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EFFECTS OF A READING INFERENCE STRATEGY INTERVENTION ON THE READING
AND SOCIAL INFERENCE ABILITIES OF ADULTS WITH ASPERGER SYNDROME

by

KIMBERLY A. MURZA
M.A. University of Central Florida, 2004

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the College of Education
at the University of Central Florida
Orlando, Florida

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2011

Major Professor: Chad Nye

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ABSTRACT

The ability to generate inferences is a skill that is necessary to fully comprehend a text and understand the intentions, behaviors, and emotions of a conversational partner. Individuals with Asperger syndrome (AS) have been shown to demonstrate significant difficulty in inference generation in both social contexts and in reading comprehension. Although, the reciprocity of the four components of literacy (reading, writing, listening, and speaking) has been established in the literature (Bradley & Bryant, 1983; Catts & Kamhi, 2005; Englert & Thomas, 1987; Gillon & Dodd, 1995; Hiebert, 1980; Kroll, 1981; Ruddell & Ruddell, 1994); the relationship between inference generation in reading and social inference generation is not well understood.

The present study investigated the efficacy of a language-focused reading inference strategy intervention (ACT & Check Strategy) on the general reading comprehension, inference generation in reading, social inference, and metacognitive ability of adults with AS. Twenty-five adults with AS were randomly assigned to either a treatment or a control group. The treatment group participants were divided into groups of 3-4 based on their availability and preferred location for treatment resulting in a total of 4 groups. Each group met in one-hour sessions twice a week for a total of six weeks. When controlling for pretest scores, the treatment group was found to perform significantly better on one measure of inference generation in reading and metacognitive ability compared to the control group. Significant differences between groups were not found in two measures of inference generation in reading comprehension or social inference ability.

These findings suggest that the ACT & Check strategy was effective in improving participants' ability to generate inferences as they read and their metacognitive reading ability. However, instruction in inference generation in reading does not appear to generalize to other language modalities (i.e., social inference generation). This research provides support for an explicit language-focused strategy intervention addressing the reading inference deficit area. Further research is warranted to investigate potential interventions to address social inference skills for individuals with AS.

To my amazing husband, Jan

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CHAPTER ONE: INTRODUCTION

Statement of the Problem

The prevalence of Autism Spectrum Disorder (ASD) is on the rise. From 2002 to 2006 the incidence level was increased from 1 in 150 to 1 in 110 children diagnosed with an ASD (Centers for Disease Control and Prevention, 2009). In the United States, that statistic translates to an estimated 36,500 individuals born every year who will eventually be diagnosed with an ASD (Centers for Disease Control and Prevention, 2010). ASD includes autism, Asperger('s) syndrome (AS), and pervasive development disorder not otherwise specified (PDD-NOS). Although every person with an ASD presents varying characteristics and degrees of the disorder, as the word *spectrum* in its name suggests there are some common characteristics. The broad categories of impairment include: difficulty in understanding and using language, poorly developed social skills, and repetitive behaviors (American Psychiatric Association, 2000). ASD is a lifelong condition that is typically diagnosed around the age of three. The etiology of ASD is unknown though scientists believe that a combination of genes and environmental factors play a primary role as causal agents of autism (Centers for Disease Control and Prevention, 2009).

Deficits in language comprehension and use are hallmarks of ASD however, these deficits may manifest differently in people with the disorder. Mesibov, Adams, and Klinger (1997) found 35-40% of individuals with ASD fail to develop functional language during their lifetime. In contrast, individuals diagnosed with AS are often extremely verbal. It is the social language component, known as *pragmatics* that is impaired in individuals with AS (Loukusa & Moilanen, 2009). This inability to use language in a social context can have serious social, academic, and workplace consequences.

Pragmatic language includes rules governing linguistic (e.g., topic maintenance), paralinguistic (e.g., pausing) and extralinguistic (e.g., eye gaze) aspects of social communication. The ability to *use* and *understand* these linguistic, paralinguistic, and extralinguistic cues are crucial to successful social communication (David, et al., 2010; Dziobek, et al., 2008; Pence & Justice, 2012). Individuals with AS have been found to demonstrate significant difficulty in using and comprehending these pragmatic cues in social interactions (Loukusa & Moilanen, 2009). Although it is clear that deficits in the use of these pragmatic cues can cause a communication breakdown; misinterpretation of these cues could also cause a person to make inaccurate social inferences about the feelings, intent, or general behaviors of communication partners (David, et al., 2010; Dziobek, et al., 2008). This deficit in *social inference* may contribute to the difficulty individuals with AS demonstrate in establishing and maintaining friendships and romantic relationships (Hendrickx, 2008). These social failures result in isolation and/or an extreme fear of social situations for some individuals with AS (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Woodbury-Smith, 2009).

Difficulty generating inferences is not restricted to social interactions. Individuals with AS have also been found to demonstrate particular difficulty with the integration of background knowledge with textual cues to generate inferences while reading (Smith Myles, et al., 2002; Wahlberg & Magliano, 2004). Inferences concerning characters' mental states are particularly difficult for individuals with AS (Happé, 1994a; Heavey, et al., 2000; Jolliffe & Baron-Cohen, 1999; Kaland, et al., 2002; Kaland, et al., 2005). These findings are important considering inference generation has been shown to be critical to successful reading comprehension (Anderson & Pearson, 1984; Snow, 2002).

The ability to integrate background knowledge with textual information is not only critical for success in school, but is also necessary for success in the 21st century workplace (Partnership for 21st Century Skills, 2010). To be successful in today's globally competitive workplace, individuals need a higher level of literacy (including competence in reading, writing, listening, and speaking) than previously required (Langer, 2001). This *high literacy* necessitates a command in critical thinking and problem solving including the skill of inference generation. In fact, employers include critical thinking and oral/written communication skills among the most important when searching for qualified employees (Casner-Lotto & Barrington, 2006).

If adults with AS are to become successful in society at large they must learn how to function effectively in a complex workplace requiring social interactions along with work skill competency on a daily basis. In fact, research shows that many people with higher functioning autism and AS often succeed in mainstream education through post-secondary levels of education such as undergraduate and graduate programs. However, their ability to secure and maintain full-time job status is often problematic (Howlin &

Goode, 1998, Howlin, 1997). In addition, there is evidence that the cost of supporting people with ASD who do not secure and maintain jobs is higher than supporting people with ASD in supported employment programs (Järbrink, McCrone, Fombonne, Zandén, & Knapp, 2007).

Considering the significant social, academic, and workplace challenges individuals with AS face, it is surprising that very little is known concerning how to best intervene. It is clear that both generating inferences from text and from social cues are language based skills and the reciprocity of the four components of literacy (reading, writing, listening, and speaking) has been established in the literature (Bradley & Bryant, 1983; Catts & Kamhi, 2005; Englert & Thomas, 1987; Gillon & Dodd, 1995; Hiebert, 1980; Kroll, 1981; Ruddell & Ruddell, 1994). However, the literature base has not explored the reciprocity of the specific skill of inference generation. Although there appears to be no research studies that have explored the effects of intervention on the reading inference skills of individuals with AS, studies including other populations suggest there may be certain interventions that are successful in promoting inference generation in both skilled and unskilled readers (Chan, Cole, & Barfett 1987; Fritschmann, 2006; Idol-Maestas, 1985; Schumaker, et al., 1982). In addition, certain interventions appear to improve social inference ability of individuals with AS (Stichter, et al., 2010; Turner-Brown, Perry, Dichter, Bodfish, & Penn, 2008).

As discussed, individuals with AS have been shown to demonstrate significant difficulty in inference generation in social contexts and in reading comprehension. Thus, it is important to examine whether a specific intervention targeting a common language

and literacy deficit (inference generation) is effective in improving inference generation in reading and social inference generation.

Purpose of the Study

The purpose of this study is to determine if instruction in a language-focused reading inference strategy will improve social inference, reading inference, and metacognition in reading abilities of adults with Asperger syndrome.

