ABSTRACT

Teaching Social Leisure Skills to Individuals with Autism Spectrum Disorder

Kristin Nicole O'Guinn, Ph.D.

Mentor: Jessica S. Akers, Ph.D.

A key component of the diagnosis of autism spectrum disorder (ASD) is difficulties with social engagement, and many individuals with this diagnosis self-report *often* or *always* feeling lonely. A promising protective factor against this experience is consistent social engagement with other individuals. One avenue for increasing the social engagement of adolescents with ASD is to teach them skills that will increase opportunities to engage with their peers, such as social leisure skills. In this study, two adolescent boys with ASD increased the number of general comments and appropriate reactions emitted during a popular social leisure activity, video games, following the use of a script-fading intervention. The social validity of this intervention was assessed through brief interviews with each of the participants and their caregivers following their participation in this study.

Teaching Social Leisure Skills to Individuals with Autism Spectrum Disorder

by

Kristin Nicole O'Guinn, B.A., M.A.

A Dissertation

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Approved by the Dissertation Committee

_____

Jessica Akers, Ph.D., Chairperson

_____

Tonya Davis, Ph.D.

_____

Janet Bagby, Ph.D.

_____

Christine Limbers, Ph.D.

Accepted by the Graduate School

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J. Larry Lyon, Ph.D., Dean

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DEDICATION

To Robin Erin O’Guinn.

CHAPTER ONE

Introduction

Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a developmental disability that can impact the way an individual behaves and communicates. Specific difficulties are often observed with speech and language, restricted and repetitive patterns of behaviors or interests, and social interactions (CDC, 2021). Worldwide, the median prevalence of ASD ranges from 0.63 to 14.42 per 1000 births, with the lowest reported prevalence occurring in the Middle East and the highest reported prevalence occurring in Asia (Chiarotti & Vinerosi, 2020). Diagnosticians report the increase in diagnoses of ASD over the last decade may be due to heightened awareness of features associated with ASD, as well as public de-stigmatization surrounding the diagnosis (Davidovitch et al., 2021). This increase in diagnosis has led to an increase in availability of services that are marketed to target many difficulties associated with ASD, and caregivers report feeling overwhelmed when faced with choosing which services to invest time and money in (Candon, 2021; Lindly et al., 2021). Thus, medical providers tend to recommend caregivers choose services that target the key components of concern for individuals with ASD (Davidovitch et al., 2021).

One component of ASD is difficulties with speech and language. This can be divided into two areas: difficulty with receptive language and difficulty with expressive language. Receptive language skills involve the comprehension of language, while

expressive language skills are an individual's ability to specify needs and wants through verbal or nonverbal communication (Pratt et al., 2017). Difficulties with receptive language skills would be observed if an individual has difficulty understanding what another person is saying to them. For example, an individual may be asked to throw a ball, but due to misunderstanding, the individual instead puts the ball in a box. Difficulties with expressive language often present with varying levels of ability, with 20-30% of individuals not using any vocal verbal speech such as gesturing. For those who use vocal verbal speech, their speech often has distinct characteristics such as echolalia and abnormal use of pitch and intonation. Further, there are often observed difficulties with language components such as phonology, grammar, and semantics (Pratt et al., 2017).

Repetitive or restricted interests are another key component of ASD (CDC, 2021). Repetitive behaviors may be vocal, physical, routine-based, or any mixture of these three. For example, an individual may engage in repetitive vocal behavior by emitting the same word, phrase, or sound more often than a typically developing peer would and in a non-functional way (Pratt et al., 2017). Physical repetitive behaviors may include hand flapping, eye twitching, or lining up objects. Restricted behavior with routines often presents as an obsessive adherence to sameness in routines, with the individual experiencing distress when any of these routines are broken (Pratt et al., 2017). Restricted interests may be related to topics or activities in which other peers also express interest. However, the intensity of the interest and the number topics or activities with which interest is focused is limited for autistic individuals as compared to peers (Pratt et al., 2017).

Difficulties with social interactions is one of the most noticeable components of ASD. These characteristics are so prominent that caregivers often report that their observation of these difficulties were what led them to seek professional services for their child (National Institute of Neurological Disorders and Stroke [NINDS], 2020). Difficulties with social interactions often manifest as difficulty initiating and maintaining conversations, trouble making friends, and reduced sharing of interests with others. Often, when these difficulties are observed, it is assumed that those with ASD prefer isolation or solitary activities. However, many individuals with ASD report having similar social desires as their typically developing peers, such as belonging to social groups and regularly engaging with peers (Deckers et al., 2017).

In recent years, the market for pseudoscientific products, which are advertised as being able to alleviate many of the characteristics of ASD, has grown considerably. For example, products such as essential oils, vitamin patches, and elimination diets are targeted at the parents of these individuals with the promise of decreasing or eradicating symptoms associated with ASD (i.e., restricted interests and behaviors, difficulties with language, difficulties with social interactions; Travers et al., 2016). As this market has grown, the need for identification of effective practices is more important now than it has in the past (Foster & Ortiz, 2017). Fortunately, researchers can identify interventions and procedures that have empirical support for their efficacy through identification of evidence-based practices (EBPs; Hume et al., 2021). EBPs are practices that have an acceptable amount of peer-reviewed research that demonstrates positive outcomes for individuals with ASD (National Professional Development Center on Autism Spectrum Disorder, 2021).

Applied behavior analysis (ABA) is a science with many procedures that are considered to be EBPs. ABA is a clinical discipline in which the principles of learning and behavior are implemented to address socially significant behavior. Practitioners of this discipline believe behavior is lawful (i.e., occurs for a reason) and that it can be explained and controlled by observing and manipulating environmental events that occur in relation to the behavior (Fisher et al., 2011). Often, the principles of this science are used to implement procedures that can help with many of the difficulties associated with ASD. For example, practitioners have used ABA procedures to decrease inappropriate or dangerous behaviors, increase communication, and increase pro-social behaviors (Soares et al., 2021, Severini et al., 2018; White et al., 2007).

Another reason EBPs should be used by practitioners is due to the substantial personal impact the characteristics of ASD can have on an individual. One of the characteristics of ASD that is most reported as impacting an individual's quality of life are difficulties with pro-social behaviors. Amongst a myriad of negative experiences associated with these difficulties (e.g., bullying, social isolation), adolescents with ASD frequently report overwhelming feelings of frustration when attempting to navigate social interactions and friendships. Specific examples include finding other individuals who have similar interests and preferences, initiating interactions with those peers, and understanding how to maintain a friendship (Howard et al., 2006). Each of these examples are vital for individuals with ASD to build a social network, as finding other individuals with similar interests and preferences seems to be important for friendship success in this population. Individuals with ASD who have successful friendships report that a fundamental component of attaining these relationships is building the relationship

around their shared hobbies (Sosnowy et al., 2019). Shared hobbies are credited with easing social interactions, as the individuals with ASD report these hobbies increased their levels of comfort when engaging with those individuals who would later become their friends (Sosnowy et al., 2019).

Many studies have investigated procedures to teach social skills to individuals with ASD with the hope that those skills will foster friendships (see Soares et al., 2021 for a review). One specific skill often targeted within the literature is engagement in conversations. While these studies contribute critical information to research in social interactions, a limitation is that most of the conversations occur in contrived settings. For example, conversations often occur in sterile settings, such as a clinical room with only chairs and a table, with individuals whom the participant is unlikely to interact with outside of the study. This is an important limitation to consider, since the setting and environment within which two individuals regularly interact can impact the long-term success of their friendship (Sosnowy et al., 2019). For example, many individuals with ASD who report having successful friendships attribute that success, in part, to mutual interests or hobbies (Sosnowy et al., 2019). This is unsurprising, as individuals who share a hobby or other leisure interest encounter more opportunities to engage in those behaviors that foster friendships. For example, a mutually preferred activity can provide a ready-made topic for conversation which can ease the stress of individuals with ASD who may encounter difficulties with initiating conversations (Rabinowitz & Glinn, 2021). Further, similar hobbies or interests could result in repeated interactions between the same group of individuals, which is another important component to maintaining friendships (e.g., regular attendance at sporting events; McPherson et al., 2001).

Thus, to provide rich environments for social interactions and potential friendships, an assortment of preferred leisure skills is important for an individual with ASD. Leisure skills are the subset of behaviors that are needed for an individual to engage in activities other than those necessary to maintain their living environment, occupation, or health. Activities are typically designated as leisure if they promote recreation and relaxation in the absence of contingent external reinforcers (Nijhof et al., 2018; Turygin & Matson, 2014). That is, the individual engages in the activity because the activity itself functions as a conditioned reinforcer. Individuals who regularly engage in leisure skills have more opportunities for social engagement through leisure activities than those individuals who do not regularly partake in them (Sosnowy et al., 2019). When given the opportunity to engage in leisure activities, adults with a diagnosis of ASD experience several additional benefits such as, increases in physical health, increases in social engagement, and the potential to slow age-related cognitive decline (Abells et al., 2008; Fernandez-Mayoralas et al., 2015; Orsmond et al., 2014). Although the benefits of leisure engagement are well established for this population, many direct-care providers report that facilitating development of these skills is a low priority (Williams & Dattilo, 1997).

Individuals with ASD tend to have copious amounts of free time, but unfortunately most of this time is not spent engaging in constructive leisure activities (Solish et al., 2010). This could be due to associated features with the diagnosis, such as highly restrictive interests, repetitive behavior, and inflexibility, but some research suggests it may be due to environmental constraints such as lack of resources, supports, and opportunities (CDC, 2021; Hawkings et al., 1999). For individuals with more

significant disabilities, the impact is even greater. These individuals are found to play mostly passive roles in recreation and leisure and are unlikely to learn and generalize skills needed to engage in these activities without explicit instruction and support (Browder & Spooner, 2011; Williams & Dattilo, 1997).

To date, most of the research on teaching leisure skills to individuals with ASD has centered around children (Jung & Sainato, 2011). Given the importance of establishing strong leisure skill repertoires, and especially considering the impact this repertoire has on an individual's ability to make friends, it is important to understand how we can use these skills to best support adolescents and adults with ASD.

CHAPTER TWO

A Systematic Review of Interventions used to teach Adolescents and Adults with ASD Leisure Skills

Introduction

As stated in the previous chapter, regular participation in leisure activities contributes to positive developments in health and general well-being. For example, adolescents who regularly participate in leisure activities demonstrate better mental health, better behavioral health, increased social connectedness, and tend to have more friendships (Agans et al., 2014; Mahoney et al., 2005; Zarrett et al., 2009). In addition, adults who regularly engage in leisure activities tend to have better overall physical health than those who do not, and report fewer feelings of depression, isolation, and anxiety (Chang et al., 2014; Kim et al., 2014). The benefits of leisure engagement extend into later adulthood as well. For example, individuals who frequently engage in leisure activities have slower age-related cognitive decline. This is likely because these individuals have more opportunities to practice established skills, as well as more opportunities to continue learning new skills. Further, older individuals who frequently engage with leisure activities tend to have higher levels of social engagement than their peers who do not (Jopp & Hertzog, 2010; Singh & Kiran, 2014). In addition to these benefits, leisure activities can provide critical opportunities for building friendships as these activities present the ideal situation to promote social interactions between individuals with ASD and their peers.

Investigation into literature reviews evaluating behavioral procedures used to teach individuals with ASD to engage in leisure activities reveals prior research has largely centered around children (Jung & Sainato, 2013; Kent et al., 2020; Kossyvaki & Papoudi, 2016). For example, Jung and Sainato (2013) reviewed empirical studies that taught children with ASD to engage in specific play skills. These researchers discovered that modeling, both live and video, was the most common intervention used to promote play skills. Systematic prompting procedures were the next most common. Both of these interventions resulted in an increase in appropriate play skills for participants; however, since this review only focused on studies that included participants aged 13 or younger, limited conclusions can be drawn regarding their efficacy with older populations. This is discouraging as adolescents and adults benefit considerably from engagement in leisure activities. To date, no literature review has specifically focused on behavior analytic procedures used to teach adolescents and adults with ASD leisure skills. Thus, it is important to determine the state of the literature on teaching leisure skills to these individuals. The purpose of this literature review is to (a) identify studies that include interventions to develop leisure skills in adolescents and adults diagnosed with ASD, (b) explore the features of these interventions, and (c) suggest recommendations for future research and practice.

Methods

Eligibility Criteria

I identified studies for this review based on five criteria: (a) at least one participant was diagnosed with ASD, (b) the participant was an adolescent or an adult

(i.e., age 10 or older; World Health Organization, 2021), (c) the independent variable was a behavioral or educational intervention designed to teach adolescents and/or adults with ASD a leisure skill, (d) the dependent variable was a leisure skill or activity, (e) the experiment was evaluated by single case design methodology, (f) the study was peer-reviewed, and (g) the study was published in English. For our purposes, leisure skills were defined as the subset of abilities that are necessary for an individual to carry out activities that are conducted for recreation and relaxation, and are not necessary to maintain one's living environment or vocation (Turygin & Matson, 2014). I limited studies to those which included a single case design because this design is predominantly found in educational and behavioral research. No other restrictions were in place.

