Spring 1-1-2014

Use of a Visual Cueing System to Retell Events: Child with Fetal Alcohol Syndrome

Margaret Anne Morton
University of Colorado at Boulder, margaret.morton@colorado.edu

USE OF A VISUAL CUEING SYSTEM TO RETELL EVENTS: CHILD WITH FETAL ALCOHOL SYNDROME

by

MARGARET MORTON

B.A., University of Colorado, 2011

A thesis submitted to the

Faculty of the Graduate School of the

University of Colorado in partial fulfillment

of the requirement for the degree of

Master of Arts

Department of Speech, Language and Hearing Sciences

2014

This thesis entitled:
Use of a Visual Cueing System to Retell Events: Child with Fetal Alcohol Syndrome
written by Margaret Anne Morton
has been approved for the Department of Speech, Language and Hearing Sciences

Christine Yoshinaga-Itano, Ph.D.

Amy Thrasher, MA, CCC-SLP

Anne Whitney, Ed.D, CCC-SLP.

Date

The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

IRB protocol # 13-0191

Morton, Margaret Anne (M.A., Speech, Language, and Hearing Sciences)

Use of a Visual Cueing System to Retell Events: Child with Fetal Alcohol Syndrome

Thesis directed by Professor Christine Yoshinaga-Itano.

Abstract

A descriptive case study design was used with a 5-year old male subject diagnosed with Fetal Alcohol Syndrome (FAS). The purpose of the study was to explore the effectiveness of a visual cueing system (VCS) to assist a child with FAS in retelling the events in a completed activity. Initial questions included: 1) Is the subject able to retell the correct sequence of events in free recall without a visual support? 2) Does the subject's accuracy in retelling the sequence of events improve across sessions with greater exposure and experience using the VCS? 3) Does an increased number of the subject's distractive behaviors before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events? 4) Does an increased number of clinician redirection attempts before and during the activity retell impact the subject's accuracy in using a VCS to verbally sequence events? 5) Is there a similarity between the number of subject's distractive behaviors compared to the number of clinician redirection attempts? 6) Does the subject's ability to retell a sequence of events, as measured by the NEPSY-II, improve following intervention using the VCS?

Due to procedural limitations, baseline data regarding the subject's success in retelling a sequence of events without visual supports was not collected. Therefore, the initial questions posed by the principle investigator were unable to be adequately addressed in the present study. Multiple variables were coded post hoc in order to review the relationship between these measures and the child's accuracy in retelling the activity events. Post hoc

coding included: Subject's quality verbal interactions, adult references to "help," and subject's percentage of events included in retell. Results from the post hoc analysis suggest a positive relationship between the subject's number of quality verbal interactions and his overall success in retelling events in the activity, as well as possible generalization of skills in retelling events in a narrative retell task.

CONTENTS

CHAPTER I

INTRODUCTION

The present study was completed at a public state university speech, language, and hearing center. The Visual Cueing System (VCS) intervention utilized within the study was conceptualized following a conversation with the subject's parents. Each parent expressed concerns about the child's inability to retell and sequence events from his day. The following study aims to explore the clinical application and effectiveness of using a VCS to promote retelling of activity sequences in the appropriate order, the possible relationship between the subject's and clinician's behavior on the subject's success in retelling the sequence of events, the relationship between quality verbal interaction between the child and adults on the subject's retell of events, and the potential generalization of retell skills to a narrative retell task.

LITERATURE REVIEW

FETAL ALCOHOL SPECTRUM DISORDER

Fetal Alcohol Syndrome (FAS) was first recognized in the United States over 40 years ago, when Jones, Smith, Ulleland, and Streissguth (1973) first reported distinctive characteristics of children born to mothers who drank excessively over the course of their pregnancy. Since its initial discovery, the term Fetal Alcohol Spectrum Disorder (FASD) is recognized by the National Institute on Alcohol Abuse and Alcoholism as well as the Centers for Disease Control and Prevention, to discuss the range and variety of impairments resulting from prenatal alcohol exposure (as cited in Sokol, Delaney-Black, & Nordstrom, 2003, p. 2996). In their book *Fetal Alcohol Effects: Diagnosis, Epidemiology, Prevention, and Treatment*, Stratton, Howe, and Battaglia (1996) explain the diagnosis

under FASD including: Fetal Alcohol Syndrome (FAS) with confirmed alcohol exposure, FAS without confirmed alcohol exposure, Partial Fetal Alcohol Syndrome (pFAS) with confirmed alcohol exposure, Alcohol-Related Birth Defect (ARBD) and Alcohol-Related Neurodevelopmental Disorder (ARND).

Over the years, researchers have worked to create distinctive criteria by which to diagnose children with FAS, pFAS, ARBD, or ARND. Diagnostic criteria include: facial dysmorphology, growth deficiencies, and an impacted central nervous system (CNS) (Stratton et al., 1996). Differential diagnosis is dependent upon the variations in presentation of the diagnostic criteria, with facial dysmorphology necessary for the diagnosis of FAS. Due to the difficulty of identifying the remaining criteria, estimates suggest more than 50% of children with neurocognitive and behavioral challenges as a result of prenatal alcohol exposure may go unidentified and untreated (Mattson, Goodman, Caine, Delis, & Riley, 1999).

Jones et al. (1973) original research examined the effects of excess alcohol intake prenatally; however, according to the National Institute on Alcohol Abuse and Alcoholism (1997), research suggests it is possible there is no amount of alcohol that is safe to consume during fetal development without potential irreversible impacts to the developing fetus (as cited in the National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2000, p. 291).

The lifelong effects of prenatal alcohol exposure are heterogeneous, varying in severity across individuals. Physical malformations and growth deficiencies may be recognizable at birth, while other effects such as impacted cognitive, behavioral, and academic skills may become more apparent as the child develops (NIAAA, 2000; Chudley et al., 2005). Neuropsychological deficits seen in FAS include the areas of visual-spatial abilities, cognitive flexibility, planning, processing speed, and declarative memory (Olson, Feldman, Streissguth, Sampson, & Brookstein, 1998).

EXECUTIVE FUNCTION

Executive function (EF) is an umbrella term, commonly referring to an individual's higher-level mental processes such as planning, organizing, working memory, set shifting, and inhibition. These cognitive functions are necessary to engage in goal-directed behavior, including monitoring behaviors based on receiving and incorporating feedback from different sources (Mattson et al., 1999; Kodituwakku, Kalberg & May, 2001). Challenges in EF may significantly impact an individual's ability to engage in daily tasks, social interactions and overall independence (Mattson et al., 1999).

Mattson, Goodman, Caine, Delis and Riley (1999) examined the EF abilities in 28 children, ages 8 to 15 years old. Three groups were included in the study: Children diagnosed with FAS, children exposed prenatally to alcohol without a diagnosis of FAS (Prenatal Exposure to Alcohol– PEA), and non-exposed controls. Both groups of children prenatally exposed to alcohol "demonstrated deficits on measures of planning ability, cognitive flexibility, selective inhibition, and concept formation and reasoning" when compared to non-exposed controls (Mattson et al., 1999, p. 1813). The authors then compared the two groups prenatally exposed to alcohol, those with the diagnosis of FAS and those identified as PEA. Results indicate the two groups performed similarly on most tasks, suggesting individuals without the characteristic facial dysmorphology and growth deficiencies experience similar EF deficits. The areas of challenge noted in the study by Mattson and colleagues are consistent with EF challenges noted in the subject included in the present case study.

Children with complex profiles such as those seen in individuals with FAS have a difficult time engaging in self-regulatory behaviors. As discussed by Kodituwakku, Handmaker, Cutler, Weathersby, and Handmaker (1995), research suggests children with FAS experience challenges in maintaining self-regulation, which requires a high level of

executive functioning. Self-regulation, as defined by Luria in 1966, involves three components including "programming, regulation, and verification of goal-directed behavior" (as cited in Kodituwakku et al., 1995, p. 1558). As cited in their article, Kodituwakku et al. (1995) explain the two models of attentional systems developed by Norman and Shallice in 1980 (p.1558). According to Kudituwakku and colleagues (1995), the first system "relates to routine programs and does not involve deliberate attention," while the other, known as the Supervisory Attentional System, "plays a significant role in deliberate conscious control" in such areas as "planning, decision making, and trouble shooting" (p. 1558). Therefore, a primary function of the Supervisory Attentional System is to inhibit "irrelevant responses" (Kodituwakku et al., 1995, p. 1559).

Kodituwakku and colleagues (1995) hypothesized that because children with FAS or FAE demonstrate behavioral characteristics regulated by the Supervisory Attentional System such as "distractibility, impulsivity and perseveration," they believed these children would demonstrate greater challenges in self-regulation behaviors than non-exposed controls (p. 1559). The Norman-Shallice theory of attentional systems, as it relates to the Supervisory Attentional System, aligned with the original belief within the present study. Specifically, the principle investigator of the present study hypothesized that when the subject engaged in distractive behaviors, he experienced difficulty in engaging in self-regulatory behaviors to avoid irrelevant responses. It was hypothesized that the distractive behaviors would therefore lead to difficulty in accessing important information from the activity, and therefore, the subject would demonstrate difficulty in retelling events from the activity.

VISUAL AIDS

There is a breadth of research exploring the use of Visual Aids as intervention to support children with developmental disorders, with the bulk of research involving children

with Autism Spectrum Disorder (ASD). Commonly used visual aids include video modeling, scripts, and visual activity schedules. Despite differences in several developmental characteristics of the two disorders, Nanson (1992) noted similar behavioral challenges in children exposed prenatally to alcohol and children with ASD (as cited in NIAAA, 2000, p. 294). Although a significant number of studies are limited to single or multiple case studies, a large body of evidence exists regarding the use of visual support systems with children with ASD (Dettmer, Simpson, Myles, & Ganz, 2000; Banda & Grimmett, 2008; Murdock & Hobbs, 2011). Therefore, the goal of the present study was to examine the possible benefits of utilizing visual aids with this specific child with FAS.

In a recent study conducted by Murdock and Hobbs (2011), three preschool-aged children diagnosed with ASD were provided individualized visual cueing systems (VCS) including written text and pictures within the cue. The purpose of the study was to investigate the use of the VCS in aiding the children in telling the events of their school day. The design of the study utilized multiple phases including: baseline, complete cue, partial cue, generalization, and follow-up. Each participant increased the number of events he/she reported. Additionally, researchers noted the subjects generalized the skills learned during the study to inform parents of the events of their day. In the final phase, results indicated maintenance of skills for 2 of the 3 children. Researchers concluded the VCS were effective in helping the children retell the events of their day.

Within the present study, the VCS utilized elements from scripting and visual activity schedules, the design of which was greatly influenced by the Murdock and Hobbs study from 2011. The written text, *First, Next, Then, Finally,* appeared upon each VCS in accordance with each event within the daily activity. It is the purpose of this study to explore the possible effect of using a similar VCS structure to support a child with FAS in retelling events from a session activity.

CHAPTER II

METHOD

PARTICIPANT

A single, four-year, nine-month old male participated in this study. Data collection began in April of 2013 and concluded in October of 2013, at which time the participant was five years, three-months. The participant, Sam, was born to a mother of Native American heritage. The pregnancy was reported as complicated with gestational diabetes and high blood pressure. Sam was adopted at the age of three weeks old. Sam received the diagnosis of Cognitive Disorder – Not Otherwise Specified and Fetal Alcohol Syndrome in February of 2013 from a clinic specializing in FASD. Sam had been attending a university preschool program in a department preparing students for the profession of speech-language pathology since fall of 2011. Sam continued to attend the university program while also enrolled in a preschool not affiliated with the university. Sam was referred for individual speech and language services, at which time he became a candidate to participate in the present study.