Research Questions

1. Is there a difference in ability to generate inferences when reading between adults with Asperger syndrome who receive a reading inference strategy intervention and those who do not?
2. Is there a difference in ability to generate social inferences between adults with Asperger syndrome who receive a reading inference strategy intervention and those who do not?
3. Is there a difference in metacognitive ability in reading between adults with Asperger syndrome who receive a reading inference strategy intervention and those who do not?

Hypotheses

1. Adults with Asperger syndrome who receive a reading inference strategy treatment will perform significantly better on measures of reading inference ability than those participants who do not receive the treatment.
2. Adults with Asperger syndrome who receive a reading inference strategy treatment will perform significantly better on a measure of social inference ability than those participants who do not receive the treatment.
3. Adults with Asperger syndrome who receive a reading inference strategy treatment will perform significantly better on a measure of metacognitive ability in readings than those participants who do not receive the treatment.

Limitations of the Study

Several limitations apply to this study:

1. First, the participants will all be adults living in the Central Florida area and may not be representative of participants living in other areas.
2. Because they will have the option of participating, the study participants may differ from those adults who decide not to participate in the study, limiting the generalizability of the results.

3. Although different forms of the instruments are being used for most dependent variables, it is possible that the participants' posttest scores may be affected by participating in a pretest condition using the same instrument (Campbell & Stanley, 1963).
4. Objectivity could be affected by the researcher's knowledge of group assignment.
5. Knowledge of group assignment could also affect the participants' performance on study tasks.
6. Due to limited access to the target population and the fact that participation is voluntary, it is expected that a limited number of participants will be successfully recruited. Small sample size increases the likelihood of committing a Type II error and limits generalizability.
7. Although participants will be randomly assigned to the treatment or control group, treatment participants will be assigned to a group of three to four participants based on availability and preferred location for treatment. Since treatment participant assignment to group will not be random it is recognized as a potential confounder.

Delimitations

The delimitations of the study include the following:

1. The study included two groups of participants; (a) an experimental group of 13 adults with AS; and (b) a control group of 12 adults with AS.
2. Study participants had to meet the following inclusion criteria:
 - a. be diagnosed with AS or high-functioning autism;
 - b. speak English as their first language,
 - c. score at least at the 8th grade reading level;
 - d. score at least one standard deviation below the mean on at least one subtest of the social inference measure.
3. Experimental group participants were grouped together in treatment groups based on availability and desired treatment location.
4. Study participants completed all pretest measures within two months of the start of the intervention program.
5. Study participants completed all posttest measures within one month of the completion of the intervention program.
6. The length of each treatment session was one hour.
7. Treatment sessions were held twice a week for six weeks.

Assumptions

Several assumptions will be made in order to conduct this study:

1. Each participant's diagnosis of AS is accurate and implies similar categories of deficits and social/behavioral characteristics.

2. The researcher, an ASHA certified and state licensed speech-language pathologist, is qualified to conduct the intervention program.
3. The researcher, an ASHA certified and state licensed speech-language pathologist, and graduate student-clinicians supervised by the researcher; are qualified to administer and score all assessment tasks.

Operational Definitions

1. *Adult*: 18 years 0 months and older
2. *Diagnosis of AS or HFA*: Determined from the University of Central Florida Center for Autism and Related Disorders (CARD) records.
3. *English as first language*: As self-reported by each participant.
4. *Eighth-grade reading level*: For purposes of this study reading level was defined by results on the Group Reading Assessment and Diagnostic Evaluation (GRADE) (Williams, 2001a) Comprehension Composite grade equivalency score.
5. *Inference in reading*: The ability to go “beyond what is explicitly stated in order to make sentences cohere (local coherence) and relate information in the text to world knowledge (global coherence)” (Laing & Kamhi, 2002, p. 437).
6. *Language-focused strategy intervention*: An intervention in which individuals are explicitly instructed in the foundational language and metacognitive skills necessary to successfully use the given strategy independently.

7. *Metacognition*: The knowledge of cognition and the ability to reflect on and regulate those thoughts (Campione, Brown, & Connell, 1989).
8. *Reading Comprehension strategy*: “Any activity a student might engage in (including mental activities, conversations with others, or consultation of outside references) to enhance comprehension or repair it when it breaks down” (Torgesen, et al., 2007, p. 1).
9. *Social inference skills*: Related to the Theory of Mind and can be defined as, “the ability to infer what another individual is thinking or feeling based on their verbal and/or non-verbal cues in the context of ongoing behavior and events” (Schenkel, Marlow-O’Connor, Moss, Sweeney, & Pavuluri, 2008, p. 791).
10. *Strategy instruction*: “A strategy is an individual’s approach to a task; it includes how the person thinks and acts when planning, executing, and evaluating performance on a task and its outcomes” (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991).
11. *Theory of Mind*: Originally coined by Premack and Woodruff (1978). “Being able to conceive of mental states: that is, knowing that other people know, want, feel, or believe things” (Baron-Cohen, Leslie, & Frith, 1985, p. 38).

CHAPTER TWO: LITERATURE REVIEW

This chapter presents the rationale for conducting this research experiment on a novel language-focused inference strategy for adults with Asperger Syndrome (AS). Two major topics will be explored first in this review: (a) the nature of AS, including the unique social, behavioral, and intellectual traits of the disorder, and (b) the cognitive processes, categories, and instructional strategies applied to inference generation. A primary goal of this study is to determine whether an inference strategy targeting one aspect of language (inference generation in reading) generalizes to a different language modality (social inference). Thus, additional discussion on inference generation in reading and social inference will provide the reader with the context necessary for understanding the research questions. Discussions of inference generation in reading will be embedded within the broader framework used to understand reading comprehension via a constructivist theoretical model. The topic of social inference will be briefly introduced in the AS discussion as it relates to theory of mind. A complete review of the literature on social inference will follow the discussion of reading comprehension. Finally, because the intervention program teaches a strategic approach to inference generation in reading, a discussion of metacognition and specifically the literature related to strategy instruction will complete this review.

Although this study is not a systematic review and meta-analysis, a transparent and complete explanation of the search strategy provides a summary of the process of

identification, selection, and inclusion of the studies serving as the basis for the literature review in the present study.

Information Retrieval

In order to locate and evaluate an appropriate body of literature for the present study, five major content areas were identified: (a) AS, (b) reading comprehension, (c) inference generation, (d) social inference, and (e) metacognition. Using procedures outlined for a systematic review (Hamerstrøm, Wade, Jørgensen, 2010), key terms and related synonyms were established to identify appropriate literature for each area. Further, key researchers in each of the four areas were identified and used as search terms for additional references. A detailed account of the search strategy is provided in Appendix A.

Electronic Search Strategy

The following electronic databases were used to search for studies related to each of the four content areas without limitation as to the chronological indexing of the bibliographic references:

- (a) ERIC 1966-present
- (b) PsycINFO 1887-present
- (c) Dissertation and Theses 1861-present

Due to the nature of the five different content areas of investigation (AS, reading comprehension, inference generation, social inference, metacognition) multiple searches were conducted using various combinations of terms across each area. The search terms were developed to narrow the search somewhat but to keep it broad enough to be as inclusive as possible. Appendix A describes the 12 different searches conducted in each database.

Ancestry Search Strategy

Once the electronic search was complete, full texts were retrieved for those citations appearing to be pertinent to the four content areas. Once the full text references were determined to be included in the review of literature, a hand search for additional citations was conducted by combing the reference lists of those included studies.