Information Sources and Search Procedures

I conducted a four-step search process in February 2021 to identify studies for this review. These steps included (a) a systematic search of electronic databases, (b) a backwards search of all included articles, (c) a forward search of all included articles, and (d) a hand search of two peer-reviewed journals. The databases I selected for the initial step of our search included Education Research Complete, Education Research Information Center (ERIC), and Psychological Information Database (PsycINFO). All three databases were accessed through Baylor University's library. The terms I used to identify potential articles within these databases were entered into the keywords field. These terms included *autism, ASD, autism spectrum disorder, leisure skills,* and *leisure*. These terms were entered using Boolean operators. Limiters used included English language and peer-reviewed journals.

The backwards search was conducted on all studies meeting full inclusion criteria for this review. To conduct this search, I compared all citations from the references of each article against our inclusion criteria. A forward search was conducted using Google scholar to identify any articles that included a citation of a study included in our review. To conduct this search, I identified each included study in google scholar and then selected the link titled "Cited by X". Every study that contained a citation to an included article was compared against my inclusion criteria. My final search was a hand search spanning January 2011-February 2021. This search was conducted for *Journal of Applied Behavior Analysis* and *Behavior Analysis in Practice*. I selected these journals because there was a high volume of publications identified that met inclusion criteria for this review in both journals.

Data Collection

I collected data by extracting the following information from the included studies: (a) participant information, (b) setting, (c) implementer, (d) data collection procedures, (e) study procedures, and (f) quality indicators of single-case design based on the What Works Clearinghouse (WWC) standards. The WWC standards were selected as the quality indicator because they are endorsed through the Institute of Education Sciences through the U.S. Department of Education. The participant information I extracted included the age of the participants, the gender of the participants, the diagnoses of the participants, and any assessment information that was reported. I extracted data on assessments used with participants to help us understand what skills the participants had prior to receiving intervention procedures, and to identify what skills the researchers were

interested in. I extracted information regarding the study procedures including type of intervention procedures, maintenance procedures, generalization procedures, fading procedures, and experimental design information.

Design standards. Based on the WWC standards, a study could receive a rating of *Meets Standards, Meets Standards with Reservations,* or *Does Not Meet Standards*. The requirements for single-case design studies are as follows: (a) the experimenter must actively manipulate the independent variable, (b) a second observer must measure the dependent variable for at least 20% of sessions to obtain interobserver agreement data, (c) the researchers must have obtained acceptable interobserver agreement data on average from the second observer (i.e., 80% or higher for percentage agreement and 0.60 or higher for kappa). If I determined a study did not meet any of these three criteria, the study was rated as *Does Not Meet Standards.* Studies were rated as *Meets Standards with Reservations* if they met all of the aforementioned criteria, with the addition of the required number of data points per phase depending on the design (e.g., at least three for multiple baseline designs). Studies were rated as *Meets Standards* if all the aforementioned criteria were met, with the addition of the required number of data points per phase (e.g., at least five data points per phase for multiple baseline designs).

Evidence standards. I further examined each study that *Met Design Standards with or without Reservations* to determine the strength of the causal relationship between the independent and dependent variables. The strength of this relationship is measured by demonstrations of effect, or changes in the dependent variable that were unlikely to occur

without the manipulation of the independent variable. Demonstrations of effect must occur at least three times, at three separate points in time, to suggest a causal relationship (WWC, 2017). Reviewers evaluated data for demonstrations of effect by analyzing six features: (a) level, (b) trend, (c) variability, (d) immediacy of effect, (e) overlap, and (f) consistency of patterns across similar phases (Kratochwill & Levin, 2014). All reviewers completed a training module through the Advanced Training on Single-Case Research Methods (2018) prior to examining the studies.

I rated a study as providing *Strong Evidence* when visual analysis indicated three or more demonstrations of an effect and no noneffects. A study was rated as providing *Moderate Evidence* if there were three demonstrations of an effect and an additional demonstration of a noneffect. Any study not meeting these criteria was rated as providing *No Evidence.*

Inter-rater reliability. I conducted inter-rater reliability (IRR) to determine the accuracy of the search procedures and accuracy of the data extracted. A second reviewer replicated 100% of the database search. Each article was screened and reviewed by the primary and second reviewers. Each reviewer independently determined if an article should be included or excluded. IRR was then calculated using percent of agreements. An agreement was counted if both the second reviewer and the primary reviewer included or excluded the study. IRR was calculated as the number of agreements divided by the number of agreements plus the number of disagreements multiplied by 100 to obtain a percentage. IRR for the search procedures was 98%. The primary reviewer and the second reviewer discussed disagreements and made a final decision regarding inclusion.

IRR was conducted for all data extracted (i.e., descriptive coding, WWC ratings) from 100% of the included studies. As with the search, the second author extracted data from the included studies and these data were compared to the data extracted by the first author. IRR for this information was calculated as the number of agreements divided by the number of agreements plus disagreements multiplied by 100 to obtain a percentage. An agreement was considered to occur if both the first and second author extracted the same information from each article. Any disagreements were discussed between the raters until a consensus was reached. The IRR for descriptive coding was 96%, and the IRR for WWC design standards was 97%.

Results

Study Selection

I conducted a four-step search process in February 2021 to identify studies for this review. A summary of this search process, including reasons for study exclusions, can be found in Table 1. I identified 530 potential studies following the initial database search. Of those 530 studies, 131 were duplicates. All of these duplicates were removed from the search. The abstracts and titles of the remaining 399 studies were compared against the inclusion criteria to determine eligibility to move to the next phase of the search process. From these studies, 54 were retrieved for a full text review where their eligibility was assessed against the inclusion criteria. Thirteen of these studies were excluded because they did not include a participant with a diagnosis of ASD, 12 studies were excluded because they did not include participants who were adolescents or adults, two studies were excluded because they did not evaluate an independent variable designed to teach a

leisure skill, and six studies were excluded because they did not use single-case design methodology. A hand search was conducted for *The Journal of Applied Behavior Analysis* and the journal *Behavior Analysis in Practice* for the last ten years of publication. No additional studies were identified from this search. Following this step, 18 studies were identified to be included in this review. Each of these 18 studies underwent a backwards search and a forward search. Seven additional studies were identified from these searches as potential inclusions. None of these additional studies met the inclusion criteria, resulting in 18 studies included in this review.

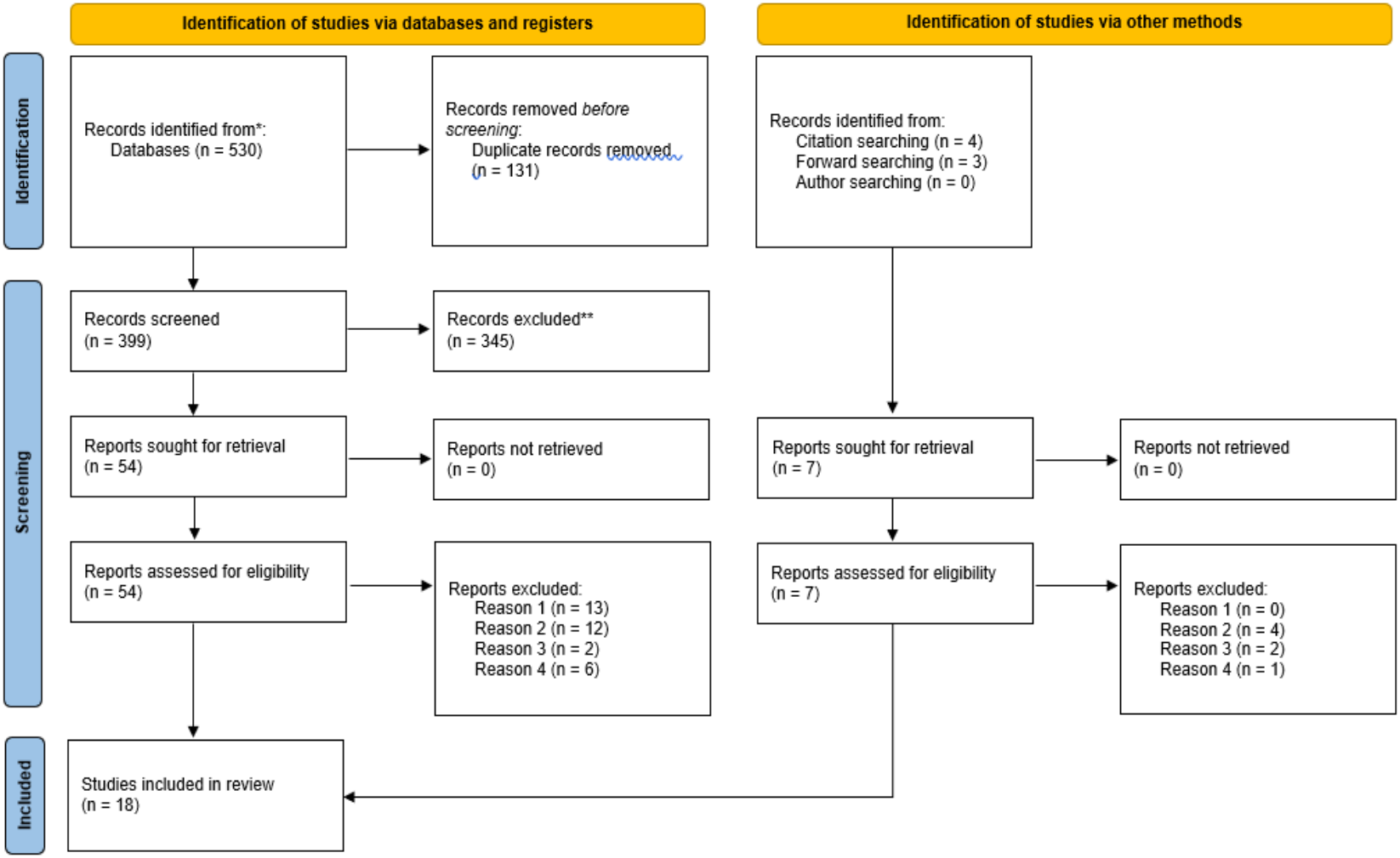

Figure 1. PRISMA flow chart.

Study Characteristics

All 18 included studies underwent a data extraction process. Through this process, we extracted data regarding descriptive information, WWC design standards, and WWC strength of evidence. Descriptive information is summarized in Table 2.

Participant information. Forty-nine participants were included in this review. Participants ranged in age from 10 years old to 45 years old, with an average age of 23. Thirty-seven (76%) participants were male and 12 (24%) participants were female. All participants were identified as receiving a diagnosis of ASD. Twenty-six participants (53%) had additional diagnoses including intellectual disability (n = 22, 85%), attention deficit hyperactivity disorder (n = 5, 19%), and other various diagnoses (n = 4, 15%) including facial dysmorphism, anencephaly, and sensory integration disorder. For most participants, assessment information was provided (n = 30, 61%). Of these, many participants had multiple assessments reported (n = 17, 57%). The Vineland Adaptive Behavior Scales © was reported most frequently (n = 14, 47%). The next most reported assessment was the Stanford-Binet Intelligence Scales © (IQ; n = 11, 37%).

Setting and implementer. Schools were the most common setting in which participants received intervention procedures (n = 26, 53%). Following schools, an individual's workplace (n = 12, 24%) and their home or residence (n = 7, 14%) were the next most common. Some participants received intervention procedures at a clinic (n = 5, 10%), and one participant received intervention procedures in the community at a rock-climbing gym (2%). It should be noted two participants received intervention procedures in two settings, at a clinic and at their home.

Table 1. Participant Descriptive Information

Citation	Ages	Gender	Leisure Activity Taught
Beaver et al. (2017)	15-17 years	1 female, 2 males	Making soap
Blum-Dimaya et al. (2010)	11-12 years	1 female, 2 males	Playing guitar hero
Canella-Malone et al. (2016)	12-21 years	2 females, 3 males	Playing with air rocket, basketball, bubble gun, darts, dominos, Lite-Brite, Mr. Potato Head, origami, puzzle; creating an art portfolio; taking selfies; and exercising
Carlile et al. (2013)	12 years	1 male	Playing with NERF basketball set, Air Hogs Heliblaster, tabletop pinball machine, Perplexus, spinning tops, Paper Jamz Drums, Crayola Color Expansion markers, Slinky, pin toy, remote control car
Edrisinha et al. (2011)	33-39 years	3 males	Taking picture and printing picture

Citation	Ages	Gender	Leisure Activity Taught
Gaylord-Ross et al. (1984)	17-20 years	2 males	Playing Pacman, Galaxian; listening to Walkman; chewing gum
Greenberg et al. (2016)	11 years	1 male	Making a painting
Ivy et al. (2019)	11-12 years	2 females, 1 male	Playing with a bracelet-making kit, speed stackers, stencils, Legos, puzzle, drawing book, dry erase board, collage-making kit, coloring book; reading magazines
Jerome et al. (2007)	24-32 years	2 males	Accessing and using the internet
Kaplan-Reimer et al. (2011)	11 years	1 female	Climbing at an indoor rock gym
Matsushita & Sonoyama (2010)	11 years	1 male	Throwing a baseball
McKay et al. (2014)	37 years	1 male	Playing with legos
Nepo et al. (2020)	34-45 years	4 females, 8 males	Playing with puzzle, balloon, christmas game, matching game, memory game, dino; reading a magazine

Citation	Ages	Gender	Leisure Activity Taught
Sherrow et al. (2016)	17-18 years	2 males	Playing Wii
Spriggs et al. (2016)	10-11 years	3 males	Playing Wii, Nintendo DS, Power-Joy Joy Stick, V-Flash
Stahmer & Schreibman (1992)	12-13 years	1 female, 1 male	Playing with Lights Alive game, Sesame Street game, crossword puzzle, Barbie, Legos, stickers, magic markers; reading books
Vuran (2008)	21-23 years	2 males	Sculpting clay
Wall & Gast (1997)	15 years	2 males	Playing horseshoes, Jenga, Bottle Tops, UNO, checkers; listening to the radio

For most participants, the researcher served as the primary implementer (n = 28, 57%). Fourteen participants received instruction from an unspecified instructor (29%), eight participants received procedures from their teacher (16%), and for two participants their parents were the primary implementer (4%). Of the implementers who were not researchers, only five were reported to have been trained to implement the research procedures. One of these implementers was formerly trained in behavior analytic techniques, two of these implementers were given systematic instruction, and two of these implementers were trained in the procedures while participating in a prior study.