According to parent report, observations in preschool and individual intervention, as well as the diagnostic evaluation report, Sam presented with challenges in EF consistent with those characteristic of children with FAS. Specifically, Sam demonstrated difficulty in maintaining organization, managing inhibition and impulse control, regulating emotions, and attending to tasks. Sam demonstrated additional challenges in expressive language and fine and gross motor skills.

Sam was observed following simple multi-step directions. He has been reported to communicate needs and desires independently through short phrases and sentences, but has been observed to use physical behaviors such as grabbing and/or pushing to obtain a desired object from peers. Sam has been observed able to remain focused on an activity up

to approximately 15 minutes, with quality of interaction and time of attending dependent on his interest in the task. Prior to the initiation of the study, both parents and the supervising speech-language pathologist reported that Sam had difficulty relating events, both in the number of correct elements expressed and the order of elements expressed.

During his time in the university program, Sam became familiar with and responded to the use of visual activity schedules to assist in on-task behavior and transitioning from one activity to another. Therefore, visual activity schedules were presented at the beginning of preschool and individual therapy to assist Sam in transitions between activities. Sam's responsiveness to visual activity schedules influenced the decision to use a VCS with him. Approval for the study was given by the University of Colorado-Boulder Human Research and Internal Review Board (IRB) (Protocol **#:** 13-0191). Parental consent was provided in written form from both of Sam's parents.

The present study aimed to explore the following questions regarding the use of a VCS with a child with FAS:

1. Is the subject able to retell the correct sequence of events in free recall without a visual support?
2. Does the subject's accuracy in retelling the sequence of events improve across sessions with greater exposure and experience using the VCS?
3. Does an increased number of the subject's distractive behaviors before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events?
4. Does an increased number of clinician redirection attempts before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events?
5. Is there a similarity between the number of subject's distractive behaviors compared

to the number of clinician redirection attempts?

6. Does the subject's ability to retell a sequence of events, as measured by the NEPSY-II, improve following intervention using the VCS?

SETTING

The VCS was implemented during individual therapy sessions. Final data was collected at an early learning center, where individual therapy was moved due to extenuating circumstances. The VCS was integrated into therapy, resulting in the content of the VCS paralleling the theme or storybook for the day's session. Sam's graduate student clinician presented the VCS in all sessions. Completion of the VCS activity occurred within the first 20 minutes of therapy, involving Sam's attending parent who assisted in making the activity in 6 of the 8 sessions. No sessions included both parents, however, Sam's father participated in 5 of 8 sessions, his mother participated in 1 session, and no parents were present for 2 of the sessions.

INDEPENDENT VARIABLE

The VCS was the independent variable in the present study. The VCS was constructed on a piece of colored construction paper approximately 8 ½ by 11-inches. The paper was folded in half at the width of the page with duplicate activity materials taped onto the VCS to represent the steps required for completion of the activity. Construction of the VCS was designed to emulate the task of reading a book, beginning at the top left corner of the left page, following the events down the page, then transitioning to the top of the second page. The structure of the VCS was designed to support Sam's individual therapy goal of development of pre-literacy skills.

Materials were created uniquely for each session, with the content dependent on the session book or theme. For example, during the second sessions in which the storybook used was the *Three Billy Goats Gruff*, construction of a paper plate goat mask became the activity in which the VCS was utilized. Sam was presented with a completed example of the mask then shown the VCS with the step-by-step sequence of events within the activity included. Each event was taped onto the paper in order accompanied by the transition words: *First, Then, Next, Finally*. Activities completed over the course of the study differed in regards to the number of events in the sequence, varying from 3 to 6 events within a single activity.

Themes:

1. *Three Billy Goats Gruff*
2. *Three Billy Goats Gruff*
3. *Humpty Dumpty*
4. *Hickory Dickory Dock*
5. *Little Miss Muffet*
6. *Chicka Chicka Boom Boom*
7. *Ladybug – Animals/Safari*
8. *Rainbow Fish*

MODERATING VARIABLES

The moderating variables included were elements coded that were not manipulated by the clinician but were variables that may have modified the relationship between the independent variable and the dependent variable. These measures included: the number of Sam's distractive behaviors per minute and the number of clinician redirection attempts per minute. These variables were coded according to the definitions presented in the section "Transcription and Coding." Totals were collected for each variable then divided by the number of total minutes viewed from each session.

DEPENDENT VARIABLE

The dependent variable was the accuracy of the order in which Sam retold the sequence of events from the activity. Prior to conducting the study, a coding system for Sam's responses was created which is discussed in the subsequent section "Transcriptions and Coding."

DESIGN

A case study design was used in this study. The study included three phases: Immediate Retell Using the VCS (*Phase One*), Delayed Retell Using the VCS (*Phase Two*) and Final Data Collection –*Narrative Memory* for ages 3-4 and ages 5-16 (*Phase Three*). During conceptualization and implementation of the study, it was believed Sam had been administered the NEPSY-II *Narrative Memory* during his diagnostic evaluation. It was discovered the subtest was not administered as part of the battery of tests during the evaluation; therefore, no baseline data could be included. The design of the study, less the baseline data, allowed researchers to measure the accuracy with which the participant retold events under two different time conditions; followed by final data to measure possible generalization of retell skills to a narrative retell task.

Phase One- Immediate Retell Using the VCS: Within the first 20 minutes of therapy, Sam and the present adults worked together to complete the activity from the VCS. Immediately following completion of the activity, Sam was prompted with variations of: "Let's talk about what we did so you can tell it to (your teacher or mom) later." The clinician displayed the VCS while using visual prompts such as pointing to the initial step. If Sam did not respond immediately, the verbal prompt, "First we…" was used to initiate the retell process along with additional visual prompts such as pointing to the events on the

VCS. Further prompting and cueing was used as needed to engage and maintain Sam's attention.

***Phase Two- Delayed Retell Using the VCS*:** Sam and the present adults completed the activity within the first 20 minutes of each session. Procedures from *Phase One* were followed through completion of the activity. Following the activity, the parent left the session and Sam was engaged in unrelated therapy tasks for an average of 22 minutes. Following these unrelated therapy tasks, Sam was shown the VCS, then provided with a prompt to initiate the retell. Additional verbal and visual prompts were used if the original prompt did not result in Sam's retelling of events.

Phase Three- Final Data Collection: The subtests *Narrative Memory* for ages 3-4 and 5-16, from the NEPSY-II, were used for final data collection. The NEPSY-II is designed to assess a variety of domains in child development including: Attention and Executive Functioning, Language, Memory and Learning, Social Perception, Sensorimotor, and Visuospatial Processing. Specifically for this study, the subtest *Narrative Memory* was included as the measurement of Sam's ability to retell events from a story presented auditorily.

Due to Sam's compliance and necessary clinician deviations from the standardized testing instruction, a detailed account of testing and Sam's scaled scores have been included in the results.

DATA COLLECTION

Video data collection occurred during individual therapy sessions. During *Phase One*, data was collected beginning from the time Sam entered the session to when he had completed the activity and retell.

During *Phase Two*, Sam was prompted to retell the activity events following an interval of an average of 22 minutes between activity completion and activity retell. During the interim period, Sam was engaged in unrelated activities addressing Sam's additional speech and language therapy goals. Data was collected from the beginning of the session through completion of the activity followed by an additional ten minutes of recording, beginning ten minutes prior to completion of activity retell. Sessions were recorded using a handheld video camera.

Treatment fidelity: Treatment fidelity was maintained within presentation of the VCS with regard to the initial prompting of the activity retell using the VCS. However, the clinician was required to use clinical judgment to maintain Sam's engagement in the activity. Therefore, the number and type of prompts following the initial prompt varied depending on Sam's level of engagement in the activity.

Training for coding consisted of two sessions, each lasting approximately 45 minutes. Upon completion of the second training session, it was believed the additional coder understood and could reliably complete the coding. Review of subsequent coding proved unreliable.

Intra-rater reliability: Coding was completed by the primary researcher twice, with each coding session occurring over two weeks apart. Using a correlation coefficient, intra-rater reliability of coding Sam's distractive behaviors resulted in r=0.96 accuracy and reliability of clinician redirection attempts was r=0.90.

Inter-rater reliability: Inter-rater reliability proved to be inconsistent when coding Sam's distractive behaviors, resulting in r=-0.4 correlation, with a correlation of r=0.99 for redirection attempts by the clinician. The additional coder coded 37.5% of the video sessions. The principal investigator decided not to continue inter-rater reliability coding for distractive behaviors unless coding that required less coder subjective judgments could be

designed. The principle investigator decided to wait until after the initial analysis was completed before pursuing inter-coder training.

TRANSCRIPTION AND CODING

In order to maintain fidelity of the task as a retell task and avoid conflict due to imprecise or unknown vocabulary, accepted responses included statements about the function of the event as well as Sam's pointing to the material upon the VCS or completed activity accompanied by the demonstrative "this" or "that." For example, Sam could point to the piece of paper plate cut out and state, "This." If the function of the piece of plate cut out was to be the ears for the activity, Sam would also be able to state, "Ears" as a correct response. Due to a limited viewing field on the videotape, a clinician summarization of Sam's responses was also used to code the order and events provided by Sam. Subject behaviors and clinician redirection attempts were coded during review of video sessions using the following codes presented in *Figure 1* and *Figure 2*:

Subject Distractive Behaviors	
Physically removing self from activity	Subject removes himself from target activity such as standing, turning away, crawling from activity.
Walking from activity	Subject walks from activity.
Deconstructing	Subject removes part(s) from activity and does not replace item.
Comment	Subject makes comment unrelated to target activity. Comments about previous therapy activities are not included in coding.
Engaging with materials outside target activity	Subject engages in playing with object outside target activity. Engagement with multiple activities is marked individually.

Figure 1 Definition of Subject Distractive Behaviors included in coding.

Clinician Redirection Attempts	
Choice between two options	Clinician offers subject option between two preferred behavior choices.
Acknowledgment of subject behavior	Clinician comments on or models language about the subject's distractive behavior. Includes commenting on what subject is doing or modeling language regarding why or how subject is feeling while engaged in distractive behavior.
Statements	Clinician uses direct statements about desired subject behaviors.
Suggested behaviors	Clinician makes comment regarding desired subject behavior.

Figure 2 Definitions of Redirection Attempts by clinician included in coding.

CHAPTER III

RESULTS

Each session (N=8) was coded for the following: Sam's accuracy in sequencing the events during retell, Sam's distractive behaviors, and clinician redirection attempts. Sam's accuracy in sequentially retelling events was compared with the data related to his distractive behaviors and the clinician redirection attempts.

Question 1: Is the subject able to retell the correct sequence of events in free recall without a visual support?

It was believed that the NESPY-II *Narrative Memory* was administered during Sam's child development diagnostic evaluation. However, this subtest was not included in the battery of tests in his diagnostic evaluation and therefore, it was not possible to conclusively determine whether Sam was able to complete free recall of a sequenced event. Therefore, Sam's parents and supervising speech-language pathologist were consulted prior to initiation of the VCS intervention, at which time it was determined it was highly unlikely Sam would be able to correctly sequence events in a free recall environment. It was observed that when provided the visual support of the VCS, Sam was able to sequence events with 100% accuracy in sequencing events in the first session.

Question 2: Does the subject's accuracy in retelling the sequence of events improve across sessions with greater exposure and experience using the VCS? -

It was hypothesized that Sam's accuracy in sequencing events would increase across sessions as Sam's exposure to and experience with the VCS increased, despite the differing time environments (immediate vs. delayed retell). *Figure 3* depicts Sam's success in retelling the sequence of events over the course of *Phase One* and *Phase Two* using the VCS. *Phase One* is represented by the solid bars, dated 4/1/2013 through 5/1/2013 while *Phase Two* is represented by the patterned bars, dated 6/10/13 through 6/17/13. Sam

maintained 100% success in sequentially retelling events during the first three sessions in *Phase One*, then experienced a decrease in performance for the final two sessions in this phase. During *Phase Two,* Sam began this phase with relative success by sequencing 80% of the activity correctly in the first session; however, Sam experienced a significant decrease in accuracy in the second session (16%). By the final session, Sam achieved 100% success in sequencing events following delayed retell.