Asperger Syndrome Characteristics

The Diagnostic and Statistical Manual of Mental Disorders (DSM) is the standard for classifying mental disorders within the United States (House, 2002; Tidmarsh & Volkmar, 2003). A revision of the most current version, the DSM-IV (2000), is underway and expected to be released in 2013. Proposed revisions are currently available and dramatically change the way in which people with Autism Spectrum Disorder (ASD) are diagnosed (American Psychiatric Association, 2011). An explanation of the differences of diagnostic criteria is important because the DSM-V criteria do not specify

AS as an independent classification separate from ASD whereas the DSM-IV criteria do make such a distinction. Further, the present study's participant population all received the diagnosis of AS, but would have received the diagnosis of ASD if the DSM-V criteria were used. Although this diagnostic distinction may appear irrelevant, it is important to consider because of the approach this literature review takes. Some research in the area of ASD distinguishes between AS and higher-functioning forms of autism (HFA); other studies do not. As the DSM-V and other researchers (Frith, 2004; Gillberg & Ehlers, 1998; Howlin, 2003; Miller & Orzonoff, 2000; Scholpler, 1998; South, Orzonoff, & Macmahon, 2005; Szatmari, 1998) suggest, a distinction does not appear to be useful clinically. In order to include all research concerning individuals with ASD who are higher-functioning, a decision was made to include studies with participants diagnosed with both HFA and AS. Both these populations will be referred to as AS in the review of the literature. A discussion of the diagnostic criteria of both the DSM-IV and DSM-V follows to illustrate the current state of the diagnostic process for individuals similar to this study's participants.

DSM-IV Definition

The DSM-IV specifies ASD, as an umbrella term for five independent conditions: Autistic Disorder, AS, Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), Rhet Syndrome (RS), and Childhood Disintegrative Disorder (CDD). The DSM-IV identifies three primary areas of deficit that define ASD: social-interaction, communication (verbal or nonverbal) and repetitive behaviors or interests. Within each

of these areas one or more specific behavioral symptoms are required for a diagnosis. Symptoms listed within the category of social-interaction impairments include; (a) impairment in nonverbal behaviors, (b) failure to develop peer relationships, (c) no sharing of interests with others, and (d) lack of social or emotional reciprocity. The category of communication includes; (a) a delay in or lack of spoken language, (b) deficits in conversational initiation and maintenance, (c) stereotyped and repetitive use of language or idiosyncratic language use, and (d) a delay in or lack of pretend play. The category of repetitive and stereotyped behavior includes (a) unusual interests, (b) nonfunctional routines/rituals, (c) stereotypical motor mannerisms, and (d) interests in parts of objects.

The DSM-IV definition of AS requires that individuals demonstrate deficits in social-interaction and repetitive and stereotypical behavior, interests, and activities, *only*. At least two of the symptoms in the category of social-interaction deficits and one or more symptoms from the category of stereotypical behavior, interests, and activities must be present. The DSM-IV also specifies that a diagnosis of AS is only appropriate if the above symptoms are present *and* the individual meets three additional criteria: (a) the present symptoms cause significant impairments in social or occupational functioning, (b) no general delay in language, and (c) no delay in cognitive development, self-help skills, adaptive behavior, or curiosity about the environment.

DSM-V Definition

There has been speculation about the differential diagnosis of AS and what has been termed *high functioning autism*. However, a number of researchers have suggested that differentiating AS from a higher-functioning form of autism is not possible or is not useful clinically (Frith, 2004; Howlin, 2003; Gillberg & Ehlers, 1998; Miller & Orzonoff, 2000; Scholpler, 1998; South, Orzonoff, & Macmahon, 2005; Szatmari, 1998). The DSM V Committee on Neurodevelopmental Disorders supports this viewpoint and has revised the diagnostic criteria to include the diagnoses of autism, AS, PDD-NOS, and CDD under the single category of ASD only (Lord, 2011). Thus, a diagnosis of AS using the DSM-V criteria will not be possible.

The committee provides several rationales for this change. First, they argue that while differentiations among individuals with ASD and typically developing individuals or others diagnosed with non-spectrum disorders has been accomplished reliably and with validity, differentiation among ASD disorders (i.e., autism, AS, PDD-NOS, CDD) has been inconsistent. Second, they suggest that because ASD is defined by a common set of behaviors, it is more accurate to describe individuals using a single diagnostic category that allows for individual descriptions based on specifiers such as severity and associated features such as intellectual disability (American Psychiatric Association, 2011). Third, the DSM Committee provides a rationale for reducing the diagnostic domains from three (social-interaction, communication, and repetitive behaviors or interests) to two (social/communication deficits, and fixated interests and repetitive behaviors). The committee suggests, for example, that social and communication deficits

are inseparable, and delays in language should not define a diagnosis of ASD as these delays are more accurately considered as factors that influences clinical symptoms.

In addition to these diagnostic criteria, the DSM-V has developed guidelines for assigning severity levels for individuals diagnosed with ASD. These severity levels are based on the level of support an individual would require according to three categories: (a) Level 1: requiring support, (b) Level 2: requiring substantial support, and (c) Level 3: requiring very substantial support. These severity distinctions are important to consider because they differentiate individuals within the spectrum of ASD. Without these severity levels, one might assume that all people with ASD present similarly in their abilities and behavioral characteristics when it is clear this is not the case.

Pragmatic Language

The criteria used to diagnose AS revolves around the qualitative impairment in social interactions. When these deficits are applied to human interactions, they can be clinically understood in terms of pragmatic language functioning. For example, individuals with AS may demonstrate difficulty in social interaction with an inability to participate in verbal turn-taking to carry on a conversational exchange. The difficulty in social reciprocity, among the diagnostic criteria, reflects a deficit in pragmatic language performance or function. Loukusa and Moilanen (2009) describe how the term pragmatics is used to convey the specific social deficits of individuals with AS:

Definitions of pragmatics vary according to the theoretical background and focus of the study. However, regardless of differences in definition there is a consensus

that utilization of context when inferring the meaning of an utterance belongs to the field of pragmatics, and that social and cognitive factors affect the pragmatic aspects of language comprehension and expression. The same expression can have a different meaning in a different communicative situation, and by exploiting context it is possible to understand the speaker's intention. In a comprehension situation, there is a need to understand the linguistic information of an utterance, but without cognitive abilities that are necessary for pragmatic inference, utterance interpretation remains lacking. (p. 891)

Pragmatic language pertains to the use of language in a social context and consists of a set of rules that govern how people use language for different functions, organize language in discourse, and understand and use social conventions (Pence & Justice, 2012). Pragmatic language includes rules governing linguistic (e.g., word choice, topic maintenance), paralinguistic (e.g., pitch, pausing), and extralinguistic (e.g., eye gaze, gestures) aspects of social communication. The skill of using one's social knowledge and contextual information to infer the underlying meaning of an utterance is a pragmatic language skill (Loukusa & Moilanen, 2009) known as social inference. Consistent misinterpretation of linguistic, paralinguistic, and extralinguistic cues could cause a person to make inaccurate social inferences about the feelings, intent, or general behaviors of communication partners (David, et al., 2010; Dziobek, et al., 2008).

Difficulty with inference has significant implications for one's social and professional life. Individuals with AS often struggle to establish and maintain friendships and often have difficulty engaging in romantic relationships (Hendrickx, 2008). For some, these difficulties and subsequent social failures result in isolation and/or an

extreme fear of social situations (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Woodbury-Smith, 2009).

Workplace Considerations

Similar difficulties in accurately interpreting social interactions and appropriately responding to the social demands of the workplace contribute to the fact that many people with AS are unemployed or underemployed (Goode, Rutter, & Howlin, 1994; Howlin & Mawhood, 1996; Nesbitt, 2000). Although specific data for AS are lacking, only 15% of people with an ASD (including AS) are employed (Cameto, Marder, Wagner, & Cardoso, 2003).