Leisure skill or activity. The type of leisure skill or leisure activity taught was categorized as being high-tech (i.e., an activity that requires a battery or has to be plugged in) or low-tech. Each activity was then categorized as one of the following: (a) video game, (b) online browsing, (c) art or craft, (d) athletic activity, (e) indoor game, (f) elective self-care, and (g) music. Some participants were taught multiple leisure skills or activities, and thus the activity was recorded across multiple categories.

Roughly half of the participants were taught high-tech games or skills (n = 27, 55%), and half of the participants were taught low-tech games or skills (22, 45%). Additionally, about half of the participants were taught more than one leisure skill or activity (n = 21, 43%). Fifteen participants were taught to use various tablet applications (31%), fourteen participants were taught arts and crafts activities (n = 14, 29%), ten participants were taught to use video games (n = 10, 20%), and nine participants were taught to play indoor games (n = 9, 18%). All of the participants who learned to use the tablet applications were from the same study (Nepo et al., 2020). Six participants (12%) were taught athletic activities, three participants (6%) were taught to play music, two

participants (4%) were taught to browse the internet, and two participants (4%) were taught to engage in elective self-care activities (e.g., painting nails, applying a facemask). Additionally, most participants were taught solitary leisure activities (n = 41, 84%).

Dependent variable. The dependent variables measured most frequently across participants includes percentage or frequency of steps completed correctly (n = 42, 86%), on-task behavior (n = 16, 33%; i.e., independent and correct engagement with the materials), and duration of time spent engaged (n = 15, 31%). Additional dependent variables measured included number of vocal verbal social interactions (n = 2, 4%; Gaylord-Ross et al., 1984) and number of feet climbed (n = 1, 2%; Kaplan-Reimer et al., 2011). For many participants, data were collected on multiple dependent variables (n = 21, 43%).

Procedures. I grouped procedures into the following categories: (a) intervention procedures, (b) maintenance, generalization, and social validity, and (c) experimental design.

Intervention. Most participants received an intervention that included a task analysis (n = 29, 59%). For example, in one study, a task analysis was used to teach adolescents with ASD to play a video game (Blum-Dimaya et al., 2010). This task analysis contained 26 tasks and instructed the participant how to set up, turn on, and turn off the game system. All three participants in this study were able to correctly and independently follow the task analysis to engage with the gaming system following these procedures. Thirteen participants (27%) received an intervention that included a video model. It should be noted that for all participants who received an intervention including

a video model, a task analysis was also used in combination with the video model**.** In Edrisinha et al. (2011), video prompting procedures with an embedded task analysis were used to teach adults with ASD to take a digital photograph and print it. This task analysis consisted of 11 tasks. Each task had a corresponding video model to illustrate how to complete the task. Tasks included turning the camera on, finding an object to photograph, steps to capture the photograph, and steps to print the photograph. An activity schedule was used with 13 participants (27%). Five participants (10%) received an intervention that included a live model, and two participants (4%) were taught to use a self-management procedure.

Maintenance, generalization, social validity. I extracted maintenance, generalization, and social validity data because this information is critical to the external validity of research findings (Calder et al., 1982). External validity is the extent to which conclusions drawn from an experimental study are applicable to contexts outside of the study. For individuals diagnosed with ASD, studies with sound external validity would demonstrate success by the individual continuing to use skills taught after the study has ended (i.e., maintenance), demonstrate success by the individual using the skills taught in additional settings or with different individuals present (i.e., generalization), and demonstrate success by the skill having a positive impact on the individual's life (i.e., social validity). Within our review, I found that maintenance was assessed for 22 participants (45%). Generalization was assessed for most participants (n = 31, 63%). Of these 31 participants, 19 (61%) had generalization assessed in a new setting, nine (29%) had generalization assessed with novel stimuli (i.e., novel activity), and three (10%) had

generalization assessed with a novel peer. Social validity was assessed for 27 participants (55%).

Experimental design. A single case design was used across all participants to evaluate the effectiveness of intervention procedures. The most frequently used design was a multiple-probe design (n = 33, 67%). Eight participants' behavior change was evaluated by a multiple baseline design (n = 16%). An alternating treatment design was used with four participants (8%), and a changing criterion design was used with one participant (2%).

Quality indicators. The 18 studies included in this review contained 28 cases. I defined cases as a single unit of data analysis (i.e., a visual representation of data often recorded as a graph; Kratochwill & Levin 2010). I analyzed each case separately for overall quality and visual analysis rating using the WWC standards (WWC, 2017). A summary of these results can be found in Table 3.

I first assessed the overall quality of the design. Most of the cases *Met Standards with Reservations* (n = 12, 43%; e.g., six demonstrations of effect with three to four data points in each phase). An additional eight cases (28%) *Met Standards without Reservations* (e.g., six demonstrations of an effect with at least five data points in each phase). I then employed visual analysis to determine the quality of the evidence for the 20 cases that met design standards. If the case included three demonstrations of an effect and no demonstrations of a non-effect, the case was given a rating of *Strong Evidence* (n = 16, 80%). Three demonstrations of an effect and one demonstration of a non-effect

resulted in a rating of *Moderate Evidence* (*n* = 0, 0%). Less than three demonstrations of an effect resulted in a rating of *No Evidence* (*n* = 4, 20%).

Table 2. WWC Design Standards Information

Citation and Case	Design	Design Rating	Strength Rating
Beaver et al. (2017) – Figure 1	Alternating treatment	Does not meet	N/A
Beaver et al. (2017) – Matthew	Alternating treatment	Does not meet	N/A
Blum-Dimaya et al. (2010) – Figure 2	Multiple probe	Meets with reservations	Strong evidence
Blum-Dimaya et al. (2010) – Figure 3	Multiple probe	Meets with reservations	Strong evidence
Canella-Malone et al. (2016) - Gemma	Multiple probe	Meets with reservations	Strong evidence
Canella-Malone et al. (2016) – Abel	Multiple probe	Meets with reservations	Strong evidence
Canella-Malone et al. (2016) - Wendy	Multiple probe	Meets with reservations	Strong evidence
Canella-Malone et al. (2016) - Wayne	Multiple probe	Meets with reservations	Strong evidence
Canella-Malone et al. (2016) - Clay	Multiple probe	Does not meet	N/A
Carlile et al. (2013) – Figure 2	Multiple probe	Meets with reservations	Strong evidence
Carlile et al. (2013) – Figure 3	Multiple probe	Meets with reservations	Strong evidence
Endrisinha et al. (2011) – Figure 1	Multiple probe	Meets with reservations	Strong evidence
Gaylord-Ross et al. (1984) – Figure 1	Multiple baseline	Does not meet	N/A
Gaylord-Ross et al. (1984) – Figure 2	Multiple baseline	Does not meet	N/A
Greenberg et al. (2016) – Participant A	Reversal	Meets with reservations	Strong evidence
Ivy et al. (2019) – Figure 1	Multiple baseline	Meets without reservations	No evidence
Jerome et al. (2007) – Figure 1	Multiple baseline	Meets without reservations	Strong evidence
Kaplan-Reimer et al. (2011) – Figure 3	Multiple baseline	Does not meet	N/A
Matsushita & Sonoyama (2010) - Ichiro	Changing criterion	Does not meet	N/A

Citation and Case	Design	Design Rating	Strength Rating
McKay et al. (2014) – Fred, Figure 7	Alternating treatment	Meets without reservations	No evidence
Nepo et al. (2020) – Figure 1	Multiple probe	Meets without reservations	No evidence
Nepo et al. (2020) – Figure 2	Multiple probe	Meets without reservations	Strong evidence
Sherrow et al. (2016) – Figure 1	Multiple probe	Meets without reservations	Strong evidence
Spriggs et al. (2016) – Figure 1	Multiple probe	Does not meet	N/A
Stahmer et al. (1992) – Figure 1	Multiple baseline	Meets without reservations	No evidence
Vuran et al. (2008) – Figure 1	Multiple probe	Does not meet	N/A
Wall et al. (1997) – Figure 3	Multiple probe	Meets with reservations	Strong evidence
Wall et al. (1997) – Figure 4	Multiple probe	Meets with reservations	Strong evidence

Discussion

Leisure skills, those behaviors an individual engages in during activities that promote recreation and relaxation, are important for individuals with ASD to have in their repertoire (Nijhof et al., 2018; Turygin & Matson, 2014). The 18 studies included in this review indicate individuals with ASD respond well to interventions designed to increase leisure activity participation. Efficacy was demonstrated across studies with interventions such as task analyses, live and video modeling, and self-management (see Table A.3.). From these 18 studies, all cases were analyzed for overall quality and 12 studies were analyzed for visual analysis rating according to the WWC standards (2017). Most cases were rated as *Meet Standards* or *Meet Standards with Reservations*, and most cases demonstrated strong evidence of effect following visual analysis.

Research Trends and Future Research

Most participants included in these studies were taught solitary leisure activities; however, teaching leisure activities that include a social component are critical for older individuals with ASD. Many adolescents with ASD report having similar social desires as their typically developing peers, such as the desire to belong to a social group (Deckers et al., 2017). This contrasts with the common perception that adolescents with ASD prefer isolation over social interaction (Jaswal & Akhtar, 2019). In fact, many adolescents with ASD self-report *often* or *always* feeling lonely (Lasgaard et al., 2019). These feelings of loneliness may contribute to the large percentage of individuals with ASD who suffer from depression and suicidal ideation (Hedley & Uljarevic, 2018).

A promising protective factor against this risk is consistent social interaction with other individuals (Hedly et al., 2018). Leisure activities pose the ideal framework for

increasing social interactions, as evidenced in three studies included in this review. Two of these studies included taking turns as an action embedded within the tasks analysis (Sherrow, 2016; Wall & Gast, 1997). For example, in a 10-item task list describing how to play horseshoes, the seventh step stated, "wait for partner to take turn" (Wall & Gast, 1997). In the third study, participants were first taught to engage independently in a leisure skill, then separately taught to initiate interactions with peers using the learned leisure skill (Gaylord-Ross et al., 1984). Participants were taught to independently use a portable cassette player to play music. Once this skill was mastered, the participants were then taught to initiate interactions with their peers in the form of offering to listen to the portable cassette player simultaneously with the peer. This study, along with other research, supports increasing participants' ability to initiate verbal interactions while engaging in a leisure activity as an important component for increasing social interactions (Leach et al., 2019; Coelho et al., 2017).

Among younger individuals diagnosed with ASD (i.e., 10 years of age and below), an evidence-based intervention used to increase verbal interactions and increase novel language production during leisure activities is script fading (Akers et al., 2016). A recent review summarized 20 years of research on script fading procedures and found that scripts have also been shown to be effective with individuals of varying abilities (e.g., readers, nonreaders, differing levels of vocal-verbal behavior; Akers et al., 2016). This intervention has not yet been evaluated for use in individuals over the age of 15, therefore future research should investigate using script-fading to increase verbal initiations in adolescents and adults with a diagnosis of ASD during a leisure setting or activity.

One consideration for researchers and practitioners to bear in mind when working with older individuals (i.e., older than 10 years old) is that preferences tend to narrow as an individual ages (Birk et al., 2017). Although older individuals engage with low-tech games, the majority of adolescents and adults spend most of their leisure time engaging with high-tech activities such as video media, tablet games, app-based games, and video games (Orben & Przybylski, 2019). Despite the clear preference for high-tech leisure activities, less than half of included studies included procedures designed to teach an individual to engage in a high-tech leisure activity. Examples of high-tech activities taught include video games (i.e., Guitar Hero™, Wii Sports ™, Packman ™; Blum-Dimaya et al., 2010; Gaylord-Ross et al.,1984; Sherrow et al., 2016; Spriggs et al., 2016), app-based games on a tablet (Nepo et al., 2020), taking a photo and printing it (Edrisinha et al., 2011) and browsing the internet (Jerome et al., 2007). Focusing on high-tech leisure skills not only increases the likelihood that individuals with ASD will find the new activity reinforcing, but also increases the likelihood that those individuals will be engaging in a leisure activity that is socially valid for their age. Considering the social validity of an intervention, or the applied nature of the intervention, is an important dimension within the field of ABA that each practitioner is responsible for upholding (Baer, Wolf, & Risely, 1968). With this consideration, future researchers should continue to investigate teaching adolescents and adults to engage in highly preferred and socially appropriate high-tech leisure activities.

When considering the importance of incorporating participant preferences and social interactions, the online gaming community could serve as a unique platform to increase social engagement while increasing independent leisure skills. This community

is a large, diverse group that meets in a common virtual space (Williams, 2006). Further, this community promotes social interaction and friendship building without requiring individuals to spend an extensive amount of time playing (Sundberg, 2018). Since 58% of adults in the United States report that the individuals they encounter while playing online games account for a significant portion of their social exchanges on a day-to-day basis, using this platform for social engagement would remain relevant for the adolescent as they aged (Molyneux et al., 2015).