Contrary to the original prediction, Sam performed with the greatest consistency and accuracy at the introduction of the VCS intervention, when retell immediately followed activity completion. Since Sam achieved a 100% success rate in the first three sessions, Sam demonstrated that he had the skills for retelling events in sequence when provided the level of support described. However, variability of his subsequent performance indicated that success in sequencing the events of the activity may be related to characteristics other than sequencing skills.

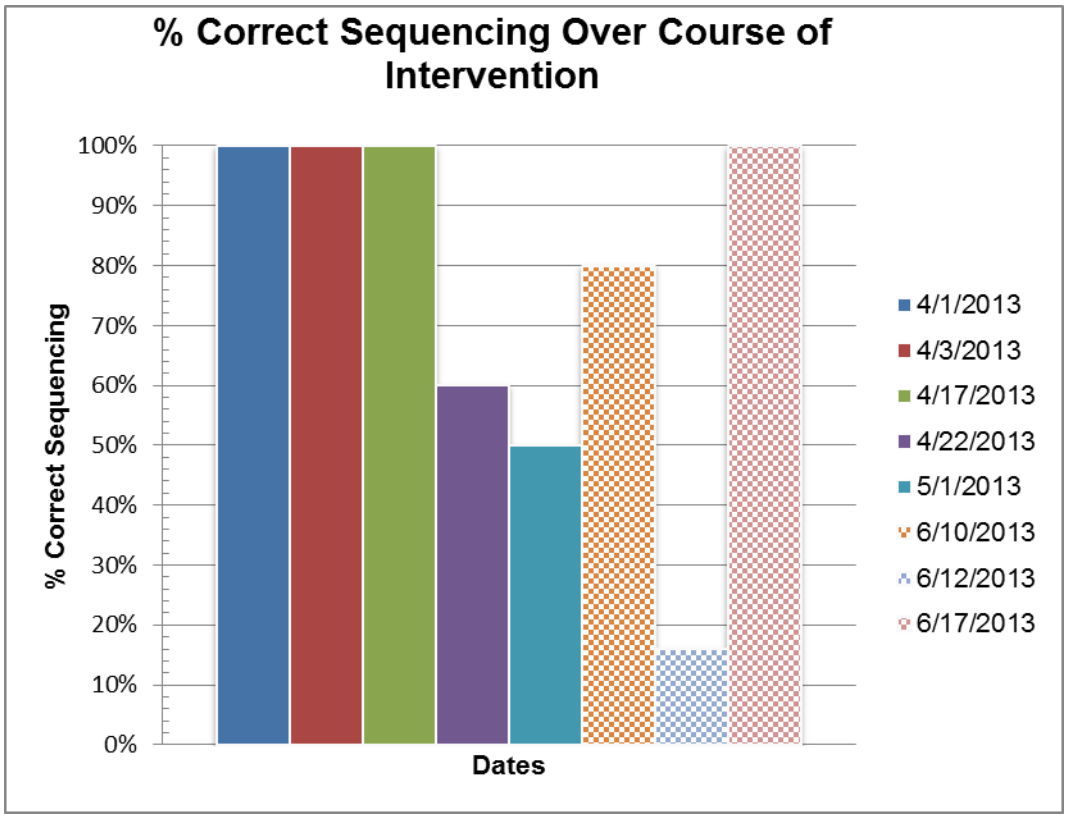

Figure 3 The percentage of event sequence retell in correct order over the course of intervention for Phase One (solid color bars) and Phase Two (hatched color bars).

***Question 3*:** Does an increased number of the subject's distractive behaviors before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events?

Within *Figure 4,* the horizontal axis represents the number of Sam's distractive behaviors per minute while the vertical axis depicts the percentage correct in sequenced event retell. The expected trend line (depicted as a solid black line) refers to the anticipated relationship between the number of behaviors per minute and Sam's success in sequentially retelling the events of the activity. It was predicted that as Sam's behaviors per minute increased, his success in sequentially retelling events would decrease.

Figure 4 depicted below graphically illustrates that as Sam's distractive behaviors increased, his percent correct in sequencing the events increased. This result is exactly opposite to what was predicted.

The number of distractive behaviors varied across sessions, ranging from <0.10 behaviors per minute to >0.68 behaviors per minute. Sam's accuracy in retell also varied, with greatest success achieved (80%-100%) during sessions when distractive behaviors were highest (0.68, 0.65, 0.55, 0.55, 0.52). The linear forecast line represents the positive relationship between the two variables. The data resulted in an r value of 0.80, with $p<0.05$ ($p= 0.01712$) indicating a very strong relationship between accuracy in retell and distractive behaviors. Increases in either variable are related to increases in the other variable.

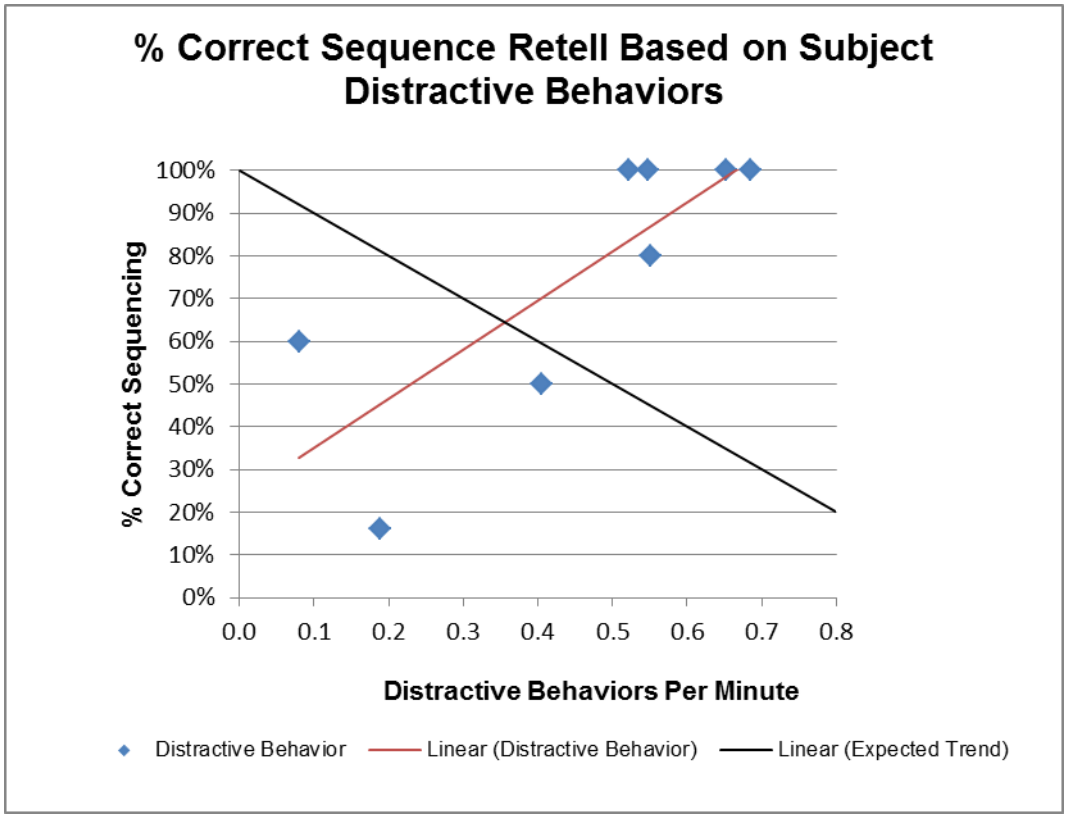

Figure 4 The percentage of events correctly sequenced during activity retell when compared to the number of distractive behaviors per minute; the expected trend line relates to the relationship between the two variables; the linear forecast line.

***Question 4*:** Does an increased number of clinician redirection attempts before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events?

Within *Figure 5*, the horizontal axis represents the number of clinician redirection attempts per minute while the vertical axis depicts the percentage correct in sequenced event retell. The expected trend line refers to the anticipated relationship between the number of clinician redirection attempts per minute and Sam's success in sequentially retelling the events of the activity. It was predicted that as the number of clinician redirection attempts per minute increased, Sam's success in sequentially retelling events would decrease.

Figure 5 presents the data related to the percentage of correctly sequenced events from the activity in relation to the number of redirection attempts by the graduate student clinician. On the 5 days recorded as having the highest number of redirection attempts per minute (1.14, 0.55, 0.52, 0.50, 0.47), Sam consistently produced retells with the greatest level of accuracy (80%-100%). The linear forecast line suggests a positive relationship between the two variables. However, the displayed data correspond to an r value of 0.68 and a $p = 0.0635$ which indicates the result is not significant at $p < 0.05$. Although the correlation did not reach a level of significant $p<.05$, it is approaching significance. If there were more sessions, it is likely that significance would have been reached. Contrary to the apriori prediction, Sam's accuracy in retell did not decrease as the clinician's redirections increased.

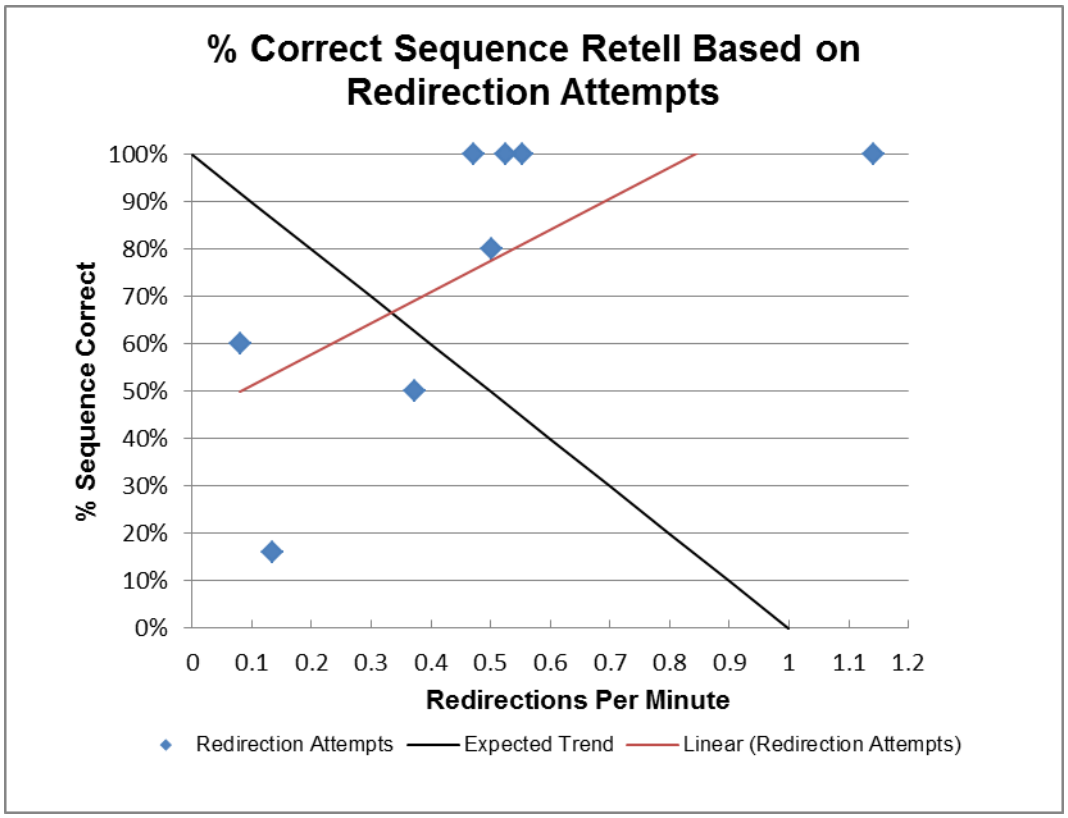

Figure 5 The percentage of events correctly sequenced during activity retell as they relate to the number of redirection attempts per minute; the expected trend line relates to the relationship between the two variables; the linear forecast line.