In a pilot study investigating the workplace experiences of people with AS, Müller, Schuler, Burton, and Yates (2003) identified four themes as obstacles to successful employment: (a) mastering the job application process, (b) acclimating to new job routines, (c) communication, and (d) navigating social interactions with supervisors and co-workers. Most relevant to this current investigation are the obstacles noted under communication and social interactions. Participants reported specific communication difficulties related to:

- (a) difficulty processing incoming information
- (b) failure to understand instruction
- (c) difficulty “reading between the lines”
- (d) being fired because of workplace miscommunication
- (e) being reprimanded for asking too many questions (p. 167)

Participants also reported the following specific obstacles related to navigating social interactions with supervisors and co-workers:

- (a) difficulties with water cooler “chit chat”
- (b) difficulties reading facial expressions and tone of voice
- (c) sense of being “odd” or “different” from workplace colleagues
- (d) sense of isolation or alienation within the workplace
- (e) being fired for failure to understand social requirements of job (p. 167)

Theoretical Framework for Asperger Syndrome

Two prominent theories in the field of ASD, the Theory of Mind Deficit (Baron-Cohen, Leslie, & Frith, 1985) and the Weak Central Coherence Hypothesis (Frith, 1989) attempt to provide an explanation for the symptoms of ASD described earlier. As discussed previously, AS falls under the umbrella of ASD, thus these theories also provide a framework to understand the causes of AS.

The term “theory of mind” was originally coined by Premack and Woodruff (1978) as, “Being able to conceive of mental states: that is, knowing that other individuals know, want, feel, or believe things” (Baron-Cohen, Leslie, & Frith, 1985, p. 38). Baron-Cohen, et al. introduced the Theory of Mind Deficit to the field of autism in an attempt to explain the unique social deficits of individuals with ASD. This theory suggests that the central feature of AS is an inability to infer another person’s mental states. In other words, individuals with AS are not able to recognize that others have

distinct mental states different than their own. This inability to recognize these distinct mental states is expressed in the significant social/communication and behavioral difficulties individuals with AS experience.

One of the skills that typical adults can readily use to speculate on the mental states of others automatically and effortlessly is known as *social inference* (Gilbert, 1989; Kosciak, 2010). Although social inference is discussed in depth later in this review, it is important to introduce the concept within this discussion of theory of mind. Social inference ability is an unconscious act, used to infer another's mental state (e.g., reason for action, motivation, attitude). Speculating or guessing another's mental state with 100% accuracy is not the goal of making social inferences (Baron-Cohen, 1995). The act of making plausible guesses about the actions and intentions of others is necessary to understand others in a social context. Baron-Cohen (1995) uses the term *mindreading* to describe the state of mind one engages in during the act of making plausible guesses. Mindreading ability allows individuals to consider the plausible consequence of a social behavior.

Mindreading is intricately tied to language (Baron-Cohen, 1995). The purpose of engaging in social dialogue is to inform or influence another person's thoughts (Baron-Cohen, 1996). Baron-Cohen argues that the ability to use language to engage in social discourse, is therefore, completely dependent on mindreading ability. For example, the ability to comprehend higher-level language acts such as irony or sarcasm is impossible without mindreading ability (Baron-Cohen, 1988; Sparer and Wilson, 1986; Happé, 1994b). Furthermore, Baron-Cohen suggests that a speaker's ability to judge his/her communicative partner's background knowledge (i.e., what he/she already knows or is

ignorant of) is a mindreading ability that influences the way the speaker uses language (pragmatic language ability). Thus, the Theory of Mind Deficit is able to account for the deficits in pragmatic language, including social inference generation, individuals with AS experience.

Baron-Cohen (1995) has termed the inability to mind read as *mindblindness*. Numerous studies have provided support for mindblindness as an explanation of the social deficit patterns seen in AS (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Baron-Cohen, Wheelwright, Scahill, Lawson, & Spong, 2001; Happé, 1994a).

While the Theory of Mind Deficit is useful in explaining how one understands or recognizes the mental state of others, it does not explain the other characteristics of ASD such as restricted and unusual interests and activities. Frith (1989) proposed the Weak Central Coherence Hypothesis in an effort to explain the social interactions and communication deficits of individual with AS in terms of an inability to integrate information to generate meaning. Kanner (1943, reprinted in Kanner, 1973) explained this deficit as “The inability to experience wholes without full attention to the constituent parts” (p. 38). According to Frith, humans have a desire to use top-down processing to understand the higher-level meaning of information, to determine the gist. Individuals with AS, however, are better at processing in a piecemeal way (Jolliffe & Baron-Cohen, 1997; Shah & Frith, 1983). When a task requires the integration of information, research has shown that individuals with AS have difficulty extracting meaning from the task (Jarrold & Russell, 1997; Jolliffe & Baron-Cohen, 2001). For example, when given

puzzle-like pieces of a line drawing of an object, individuals with AS had significant difficulty integrating the pieces to determine the object (Jolliffe & Baron-Cohen, 2001).

In conclusion, individuals with AS present with unique deficits in social interaction including pragmatic language and specifically social inference skills which are the focus of this study. Both the Theory of Mind Deficit (Baron-Cohen, Leslie, & Frith, 1985) and Weak Central Coherence Hypothesis (Frith, 1989) attempt to explain the cause of these deficits. Although each focuses on different aspects of the disorder, together they provide a thorough explanation for the unique pragmatic difficulties individuals with AS encounter. The ability to integrate background knowledge with either pragmatic cues (social inference) or textual cues (inference generation in reading) requires certain cognitive and linguistic abilities. The question that arises then is what are these underlying *linguistic* and *cognitive processes* of inference generation? As will be discussed later in this review, it is the metacognitive and linguistic processes that allow readers to engage in a strategic approach to reading that involves inference generation. Similarly, inference generation is a process that can also be applied to social interactions in a way that allows individuals to generate inferences regarding another's motivation, behavior and attitude. The following is a discussion of the process, categories, and instructional strategies applied to inference generation in general.

Inference Generation

A higher-level language process that is necessary for reading comprehension and mentalizing is inference generation. Walter Kintsch has been credited with two seminal works (Kintsch, 1974; Kintsch & van Dijk, 1978) that have contributed to the current theories of text comprehension and inference generation specifically. Although his theories deal primarily with inference generation in reading, aspects are useful in also understanding social inference generation. Kintsch's theory of interactive text processing focuses on the proposition as the unit of meaning in text rather than the word or sentence. Interactive text processing theory also proposes that readers substitute one proposition, called a macroproposition, for several propositions (Goldman, Golden, & van den Broek, 2007).

A proposition is the basic idea of a clause or sentence (Singer & Leon, 2007). It is composed of a predicate and at least one argument (Kintsch, 1972). A predicate consists of main verbs, adjectives, and connectives whereas an argument includes nouns, pronouns, and embedded propositions (Snow, 2002). Kintsch was able to show relationships between propositions, reading time and memory. Kintsch and van Dijk (1978) expanded this work to include the interactions among the text, reader, and the task. Specifically, Kintsch and van Dijk explained inference generation as being governed by a limited-capacity verbal working memory. Therefore, as a person reads a passage, not all propositions read previously are available to make connections across passages of text. When new propositions fail to connect, a reader may reactivate prior

propositions or resort to making inferences based on prior knowledge. Readers then create an explicit text base of propositions and an implicit text base that consists of both the explicit text base and inferences made during processing.

Later, Kintsch expanded on his work with the development of the *Construction-Integration* (CI) model (1988). This model provides a framework for understanding how proficient readers infer meaning from a text. It is comprised of a process of constructing a text base (from linguistic input and the reader's background knowledge) followed by an integration process described below. The steps for constructing a text base offered by Kintsch (1988) include:

- (a) forming the concepts and propositions directly corresponding to the linguistic input; (b) elaborating each of these elements by selecting a small number of its most closely associated neighbors from the general knowledge net; (c) inferring certain additional propositions; and (d) assigning connection strengths to all pairs of elements that have been created. (p. 166)

Kintsch (1988) postulated that a created text base may provide an abundance of information, but it is most likely incoherent and contradictory. At that point the text base undergoes a process of integration by the reader to form a *coherent structure*. During this integration process, the reader considers both his/her knowledge base and the context of the particular text (e.g., topic matter, discipline). Through this integration the reader is able to discard irrelevant content. The integration process usually occurs successfully and automatically. However, if the integration process fails, an extensive problem-solving activity is necessary for the reader to create accurate inferences.