Limitations

A few limitations exist in this literature review that must be discussed. First, it is possible some studies that may have fit inclusion criteria were overlooked during the search process. Multiple ancillary searches were conducted to reduce the likelihood of this occurring. Second, the studies included in this review were limited to those that used single case designs. Single case designs have some limitations that must be accounted for, such as small sample sizes that may limit generalization of some findings. Single-case designs are, however, well-suited for behavioral interventions where a participant's outcomes are compared to their own baseline to determine meaningful results (Smith, 2012). Further, this review is limited by the small number of included studies, as only 18 studies met the inclusion criteria for this review. As a result, the findings should be interpreted with caution.

Conclusion

In conclusion, the studies I described in this review represent interventions designed to increase independent leisure skills among adolescents and adults with ASD.

Though I was able to investigate a variety of effective procedures, such as live and video modeling, task analyses, and self-management procedures, there is room for expansion of this literature base. First, most studies taught solitary leisure skills. Leisure skills have the potential to be a great opportunity to increase social interactions while individuals are engaging in a preferred leisure activity, therefore more research is needed on instructing individuals with ASD to engage in these activities with other individuals present. Second, most studies only measured correct engagement with the leisure activity. By only measuring this single variable, researchers are omitting important considerations such as preference for a specific activity. Further, by considering activities that an individual with ASD is more likely to prefer, researchers can increase the social validity of those intervention procedures and increase the likelihood the behavior change will maintain over time. This can be easily achieved by increasing the use of high-tech leisure activities over low-tech leisure activities. Thus, researchers interested in expanding this literature base should focus on increasing social interactions within leisure skills and continuing to evaluate procedures for teaching leisure skills with high-tech activities.

CHAPTER THREE

Methods

Purpose

The purpose of this study was to evaluate intervention procedures designed to increase social interactions among adolescents with ASD while engaging in a popular social leisure activity. Specifically, the research questions were as follows:

1. To what extent will a script-fading intervention increase appropriate reactions to events encountered during a multiplayer videogame for adolescents with ASD?
2. To what extent will a script-fading intervention increase appropriate general comments during a leisure activity for adolescents with ASD?
3. To what extent will a task-analysis increase correct video game setup for adolescents with ASD?
4. To what extent will appropriate reactions and general comments generalize to an online videogame format for adolescents with ASD?
5. What are participant and caregiver perceptions of this intervention?

Procedures

Participant Recruitment

I recruited two participants from the Waco area by contacting families who were currently receiving services, had received services in the past, or were on a waitlist to receive services at a university clinic via phone and email. I also recruited through a flyer

posted on social media sites such as Facebook and Twitter. The inclusion criteria for participation were as follows: (a) between the ages of 10 and 17, (b) have a diagnosis of ASD, (c) have a generalized verbal imitation repertoire, (d) independently and correctly follow written instructions, and (e) use vocal verbal speech as a primary means of communication, (f) caregivers or therapists must have anecdotally reported that the participants engaged in limited verbal exchanges with their peers, and (g) participants also had to report an interest in video games. All participants and peers within this document are referred to by pseudonyms.

I completed a two-part preassessment with each potential participant prior to the start of the study to ensure they met these criteria. The first part consisted of an interview with a caregiver and caregiver self-completion of the Social Communication Questionnaire (SCQ; Rutter & Bailey, 2003). I conducted the SCQ as an additional measure to gain a more complete understanding of each participant's communication skills and social behaviors. During the first portion of the preassessment, I first interviewed the caregiver to ensure the participant had the required skills and interests. A full transcription of this interview can be found in Appendix A.1. The caregiver then completed the SCQ by completing the accompanying survey. I remained present while the caregiver completed the survey form in case the caregiver had any questions. Following this first part (i.e., parent interview and SCQ) I completed the second phase of the preassessment, which included conducting an observation with the participant. The purpose of this observation was to ensure the participant had the prerequisite skills to successfully complete this study such as the ability to read, the ability to follow written instructions, and demonstrated interest in video games. I included data collection sheets

for this part of the preassessment in Appendix A.2. To complete these observation sessions, I provided the participant with a written task list, which can be viewed in Appendix A.2. This observation was done with or without the caregiver present. If the caregiver was present, I instructed the caregiver to provide no instructions. Once the participant was provided with this written task analysis, I gave the verbal instructions: "will you please read and follow these instructions for me?". I provided no other prompting or directions and observed the participant to see if they accurately completed the written steps. I collected data on the number of steps the participant completed independently. Each observation lasted about three minutes.

Elias. Elias was 17 years old. He self-identified as a white male and attended high school through an online homeschool program. I completed the initial caregiver interview with Elias's biological mother. She reported that Elias communicated clearly in full sentences, had no trouble imitating verbal phrases that contained multiple words, and could easily follow multi-step instructions. When asked if Elias considered interacting with his peers as important, she said yes because he often spoke with her about wanting friends that "liked to play games as much as he does". She described video games as Elias's "whole life", saying video games were easily his favorite leisure skill to engage in. During the second part of the preassessment, Elias independently and correctly engaged in 100% of the steps listed on the task analysis.

Julien. Julien was 14 years old. He self-identified as a Hispanic male. He attended junior high at a local private school. I completed the initial caregiver interview with Julien's biological mother. She reported Julien communicated in multi-word sentences,

could easily imitate multi-word phrases, and could follow multi-step instructions. She reported Julien's interest in interacting with peers his age as "somewhat". When asked to elaborate, she said he seemed to enjoy interacting with peers his age when she observed him doing so, but that he never talked about wanting to interact with friends more often. She reported that Julien loved video games, and that he often talked about wanting to be a game developer in the future. Julien independently followed all steps listed in the task analysis with 100% of steps followed correctly.

Peer Recruitment

I recruited peers through the same university clinic (i.e., siblings of past, current, or potential clients), through undergraduate special education courses, and using a flyer posted on social media sites such as Facebook and Twitter. I made the decision to recruit undergraduate students as peers after recruiting Elias. The siblings from the clinic who were interested in participating as peers were all considerably younger than Elias (i.e., 12 years old). Since Elias was 17 and completing his senior year of high school, I felt it would be more appropriate to have a peer that was college-age rather than a peer that was in early middle-school interacting with him throughout the study. I also had some of these undergraduate peers interact with Julien during his sessions when the younger peer was not available. I completed a preassessment with each potential peer prior to participation in this study or with the parent of the peer if they were less than 18 years old. The preassessment consisted of a short interview completed by the researcher. This preassessment was conducted to determine if the peer would be a good fit for this study. The characteristics of the peer I wanted to identify through this interview included an enjoyment of video games, the ability to follow verbal instructions, and patience with

peers who might exhibit unexpected or atypical behaviors. The transcript for this preassessment can be found in Appendix A.3. General information such as peer gender and age can be found in Table 3.

Table 3. Peer descriptive information.

Peer	Gender	Age
Lila	Female	12
Zane	Male	20
Laura	Female	19
Matthew	Male	26
Aleah	Female	19
Taylor	Female	21
Nelly	Female	22

Setting and Materials

I conducted all sessions at a university clinic within designated therapy spaces. I arranged furniture within the therapy spaces so that the furniture mimicked a typical living room setup within a home. I used the following materials during research sessions: general office supplies for data collection, two Nintendo Switches ™, video games that have multiplayer features, the Discord Online App ™ for communicating virtually, and visual scripts.

Nintendo Switches ™ were used as the platform for all video game play. I selected three video games that are compatible with this platform and have multiplayer features. The multiplayer feature allowed the peer and the participant to play the same game simultaneously. I used the Nintendo Switch Online App ™ during generalization probes to assess the extent to which the skills were used when the peer was in a different geographical location than the participant, but both were still engaging with the same game simultaneously.

I used visual scripts to teach comments and reactions during teaching sessions. Scripts consisted of written phrases that appeared on a prerecorded video clip. These phrases were relevant to the games played by the participant and peer. Each video clip included three scripts for general comments, one script for a positive reaction, and one script for a negative reaction. Each clip was approximately 1 min. By using prerecorded clips, each participant was exposed to a consistent number of learning opportunities during each teaching session. I created three script videos for each game. Since each script video contained five scripts, 45 scripts were taught across all three games.

Dependent Variables

The first dependent variable was the rate at which the participant emitted an appropriate reaction in response to an event that occurred within the game throughout the duration of gameplay. I defined an event as occurring when the peer or participant had a success within the game, or when the peer or participant experienced a loss or setback. For example, a success within the game occurred if the peer or participant acquired an item they were searching for, or if they defeated an opponent. An example of a loss or setback occurred if the peer was defeated by an opponent within the game. A reaction was scored as a correct verbal response if it occurred within 5 s of the completion of an in-game event, was appropriate to the event, and included an intensifier word. An intensifier was defined as a word that ads strength to a phrase without affecting it's meaning such as "yes!" "no!" or "dang!". An appropriate reaction would be a positive statement in reaction to success (e.g., "yes! Great job!"), or a consoling statement in response to a setback (e.g., "that stinks, better luck next time"). Each phrase was

considered complete once there was a pause in responding for at least 5 s, or if the participant paused responding while the peer emitted a phrase.

The next dependent variable I measured was the rate of general verbal comments made throughout the duration of gameplay. This dependent variable was selected to mimic typical comments made while playing a game with another individual that are not in direct response to an event. Comments were not counted if they were immediate repetitions of peer's statements, unintelligible, or stereotypic phrases. Each phrase was considered complete once there was a pause in responding for at least 5 s, or if the participant paused responding while the peer emitted a phrase.

As an additional measure, I measured the rate of total phrases emitted for each participant. This measure was added to provide a clearer comparison of responding in baseline and intervention after I observed variable amounts of appropriate reactions to events across both participants. I calculated this measure by summing the total number of appropriate reactions and general comments observed during each session.

Lastly, I measured independent task analysis completion. This task analysis consisted of items necessary to operate the gaming system and access each specific game. Independent task analysis completion was scored as the percentage of steps of the task analysis completed independently. Because both participants met mastery criteria for this dependent variable in baseline, data were only collected for this variable during baseline sessions.

Interobserver Agreement

I served as the primary data collector throughout the duration of this study. A second trained research assistant collected interobserver agreement data on at least 33%

of sessions in each phase. The research assistant and I collected data both live and from video-recorded sessions. Interobserver agreement during all phases was calculated by summing the total number of responses recorded by each observer and then dividing the smaller total by the larger total. This number was then multiplied by 100 to obtain a percentage. For Elias, interobserver agreement in baseline for Game 1 averaged 90% (*range* = 80% to 100%) and in test sessions averaged 93% (*range* = 87% to 100%) For Game 2, baseline interobserver averaged 100% and test session interobserver agreement averaged 93% (*range* = 91% to 95%). During Game 3, interobserver agreement for baseline sessions averaged 100% and for test sessions averaged 90% (*range* = 86% to 92%). For Julien, during Game 1, baseline levels of interobserver agreement averaged 95% (*range* = 90% to 100%) and for test sessions levels of interobserver agreement averaged 96% (*range* = 92% to 100%). During Game 2, interobserver agreement during baseline sessions averaged 100% and during test sessions averaged 94% (*range* = 86% to 100%). Interobserver agreement for Game 3 averaged 94% (*range* = 83% to 100%) for baseline sessions and averaged 95% (*range* = 87% to 100%) for test sessions.

Treatment Fidelity

A trained observer measured the experimenter's treatment fidelity in at least 30% of all sessions in each phase. A treatment checklist was provided to the observer prior to each condition. This ensure all phases were implemented accurately and consistently.

Elias. For Game 1, treatment fidelity was completed for 80% of baseline sessions, 92% of teaching sessions, and 100% of test sessions. Treatment fidelity for Game 1 averaged 100% in baseline sessions, 98% (*range* = 86% to 100%) in teaching sessions,

and 100% in test sessions. For Game 2, treatment fidelity was completed for 100% of all sessions. Treatment fidelity for baseline, teaching, and test sessions averaged 100%. In Game 3, treatment fidelity was completed for 73% of baseline sessions, 100% of teaching sessions, and 100% of test sessions. Treatment fidelity in baseline averaged 100%, in teaching averaged 92% (*range* = 86% to 100%), and in testing averaged 94% (*range* = 83% to 100%).

Julien. During Game 1, treatment fidelity was completed for 83% of baseline sessions, 100% of teaching sessions, and 90% of test sessions. For baseline and testing sessions, levels of treatment fidelity averaged 100%. Treatment fidelity averaged 98% (*range* = 86% to 100%) for teaching sessions. For Game 2, treatment fidelity was completed for 88% of baseline sessions, 100% of teaching sessions, and 100% of test sessions. Across all Game 2 sessions, treatment fidelity averaged 100%. For Game 3, treatment fidelity was completed for 90% of baseline sessions, 100% teaching sessions, and 100% of test sessions. Across all phases, treatment fidelity averaged 100%.

Design

The data collected on the occurrence of these dependent variables was analyzed using single-case design methodology. Within single-case designs, repeated measurement of an individual participant's responding throughout the study allows an individual to serve as their own control, or comparison, to document socially significant changes in their behavior (Kratochwill & Levin, 2014). Credibility of this design is established as the environment is held constant, while repeated demonstrations support that the manipulation of the independent variable is associated with predictable changes in the

dependent variable (Kratochwill & Levin, 2014). Single-case design methodology allows us to base the amount of progress for each participant on their performance levels prior to receiving intervention procedures.