***Question 5*:** Is there a similarity between the number of subject's distractive behaviors compared to the number of clinician redirection attempts?

Figure 6 compares the number of Sam's distractive behaviors to the number of clinician redirection attempts for each session. In 7 of 8 sessions, the number of Sam's distractive behaviors is equal to or greater than the number of clinician redirection attempts. In the same 7 sessions, the greatest difference between the number of Sam's distractive behaviors and the number of clinician redirection attempts is 0.13 occurrences per minute. In the session dated 4/3/2013, the number of clinician redirection attempts was 95% greater than Sam's distractive behaviors, nearly twice Sam's distractive behavior count.

The findings represented in *Figure 6* are contrary to the initial hypothesis. It was hypothesized that Sam would require a greater number of clinician redirection attempts per each "distractive' behavior with one exception, data collected from the session dated 4/3/2013 (see Discussion for possible explanation).

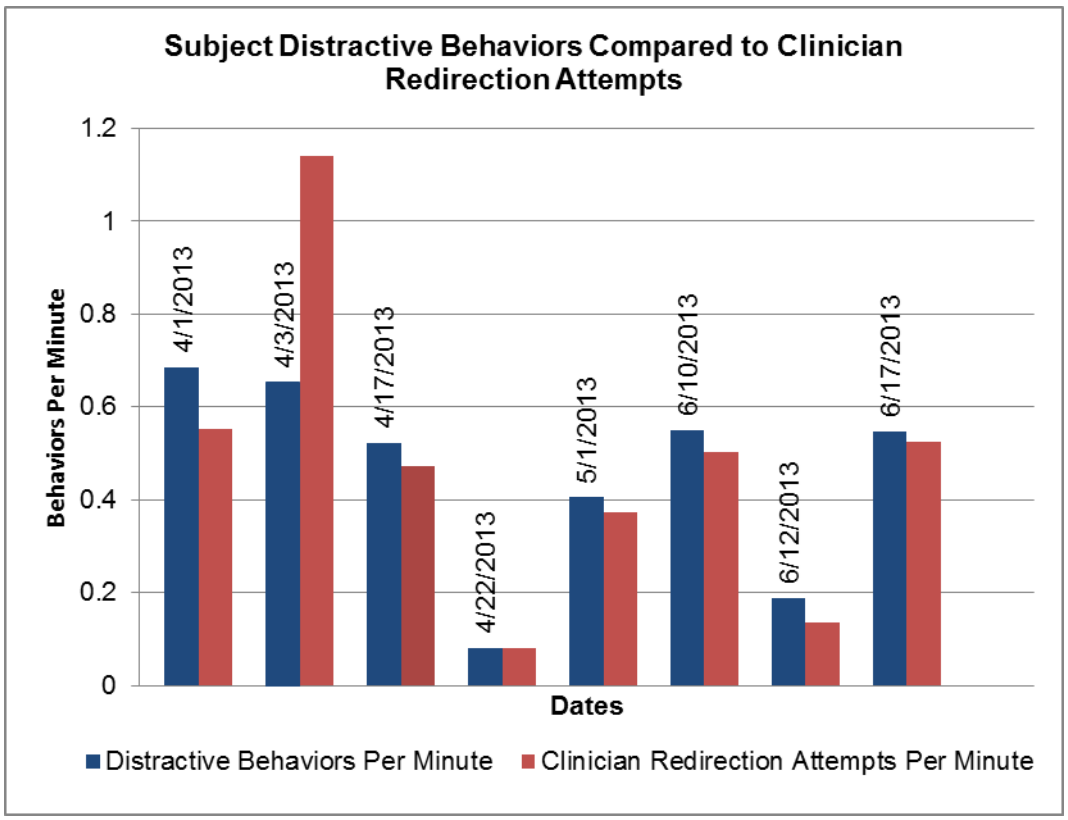

Figure 6 Number of subject distractive behaviors compared to the number of clinician redirection attempts.

ADDITIONAL OBSERVATIONS

Two sessions were not included for coding due to Sam's deviation from the VCS sequence during completion of the activity as it was designed. Deviation from the original sequence as displayed on the VCS did not allow for Sam to utilize the VCS to retell events from the activity. Therefore, these sessions became invalid measures to use in the analysis of Sam's retell as it relates to use of the VCS. Review of the videos provided insight into Sam's motivation and regulation to engage in the session activities. On the video dated

4/24/2013, Sam and his father were engaged in completing the activity as shown on the VCS. During the initial event in the sequence, Sam encountered difficulty with the task, at which time he requested his father assist him. After verbal encouragement, he altered his attempt at the task, but encountered additional difficulties. Following this second challenge, Sam refused to place the remaining events on his character, choosing to place only a select few items in a different order than shown on the VCS.

In the video dated 6/19/2013, Sam entered the room with little energy, slouching and cowering into his father's lap during completion of the activity schedule. He did not engage in verbal interactions, using gestures and noises to interact. Following maximal clinician prompting and hand over hand guidance from his father, Sam continued to resist verbal prompts and suggestions of completing the project with all the elements displayed on the VCS. When prompted to retell the events in the activity, Sam initially acquiesced, but soon became distracted by rolling a ball around the room and did not return to retelling the events despite multiple verbal and visual prompts.

***Question 6*:** Does the subject's ability to retell a sequence of events, as measured by the NEPSY-II, improve following intervention using the VCS?

The NEPSY-II, *Narrative Memory* ages 5-16, was used to collect final data on September 30, 2013. Sam entered the room and began playing with a toy not intended for the session. Sam required minimal prompting to leave the toy so that testing could begin. He sat at the table with his head resting on his hands as he listened to the story presented by the clinician. Following three prompts to elicit the free recall portion of the test, Sam responded with "I don't know" and stated he didn't remember anything from the story. Therefore, the free recall was abandoned and the cued recall began.

During cued recall, Sam enthusiastically responded to clinician questions. Occasionally, Sam volunteered information that was accurate and followed sequentially in

the story. Also during cued recall, the clinician failed to ask one of the test questions. Sam was not provided the opportunity to answer this question, therefore, the scaled score may be slightly lower than Sam could have achieved. Despite his extraneous movements, Sam cooperated in 2 of 3 tasks and appeared engaged and regulated during these sections. He received a scaled score of 8 for the combined subtests Free Recall and Cued Recall. Sam correctly answered 13 of the 15 questions presented on the Recognition Questions portion of the NEPSY-II, ages 5-16. Testing was rendered invalid when testing was interrupted during the Cued Recall section. Therefore, the NEPSY-II *Narrative Memory* ages 3-4, was also administered to obtain reliable scoring.

On October 11, 2013 the NEPSY-II, ages 3-4, was administered. As Sam entered the room, he required multiple attempts to redirect his attention to sit in his chair at the therapy table. Sam was noted as appearing "shy" as he sat down, placing his hands around the bill of his hat and pulling the hat over his eyes. This physical presentation was consistent with Sam being disengaged according to the "Client State Checklist" which will be described in the following section.

As the clinician began testing, Sam's attention continually shifted back to the camera. He played with his hat and frequently reached for the stimulus book. Following presentation of the stimulus picture and initial reading of the short story, Sam was prompted to begin retelling what he remembered from the story. He replied by stating, "I don't want to tell it." Following two more prompts, free recall was abandoned to avoid deviation from the protocol. Therefore, cued recall became the primary measure.

The cued recall portion of the NEPSY-II *Narrative Memory* ages 3-4, consisted of the clinician providing the subject with questions from the story. Sam correctly answered 6 of the 14 questions. Sam correctly answered 9 of 13 questions in the Recognition Questions portion of the NEPSY-II. Scaled scores for the NEPSY-II are derived from combining Sam's

scores from both the Free Recall and Cued Recall. Sam scored within the low average range on the Free Recall and Cued Recall subtests with a combined scaled score of 7.

METHOD: POST HOC ANALYSIS PHASE

The following adaptations were made during post hoc analysis. Study parameters for the administration of the VCS intervention remained consistent with the previous methods except when indicated in the following sections.

AMENDMENTS POST HOC

The following are the questions raised and analyzed in the post hoc analysis.

1. Does the subject's number of events included in retell increase with greater exposure and experience using the VCS?
2. Does an increased number of quality verbal interactions during completion of the activity and activity retell relate to an increase in the number of events included in the retell?
3. Does the number of adult references to "help" correspond to the number of quality verbal interactions produced by the child?
4. Does the subject's ability to retell events within a narrative, as measured by the NEPSY-II, improve following intervention using the VCS?
5. Can a checklist of behaviors be used consistently to identify a subject's state as he begins therapy sessions?

SETTING: CONSISTENT WITH ORIGINAL DESIGN

INDEPENDENT VARIABLE: CONSISTENT WITH ORIGINAL DESIGN

MODERATING VARIABLES: AMENDMENTS POST HOC

Sam's number of quality verbal interactions per minute, and the number of adult references to "help" per minute were included as the moderating variables in the post hoc analysis. These variables were coded according to the definitions presented in the following section "Transcription and Coding: Amendments Post Hoc." Totals were collected for each variable then divided by the number of total minutes viewed from each session.

DEPENDENT VARIABLE: AMENDMENTS POST HOC

The dependent variable was the total number of events included in the retell. Prior to conducting the study, a coding system for Sam's responses was created which is discussed in the subsequent section "Transcriptions and Coding: Amendments Post Hoc."

DESIGN: CONSISTENT WITH ORIGINAL DESIGN

DATA COLLECTION: AMENDMENTS POST HOC

Data collection only included Sam's engagement in the activity and activity retell and did not include time prior to the activity that included the VCS. Therefore, data collection began as the clinician prompted Sam to begin the activity involving the VCS. During *Phase One*, coding was discontinued immediately following the activity retell. During *Phase Two*, data collection ceased immediately following completion of the activity. Collection was resumed as the clinician prompted Sam to begin the activity retell then ceased after Sam provided the final event in the retell.

Phase One-Immediate Retell Using the VCS: Data was collected from the beginning of the target activity using the VCS, through completion of the target activity event retell.

Phase Two-Delayed Retell Using the VCS: Data was collected from the beginning of the target activity to completion, then again during event retell at the end of the session. Sessions were recorded using a handheld video camera.

Indications from the previous coding were rendered invalid potentially in part due to decreased understanding on the part of the additional coder. Therefore, post hoc training for coding was increased to approximately 3.5 hours, over 2 sessions. Training for the second coding set involved discussion of the coding rules, as well as review of 2 videos in which the VCS was implemented but could not be included in the results due to Sam's deviation from the VCS.

Intra-rater reliability: Using a correlation coefficient, intra-rater reliability for the subject's quality verbal interactions was r=0.99 and intra-rater reliability of number of adult references to "help" was r=0.95.

Inter-rater reliability: Inter-rater reliability for coding included 100% of the video sessions. Correlation coefficient for Sam's quality verbal interactions was r=0.99 and r=0.81 for adult references to "help."

TRANSCRIPTION AND CODING: AMENDMENTS POST HOC

The acceptable responses procedure remained consistent with the previous response coding system included in the original design. The following moderating variables were reviewed during post hoc analysis.