This discussion focused on Kintsch's work in the area of inference generation while reading. The CI model explains how inferences are made during reading but does not address the types of inferences that can be made. In order to address appropriate intervention strategies for inference generation, an understanding of the type of inferences is useful. A discussion of the categories of inferences follows.

Inference Categories

Magliano and Graesser (1991) identified 11 categories of potential types of inferences that may be made when reading a literary text. As suggested by the CI model, all these inference categories require the reader to integrate textual information with his/her knowledge base. Some inference categories require a global understanding of a passage while others depend on a more local interpretation of text elements. Table 1 describes each of Magliano and Graesser's inference categories.

Table 1: *Magliano and Graesser's Inference Categories, Descriptions, and Examples*

Inference category	Description	Example
Anaphoric reference	An inference that requires the reader to determine the antecedent to a referent, typically a pronoun	I ordered a <i>sandwich</i> , it looked delicious. <i>Sandwich is the referent for it</i>
Causal antecedent	Bridging inferences that relate an event with previously read text	There was no time for lunch. I ended up with a mess all over my blouse. <i>The narrator had to eat too quickly and sloppily</i>
Causal consequence	Prediction inferences based on story events	I had a presentation in one hour. <i>The narrator will either have to clean up her blouse or find something else to wear</i>
Instrument	The inference of some type of tool, resource, or body part used by the agent to complete an action	I tried to get the stain off as best as I could. <i>The narrator probably scrubbed the stain with a wet cloth</i>
Instantiation of noun category	Inferences requiring a reader to provide a referent for a category based on his/her background knowledge	I always ruin my clothes! <i>blouse falls in the clothes category</i>
Superordinate goal	Inferences concerning why a character might do something	I ran down the street to find a store. <i>The narrator wants to buy a new blouse</i>
Subordinate goal/actions	Inferences about how characters achieve their goals	I ran down the street to find a store. <i>The narrator is running to try to quickly find a place that sells blouses</i>
State	Inferences about the condition of the world based on the time frame of the text	I ran down the street to find a store. <i>It would be unacceptable for the narrator to have stains on her blouse during the presentation.</i>
Theme	Inferences about the main idea or moral of the story	The entire passage <i>Sometimes hurrying can cause</i>

more wasted time in the long run

Inference category	Description	Example
Reader emotion	Inferences about the character's emotional responses to story events	I ran down the street to find a store. <i>The narrator is frantic and nervous</i>
Author's intent	Inferences concerning the motivation of the author in writing the text	The entire passage <i>The author wants to convey the idiom, "Haste makes waste"</i>

A review of each of these inference categories suggests that some are more easily made than others during reading. In fact, inference categories are either constructed on-line (while reading) or off-line [after reading (e.g., during retrieval tasks)]. Of those constructed on-line, some require more effort than others. For example linguistic inferences such as anaphoric inferences are activated more quickly than causal consequence inferences (Graesser & Kreuz, 1993). In addition, research suggests that individuals are able to generate considerably more inferences when they read narrative versus expository texts (Graesser & Kreuz, 1993; Trabasso & Magliano, 1996). However, several researchers have found that readers are able to generate inferences more *easily* when reading expository texts when compared to narrative texts (Baretta, Tomitch, MacNair, Lim, & Waldie, 2009; Horiba, 2000). This suggests that there is more of an opportunity to generate inferences when reading narrative type texts versus expository texts. The variety of inference categories and the ease with which they can be constructed during or following reading and depending on the type of the text suggest that learning to generate inferences may not be an all or nothing type of skill in written or social contexts.

A prime question posed for the present study involves the efficacy of teaching adults with AS to generate and comprehend inferences from written text. Thus, the present study provides an intervention program for inference generation across multiple categories of inference generation.

Inference Instruction

Although the target population of the present study is adults with AS, no empirical studies were located that addressed instruction in inference generation in reading with this population. In fact, the available research in this area focused exclusively on typically developing populations of students. Thus, a discussion of the available research on inference instruction with typically developing students provides a reference point for further investigation of inference generation and comprehension instruction for adults with AS.

The National Foundation for Educational Research (NFER) of the United Kingdom (Kispal, 2007) was commissioned by the Department for Children, Schools, and Families to conduct a narrative review of the literature on the topic of inference skills in reading and related effective instructional practices. Although the review was limited in its scope (i.e., British literature from 1988-2007; international literature published in the English language from 1999-2007), it did explain the search strategy in detail (e.g., search terms used, databases searched). The review included both experimental and theoretical literature. Inclusion criteria for the experimental studies included; (a) focus on effective teaching methods, (b) comprehension outcome, (c) appropriate sample

characteristics, (d) adequate detail on teaching methodology, and (e) school setting. Inclusion criteria for the theoretical literature included; (a) peer-reviewed, and (b) reference empirical literature.

Findings from the NFER (Kispaal, 2007) review suggested that there are a number of qualities students need to demonstrate in order to adequately generate inferences while reading including: (a) actively read to comprehend text (b) monitor comprehension, and (c) possess a high-level of vocabulary and working memory ability. Kispaal suggested that inference ability is facilitated by possessing both a wide background knowledge base (knowledge net), and the same cultural background reflected in the text. Kispaal also reported that although the research base is limited in the area of effective instructional practices, available research does point to certain practices that seem effective. These practices include, (a) modeling of inference generation, (b) increasing decoding and vocabulary ability, (c) instruction in text structure, (d) questioning by the teacher and by the student, (e) activation of prior knowledge, (f) work in prediction skills, (g) listening comprehension practice, (h) careful choice of texts, and (i) work with texts in other disciplines.

Several studies have reported the effects of intervention programs designed to improve the inference generation of typically developing students. Carnine, Kameenui, and Wolfson (1982) investigated the effects of a strategy designed to improve students' abilities to infer characters' motives in narrative texts. Thirty fourth-, fifth-, and sixth-grade students were assigned to one of three groups using a stratified randomization procedure: (a) Facilitative Questions and Practice Group, (b) Practice and Feedback Group, or (c) Control Group. The Facilitative Questions and Practice Group was provided

with instruction regarding the use of a question-asking strategy to determine the motives of characters while the Practice and Feedback Group practiced reading and answering questions without the question-asking strategy instruction. Both groups received three intervention sessions.

Results indicated that both treatment groups performed significantly better than the control group in their ability to generate accurate inferences about characters' motives. The study suggested that simply increasing students' awareness of character motivation whether through a questioning-strategy or practice and feedback with texts results in an improvement of students' ability to identify character's motives.

In contrast to the above study, Carr, Dewitz, and Patburg (1983) were interested in expository text comprehension. Using a quasi-experimental research design, they examined the impact of two different but related inference strategies on the inferential comprehension of 75 sixth-graders assigned to one of three groups: cloze procedure, cloze procedure plus, and control. Students in the cloze procedure group received an intervention using a cloze procedure integrating background knowledge and text clues and a self-monitoring checklist while the same intervention with the addition of a structured overview was provided for the cloze procedure plus group. The intervention for both treatment groups consisted of 40 sessions delivered over 8 weeks varying in instruction time but not exceeding 40 minutes per session. Following the intervention period, both treatment groups were found to perform significantly better on measures of inferential comprehension and literal comprehension when compared to the control group. Significant differences between the treatment groups were not found. These

results suggest that adolescents can be taught to generate inferences when reading expository texts through explicit strategy instruction.

In a follow-up study, Dewitz, Carr, and Patburg (1987) investigated similar interventions with 101 fifth grade students of varying reading ability assigned to one of four conditions. Students were assigned by class to the same interventions described above or a structured overview only intervention or control group. Analysis of the post treatment performance revealed significant class differences favoring the groups using a cloze procedure in both inferential and literal comprehension ability. These findings suggest that instruction in the use of an inference strategy that focuses on the integration of background knowledge and text clues (i.e., the cloze procedure) is more effective than instruction that focuses only on the organization of expository texts.