The specific single-case design I used in this study was a concurrent multiple baseline design across games. When using a concurrent multiple baseline design, data are collected simultaneously across different tiers. For our study, the tiers were three different games. I used block randomization to determine the order of sessions, with each session consisting of one game played. As data were collected, the intervention procedures were introduced in a staggered fashion across these tiers. Experimental control is demonstrated when the effects of the intervention procedures are observed only in the tiers where the intervention procedures have been introduced (Kratochwill & Levin, 2014). This design is appropriate when it is not desirable to reverse the effects of a treatment condition, such as when teaching a social leisure skill.

Baseline

Baseline sessions were conducted with each participant across all tiers. These sessions provided data for each participant's current level of responding across dependent variables and served as a comparison against which I assessed the effectiveness of the intervention procedures. Baseline sessions occurred with the peer present in a therapy space at the university clinic. All baseline sessions were 5 mins in length or until the end of the race or match, whichever came first. It should be noted that although data were no longer collected following 5 mins of gameplay, the participant and peer were allowed to play until each match was finished even if it extended past 5 min (e.g., completing each race, completing each battle). During each baseline session, the participant and peer

played one of the three games. At the start of each baseline session, I instructed the participant and peer to play the designated game together. The peer and participant were in the same room, close enough that they could hear each other's verbal comments and view the game played on a shared screen. During this time, the data collector (i.e., myself or a research assistant) observed and recorded data on the dependent variables but did not provide any prompting to evoke or diminish responding on those variables. If the participant did not initiate game setup within 15 s of the instruction, or completed a step of the setup incorrectly, a research team member setup the game for the participant. I provided verbal prompts as necessary to redirect the participant or peer back to the game. I only needed to use these verbal prompts infrequently for Julien.

Teaching Sessions

Teaching sessions consisted of script-fading procedures to promote appropriate reactions to in game events and general comments. Since neither participant scored less than 90% accuracy on task analysis completion for setting up the game in baseline, I did not provide instruction for this dependent variable. The peers were not present during teaching sessions.

These sessions began with the participant and me sitting at a shared table with a laptop or tablet containing the script video sitting in front of us. Prior to playing the script video, I provided the verbal instruction "read each phrase that pops on the screen in a loud enough voice that I can hear you". All scripts were embedded in pre-recorded videos of gameplay for each game; therefore, the participant was not actively playing the game when exposed to the scripts. For scripted reactions, the in-game event was the success or failure of the player in the pre-recorded game clip. Game clips were pre-randomized so

that each session featured three scripts for general comments, a script for positive reaction, and a script for negative reaction. When each script appeared following the antecedent event in the pre-recorded clip, I paused the video and waited 3 s for the participant to engage in the vocal verbal response. If the participant did not respond within those 3 s, I prompted the participant to emit the response by pointing to the script. If the participant did not respond within 3 s to the gestural prompt, I provided a vocal verbal prompt in addition to the gestural (i.e., "say [scripted phrase]). If the participant did not vocally state the reaction or general comment within 3 s of the verbal and the gestural prompt, I repeated this procedure until the participant repeated the phrase. Data from these sessions were not graphed. These sessions directly preceded a testing session, during which data were recorded.

Script fading. I initiated fading of the scripts once the participant independently followed three scripts from each set (i.e., three scripted reactions and three comments) at 100% accuracy for two consecutive sessions. I faded scripts one third of a phrase at a time from the end to the beginning with the final fading step being complete removal of the scripts.

Testing Sessions

Testing sessions occurred following each teaching session. The procedures for these sessions were identical to baseline sessions, except for one modification made for Elias in Game 1.

For Elias, I introduced a tactile prompt during the fifth test session in Game 1. This tactile prompt was discontinued following the ninth test session. I made the decision

to implement a tactile prompt after observing no increases in responding following the first four test sessions. The tactile prompt was delivered through an iOS application called Virtual MotivAider©. Through this application, a prompt was delivered every 20 s. The prompt caused the phone to vibrate, and a message appeared on the screen with the phrase "say something". Elias would set the prompting device on his leg during those sessions so he could feel when the device emitted the prompt. The first time I introduced the tactile prompt, I provided a verbal statement to Elias that clearly indicated what behavior I wanted him to emit when the prompt was delivered (i.e., "when you feel this vibrate, I want you to say something to your friend while you two are playing"). This rule was never stated again during following sessions.

Generalization Probes

I conducted generalization probes to explore the extent to which participants continued to engage in these responses when the peer was in another room and conversation occurred over a communication application. I conducted a generalization probe once during baseline sessions and once following teaching sessions for each game with each participant. This probe mimicked baseline session procedures, except the peer and participant were in different rooms and verbally engaging over the iOS application Discord ©. This probe assessed the extent to which the behavior generalized from in-person comments to a communication application with the peer out of sight.

Social Validity Evaluation

Social validity measures were obtained with each participant following the completion of all sessions to obtain a summative evaluation of the broader impacts of this

project. During these interviews, the participants were prompted to describe their experience, report on aspects they did and did not like, and discuss more generally their thoughts regarding the effectiveness of the procedures. The interview questions can be found in Appendix A.4.

CHAPTER FOUR

Results

Overview

This study was designed to evaluate a novel script-fading procedure to increase social interactions during a high-preference leisure activity among two participants with ASD. The high-preference leisure activity was engagement in multi-player video games. Specifically, this study aimed to (a) increase appropriate reactions to in-game events, (b) increase appropriate general comments during gameplay, (c) assess generalization of these skills to an online video play format, and (d) understand participant perceptions of this intervention.

*Elia*s

I conducted preassessments with Elias prior to the start of the study to ensure he could demonstrate the prerequisite skills to succeed in this study. The first assessment I conducted was the SCQ, which was completed by Elias's caregiver. Elias received a score of eight on this measure, which is seven points below the cutoff for potential ASD. When conducting the SCQ, a score of 15 or higher indicates a potential diagnosis of ASD. It should be noted that Elias has received a diagnosis of ASD through a psychiatrist unaffiliated with this study, and these results do not negate that diagnosis. The second preassessment I conducted was an observation to determine if Elias could read and follow a task analysis. Elias completed all of the steps in this task analysis independently.

The overall results for Elias are depicted in Figure 2. With Elias, the research assistant and myself collected data on the two of the three primary dependent variables throughout the entire study (i.e., frequency of appropriate reactions and frequency of appropriate comments). For the third dependent variable, independent task analysis completion, data were only collected during the first two baseline sessions. Data collection stopped following these sessions because Elias met mastery criteria for the independent video game set up. The mastery criteria for this independent variable to be discontinued was two sessions with the participant completing at least 90% of the steps in the task analysis independently. In addition, the sum of the number of appropriate reactions and appropriate general comments are graphed as total phrases.

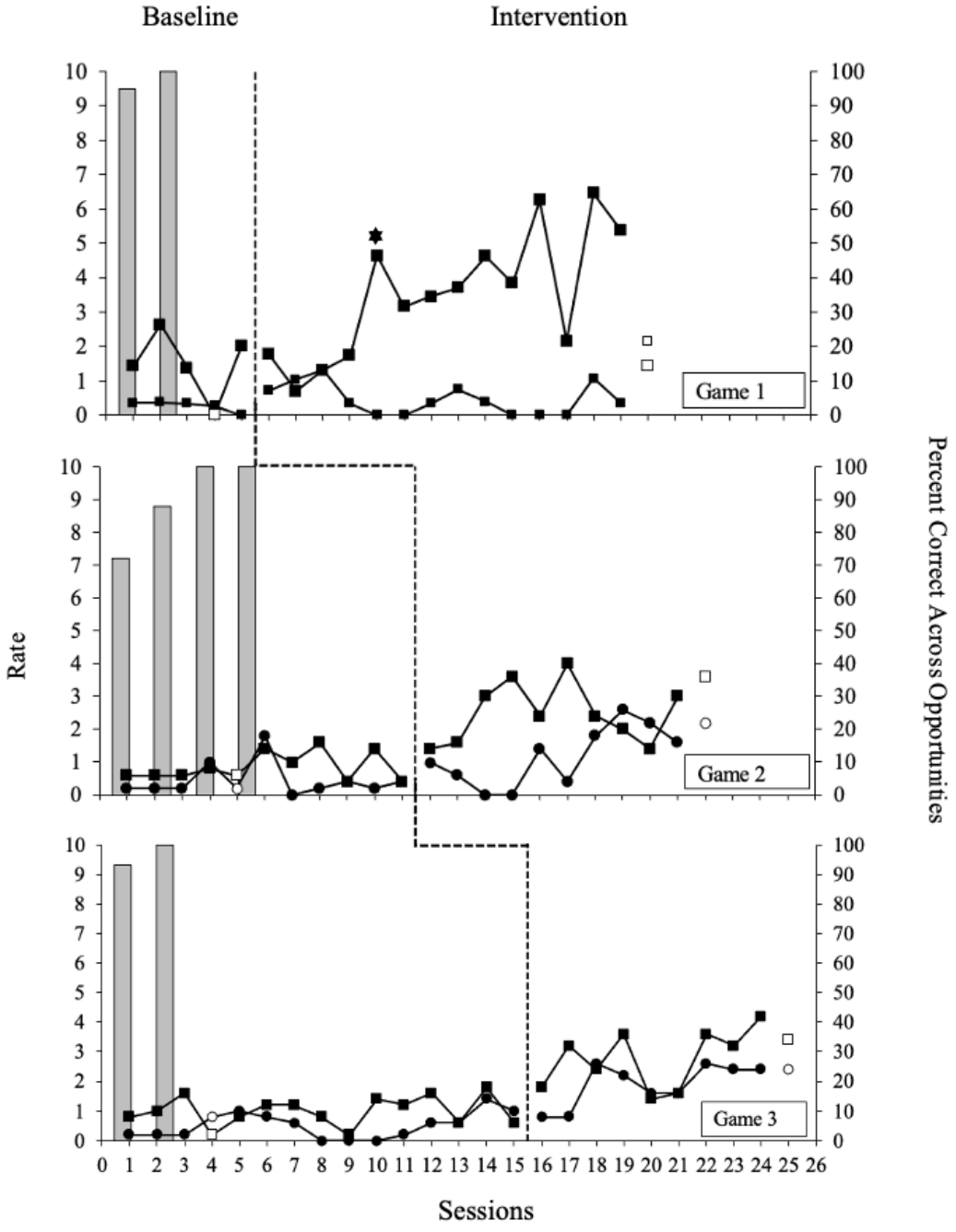

Figure 2. Rate of comments and reactions emitted per minute during gameplay for Elias. Comments are represented by closed squares; reactions are represented by closed circles. Generalization probes are represented by open squares and open circles. Percent correct responses across task list items are represented by the bar graphs.

The results depicting general comments can be viewed in Figure 2. During baseline, some variability can be observed; however, overall, Elias displayed low responding for rate of comments per minute for Game 1 *(M* = 1.5, *range* = 0 to 2.6). General comments were defined as any comment that was related to game play that was not in direct response to an in-game event. A comment was considered complete once the participant paused vocalizations for at least 5 s, or if the participant paused vocalizations while the peer emitted a comment or reaction. For Game 2, I observed slightly more variability, but responding remained at low levels despite this variability (*M* = 0.9, *range* = 0.4 to 1.6). Once again, with Game 3, I observed variation in the rate of comments emitted, but even with that variation responding remained low (*M* = 1, *range* = 0.2 to 1.8).

The results for rate of appropriate reactions per minute can be viewed in Figure 2. For rate of reactions, I observed consistently lower responses than comments across all three games during baseline sessions. Rate of appropriate reactions per minute was defined as multi-word vocalizations emitted by the participant in response to an event that occurred within the game that included an intensifier. During Game 1, I observed near zero levels of appropriate reactions (*M* = 0.3, *range* = 0 to 0.4). With Game 2, I once again observed near zero levels of responding except for an increase observed in two sessions, session 4 and session 6 (*M* = 0.4, *range* = 0 to 1.8). During Game 3, appropriate reactions occurred with more variability than during Game 1 and Game 2, but at low levels (*M* = 0.5, *range* = 0 to 1.4).

Upon the introduction of intervention with Game 1, I continued to see low responding in the first four sessions across both general comments and appropriate

reactions. After observing low levels of responding, I decided to implement a tactile prompt delivered through the iOS application Motivaider ©. I hypothesized that Elias was allocating all his attention to the game, and I believed the tactile prompt would redirect his attention back to his peer. The tactile prompt was only present for five test sessions (i.e., sessions 5 through 9). With the implementation of the tactile prompt, an immediate increase in comments was observed; however, no noticeable increase in appropriate reactions occurred.

For Game 1, during test sessions, the average rate of comments (*M* = 3.4, *range* = 0.7 to 6.5) gradually increased to higher levels of responding than were observed in baseline, with the most robust increase following the introduction of the tactile prompt. With Game 2 (*M* = 2.6, *range* = 1.4 to 3.6), during the first two sessions I observed similar levels of responding as baseline but with an increasing trend. This trend continued through the next few sessions, until session 19, where I observed a decrease in responding before returning to higher levels during session 21. During Game 3 test sessions, I observed an immediate increase in general comments that remained at levels higher than baseline throughout all test sessions (*M* = 2.8, *range* = 1.4 to 4.2).

