify the games to better serve children of varying functioning levels. In addition, the games are not specifically tailored for preschoolers, which may have contributed to the outcomes in emotion recognition. Preschool children may benefit from games that specifically teach emotion recognition. The present study involved a small population obtained from a restricted geographic area, thus future studies may seek to incorporate more communities in order to obtain results that may be generalizable to the general population. In its current form, FaceSay™ has demonstrated efficacy in improving face recognition skills for preschool children enrolled in Head Start, contributing to the children's overall social-emotional development. The game has added benefits for children with higher cognitive functioning as well.

Limitations

The present study had a relatively small sample size given the study design. This sample size likely had an adverse effect on some of the study results. Related to sample size, it is also important to consider sampling procedures. The study was restricted to Head Start programs in a specific city, with limited demographic variability. These factors limit the generalizability of the results. Additionally, the study was an intervention, and it was determined that 12 weeks was sufficient time for the intervention given outcomes from previous studies. However, there have not been analyses comparing the effects of varying the intervention length, the maintenance of skills following the intervention, nor has the study sought to evaluate the children's ability to apply the improvements in face recognition in a naturalistic setting. Future studies may seek to address these issues in order to increase the statistical support for FaceSay™. With regard to the game design, FaceSay™ was designed specifically for children with Autism Spectrum Disorders. The games were originally used in a school age and adolescent population. In the current form, FaceSay™ employs avatars that are unfamiliar to the children and all of one ethnic background. Given the variability in ethnicity of the Head Start population in comparison to the other populations studied, it may be useful to consider the effects of incorporating diversity into games. In addition, the games were not specifically designed at the developmental level of preschoolers, which resulted in one of the games being omitted. It would be useful to create a game that would introduce emotions and instruct the children on the similarities and differences in emotions, as the study results indicate that the game has not demonstrated improved emotion recognition in preschoolers as was previously reported in the school age/adolescent population.

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THE UNIVERSITY OF
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Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator:	PEREZ, TRISTA A
Co-Investigator(s):	
Protocol Number:	**X070228006**
Protocol Title:	*Social and Cognitive Development in Head Start Population*

The IRB reviewed and approved the above named project on 4-6-12. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 4-6-12

Date IRB Approval Issued: 4-6-12

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

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