Quality verbal interactions (QVIs) and adult references to "help" were coded using the following guidelines in *Figure 7* and *Figure 8:*

Subject's Quality Verbal Interactions	
Questions	Request information regarding the activity, materials within the activity, whether something is correct, or where an item is within the room.
Want/Need	Expresses a want or a need including requests for help.
Reference	Subject refers to outside experience or concept while discussing elements/materials from session.
Instructional Statements	Subject provides explanation on how to accomplish task; subject explains materials necessary to accomplish a task.
Offers help	Subject states or suggests he will help the adult complete a task.

Figure 7 Definition of Subject's Quality Verbal Interactions included in coding.

Adult References to "Help"	
Suggesting help	Adult suggests subject assist in completing a task. Phrases including "show him/her," "show me," or "help" should be included.
Requesting help	Adult requests help in completing a task; adult asks subject to clarify or remark if something is correct; adult asks child to demonstrate how to complete a task.
Offers help	Adult offers to help child complete a task.

Figure 8 Definitions of Adult References to "Help" included in coding.

RESULTS: POST HOC ANALYSIS PHASE

The following results relate to the post hoc analysis. The number of sessions reviewed is consistent with those viewed in the previous results section.

Within the post hoc analysis, the number of Sam's quality verbal interactions (QVIs), and adult reference to "help" were observed and calculated. The accuracy of total

events recalled was compared with the coding for Sam's number of QVIs and the adult references to "help."

Question 1 post hoc: Does the subject's number of events included in retell increase with greater exposure and experience using the VCS?

Figure 9 illustrates Sam's percentage of events included in the activity retell over the course of both *Phase One* and *Phase Two*. *Phase One* is represented by the solid bars, dated 4/1/2013 to 5/1/2013, while *Phase Two* is represented by the patterned bars, dated 6/10/2013 to 6/17/2013. Sam experienced the most consistent success during the initial intervention phase, producing 100% of events in an activity in 4 of 5 opportunities. During the final session of *Phase One,* Sam experienced a decrease in performance level, producing 50% of the items in the activity retell. Sam performed at a high level in *Phase Two* of intervention as well, producing a minimum of 80% of items across all sessions, with highest marks reaching 100%. Although Sam did not produce 100% of events in all sessions, he consistently performed well in both phases for event inclusion with the exception of the single outlier.

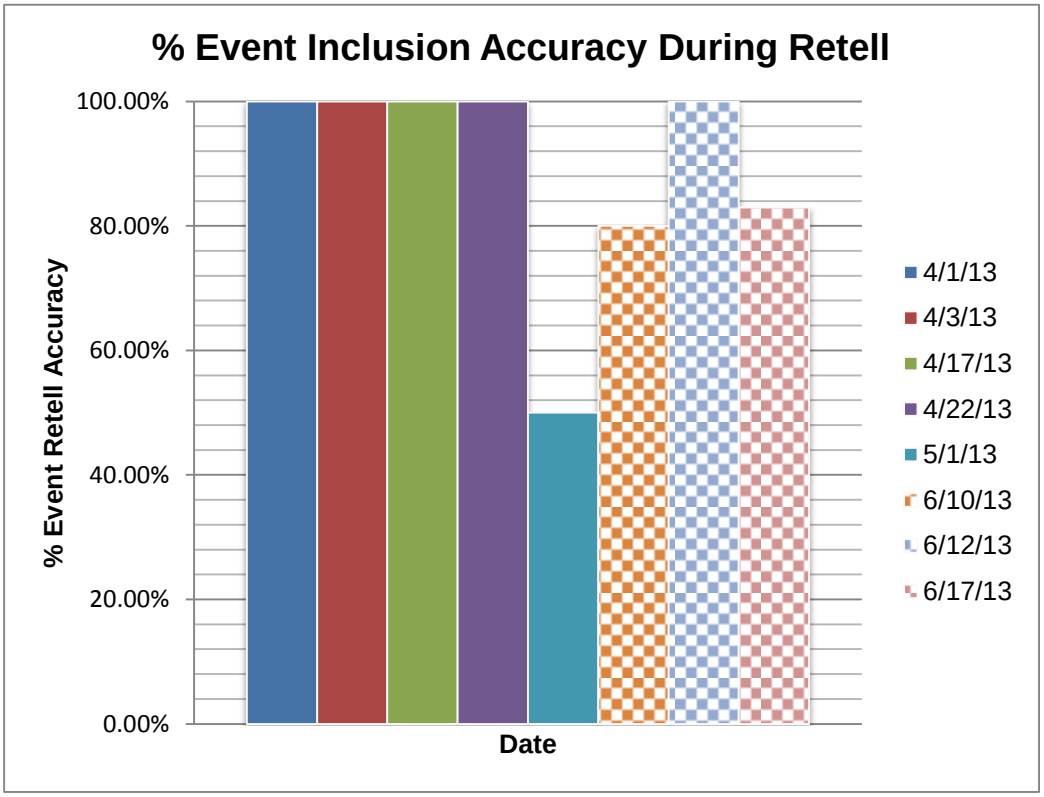

Figure 9 The percentage of events included in retell over the course of *Phase One* and *Phase Two* of intervention.

Question 2 post hoc: Does an increased number of quality verbal interactions during completion of the activity and activity retell relate to an increase in the number of events included in the retell?

Figure 10 illustrates Sam's percentage of events included in retell in relation to his number of QVIs per minute. Sam achieved 100% success in 5 of 8 sessions. Each session in which he included 100% of events correlates with 5 of the 6 highest number of Sam's QVI per minute (2.98, 2.17, 1.99, 1.77, 1.60). In two sessions, despite a decrease of nearly 50% from his average QVI of 1.73 (0.88, 0.51), Sam maintained a high degree of accuracy in event retell (83%, 80% respectively). In a single session, Sam produced the fourth highest number of QVI (1.97), but included the lowest number of events in retell (50%). The linear forecast line indicates a positive relationship between the two variables. However, the

relationship was r=0.28, indicating a weak relationship between these two variables. The p value of 0.501 indicates that the correlation did not reach a level of significance p<.05. Thus, the data from these sessions indicate that no true relationship or a very weak relationship exists between Sam's QVIs and his success in event retell. When the outlier session of 50% event inclusion is removed from the data, r=0.84 with a p value of 0.018. This suggests the possibility of a positive relationship between the two variables.

Due to the limited number of data points collected, a single outlier will have an increased effect on the statistically reported relationship between two variables. As the remaining 7 sessions suggest a strong positive relationship, the single outlier should be interpreted with caution.

It is interesting to consider the relationship suggested by the remaining 7 of 8 sessions. This representation may be the more appropriate interpretation of results as the occurrence of Sam's success with higher QVIs far exceeds that of the single session in which Sam struggled. The r=.84 with a p=.018 indicates an extremely strong relationship between these variables when the single outlier is not included in the analysis.

With the single outlier removed, the data indicates there is a strong relationship between the number of Sam's QVIs and his success in retelling the events from the activity. This finding supports the hypothesized effect that there is a positive relationship between the number of QVIs and Sam's success in event retell.

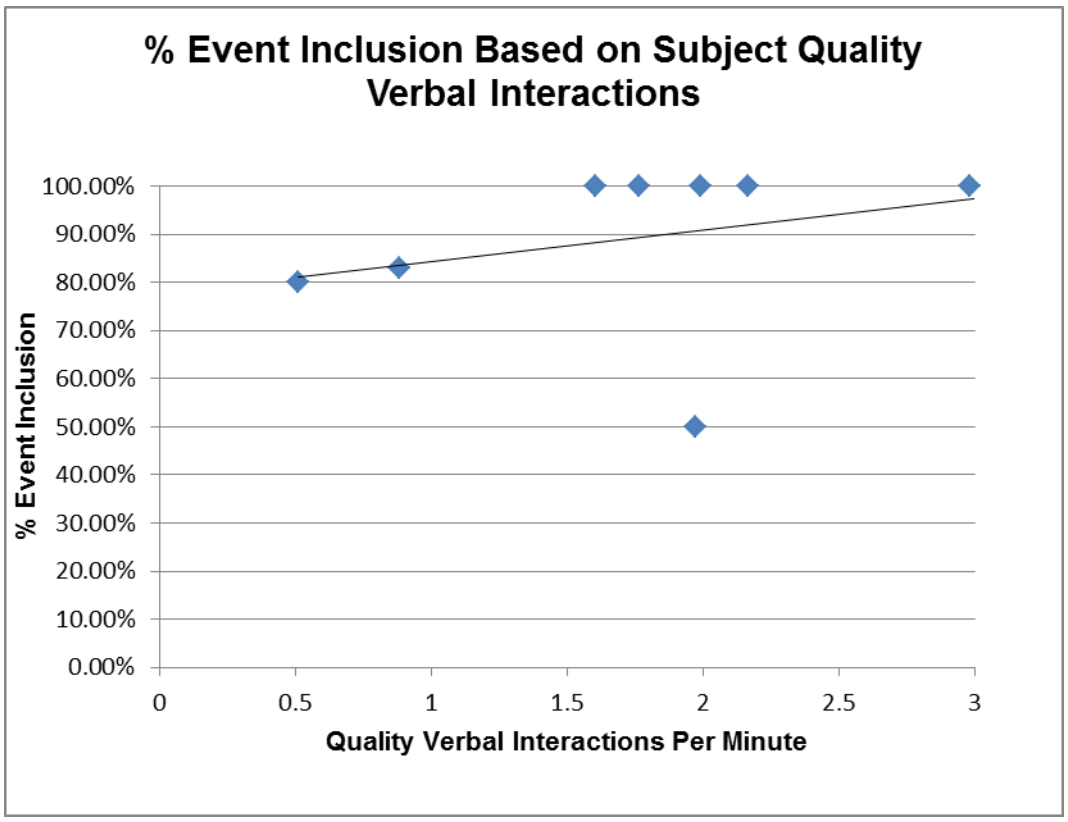

Figure 10 The percentage of events included in activity retell in relation to the number of subject quality verbal interactions.

***Question 3 post hoc*:** Does the number of adult references to "help" correspond to the number of quality verbal interactions produced by the child?

Figure 11 represents the number of subject QVIs as they correlate to the adult references to "help." In 6 of 8 sessions, the adult references to "help" occurred below a single occurrence per minute, but varied in frequency from 0.3 to 0.89 occurrences per minute (average 0.66 per minute within the 6 sessions). In the remaining 2 sessions, the adult references to "help" increased to 1.49 and approximately 2 occurrences per minute. Despite variation in adult reference to "help," Sam's frequency of QVI remained consistently within 1.60 and 2.17 in 5 of 8 sessions. In the remaining 3 sessions, Sam produced "uncharacteristically" low and high frequency QVIs. During the sessions of low QVIs, the adult references to "help" varied in frequency from 0.63 to 0.89 occurrences per

minute. On the day in which Sam produced an uncharacteristically high number of QVIs (2.98), the adult reference to "help" was also uncharacteristically high (2.1). The data presented have an r= 0.45 and a p value of 0.263 indicating that there is a moderate relationship that did not reach a level of significance p<.05.