Game 1 reactions increased slightly during the first four test sessions, but then returned to baseline levels (*M* = 0.6, *range* = 0 to 2.2). During Game 2, I observed an initial decrease in appropriate reactions. Following session 16, appropriate reactions began to increase. The last four test sessions remained at higher levels than observed in baseline (*M* = 1.3, *range* = 0 to 2.6). For Game 3, I observed some variability in the rate of appropriate reactions, but overall increased levels as compared to baseline (*M* = 1.9, *range* = 0.8 to 2.6).

The increases in the rate of total phrases emitted (i.e., general comments plus appropriate reactions) reveals important information about this intervention for Elias. These results can be viewed in Figure 3. For example, during Game 2, when I observed a decrease in general comments following session 19, I observed an increase in appropriate reactions. By combining these two variables, I was able to determine Elias was emitted phrases on an increasing trend overall, and therefore benefitting from the intervention. For Elias, the rate of total phrases emitted reflected baseline levels for appropriate reactions and general comments for all three games (Game 1, *M* = 1.8, *range* = 0.3 to 3; Game 2, *M* = 1.3, *range* = 0.8 to 3.2; Game 3, *M* = 1.5, *range* = 0.2 to 3.6). Differentiation between rate of total phrases emitted and the individual variables becomes more apparent during test sessions (Game 1, *M* = 4, *range* = 1.7 to 7.5; Game 2, (*M* = 3.8, *range* = 2.2 to 5.6; Game 3, *M* = 4.8, *range* = 3 to 6.6).

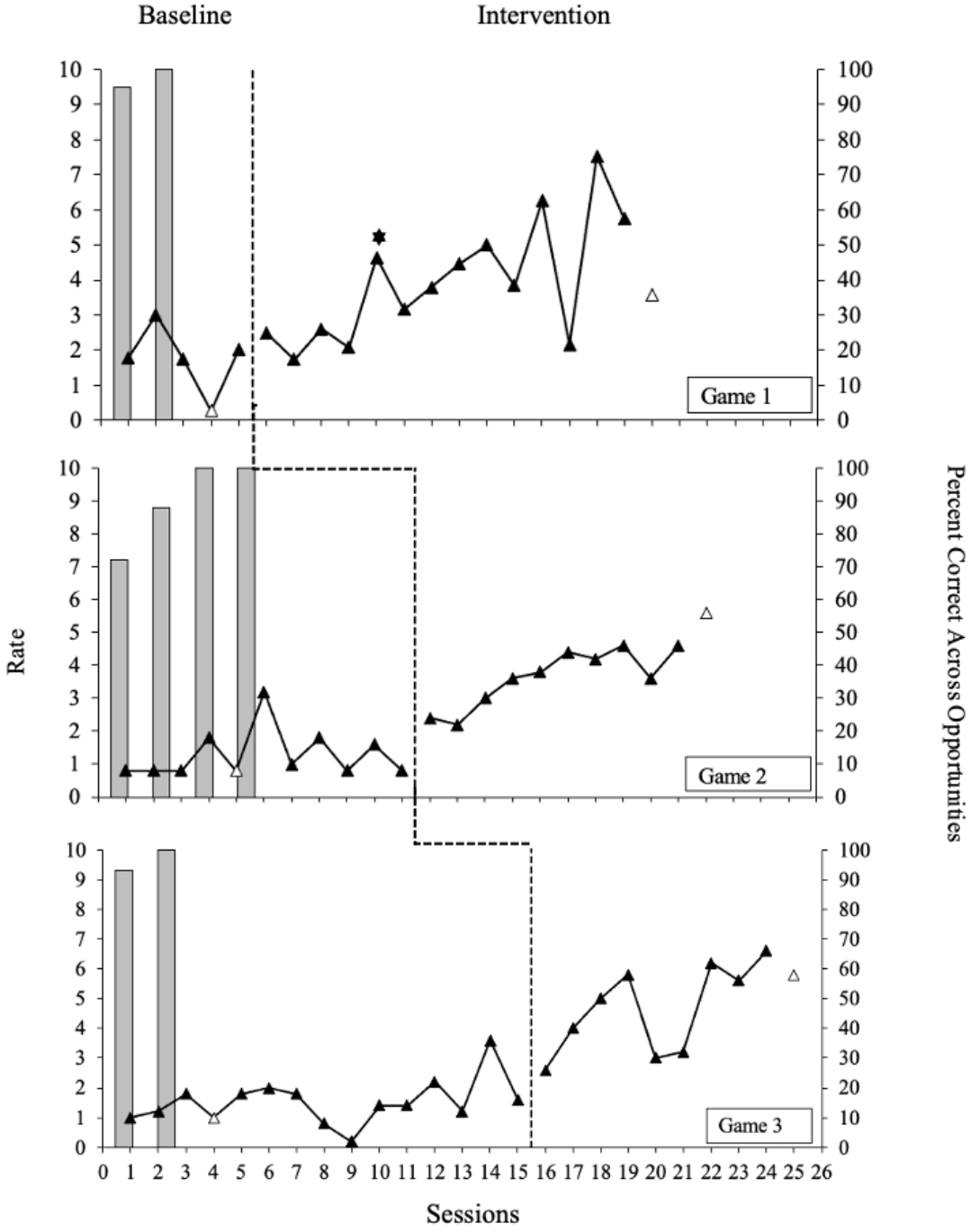

Figure 3. Rate of total phrases emitted per minute for Elias. Generalization probes are represented by open triangles.

When conducting generalization probes with Elias, I observed similar but slightly decreased responding across all variables in comparison to baseline and test sessions. In Game 1, I observed lower responding in the baseline generalization probe than other non-generalization probe baseline sessions. This pattern was replicated in Game 2 and Game 3. When I conducted the generalization probe for Game 1 during the test sessions, I observed lower levels of responding compared to the other non-generalization test probe sessions. Though I observed lower levels of responding than other non-generalization test probes, I still observed higher levels of responding during the test phase generalization probes than for all baseline sessions. This pattern did not continue for Game 2 or Game 3. During both of those games, I observed high levels of responding during the generalization probe conducted during the test sessions.

Julien

Prior to the start of the study, I conducted two preassessment with Julien to ensure he could demonstrate the prerequisite skills to succeed in this study. The first preassessment was the SCQ, which was completed by Julien's caregiver. Julien's score on the SCQ was 21. This is six points higher than the cutoff for potential ASD, which is a score of 15. Secondly, I conducted the brief observation to ensure Julien could read and follow a task analysis. Julien completed the steps in this task analysis completely independently.

Results for Julien are depicted in Figure 4. Data were collected throughout the study on rate of appropriate reactions and rate of appropriate comments per minute. As with Elias, Julien met mastery criteria for independent task analysis completion in baseline (i.e., two sessions with at least 90% of steps completed independently), meaning

no data were collected on this variable following the fourth session. All data were collected by a research assistant and myself.

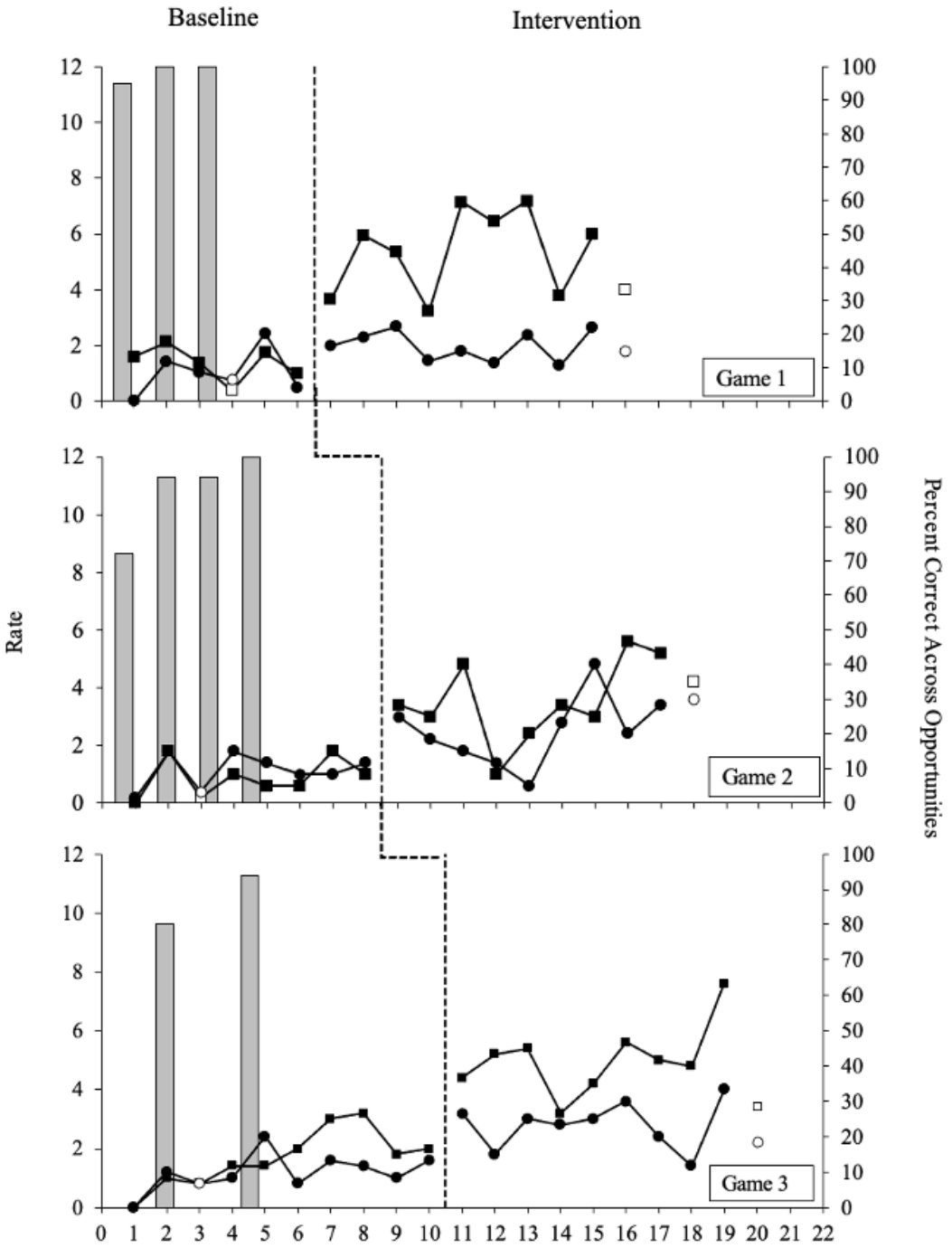

Figure 4. Rate of comments and reactions emitted per minute during gameplay for Julien. Comments are represented by closed squares; reactions are represented by closed circles. Generalization probes are represented by open squares and open circles. Percent correct responses across task list items are represented by the bar graphs.

Results for general comments can be observed in Figure 4. During baseline for Game 1, I observed consistently low levels of responding for rate of general comments (*M* = 1.4, *range* = 0.4 to 2.1). I observed similar low responding for general comments during Game 2, with a slightly increasing trend (*M* = 0.9, *range* = 0 to 1.8). For Game 3, I initially observed low levels of general comments. However, following the introduction of intervention procedures in Game 1, an increasing trend in responding was observed. With this increase, I observed a slightly higher rate of general comments (*M* = 1.7, *range* = 0 to 3.2); however, general comments stabilized prior to the introduction of the intervention.

The results for appropriate reactions can be observed in Figure 4. During baseline for Game 1, I observed similar levels of appropriate reactions (*M* = 1, *range* = 0 to 2.4) as general comments. This pattern continued for appropriate reactions observed in Game 2 (*M* = 1.1, *range* = 0.2 to 1.8). During Game 3, the rate of appropriate reactions observed during baseline remained at a consisted level throughout the phase (*M* = 1.2, *range* = 0 to 2.4).

Once intervention was initiated for Game 1, I observed an immediate increase in general comments (*M* = 5.2, *range* = 3.2 to 7.2). Responding on this dependent variable in Game 1 continued at a higher level than baseline for all test sessions. For Game 2, an immediate increase in general comments (*M* = 3.6, *range* = 1 to 5.6) was observed. A decrease in responding on all variables was observed in sessions 12 and 13 but returned to higher levels for the rest of the test sessions. During Game 3, an increase in responding was observed for general comments (*M* = 4.9, *range* = 3.2 to 7.6).

At the start of test sessions for Game 1, I observed a slight increase in appropriate reactions (*M* = 2, *range* = 1.3 to 2.6); however, the increase was not as dramatic as the increase of general comments. During Game 2, I observed an immediate increase in level of appropriate reactions as compared to baseline followed by a decreasing trend. During session 14, responding returned to initial levels observed at the start of the test phase (*M* = 2.6, *range* = 0.6 to 4.8). While playing Game 3, I observed relatively consistent increased levels of responding when compared to baseline (*M* = 2.7, *range* = 1.4 to 3.6).