In an investigation of a general-reciprocal inference procedure (GRIP), Reutzel and Hollingsworth (1988) assigned 71 regular third grade students to one of three groups: (a) GRIP group, (b) basal inference instruction group, or (c) control group who received their normal instruction using basal readers. All groups received 50-minute lessons over 19 days.

Participants in the GRIP group were taught how to highlight categories of inferences to generate inferences in passages. During each lesson they also wrote their own passages using the categories of inferences they previously learned. Each student then paired with another student and swapped passages. The students then read their partner's passage, underlining key words indicating an inference category and generated an inference. The student then discussed the accuracy of his/her inference with the author of the passage. The basal inference instruction group learned about the same

inference categories as the GRIP group but according to a basal teacher manual. Participants in the control group received basal reader lessons according to the scope and sequence guide of the teacher's manual.

An analysis of the three groups' performance yielded large treatment effects favoring the GRIP group when compared to both the basal inference instruction group and the control group on measures of inference type knowledge and reading comprehension measures. These results were interpreted to suggest that explicit instruction in inference categories including a metalinguistic component appear to improve students' reading comprehension ability.

The preceding discussion described the processes involved in inference generation, the categories of inferences and instructional approaches to inference generation during reading for typical elementary age children. No evidence was found for inference generation intervention for either disabled or typically developing adolescents or adults. To fully understand the process of inference generation during reading a discussion of reading comprehension is useful to introduce a framework for understanding reading comprehension as related to the present study.

Reading Comprehension: Overview

To provide a framework for reading comprehension it is necessary to understand how it fits into the broader concept of reading. The simple view of reading suggests that reading consists of only two components, decoding and listening comprehension (Droop

& Verhoeven, 2003; Gough & Tunmer, 1986; Hoover & Gough, 1990). To efficiently and accurately decode words, a specific knowledge of letters, sounds, and words is necessary. In contrast, many authors conceptualize that reading comprehension requires a set of higher-level cognitive processes that are not easily quantified (e.g., Catts & Kamhi, 2005; Duke, Pressley, & Hilden, 2004; Snow, 2002). One's ability to comprehend a text is highly dependent on one's basic language skills and background knowledge of the topic matter (Duke, Pressley, & Hilden, 2004; Kamhi, 2012; Snow, 2002). Thus, from a simple view of reading performance, it can be argued that reading comprehension cannot be separated from listening comprehension.

For most individuals, the process of reading is effortless (Graesser, 2007). This is remarkable considering the skills needed to comprehend the unique phonological and morphological aspects of words, the syntactic structure of sentences, and the meaning of those sentences considering context and background knowledge (Duke, Pressley, & Hilden, 2004; Graesser, 2007). It is the integration of context and background knowledge that allows readers to demonstrate higher level reading and language skills such as inference generation (Anderson & Pearson, 1984; Graesser & Britton, 1996). This process of inference generation not only requires basic decoding and comprehension skills but also necessitates a command of foundational language and metacognitive abilities (Fritschmann, 2006; Snow, 2002).

Theoretical Model for Reading Comprehension: Constructivism

Although there are many theories and models of reading, the constructivist model (Anderson & Pearson, 1984; Rosenblatt, 1995) provides an appropriate framework to explain the cognitive and linguistic requirements of inference generation during reading. In order to understand the process of inference generation during reading comprehension as conducted and assessed in the present study, a discussion of the constructivist model is offered. The constructivist model of reading comprehension is most relevant to this research because of the emphasis on the reader's role in creating meaning.

Early models of discourse comprehension, which primarily focused on sentence-level parsing and semantic features, failed to consider the engagement of the reader and its implications for the reading process (Glenberg, Meyer, & Lindem, 1987). In contrast, constructivists place the emphasis on the reader and his/her mental representation of the text (Anderson & Ortony, 1975; Glenberg, Meyer, & Lindem, 1987). Glenberg, et al. suggested that the construction of mental models requires continual access and interaction among a reader's linguistic, pragmatic, and world knowledge and described mental models as being updateable, manipulable, and perceptual-like and helps to explain the role of mental representations in discourse comprehension drawn from a written text. Snow (2002) provides a model of reading comprehension that aligns with the constructivist framework,

We define reading comprehension as the process of simultaneously extracting and constructing meaning through interaction and involvement with written language.

We use the words *extracting* and *constructing* to emphasize both the importance

and the insufficiency of the text as the determinant of reading comprehension (p. xiii).

Constructivist models are not exclusive to written discourse comprehension.

Graesser & Kreuz (1993) state that, “Constructionist theories assume that comprehenders actively construct cognitive representations when they perceive events in the world, make decisions, solve problems, comprehend text, and execute most other cognitive activities” (p. 151). Much of the research support for constructivist models began in the field of psycholinguistics in an effort to explain sentence memory (Anderson & Ortony, 1975; Bransford, Barclay, & Franks, 1972). Researchers found they had to account for the unique contributions of the reader because the strikingly different interpretations readers derived could not be accounted for by the meaning of the words themselves. In seminal studies investigating sentence comprehension and memory, researchers found that participants consistently assigned more information to text than could be accounted for by the actual linguistic strings of the stimulus (Anderson & Ortony, 1975; Bransford, Barclay, & Franks, 1972; Morrow, Bower, & Greenspan, 1989). These studies suggest that research in discourse comprehension should not be mere textual analyses but instead focus on the social processes of written and oral discourse.

In a primary work in constructivist theory, Schmidt (1981) argued for a literary system approach. Instead of considering the literary work as containing the meaning in itself, he encouraged researchers to consider the active role of the reader and what he or she brings to the literary work in terms of their linguistic skills and background knowledge. Schmidt described the constructivist model as a literary system approach consisting of four roles of the active reader: producing, mediating, receiving, and

processing. As Schmidt suggested, researchers studying reading comprehension with a literary system lens would evaluate different variables than the researcher primarily interested in analyzing the literary work itself.

Reading Comprehension and Asperger Syndrome

Numerous researchers (Bradley & Bryant, 1983; Catts & Kamhi, 2005; Englert & Thomas, 1987; Gillon & Dodd, 1995; Hiebert, 1980; Kroll, 1981; Ruddell & Ruddell, 1994) have provided evidence that reading comprehension is intricately tied to language processing. Specifically, higher-language processing skills including comprehending text and conversation have been shown to be problematic for individuals with autism (Happé, 1994a; Snowling & Frith, 1986; Tager-Flusberg, 1982; Tager-Flusberg & Anderson, 1991).

Individuals with AS have also been found to have particular difficulty with integrating background knowledge with text clues to draw inferences (Smith Myles, et al., 2002; Wahlberg & Magliano, 2004) and generating inferences about characters' mental states from written text (Happé, 1994a; Heavey, et al., 2000; Jolliffe & Baron-Cohen, 1999; Kaland, et al., 2002; Kaland, et al., 2005). Happé's Strange Stories Test has been used in several of these studies (Happé; Heavey, et al.; Jolliffe, et al.; Kaland, et al., 2005) to measure the ability of adolescents and adults with AS to comprehend a story character's non-literal speech. The stories described typically occurring events and were written to be unambiguous. Typically developing individuals and individuals without ASD who had a mild intellectual disability were able to correctly interpret the situation.

In contrast, the researchers found individuals with AS exhibited significant difficulty providing the mental state explanations of characters' nonliteral speech (Happé; Heavey, et al.; Jolliffe, et al; Kaland, et al., 2005).