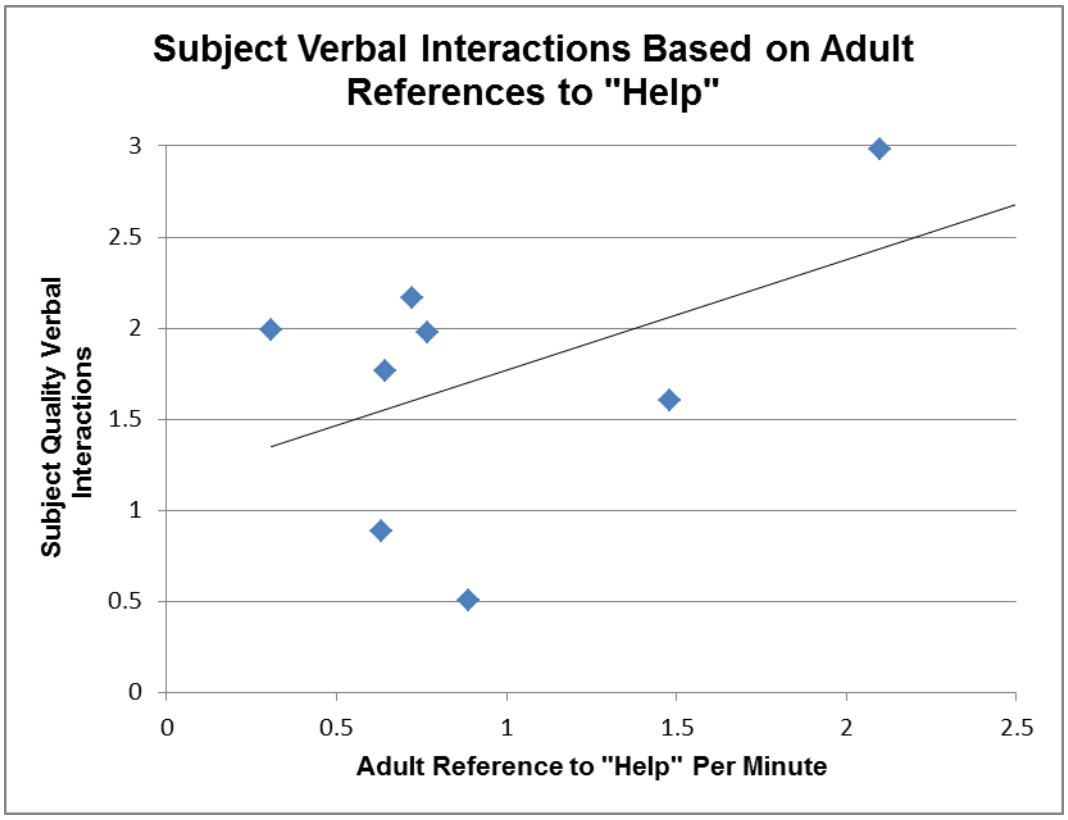

Figure 11 The number of subject quality verbal interactions as they relate to the adult references to "help."

***Question 4 post hoc*:** Does the subject's ability to retell events within a narrative, as measured by the NEPSY-II, improve following intervention using the VCS?

Measures were reviewed according to original results of the NEPSY-II in the original design. The task of retelling specific details/events from the story relates to the Cued Recall section of the NEPSY-II *Narrative Memory* subtest. Refer to Question 6 in the original design for an account of Sam's performance on the NEPSY-II *Narrative Memory,* ages 3-4 and 5-16.

Question 5 post hoc: Can a checklist of behaviors be used consistently to identify a subject's state as he begins therapy sessions?

During review of the videos, Sam was observed to enter the sessions in varying states of physical appearance and overall responsiveness to clinician and parental interactions. Sam appeared to enter into sessions in one of two states; either he entered and appeared regulated and ready to participate, or he entered and required significant amounts of time and assistance from the adults in the room to become involved in the session. The states were labeled as "regulated" and "disengaged" respectively.

For the present study, a checklist was created relating to Sam's physical and verbal responsive state as he entered the room. The following is a list of the observations made regarding his state during the first three minutes of each session. If Sam engaged in behaviors in both categories, he was considered to fall into whichever category had more noted behaviors:

Client State Checklist

Regulation	Disengaged
Subject asks questions about/comments on environment	Subject sits in mom/dad's lap during schedule and/or activity
Subject interacts with elements in the room	Subject uses sounds/gestures to communicate rather than words
Subject engages clinician and/or parent in verbal interactions	Subject appears to be slouching and uses items from home to put in front of his face
Subject participates physically and verbally in completion of visual schedule	Subject has little involvement or uses little language while creating visual schedule

Figure 12 Behaviors that determine Sam's state by watching the first 3 minutes of each session.

The “Client State Checklist” provided a way to gauge Sam’s mood and willingness to participate in session activities. It is on the days when Sam entered and was noted as “disengaged” that he was more likely to refuse activities and required prompting and encouragement to participate. During coding, inter-rater reliability was 88% with regard to recognizing Sam’s state during the beginning of sessions.

CHAPTER IV

DISCUSSION

LIMITATIONS

The initial purpose of this study was to explore the clinical application of a VCS intervention used with a child with FAS in retelling events from a previously completed activity. However, the absence of baseline data on the NEPSY-II for the free recall or cued recall situation prior to initiation of the VCS intervention precluded the possibility of determining the effect of the VCS on Sam's retell. Without the baseline data, it was impossible to determine whether Sam had the ability to tell an event correctly in a sequenced order and the VCS simply helped him display a skill he already possessed, or whether he learned to retell an event because of the VCS intervention and generalized this skill to a cued recall situation after the intervention was completed.

The first limitation was the inability of the results to be generalized to the population of individuals diagnosed with FAS due to the single case study design. Although the child presented in this study experienced challenges characteristic of children with FAS, the profile of each child with this diagnosis is unique. Therefore, the results relating to a 5 year old child with FAS may look very different from another 5 year old child with FAS. Future research must include a larger population sample, varying across age and learning profiles in order to generalize results to the population of individuals with FAS.

The next limitation to the present study was the limited number of sessions included for coding. Although results from the study suggested trends between variables, no conclusions could be made regarding relationships between these variables. A reduced number of data points resulted in a statistical power issue, meaning that the results from this study may not represent a significant effect based on the intervention. Therefore, a lack of significance does not necessarily mean that a strong relationship between two

variables is not present, only that the number of sessions was not sufficient to demonstrate a significant relationship.

In order to explore the effects of a VCS used with individuals with FAS, an ABAB study design may prove more advantageous in determining a relationship between variables. However, since the child's state was highly related to Sam's motivation to engage in the intervention, an ABAB design without consideration of child state may result in inconclusive findings. Future research must include a significantly larger sample size as well as an increased number of sessions reviewed in which the VCS can be implemented. Inclusion of a baseline and subsequent testing following intervention within the ABAB study design would provide a more meaningful set of data for interpretation of effect of the intervention.

. Beyond the limited number of subjects and data collected, the study was limited by the procedural implementation by the graduate student clinician. Variations in execution occurred for two reasons. First, the clinical environment in which the intervention was implemented occurred within and were influenced by the parameters of the ongoing therapy session. Therefore, deviation and adjustments were made to the procedure throughout the intervention activity to support Sam's engagement in completion of the activity. Furthermore, as Sam was receiving intervention for speech and language services beyond the use of the VCS, implementation of the VCS was frequently influenced by the additional therapy activities or techniques involved in meeting Sam's therapy goals and objectives.

Next, procedural codes and definitions were not created until after implementation of the VCS had begun. This resulted in variations of acceptable prompts, responses, as well as number and type of additional visual and verbal supports allowed during the activity and activity retell. Flexibility in the procedural codes also resulted in difficulty creating

definitions for the variable codes included in this study. Ultimately, the retro-fitted coding impacted the inter-rater reliability for the initial moderating variable, "Subject distractive behaviors," as well as the post hoc moderating variable, "Adult references to help."

Similarly to errors in procedural and coding definitions, human error was a significant limitation to the present study. With regards to the inter-rater reliability, the principle investigator did not allocate enough time and resources to teaching the additional coder the definitions and expectations for the coding set analyzed prior to the post hoc analysis. This was a factor in poor reliability for Sam's distractive behaviors. Additionally, despite efforts to make coding detailed and defined to eliminate the possibility of interpretation of behaviors, it is difficult to remove all elements of interpretation, particularly when examining human behaviors.

Finally, limitations arose as a result of technical difficulties involved with the video recordings. The first limitation occurred when equipment failed and required a transition to new recording equipment and ultimately a lapse in time in which data could be collected. Also, though convenient and mobile, the video cameras used throughout sessions did not accommodate a larger viewing field. This reduced the amount of information that could be gathered from the visual field. Furthermore, despite efforts to adjust viewing to Sam's movement around the room, his frequent movements also resulted in reduced viewing availability.

Despite the limitations present in the current study, a great deal of information has been gathered surrounding the study subject that will support his parents and future clinicians in providing him quality services. Furthermore, the procedural and coding limitations of the study required the principle investigator to expand and explore different variables and interpretations, ultimately resulting in the post hoc procedure and analysis of the present study. Therefore, although the limitations presented challenges in reliability

for the current study, the post hoc analysis resulting from these limitations led to new understanding and interpretations of the study subject.

STUDY QUESTIONS

Question 1: Is the subject able to retell the correct sequence of events in free recall without a visual support?

As a result of the lack of the baseline NEPSY-II scores, there was no way to conclusively determine if Sam was able to retell the correct sequence of events in free recall without the use of a visual support prior to intervention using the VCS. However, based on parent and clinical supervisor report, Sam was likely unable to complete a sequencing task without maximal visual and verbal support.

Question 2: Does the subject's accuracy in retelling the sequence of events improve across sessions with greater exposure and experience using the VCS?

Results from the study indicate Sam did not experience greater success across sessions with greater experience and exposure to the VCS. This finding was the opposite of what was hypothesized. As indicated by Sam's success with sequenced event retell within the first 3 sessions (*Figure 3*), Sam was able to complete a sequenced retell immediately when provided the support of the VCS. Success with the VCS early in the intervention presentation may suggest Sam did not require a greater amount of exposure to successfully access and utilize the VCS. It is possible Sam had the skills to retell events but had difficulty demonstrating this ability. Based on reports regarding Sam's challenge in retelling a sequence of events, success early in the intervention phase may suggest the VCS was a highly successful intervention technique. However, the variability in his performance in subsequent sessions indicates there are likely additional moderating variables to consider when exploring his use and success with the VCS.

***Question 3*:** Does an increased number of the subject's distractive behaviors before and during the activity and retell impact the subject's accuracy in using a VCS to verbally sequence events?

Results from this study suggest the relationship between the number of Sam's distractive behaviors as they relate to successfully sequencing events, was opposite to what was hypothesized (*Figure 4*). Sam's distractive behaviors did not appear to reduce his accuracy in retelling events, but rather may have supported his success in retell based on the principle investigator's revised interpretation of the behaviors following the initial analysis. Several factors must be taken into consideration when reviewing these results.

First, there is a high incidence rate of comorbidity between FAS and ADHD (Streissguth, Barr, Kogan, & Bookstein, 1996). For children impacted by ADHD, self-regulatory behaviors may appear as distractive such as looking about the room, engaging with outside materials, etc. However, these behaviors may be the individual's way of regulating and calming his/her mind while remaining engaged in the intended activity. Although Sam does not have the diagnosis of ADHD, it cannot be conclusively ruled out that a portion of his "distractive" behaviors may have been the result of ADHD or ADHD-like attention difficulties. If a fraction of Sam's behaviors occurred as self-regulatory behaviors, it is likely these behaviors would have supported Sam's engagement and success in retell. Therefore, these behaviors would help to explain the results disproving the original hypothesis that the number of "distractive" behaviors would hinder Sam's success in sequenced retell.

Next, the amount of session time reviewed for coding both Sam's and the clinician's behaviors was significantly longer than the time involved in completing the activity and activity retell. The purpose of the extended time was to explore the possibility that Sam's regulation throughout the session may have impacted his overall success in the target

activity. Therefore, behaviors that occurred several minutes before involvement in the activity and activity retell were included in the results. Children with complex profiles such as those seen in individuals with FAS have a difficult time engaging in self-regulatory behaviors. During sessions, Sam was observed to engage in what was believed to be distractive behaviors and then become engaged again in the target activity shortly thereafter. Sam seemed to fluctuate between states of regulation and distractive behaviors. His state of regulation as measured prior to the activity or activity retell may have fluctuated to an alternate state by the time of either the activity or activity retell. Therefore, these behaviors may have had little or no effect on Sam's success in activities, which took place later in the therapy session. In the event these behaviors did not impact following session activities, Sam would have performed with the same amount of success regardless of his behaviors prior to the activity retell. Therefore, inclusion of these behaviors may have skewed the data to appear as if there were an increased number of "distractive" behaviors, ultimately indicating a relationship between these two variables that did not exist.