Similar to Elias, the increases in the rate of total phrases emitted (i.e., general comments plus appropriate reactions) reveals important information about this intervention. These results can be viewed in Figure 5. For Julien, by analyzing total phrases I was able to observe more clear differentiation in levels between baseline and intervention for all three games, with little to no overlapping data points. By combining these two variables, I was able to determine Julien was emitted phrases at higher rates than baseline, and therefore benefitting from the intervention. For Julien, total phrases emitted reflected baseline levels for appropriate reactions and general comments for all three games (Game 1, *M* = 2.2, *range* = 0 to 4.2; Game 2, *M* = 2, *range* = 0.2 to 2.8; Game 3, *M* = 2.8, *range* = 0 to 4.6). Differentiation between total phrases emitted and the individual variables becomes more apparent during test sessions (Game 1, *M* = 7.2, *range* = 4.6 to 9.6; Game 2, (*M* = 6.2, *range* = 2.4 to 8.6; Game 3, *M* = 7.6, *range* = 7.2 to 11.6).

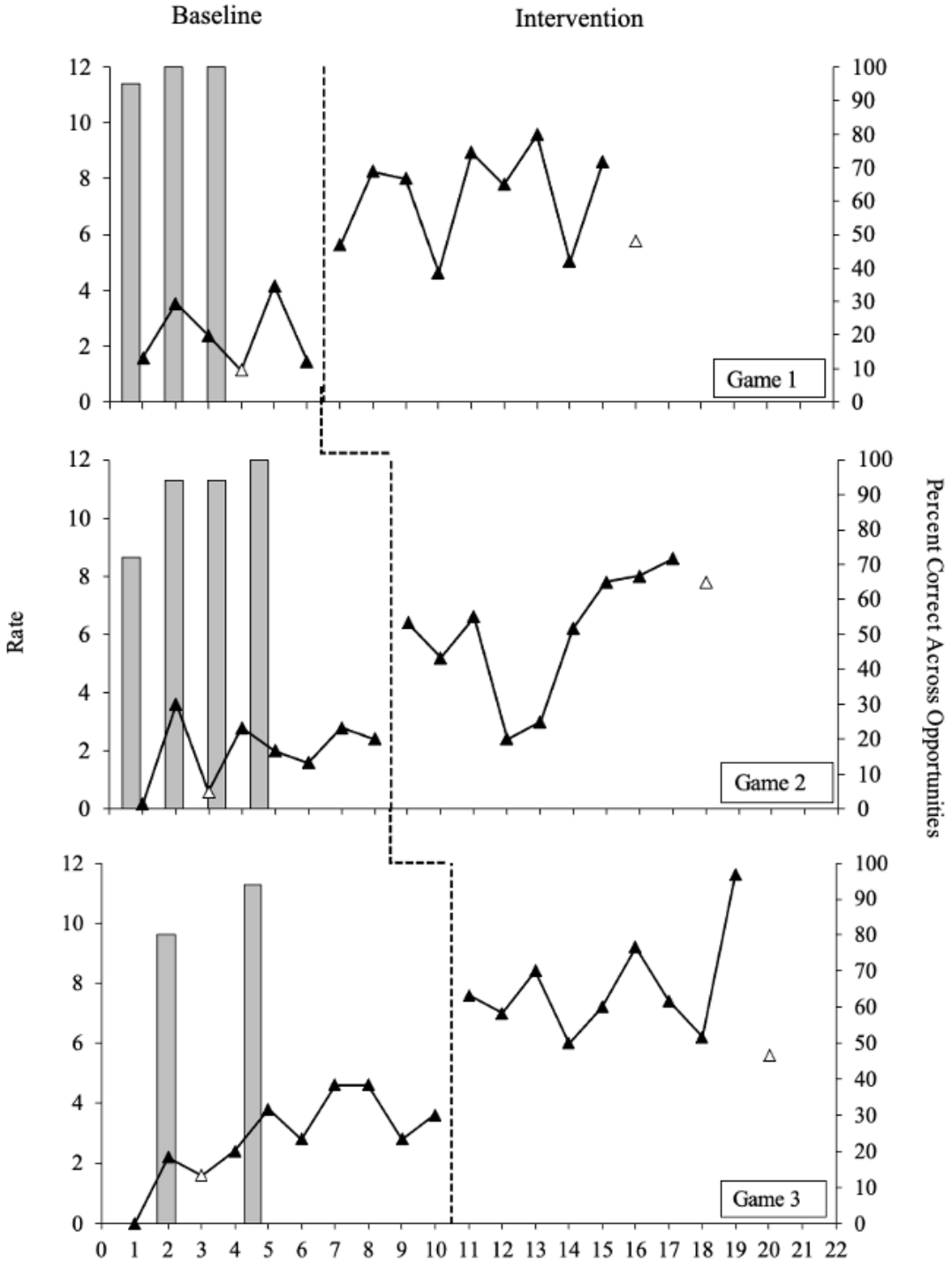

Figure 5. Rate of total phrases emitted per minute for Julien. Generalization probes are represented by open triangles.

When conducting generalization probes with Julien, I observed similar levels of responding in baseline probes as non-baseline probes for Game 1, Game 2, and Game 3. During Game 1, I observed lower levels of responding during test session generalization probes than non-probe test sessions for general comments. When observing appropriate reactions, test probe levels of responding were similar to non-probe levels of responding. For Game 2, similar levels of responding were observed during test generalization probe sessions as non-generalization probe sessions for both variables. During Game 3, I observed lower levels of responding during test generalization probes than non-generalization probe sessions, but higher levels of responding during test generalization probes than baseline generalization probes.

Social Validity

A brief interview was conducted with each participant and their caregiver to assist in drawing further conclusions about this study's relevancy to and impact on the participants. I asked the three following open-ended questions: (a) can you describe your experiences during your time in this study? (b) what are some things about this study you liked? (c) what are some things about this study you didn't like? and (d) what are your thoughts regarding the procedures?

Both participants reported they enjoyed their time in the study. Elias's caregiver elaborated that "he is sad it's ending. He looked forward to coming here each week". Similarly, Julien's caregiver reported "he often talked about the study at home, and how much he enjoyed getting to do this". When asked what aspects of the study they liked, Julien said he liked "playing games [at the clinic] and getting to help by doing a research study". Elias reported "I liked getting to play with new friends while I was here". He and

some of the peers shared gamer tags so they could play together outside of the study which is an exciting outcome. When asked what aspects they did not like, both Elias and Julien reported they did not like when they lost a game to a peer. Though they verbally reported this, it is important to note that no negative or challenging behavior was observed throughout the study when a peer would win a game. When asked about their thoughts regarding the procedures, Elias said “I liked the countdown thing that buzzed. It helped me remember to say things to [peer] when I would forget”. When asked specifically about the script videos, Elias said “it was really good to learn things to say about like what to say to something good or bad”. Julien said about the script videos “they were, they were good”.

CHAPTER FIVE

Discussion

Overview

This study examined procedures designed to increase social interactions among adolescents diagnosed with ASD while they engaged in a popular leisure activity. This study extended the current literature base on teaching leisure skills by focusing on: (a) a leisure skill that includes multiple individuals, rather than a solitary leisure skill, (b) incorporating a high-tech leisure skill that adolescents are more likely to prefer, (c) using an antecedent-based script-fading intervention, and (d) measuring the social validity of the intervention by directly interviewing the participants and their caregivers.

I observed increases in general comments and appropriate reactions, and thus an increase in total phrases emitted for both participants across all games played. Additionally, I observed both participants independently set up each high-tech game for multiple players to participate. Importantly, both participants reported positive experiences throughout their time in this study.

Task Analysis

I decided to include independent task analysis completion as a dependent variable in this study because when reviewing the leisure skills literature, a task analysis was a common intervention used to increase leisure engagement (i.e., 59% of included studies used a task analysis). Further, since I wanted to ensure that each participant was able to independently set up each video game, I believed it was important to include the task

analysis as a potential component to promote mastery of this goal. Interestingly, both participants independently completed most of the steps in the task analysis to set up each game in multiplayer mode without any instruction, meeting the criteria for exclusion of additional instructional procedures for this dependent variable. I hypothesize that the inclusion criterion for this study (i.e., participants who exhibited interest in videogames) might be the reason both participants had already mastered this skill prior to completing this study. Because this interest in gaming was already established, participants began this study with knowledge of how to use many basic gaming systems, including the one used throughout this study. This established interest in video games is different from prior literature on using task analyses to increase independent leisure skills, as my review of the leisure skills literature showed few studies measured a participant's preference for the taught activities. One study, Ivy et al. (2019), chose activities to teach participants based on reports from classroom staff familiar with the participant. The classroom staff chose activities for each participant to learn that were similar to activities the participant had been observed interacting with, or contained components the participants were known to prefer such as specific characters from television shows. Though the activities taught in Ivy et al. (2019) were thoughtfully chosen, the participants did not have an extensive prior history with similar activities such as in my study. To increase the validity of my intervention, selecting individuals who had a more extensive demonstrated preference for video games and other high-tech activities was important.

In addition, it is likely that some observational learning occurred during baseline that led to an increase in the percent of steps completed correctly. The procedures state that the researcher will finish setting up the gameplay if the participant completes a step

incorrectly, if the participant asks for help, or if more than 10 s pass between the completion of one step and the initiation of the next step. Both participants unintentionally had the opportunity to observe myself or a research assistant complete the remaining steps of the task analysis, since I did not require them to look away from the screen or to leave the room while I completed the setup. It should be noted; however, each participant was able to complete at least 90% of the steps in the task analysis on the first attempt for each game, meaning they would have likely met the criteria for exclusion of these teaching procedures even if they were blocked from viewing game setup. Future researchers should further investigate the use of a task analysis to increase video game set up with a more diverse range of participants such as those who have less interest in video games or those who have interest in video games but less prior exposure.

Script Fading

This is the first study to use an antecedent script-fading intervention. In other script-fading interventions, the implementer presents the scripts while the participant is engaging in a specific activity. For example, Krantz & McClannahan (1993) embedded context-specific scripts in a classroom for four children diagnosed with ASD. These researchers taught scripts by interrupting a relevant activity and prompting the participant to emit the language written on the script. The researcher's use of these scripts increased language production across all participants, and these effects maintained for three of the four participants at a 2-month follow up. In contrast, the participants in the current study were exposed to the scripts prior to the start of each test session, rather than the scripts appearing in-vivo during the leisure activity. This allowed the activity to occur without the presentation of the scripts interrupting the fast-paced games or interrupting the

ongoing interactions between the participant and the peer. By implementing the script-fading procedures in the presence of the participant only, I hoped to minimize any negative reactions that could have been associated with the participant being the sole recipient of additional teaching procedures. This was especially important given the scores both participants received on the SCQ, which led me to believe they would be able to attend to the differences in treatment between themselves and the peer. Among participants with different SCQ scores, this consideration may be less relevant. Future researchers should investigate the use of antecedent script-fading procedures with individuals who score lower on the SCQ, and evaluate any differences in participant perceptions or opinions. In addition, future researchers should replicate the use of antecedent script-fading interventions to solidify the findings of this study.

Further, this study is the first to use a script-fading intervention paired with a high-tech leisure activity. Prior studies have paired script-fading interventions with low-tech activities such as board games and pretend play, but each of those studies included participants below the age of 15 (Akers et al., 2016). Since the participants in this study were adolescents, and we know an individual's preferences tend to narrow as they age, it was important to consider the participant's personal preferences as well as consider what activity the participant would be likely to interact with outside of this study (Birk et al., 2017). According to the literature adolescents in the United States spend most of their leisure time engaging with high-tech activities such as video games and app-based games (Orben & Przybylski, 2019), which influenced my selection of video games as the leisure activity for this study. Given that the script-fading procedures in this study successfully increased general comments and appropriate reactions while participants engaged with a

high-tech leisure activity, future researchers should investigate the use of script-fading procedures with other high-tech leisure activities.

Despite the novel aspects of my script-fading intervention, such as its use with older individuals and use alongside a high-tech leisure activity, the results of this study align with the results of prior script-fading interventions. In Akers et al. (2015), the authors investigated the use of script-fading interventions used over a 20-year span. The authors of this review found script-fading procedures to be an empirically supported treatment and an evidence-based practice, meaning these procedures were found to be highly effective at promoting language development among individuals with ASD. The results obtained in my study further support these findings and continue to build upon the previous research associated with these intervention procedures.

General Comments

I observed increases in the frequency of general comments emitted in test conditions as compared to frequency of general comments in baseline sessions. This increase is evidence of the effectiveness of the script-fading procedures used in this study. Both participants used scripted phrases, or variations of scripted phrases, from the script videos across all games. Further, Julian often used the scripts taught for one game while playing a different game. I hypothesize this was reinforced by the peer, who would often deliver attention in the form of laughing when Julian would use these phrases in out-of-context situations. For example, he would often start Game 2, which was a fighting game, with the scripted phrase he was exposed to for Game 1, the racing game, saying “I hope I win this race”. Similarly, he would end Game 1, the racing game, with a comment from Game 3, the soccer game, by stating “I scored a goal!”. This observation

is impactful, because it suggests this type of setting (i.e., highly preferred leisure activity with a similarly aged peer) is a learning environment that allowed Julien's behavior to contact reinforcement as it would in a natural setting. As a field, we strive to teach behaviors that will naturally contact reinforcement in an individual's typical environment (Cooper et al., 2021). I believe some of Julian's commenting, such as when using phrases in out-of-context situations, began to contact reinforcement as it would in his typical environment. Further, Julien's commenting behavior suggests script-fading interventions may be successful when used to teach humor, sarcasm, or other complicated social interactions. Future researchers should investigate this possibility.