A narrative review of the literature on social inference ability of individuals with AS and HFA (Loukusa & Moilanen, 2009) identified a total of 20 studies meeting the inclusion criteria including the four using Happé's Strange Stories Test described above (Happé, 1994a; Heavey, et al., 2000; Jolliffe & Baron-Cohen, 1999; Kaland, et al., 2005) All 20 of the studies found social inference weaknesses in their participants. The authors suggested that deficits persist despite average or above average IQs and language skills of the participants in the study. Specific social inference difficulties were found when participants were required to generate inferences about; speech acts, social scripts, metaphors, jokes, sarcasm, and persuasion. Ten of the 20 studies were most relevant to this current experiment (i.e., similar participant population and discourse level inference generation tasks). Of these ten studies, nine tested individual's ability to generate inferences in reading tasks (Emerich, Creaghead, Grether, Murray, & Grasha, 2003; Happé, 1994a; Heavey, et al., 2000; Jolliffe & Baron-Cohen, 1999; Jolliffe & Baron-Cohen, 2000; Kaland, et al., 2002; Kaland, et al., 2005; Martin & McDonald, 2004; Ozonoff & Miller, 1996). Only one of these ten studies (Wang, Lee, Sigman, Dapretto, 2006) used tasks in which participants listened to speakers to generate inferences as opposed to reading stimuli to make judgments about characters.

Several experiments used story tasks similar to Happé's Strange Stories Test to assess physical and mental state inference generation ability from written text (Kaland, et al., 2002; Martin & McDonald, 2004). Kaland and colleagues designed a test battery

after the Strange Stories Test but constructed it to be contextually more complex by including questions of: lie, white lie, figure of speech, misunderstanding, double bluff, irony, persuasion, contrary emotions, forgetting, jealousy, intentions, empathy and social blunders. Similar to the findings presented previously (Happé; Heavey, et al.; Jolliffe, et al.; Kaland, et al., 2005), Kaland et al. found individuals with AS to have significantly more difficulty generating mental state inferences from written text. This finding is consistent with the mentalizing deficits in AS described previously.

Of particular interest, is an investigation conducted by Jolliffe and Baron-Cohen (2000) which investigated global coherence in adults with ASD in two experiments. The study also used stories as assessment tasks to examine the higher language processing abilities in three groups of adults; (a) normal control group, (b) adults with autism, and (c) adults with AS. All participants demonstrated average intelligence and passed second-order belief tasks (inference generation about others' beliefs).

In the first experiment, participants were asked to reorder scrambled stories across two story tasks. The first task included temporal clues (Temporal Condition) and the second did not (Coherence Condition). Participants were asked to correctly rearrange five sentences of each story to create the most coherent story possible. A total of eight stories in the Temporal Condition and eight in the Coherence Condition were presented. Both the group of adults with autism and adults with AS performed significantly poorer in the Coherence Condition and took significantly longer in rearranging the sentences than did the normal control group. No significant differences were found in the Temporal Condition. The results were interpreted to suggest that individuals with autism

and AS had more difficulty integrating linguistic information than the normal control group.

The second experiment is particularly relevant to the current study. In this experiment, the same three groups of participants were asked to listen to 10 short stories (5-7 sentences long) and to complete four tasks: (a) generate an inference about the motivation behind a character's attempt to achieve the first subgoal, (b) generate an inference about the motivation behind a character's attempt to achieve the second subgoal, (c) answer a general comprehension question, and (d) retell the story. In this experiment the primary goal was defined as the main character's desire. The term subgoal was used to describe another goal that would help the character achieve his/her primary goal. The first subgoal was directly connected to the primary goal of the character and was provided directly following the goal statement. The second subgoal was presented later in the text after the first subgoal could not be achieved or was determined not to be plausible.

Results indicated that both clinical groups performed significantly poorer when asked to infer the motivation behind the character's attempt to achieve the second subgoal. This type of inference reflects a person's ability to make connections between widely separated textual information needed to draw inferences (global inference). In addition, participants in the clinical groups performed more poorly with stories that required a higher level of integration of textual information (i.e., elaboration).

Another area of reading comprehension that demonstrates the difficulties individuals with AS exhibit is that of comprehending humor. Similar to inference generation, comprehension of humor requires individuals to revise initial assumptions

and see things in a different way (Ozonoff & Miller, 1996). In a study investigating humor comprehension (Ozonoff & Miller, 1996), adolescents and adults with AS were asked to determine the correct funny ending to a written joke. Participants listened to ten short stories and chose the correct humorous ending from a choice of five endings: (a) surprising and coherent (the correct choice); (b) coherent but not surprising, (c) both surprising and humorous but not coherent, (d) surprising but not humorous or coherent though on a related topic, and (e) surprising but not humorous or coherent and on an unrelated topic. The results showed individuals with AS had significantly more difficulty choosing the correct humorous ending when compared to controls. Individuals with AS consistently chose endings that were either surprising and humorous but not coherent or were coherent but not surprising. These findings demonstrate that individuals with AS have particular difficulty using pragmatic language to understand humor.

In a similar study, Emerich et al. (2003) examined the ability of adolescents with AS to comprehend humor using two tasks; a comic task and a joke task. Both tasks required the participants to choose the correct funny ending when provided with five choices. Both tasks used ending choices that were similar to those in the Ozonoff & Miller (1996) study. Findings also provide support to the conclusions drawn by Ozonoff and Miller (1996); pragmatic deficits of individuals with AS contribute to deficits in humor comprehension.

Martin and McDonald (2004) also examined humor comprehension of adults with AS. A story task, divided into two types; ironic jokes and lies, was used to determine the mental state inference generation ability of adults with AS. Individuals with AS performed significantly poorer in answering comprehension questions requiring mental

state inference generation than the control group. Interestingly, individuals with AS had more difficulty interpreting the stories containing ironic jokes than those containing lies.

These findings support the view that humor requires an advanced level of language and metacognitive ability (Emerich, Creaghead, Grether, Murray, & Grasha, 2003). Deficits in inference generation and the ability to integrate information have been shown to negatively affect humor comprehension (Ozonoff & Miller, 1996). Thus it is reasonable to expect that individuals with AS would have particular difficulty comprehending humor. Research has shown this to be the case (Ozonoff & Miller, 1996; Emerich et al., 2003).

Particularly relevant to this study is the research conducted by Le Sourn-Bissaoui, Caillies, Gierski, and Motte (2009) investigating the semantic and pragmatic inference abilities of adolescents with AS using written text. Each participant completed 20 semantic inference tasks and 10 pragmatic inference tasks. The semantic inference task required each participant to read ten two-sentence passages and make a causal inference by explaining why sentence number two might be factual and read ten different two-sentence passages and predict what would likely happen next. The pragmatic inference task also required the participants to read ten two-sentence passages (five simple and five complex) and respond, “Yes” or “No” to one probable and improbable proposition about the intentions of the character. The results showed that the adolescents with AS had significantly greater difficulty with generating both causal and predictive semantic inferences and making simple and complex pragmatic inferences when compared to typically developing peers. These results support the findings that

individuals with AS have deficits in mentalizing when they are presented with short passages.

This section discussed a theoretical framework for reading comprehension from a constructivist model. It is clear from current research that individuals with AS demonstrate deficits in reading comprehension and particularly inference generation. However, the ability to generate inferences is not limited to reading. As individuals engage with one another socially, they continuously generate inferences about their communication partner's intentions, feelings, and motives based on their social experience and social cues. In the present study, a primary research question focuses on the potential transfer of inference generation from written language to a social context. In particular, for individuals diagnosed with AS can inference generation strategies facilitate social interactions?

Social Inference

Social inference, also known as social cognition (Striano & Reid, 2009), has been defined by Schenkel, Marlow-O'Connor, Moss, Sweeney, and Pavuluri (2008) as, "the ability to infer what another individual is thinking or feeling based on their verbal and/or non-verbal cues in the context of ongoing behavior and events" (p. 791). As previously discussed, social interaction impairment is a hallmark of individuals with AS and is often expressed in terms of significant communicative and social difficulties individuals with AS experience. These social difficulties reflect an inability of an individual to make

social judgments based on pragmatic cues (e.g., facial expression, gestures, prosody, etc.) and the available knowledge net (e.g., conversational conventions, social experience, etc.).