Further consideration must be made regarding the definitions used in coding the "distractive" behaviors. In the initial coding set, distractive behaviors were considered any time Sam physically removed himself from the activity, made a comment that was irrelevant to the activity, deconstructed part of the activity, or engaged with materials outside the target activity. Upon further review, it was determined that the code for the "distractive" behavior labeled as "comment" included two behaviors (irrelevant comments and references) that may have had a positive effect on Sam's quality verbal interactions. On multiple occasions, Sam referred to one of the events within the VCS as an object he had previous experience with outside the therapy setting. Initially, this behavior was considered distractive, believed to detract from his focus on the VCS activity. However, as

Baker-Ward, Ornstein, and Principe (1997) suggest, an individual's encoding and understanding of an experience is facilitated in part by reference knowledge or experiences (as cited in Haden, Ornstein, Eckerman, & Didow, 2001, p. 1016 & 1028). This prior knowledge allows the individual to make sense of the novel experience and ultimately may assist in encoding it in a coherent manner. Based upon this theory of the importance of incorporating prior knowledge, it is likely Sam's references were important to his experience and overall understanding of the session activity.

Secondly, comments made that were irrelevant to the activity were also included in "distractive" behaviors. Following review of the videos, several comments included in the coding were instances when Sam requested more information regarding the clinician or an item from the room. Originally, these behaviors were considered distractive under the principle investigator's belief that they drew Sam's attention away from the VCS activity. In actuality, it is possible Sam's comment's unrelated to the activity itself may have also added a qualitative element to Sam's verbal interaction. In one instance, Sam asked the clinician why she was wearing band aids on her fingers. Although irrelevant to the task, Sam noticed the band aids while the clinician was presenting new materials. Rather than presume this behavior was off task, it may have been Sam's way of indicating he was available and ready to be engaged in a joint interaction.

As comments and references to outside experiences added a qualitative element to Sam's verbal interactions, the term "distractive" behaviors was believed to be a misnomer. Therefore, these behaviors were later included in the coding for QVIs. Inclusion of these interactions as "distractive" behaviors may have led to the perceived positive relationship between the "distractive" behaviors and the success in retell. Inclusion of these comments would have skewed the results to indicate more "distractive" behaviors than had actually occurred. An increase in the number of distractive behaviors than actually occurred would

suggest a higher number of behaviors than occurred in the session. In actuality, the number of distractive behaviors was likely much lower than indicated on the days when Sam experienced greater success.

***Question 4*:** Does an increased number of clinician redirection attempts before and during the and retell impact the subject's accuracy in using a VCS to verbally sequence events?

A goal of this study was to investigate whether a greater number of clinician redirection attempts resulted in a decrease in overall success in sequence retell. After reviewing the data, no true relationship, positive or negative, could be determined between the two variables. It is likely the number of sessions included in data collection were too limited in number. With a limited number of data to consider, a single outlier from the data collected would have reduced the correlation of the two variables.

***Question 5*:** Is there a similarity between the number of subject's distractive behaviors compared to the number of clinician redirection attempts?

It was believed that the greater number of redirection attempts indicated a greater degree of dysregulation for Sam. However, review of *Figure 6* indicates the relationship between Sam's behaviors and clinician redirection attempts was nearly a 1-to-1 relationship; in 7 of 8 sessions Sam required a single redirection for every distractive behavior in order to refocus in the desired behavior.

Based on the data collected from 4/3/2013, the clinician utilized a significant amount more redirection attempts than the number of subject "distractive" behaviors. This may indicate Sam engaged in perseverative behaviors and required multiple redirection attempts to refocus. Another consideration is the clinician utilized the redirection attempts in conjunction with one another and therefore, produced a higher frequency of redirection strategies than were necessary. The small data set does not provide another example of a

date when the clinician utilized several redirection attempts. Therefore, it is possible that Sam required a single redirection to refocus on the target task. Future research may explore the possible relationship of the Sam's state of dysregulation in relation to the number of redirection attempts by the clinician.

Finally, during review of the sessions coded for the number of clinician redirection attempts, additional observations revealed that many of Sam's distractive behaviors were preceded by the clinician's rejection of or redirection attempt regarding a request or preference made by Sam. It is possible that Sam experienced challenges in transitioning or shifting from engaging in his desired behavior to a behavior suggested by the clinician. These observations are consistent with the EF challenges faced by individuals with FAS. Future research may aim to explore the events that precede moments of dysregulation in individuals with FAS, as well as possible interventions to promote self-regulated transitions for individuals with FAS.

***Question 6*:** Does the subject's ability to retell a sequence of events, as measured by the NEPSY-II, improve following intervention using the VCS?

The final data collected from the study could not be used to indicate generalization of skills in retelling a sequence of events as Sam did not participate in the Free Recall portion of the *Narrative Memory* subtest. This section of the subtest requires the participant to recall a series of events based upon an open ended prompt with minimal visual and verbal support. This task requires the participant to recount the events as he/she remembers them in a sequential order. As Sam declined to participate in this portion of the testing, it cannot be determined that Sam generalized the skills required for sequentially retelling events using a VCS.

Sam's unwillingness to participate in this subtest was consistent with reports that Sam struggled to retell events from his day. The expectations and structure of this subtest

are much like those one would experience when asked to retell a previous event. In each of these environments, the expectation is set that the individual is to recall the events from the experience. He/she is then expected to organize the events into the appropriate order and then produce the language necessary to recount the event. It is possible Sam had a difficult time engaging in language tasks that involve high degrees of pressure and expectation, and require a significant amount of higher level mental processes. This may explain his challenge and unwillingness to participate in such tasks. Interestingly, Sam was successful and willing to engage in sequenced retell tasks when provided the visual support of the VCS. Therefore, future research may look to explore the impact of fading the VCS over time and the increased willingness of participants to engage in higher pressure language sequencing tasks.

ADDITIONAL CONSIDERATIONS

During the sessions in which both Sam and his father were creating their own projects, the tasks appeared to become a joint experience and provided Sam's father ample opportunities to request help. This allowed Sam to be in a role of "shared control" of the situation in which he was the "expert" assisting his father. Joint interactions may also be an important factor impacting Sam's success in engagement and motivation in activities. On the day in which Sam performed at 50% during event retell, Sam appeared to perseverate on the completed activity during retell. It is possible that had his father or the clinician removed the item from his hands and began to discuss it as a joint interaction, Sam would have produced more events in his retell.

DISCUSSION: POST HOC

The following sections relate to the discussion of the post hoc analysis. Within this additional analysis, 5 questions were raised and are discussed below.

STUDY QUESTIONS: POST HOC

Question 1 post hoc: Does the subject's number of events included in retell increase with greater exposure and experience using the VCS?

Based on the results from the study, Sam experienced a greater amount of success in including events from an activity when using the VCS when compared to his ability to sequence events using the VCS. Sam experienced 100% success in event inclusion within the first 4 of the 5 sessions in *Phase One*, suggesting the possibility of an immediate effect of the VCS. Sam also experience a relatively high level of success in all sessions included in *Phase Two* of the intervention, suggesting the VCS intervention strategy may prove useful for delayed retelling of events. Within the sessions when Sam produced 80% and 83% accuracy in retell, Sam required a significant amount of verbal prompting to become engaged in the activity retell, specifically requiring the clinician to provide the first event within the activity retell. It is in these sessions where the influence of the uncontrolled therapy environment appeared to impact Sam's success in retell. He required maximal cuing to become engaged in the activity retell. Therefore, alteration in the procedural expectations, changing from immediate retell to retell requiring a transition resulted in inconclusive evidence regarding the success in utilizing the VCS to retell events across sessions.

***Question 2 post hoc*:** Does an increased number of quality verbal interactions during completion of the activity and activity retell relate to an increase in the number of events included in the retell?

Review of the limited number of sessions indicated there is not an observable relationship between the number of Sam's QVIs and his overall success in the number of events included in the activity retell from the target activity. However, as previously discussed, the limited number of data collected resulted in the possibility of a single outlier skewing the entire data set. Therefore, if the single data point in which Sam included the least number of events in retell is removed, there appeared to be a strong positive relationship between QVIs and Sam's success in retelling events within a target activity ($r=0.84$). The sessions in which Sam achieved 100% retell of events occurred on the days when he produced at or above 1.5 QVIs per minute. It appeared that approximately 1.5 QVIs may have been a threshold, at which time Sam was able to accurately retell all the events within the target activity. The exception to this observation was the single day in which he scored 50% of activity retell when producing 1.79 QVIs per minute. With the exception of this single day, one hypothesis is that a minimum of 1.5 QVIs per minute indicated Sam was regulated throughout the activity and allocated a significant amount of cognitive resources to the target activity. Based on this theory, it is possible the greater Sam's cognitive involvement in an activity, the more likely he is to include all events in the activity retell.

Results from the present study only take into consideration verbal interactions that were defined as "quality" interactions. Hence, the results do not reflect Sam's overall involvement in an activity, both verbally and physically. The interactions included in the coding for QVIs were considered higher levels of processing such as recalling and associating unrelated outside experiences to the target activity. Therefore, additional forms of verbal interaction such as Sam commenting on what he was doing, or what he saw others doing, were not taken into consideration in the results. One question raised by excluding these other forms of verbal and nonverbal interaction is, is it truly the use of higher level

language interactions produced by the child that relates to his success, or is it possible that overall verbal and nonverbal involvement leads to greater success in event retell?

Another consideration surrounding this level of verbal involvement from Sam is the anticipated verbal interaction from the adults in response to his participation. Observations revealed that the more frequently Sam produced quality verbal interactions, the greater number of joint interactions and verbal exchanges experienced between Sam and the adults in the room. This increased level of conversation and engagement may have influenced Sam's understanding of the experience and emphasized salient details from the experience (Haden et al., 2001). Results from Haden, Ornstein, Eckerman, and Didow (2001) suggest there are significant benefits to children as young as two and a half years old in engaging in mother-child conversations surrounding "events in the here and now" (p. 1027). According to Haden, Ornstein, Eckerman, and Didow (2001), a significant difference was observed in the number of details recalled from novel events that related to jointly discussed events as opposed to details talked about only by the mother. Therefore, it is possible that the greater number of quality verbal interactions produced by Sam resulted in a greater number of child-adult joint conversations. Additional research is needed to explore the effect of the number and type of child-adult interactions during events and the effect on the child's success in recalling and retelling events.

Ultimately, the purpose of this study was to investigate the relationship between the previously mentioned variables and Sam's ability to retell events utilizing a VCS. However, retelling of an event using a visual support reveals only a portion of Sam's comprehension of an event. Additional research is needed to explore the effect of a VCS when combined with verbal interactions and joint experiences on a child's ability to retell and ultimately recall events.

Question 3 post hoc: Does the number of adult references to "help" correspond to the number of quality verbal interactions produced by the child?

Results presented in *Figure 11* indicate no conclusions can be made regarding the effect of adult references to "help" and Sam's quality verbal interactions. One possible reason for this may be the limitation of counting only QVIs as responses to the reference to "help." Based on observations from the video recordings, it appeared Sam engaged with the adults using other verbal interactions or nonverbal responses such as turning to face the adult, manually assisting the adult in the task, etc. Due to the coding definitions, these components could not be included in the results. However, as this became a prominent approach utilized by Sam's father, a detailed account of Sam's verbal and nonverbal responses is including in the following discussion. It is possible the approaches described below may be effective to incorporate into the home and individual therapy environments.