For both participants, I observed a steeper increase in the average number of general comments during test sessions than for appropriate reactions. I hypothesize that as more general comments were made, these comments evoked responding from the peer, which in turn evoked additional responding from the participant. For example, Elias might have made a comment about the type of car he chose to race with in Game 1. The peer might have responded with an explanation as to why he chose a specific car to race with. Elias then would have responded with an additional rationale as to why the car he chose was still a better choice than the one the peer chose. The peer might have then made a comparison to a different racing game, continuing the back-and-forth exchange. As this pattern continued, the participant would allocate more responding to continue this back-and-forth exchange. This aligns with prior research on the use of scripted phrases among individuals with ASD. In Canestaro et al. (2021), responses, rather than initiations, were observed at higher levels among most participants when overall peer vocal verbal behavior occurred at similar levels as overall participant vocal verbal

behavior. This suggests that script-fading interventions may be useful in teaching conversational exchanges in certain settings. Future researchers should investigate the contexts in which these types of exchanges might be most successful.

Appropriate Reactions

I observed a less robust increase in average number of appropriate reactions across participants as compared to the average number of general comments. There are a few reasons why this might have occurred. One reason is that in-game events that would evoke reactions remained relatively consistent depending on the type of game being played. For example, in Game 1, there was a consistent number of opportunities during each race to obtain and use items, which was often a stimulus that would evoke an appropriate reaction from the participant. Future researchers should keep this in consideration when teaching vocal-verbal responses that are highly context specific, such as appropriate reactions, by teaching more varied vocal verbal responses for stimuli that tend to remain consistent. An example of teaching varied vocal verbal responses that researchers could investigate being applied to a leisure setting can be found in Brodhead et al. (2016). These researchers increased the variability of their participant's vocal verbal behavior by teaching multiple phrases that served the same function in response to the same stimuli.

Another potential explanation is that it was difficult for appropriate reactions and general comments to occur simultaneously. If a participant was engaging in a high frequency of general comments during a session, I would observe a decrease in appropriate reactions as the opportunity for engaging in this behavior would decrease. I believe the participant lost the opportunity to emit higher levels of reactions in these

situations due to both their own vocal-verbal behavior the vocal verbal behavior of their peer. The peer's vocal-verbal behavior impacted the participant's ability to engage in appropriate reactions because when the participant would make a general comment, the peer was more likely to respond with their own comment. As the peer would respond, the participant would pause to allow that response to occur and would likely respond with their own comment, encouraging a turn-based vocal-verbal exchange that primarily consisted of general comments. As this exchange continued throughout a session, the opportunity to engage in appropriate reactions continued to decrease throughout a given session. Future researchers should investigate whether increasing these types of responses separately is more effective than attempting to increase them simultaneously.

Total Phrases

For Elias, I began summing the total phrases emitted during each session in addition to measuring general comments and appropriate reactions separately. Evaluating total phrases emitted alongside of the primary dependent variables allowed for some degree of consistency across different types of games, each of which could evoke variable types of vocal verbal responding. For example, during some sessions there seemed to be more opportunities to engage in appropriate reactions than others. During one match, there might have been more in-game stimuli that evoked reactions such as a unique fighting platform or a novel racetrack neither participant had used. In these instances, I observed increases in appropriate reactions. Similarly, some in-game stimuli seemed to evoke more general comments from the participant than appropriate reactions. By analyzing effectiveness of the intervention using the sum of the two variables, I was able to observe an overall increase in vocal verbal responding that provided a more

distinct summary of participant behavior. I believe that for this study, an increase in total phrases emitted by the participant is evidence of a socially significant change in vocal verbal behavior, despite any variability that was observed when analyzing general comments and appropriate reactions as individual variables. This raises important considerations for future research studies that focus on increasing vocal verbal responding. In some settings and contexts, an increase in specific types of vocal verbal responses may be more socially significant than total phrases emitted. Future researchers should investigate which contexts might require more differentiated vocal verbal responses, as well as investigate what kinds of vocal verbal responses might be most significant to observe across different contexts.

Elias

There was some responding that was unique to each participant that warrants further discussion. With Elias, I introduced a tactile prompt during Game 1 for five of the test sessions. I made this decision following the first four test sessions as there was only a slight increase in the average number of total phrases ($M = 6.5$) compared to baseline ($M = 4.6$). When completing the preassessment with Elias's caregiver, she had reported that Elias was very competitive when playing games, and that she believed this competitive drive is what led to his lack of social interaction with others while playing multiplayer games. After observing Elias play each game during baseline and the first four test sessions of Game 1, and considering his caregiver's report, I thought that it was possible that Elias was allocating all his attention to the game which prevented him from engaging in any other behaviors such as vocal verbal responses. Some behaviors I observed that contributed to this hypothesis included no break of eye contact with the screen, and a lack

of response or recognition when the peer would engage in any kind of vocal verbal behavior. Additionally, immediately after the gameplay ended it would be difficult to obtain his attention for a few seconds when calling his name, something that was not problematic outside of sessions. Upon the first test session with the addition of the tactile prompt, I observed an immediate increase in total phrases emitted. Once the tactile prompt was removed, Elias continued to engage in similar levels of responding. The tactile prompt was not used during any Game 2 or Game 3 sessions.

Interestingly, though I observed an increase in total phrases and general comments emitted by Elias with the implementation of the tactile prompt, I observed an immediate decrease in appropriate reactions. This may be due in part to the timing of the tactile prompt and the length of comments Elias began to emit. The tactile prompt would vibrate every 20 s. On the first instance of the prompt Elias would make a comment, usually in a form of a question to the peer related to the game, and often the participant was still responding when the prompt would reoccur. This pattern of responding would continue throughout the session. Further, the content of Elias's comments was different during Game 1 following the implementation of the tactile prompt than for the other two games. As stated previously, Elias would typically comment in response to the tactile prompt by stating something he liked about the game and then asking a similar question to the peer. I believe he paired this more conversational commenting with Game 1 and following reinforcement from the peer in the form of consistent responding to the comments, these types of comments continued for Game 1. Because comments and reactions are incompatible behaviors, as Elias allocated all his verbal responding towards

engaging in general comments, the opportunity for Elias to engage in appropriate reactions during Game 1 decreased.

Julien

For Julien, I observed increases in all dependent variables, with a higher magnitude of increase occurring for general comments. I hypothesize this occurred due to each game type providing a relatively consistent number of opportunities for reactions, with some variability observed when novel stimuli were introduced, as described previously.

For sessions 13 and 14, I observed a decrease in comments made by Julien. I believe that this decrease likely occurred due to unintentional removal of a naturally occurring reinforcer – specifically, the reinforcement provided by the peer in the form of attention in response to general comments. During these two sessions, I observed the peer acting atypically. Usually, the peer was very responsive to the participant's behavior by making comments in response to the participant's own comments. During these two sessions, the peer did not respond to any of the initial comments made by the participant. When those comments did not contact reinforcement, that behavior immediately declined. I reminded the peer to respond when Julien made comments. The peer's behavior rebounded to previous levels, and I observed a corresponding increase in the participant's behavior. This suggests that for procedures such as these, the peer's behavior is an important factor in the successfulness of the intervention.

Generalization Probes

The results of the generalization probes provide interesting insight into the participant's behavior. During baseline sessions for both participants, I saw near zero levels of total phrases during generalization probes. This aligned with the levels of responding observed during baseline sessions. When generalization probes occurred during the test sessions, I observed increased responding as compared to baseline but not at the same high level as non-probe test sessions. It is possible that a smaller increase in responding was observed during generalization sessions due to the decrease in saliency of the peer as an environmental stimulus. Prior research has shown stimulus salience within an individual's environment can have a direct effect on their behavior (Halbur et al., 2021). During non-probe sessions, the participant could easily see and hear the peer. During the probe sessions, the participant could only hear the peer's voice, which was at a lower volume than during non-probe sessions. Future researchers should investigate the interactions between stimulus saliency and social behaviors to further understand social behaviors among individuals with ASD.

Future Directions

Following the completion of this study, I have uncovered some directions future researchers should investigate. The first direction is related to the use of script-fading interventions. First, researchers should investigate the use of script-fading interventions similar to the one used in the current study with other high-tech leisure activities. Since this is the first study to use a script-fading intervention with a high-tech activity, it is likely there are components related to both the activity and the intervention that impact the efficacy of the intervention, such as pace of activity or modality of script delivery.

Second, since the participants in this study scored high on the SCQ, future researchers should investigate the efficacy of using antecedent-based script-fading interventions with individuals who score lower on this rating scale. Though prior research has used typical script-fading interventions with individuals who would score low on the SCQ, this is the first study to use script-fading as an antecedent intervention. It is possible that antecedent-based script-fading interventions might not be as successful with individuals with lower SCQ scores, and thus should be investigated. Finally, Julien often used the scripted phrases taught for one game during other games in out-of-context situations. The consequence of this behavior was the peer laughing, which I hypothesize reinforced this behavior as it continued to increase in frequency throughout the study. This observation leads me to believe that future researchers should investigate the efficacy of using script-fading to teach more complicated social skills, such as humor or sarcasm.

Another avenue for research is investigating the interaction of preference and the success of this and similar interventions. In this study, both Elias and Julien were able to independently set up the multi-player game without the aid of a task analysis. This was due to their previously expressed preference in and exposure to video games. Future researchers should evaluate whether a task analysis would be effective for a participant who did not have such a strong interest in video games, or a participant who is interested in video games but has less prior exposure. Similarly, this study was successful in teaching social leisure skills to two adolescents with ASD who reported high levels of interest in video games. Future researchers should continue to investigate the use of preferred activities, preferred items, or preferred contexts when teaching social skills to individuals with ASD.

Another consideration for future research is the most effective method for creating and teaching scripts in this context. When I selected the scripts to use during this script-fading intervention, it was difficult to account for the varied stimuli the participants might encounter while playing each type of game. This led me to select more general scripts for appropriate reactions that could be used in response to a variety of in-game events. It is possible that by providing only one response to use in reaction to a variety of events, the participants might have engaged in more repetitive vocal verbal behavior. To counteract this, future researchers should investigate teaching varied vocal responding by teaching multiple phrases that can serve the same function in response to the same stimulus. Further, I observed a decrease in appropriate reactions as general comments increased for each participant throughout test sessions. Future researchers should investigate if it would be more effective to teach each type of response (i.e., general comments and appropriate reactions) in isolation rather than in combination.

Finally, future researchers should investigate the interaction between stimulus saliency and social behavior. During generalization probe sessions, I observed lower levels of responding than during test sessions. The peer was not physically present during the generalization probes, which led me to hypothesize that the presence of the peer might be important to evoking certain social behaviors from an individual with ASD.

Limitations

This study has some limitations that must be discussed. First, having two different independent variables that measured similar behavior led to difficulty in visual analysis of effects. Though both dependent variables were distinct types of vocal verbal behavior relevant to the setting, I believe combining them as one dependent variable from the start,

rather than during visual analysis, would have provided similar information from which conclusions could be drawn.

Another limitation is that the scripts taught did not always align perfectly with the in-game events the participant might encounter. While the participant was playing the games, it was impossible to foresee each scenario that the participant would encounter within the game. I tried to consider this limitation when I created general scripts for each game that could be used in a variety of situations (i.e., as a positive reaction for a sport-based game, "good hit!"); however, it might have been more advantageous for the participants to be taught scripts specific to each in-game encounter.

Finally, one limitation that must be discussed is not blocking the participant's view when setting up the game play according to the task analysis. Both participants could complete most of the set-up steps independently on their first try; however, neither of the participants completed all steps independently initially. During subsequent sessions, the participants were able to increase the number of items on the task analysis they completed independently. I believe each participant improved on this skill by observing myself or the research assistant complete the remaining steps in the task analysis.

Conclusions

In conclusion, these script-fading procedures increased general comments for one adolescent boy with ASD, and increased general comments and appropriate reactions emitted for another adolescent boy diagnosed with ASD. This study contributed to the literature by examining the use of script-fading procedures with adolescents, examining the use of antecedent script-fading procedures, and examining the use of script-fading

procedures with a high-tech leisure skill. All procedures were well received by the participants and their caregivers.

APPENDICES

APPENDIX A

Preassessment: Participant Caregiver Interview Questions:

1. Describe your child's primary method of communication.

2. Can your child imitate verbal phrases? For example, if you said "repeat after me: I like to play games" could they say it back to you?

3. Do you think interacting with their peers is important to you or your child?

4. Can your child follow multi-step instructions? For example, if you asked your child to pick up a piece of trash, walk to the kitchen, put it in the garbage can, and then come back, would they be able to do so without reminders?

5. Does your child enjoy playing video game

APPENDIX B

Preassessment: Observation

For each item, write a (+) if the participant completes the step correctly and a (-) if the step is completed incorrectly.

Item	+ or -
Stand up from chair	
Spin in a circle	
Clap hands twice	
High-five Ms. Nicole	
Walk to box	
Choose a piece of candy	

Baylor University

Name:_____

___

Follow the instructions exactly and receive a treat at the end!

1. Stand up from your chair.
2. Spin in a circle.
3. Clap your hands twice.
4. High-five Ms. Nicole.
5. Walk to goodie box.
6. Choose one piece of candy.

APPENDIX C

Peer Preassessment Caregiver Interview Questions

1. Does your child enjoy playing video games?

2. Does your child follow instructions when asked?

3. Is your child patient with other children?

APPENDIX D

Social Validity Questionnaire

Describe your experiences during your time in this study.

What are some aspects of this study you liked? Didn't like?

What are some of your thoughts regarding the effectiveness of the procedures?

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