While engaged in the target activity during sessions, Sam's father was frequently successful in engaging him in a joint activity by either directly or indirectly requesting Sam help in completing a task. This approach by Sam's father appeared to shift the interaction from an adult controlled activity to an activity of "shared control." This perception of "shared control" appeared to have an impact on Sam's engagement and motivation to participate. For example, while both he and Sam were working on their own activities, Sam's father might have asked, "Is this how you do it?" or "Show me how you did it." Frequently Sam adjusted his focus to assist his father in the requested task. Although Sam's father did not know it, he appeared to be utilizing his own "intervention" technique of requesting Sam's help in order to engage his son in joint interactions.

Sam frequently responded when presented the opportunity to assist his father or the clinician during the activity. One hypothesis is that Sam felt a sense of control and/or investment in the activity when he was given responsibility in a task. Often, this

opportunity was presented to Sam in the form of a request or suggestion to help in various ways in the activity. The effects of this approach were two fold. First, Sam became engaged and likely felt a sense of "shared control." Second, the adults were able to help focus his attention on desired tasks.

This hypothesis was further observed during a session in which Sam entered the room, noted as "disengaged" according to the "Client State Checklist" previously described. Sam remained verbally nonresponsive and seemingly unmotivated in completing the target activity. While the session activity was being completed, the graduate clinician's supervisor entered the room and requested information about what Sam had been making. Sam's demeanor changed as he appeared to take control the moment the supervisor gave Sam the responsibility of explaining his activity. This interaction, when the graduate clinician's supervisor requested additional information from Sam, became the turning point of his involvement and engagement for the remainder of the session.

The noted observations suggest Sam's motivation and engagement in activities may be partially dependent on his feelings of control and his perceived role/responsibility in the activity. When given a role involving the responsibility of helping and control, Sam may be more likely to verbally engage and participate in joint interactions. Due to the limited number of sessions included in the coding, only the occasion involving the supervisor and an additional occasion involving Sam's father presented itself where Sam was disengaged during the activity. As Sam's father's approach of requesting help was not included in the procedure prior to data collection, this technique was not readily utilized to reengage Sam in the remaining session in which he was disengaged. However, Sam's willingness to help his father during moments of regulation as well as the alteration in his state during the interaction with the supervisor suggests requesting help from Sam during moments of disengagement may be an effective means of reengaging him in on task behavior.

Additional research is necessary to explore the effect of "shared control" and requesting of "help" as a strategy to motivate and engage Sam in activities.

***Question 4 post hoc*:** Does the subject's ability to retell events within a narrative, as measured by the NEPSY-II, improve following intervention using the VCS?

The Cued Recall section of the NEPSY-II, *Narrative Memory* ages 5-16 suggests generalization of skills in recalling details from an event. Based on parent and clinician report, Sam struggled to retell events prior to the implementation of the VCS. Review of the data indicated that during implementation, when provided the visual support of the VCS, Sam was able to successfully include 100% of events in 5 of 8 sessions. Furthermore, Sam experienced a minimum of 80% success in 7 of the 8 sessions.

During collection of final data using the NEPSY-II *Narrative Memory*, ages 5-16, Sam was auditorily presented a story then asked to provide an account of the story. When prompted with questions, Sam performed at age level in providing specific details from the story. Sam's success in recalling events from the auditorily presented story suggests Sam generalized his ability to retell details from an event. Furthermore, Sam recalled events without visual support suggesting memory of the details. Future research may explore possible generalization of skills gained from using a VCS to sequencing events from a narrative. Also, research may explore the possible maintenance of skills over time to sequencing a narrative story after intervention has been discontinued.

Question 5 post hoc: Can a checklist of behaviors be used consistently to identify a subject's state as he begins therapy sessions?

The "Client State Checklist" previously mentioned was specific to the child subject included in the present case study. However, the clinical application of creating similar checklists for future clients may be significant. First, the ability to recognize early in sessions when the client is disengaged or dysregulated would allow clinicians to adjust

plans and activities for sessions immediately. In Sam's case, recognizing when he is disengaged may prompt his clinician to reorder the events in the therapy session to include the activities that allow Sam to have "shared control" towards the beginning in order to promote his engagement. This may prompt the clinician to include activities that are known to promote client engagement. The time taken to add a new activity may prove less time consuming than trying to prompt or motivate the client to engage in the clinician-directed task. Finally, recognizing the client's state, regulated or disengaged, may indicate the amount of success the client will experience on a specific task or within a therapy session. This is suggested when comparing Sam's results on both of the NEPSY-II age level tests.

During administration of the NEPSY-II Narrative Memory, ages 5-16, Sam was recognized as being "regulated" when examined using the "Client State Checklist." During this session, Sam scored in the average range in recalling details from an auditorily presented story. In comparison, the time in which Sam was noted as "disengaged" during testing on the NEPSY-II, age 3-4, Sam scored in the low average range on a test normed for children younger than himself. Although only a single example, quantitative data from each of the NEPSY-II measures indicate state regulation may play a significant role in this individual's success or performance on a task. Additionally, results from the NEPSY-II testing suggest that Sam may be able to produce details from a story at age expected levels when he is regulated and engaged. These findings must be interpreted with caution as this was a single instance in which Sam appeared regulated and performed at age level. Further research is needed to determine the accuracy and generalization of such a checklist, as well as the possible clinical applications of such a tool.

SUMMARY: ORIGINAL AND POST HOC ANALYSIS

There is a growing interest in the area of FAS, however, more research is necessary to understand the effects of prenatal alcohol exposure and identify evidence-based practices that promote support and success for those impacted by this disorder. As the design of the present study did not provide adequate information to answer the initial questions posed, a different study design, such as an ABAB approach, should be utilized for any additional research to provide conclusive evidence of relationships between variables. Despite this limitation to the present study, the results and analysis gathered here add to the literature on possible intervention strategies to use with individuals with FAS.

Despite the limitations to the present study, several results and observations have been reviewed that inspire future research possibilities. First, additional research is needed to explore the importance of incorporating endogenous and exogenous knowledge into experiences as a foundation on which to build understanding and promote encoding of salient details. Within the present study, Sam was noted as referencing prior knowledge and experiences from outside the therapy environment to bolster his understanding of the novel task. Therefore, further research is needed to explore ways of incorporating this higher level skill into the lives of individuals with FAS.

Similarly, the number of joint interactions shared between Sam and the adults in the room and the number of verbal interactions produced by Sam appeared to have an impact on Sam's ability to retell events from the activity and overall engagement and motivation in the task. If a greater amount of cognitive resources are allocated to a task, does this impact the overall quality of the experience as well as the likelihood that the experience will be remembered? Additional research is required to explore how to encourage this involvement in tasks with populations that have different learning profiles than typically developing individuals.

Additionally, Sam was observed to respond consistently to his father's requests for assistance in completing a task. This approach appeared to promote the perception of "shared control." It is possible that "shared control" may prove motivating to a wide range of individuals struggling with self-regulation and motivation. Therefore, further research is needed to explore the effects of this approach to engaging in a joint interaction.

Finally, the use of a "Client State Checklist" within the present study became a reliable tool on which to base Sam's overall state/mood as he entered into individual therapy sessions. To this author's knowledge, the concept of a checklist to gauge a client's state is novel and has yet to be explored. The implications for use of such a checklist are positive, particularly for graduate student clinicians newly entering the experiences of working with clients with varying learning/cognitive profiles. The checklist would assist the novice clinician in immediately assessing the client's physical and emotional state and therefore, promote the clinicians success in immediately modify the clinical experience to promote the child's success in engaging in the intervention session.

BIBLIOGRAPHY

Banda, D. R., & Grimmett, E. (2008). Enhancing Social and Transition Behaviors of Persons with Autism through Activity Schedules: A Review. *Education and Training in Developmental Disabilities, 43*(3), 324-333.

Chudley, A. E., Conry, J., Cook, J. L., Loock, C., Rosales, T., & LeBlanc, N. (2005). Fetal alcohol spectrum disorder: Canadian guidelines for diagnosis. *Canadian Medical Association Journal*, *172,* 1–21.

Dettmer, S., Simpson, R. L., Myles, B. S., & Ganz, J. B. (2000). The Use of Visual Supports to Facilitate Transitions of Students with Autism. *Focus on Autism and Other Developmental Disabilities*, *15*(3), 163–169. doi:10.1177/108835760001500307

Haden, C. A., Ornstein, P. A., Eckerman, C. O., & Didow, S. M. (2001). Mother-Child Conversational Interactions as Events Unfold: Linkages to Subsequent Remembering. *Child Development*, *72*(4), 1016–1031. doi:10.1111/1467-8624.00332

Jones, K. L., Smith, D. W., Ulleland, C. N., & Streissguth, A. P. (1973). Pattern of Malformation in Offspring of Chronic Alcoholic Mothers. *The Lancet*, *301*(7815), 1267–1271. doi:10.1016/S0140-6736(73)91291-9

Kodituwakku, P. W., Handmaker, N. S., Cutler, S. K., Weathersby, E. K., & Handmaker, S. D. (1995). Specific Impairments in Self-Regulation in Children Exposed to Alcohol Prenatally. *Alcoholism, Clinical and Experimental Research*, *19*(6), 1558-1564. Retrieved from www.ncbi.nlm.nih.gov/pubmed/8749827

Kodituwakku, P. W., Kalberg, W., & May, P. A. (2001). The Effects of Prenatal Alcohol Exposure on Executive Functioning. *Alcohol Research & Health : The Journal of the National Institute on Alcohol Abuse and Alcoholism*, *25*(3), 192–8. Retrieved from pubs.niaa.nih.gov/publications/arh25-3/192-198.pdf

Mattson, S. N., Goodman, A. M., Caine, C., Delis, D. C., & Riley, E. P. (1999). Executive Functioning in Children with Heavy Prenatal Alcohol Exposure. *Alcoholism: Clinical and Experimental Research*, 23(11), 1808-1815. Retrieved from www.ncbi.nlm.nih.gov/pubmed/10591598

Murdock, L. C., & Hobbs, J. Q. (2011). Tell Me What You Did Today: A Visual Cueing Strategy for Children With ASD. *Focus on Autism and Other Developmental Disabilities*, *26*(3), 162–172. doi:10.1177/1088357611405191

National Institute on Alcohol Abuse and Alcoholism (NIAAA). (2000).*Tenth Special Report to the U.S. Congress on Alcohol and Health*. Retrieved from pubs.niaaa.nig.gov/publications/10report/10thspecialreport.pdf

Olson, H. C., Feldman, J. J., Streissguth, A. P., Sampson, P. D., & Bookstein, F. L. (1998). Neuropsychological Deficits in Adolescents with Fetal Alcohol Syndrome: Clinical Findings. *Alcoholism, Clinical and Experimental Research*, *22*(9), 1998–2012. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9884144

Sokol, R. J., Delaney-Black, V., & Nordstrom, B. (2003). Fetal Alcohol Spectrum Disorder. *JAMA : The Journal of the American Medical Association*, *290*(22), 2996–2999. doi:10.1001/jama.290.22.2996

Stratton, K. R., Howe, C. J., & Battaglia, F. C. (1996). *Fetal Alcohol Syndrome: Diagnosis, Epidemiology, Prevention, and Treatment*. Institute of Medicine, Washington DC: National Academy Press.

Streissguth, A.P., Barr, H.M., Kogan, J. & Bookstein, F. L. (1996) *Understanding the occurrence of secondary disabilities in clients with Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Effects (FAE).* Final Report to the Centers for Disease Control and Prevention (CDC), August. Seattle: University of Washington, Fetal Alcohol & Drug Unit, Tech. Rep. No. 96-06.