The social inference difficulty individuals with AS exhibit has been attributed to three social cognition processes: mentalizing (also referred to as theory of mind or cognitive empathy), emotion recognition and executive functioning (Stichter, et al., 2010). Two studies are pertinent to the discussion of deficits in social inference of individuals with AS (Dziobek, et al., 2008; David, et al., 2010).

Dziobek et al. (2008) investigated the mentalizing and emotional empathy abilities of adults with AS. Seventeen adults with AS and 18 well-matched controls were asked to; (a) infer the mental state of the individuals shown in photographs depicting emotionally-charged situations, and (b) rate their emotional response to the photographs. Findings showed the adults with AS to have significantly more difficulty with the mentalizing task than the control group ($p < .05$). However, the groups did not differ significantly in the emotional empathy task ($p = .79$).

In a related study, David et al. (2010) used computer-generated images to examine the mentalizing and visuospatial perspective-taking abilities of 19 adults with AS compared to 15 controls. Instead of using photographs, David et al. used computer-generated virtual characters expressing a preference for one of two objects. Preference was depicted through the use of facial expressions, gestures, or head/body orientation. In addition to indicating the preference of the virtual character (mentalizing task) participants were also asked to indicate which object was elevated from their own perspective and from the character's perspective (visuospatial perspective-taking task).

Findings showed individuals with AS had significant difficulty determining the preference of others compared to the control group ($p < .05$) but did not differ in their ability to take the visuospatial perspective of others ($p > .05$).

Taken together, these results support previous literature indicating individuals with AS have difficulty mentalizing. It appears that emotional empathy and visuospatial perspective-taking is preserved. However, this may have been related to the measurement task. In both studies, stimulus items were static. It is unclear whether individuals with AS demonstrate similar emotional empathy and visuospatial perspective-taking when presented with dynamic stimuli as encountered in authentic social interactions.

Holdnack, Goldstein, and Drozdick (2011) compared the performance of adolescents and adults with HFA, AS, and typically developing controls on a cognitive battery and emotion recognition tasks. Sixteen individuals with HFA and 27 individuals with AS were compared to 600 controls from the Advanced Clinical Solutions (ACS) Social Perception standardization sample. Participants were assessed using the Wechsler Adults Intelligence Scale – Fourth Edition (WAIS-IV; Wechsler, 2008) and the Social Perception subtest of the ACS (Pearson, 2009). The researchers found those participants diagnosed with HFA to demonstrate significant difficulty with all aspects of emotion recognition, including integrating facial expressions with prosody and analyzing facial expressions and body language of individuals conversing. Although participants with AS demonstrated mild difficulties in all areas of emotion recognition tested; their ability to identify emotion based on facial expression alone was the only task shown to be significantly impaired when compared to the control group.

Baron-Cohen, Jolliffe, Mortimore, and Robertson (1997) were also interested in the mentalizing abilities of adults with AS. Sixteen adults with AS were compared to 50 matched controls and 10 matched adults with Tourette Syndrome. Each participant completed two experimental tasks (Mind in the Eyes Task, Happé Strange Stories Task) and two control tasks (Gender Recognition Task, Basic Emotion Recognition Task). The Mind in the Eyes Task uses 25 photographs of the eye region of different faces. Participants were asked to choose the mental state of the individual in the photograph from a choice of two. To complete the Gender Recognition Task, participants had to simply state the gender of the 25 eye region photographs. Finally, the Basic Emotion Recognition Task required the participants to choose the basic emotion given the choice of two when presented with a photograph of an entire face.

Results suggest that individuals with AS have significantly more difficulty in mentalizing as tested by the Mind in the Eyes Task than both typically developing controls and individuals with Tourette Syndrome ($p = .0001$). The individuals with AS also had significant deficits in mentalizing as measured by the Happé Strange Stories Task. These results were reported in a separate article (Jolliffe, et al., 1997) and discussed earlier in this manuscript. The three groups did not differ significantly on either the Gender Recognition or Basic Emotion Recognition Tasks.

In a similarly designed study, Rutherford, Baron-Cohen, and Wheelwright (2002) investigated the mentalizing ability of adults with AS when presented with only the voices of individuals. Nineteen adults with AS were compared to two control groups of typically developing adults; (a) university students, (b) non-university students/graduates. Each participant listened to 40 segments of speech (2-3 second sentence or phrase) and

judged the mental attitude or emotion of the individual given 2 choices. Findings showed the adults with AS to demonstrate significant difficulty with mentalizing as measured by the Mind in the Voice Task when compared to both control groups ($p = .006$). Although there are limitations to the design of this study (e.g., providing only two choices), the results support previous findings that show mentalizing deficits in individuals with AS.

Wang, Lee, Sigman, and Dapretto (2006) assessed children and adolescents with AS for comprehension of irony when verbally presented by an adult speaker. Participants in this study listened to short scenarios and determined whether the speaker was being ironic or sincere. Three types of scenarios were presented: (a) event knowledge and prosodic cues, (b) event knowledge only, and (c) prosodic cues only. Scenarios revealing event knowledge provided participants with contextual cues about the event outcome. Scenarios containing prosodic cues were delivered with either a sincere or sarcastic tone of voice. Findings showed the group with AS to have significantly greater difficulty determining whether speakers were being sincere or ironic when provided with both event knowledge and prosodic cues or event knowledge cues only. The individuals with AS did not differ significantly from the control group when only prosodic cues were given. Although this last finding is surprising, the authors suggest it may be due to the control group experiencing more difficulty comprehending the scenarios without any event knowledge cues.

Results from Baron-Cohen et al. (1997), Rutherford et al. (2002) and Wang et al. (2006) suggest adults with AS have significant deficits in mentalizing when presented with discrete emotional stimuli such as eyes or voices. However, it is the integration of a variety of social stimuli (facial expressions, gestures, prosodic cues, etc.) that typically

developing individuals are able to do automatically and unconsciously to mentalize (Golan, Baron-Cohen, Hill & Golan, 2006). A question remains, are individuals with AS able to integrate these social stimuli to mentalize?

Golan, Baron-Cohen, Hill, and Golan (2006) developed a mentalizing and complex emotion recognition task that used a dynamic social interactions task known as ‘The Reading the Mind in Films’ task to try and answer this question. In this study, 22 adults with AS and a control group of 22 typically developing adults watched 22 short scenes from films and determined the emotion or mental state of the identified person in the film clip from four choices: the correct choice and three foils chosen for verbal difficulty according to an emotion taxonomy (Baron-Cohen, Golan, Wheelwright, & Hill, 2004). Results showed individuals with AS to have significantly more difficulty in mentalizing than the control group.

Not all social inference abilities appear to be impaired in individuals with AS. As discussed previously, although adults with AS demonstrate consistent deficits in mentalizing (Baron-Cohen et al.; David, et al., 2010.; Dziobek, et al., 2008.; Golan, et al.; Holdnack et al.; Rutherford et al.; Wang et al.) they have been shown to demonstrate comparable abilities in emotional empathy and visuospatial perspective taking (David et al.; Dziobek et al.).

In addition, White, Hill, Winston, and Frith (2006) found that adults with AS were able to demonstrate a comparable ability to matched controls in judging social attributes of facial expressions. Using a seven-point scale, participants judged pictures based on trustworthiness, attractiveness, social status, and age. Comparable abilities between the groups were noted in all categories except attractiveness of same sex faces.

Participants with AS performed significantly poorer when judging the attractiveness of pictures of same sex individuals. The authors suggest this difficulty may be due to a deficit in mentalizing because participants had to take the perspective of a member of the opposite sex. In a similar study, Ramachandran, Mitchell, and Ropar (2009) investigated individuals with AS's ability to infer character traits based on descriptions of behavior. The results suggest that individuals with AS are able to assign character traits based on behavioral descriptions with the comparable ease and accuracy as typically developing peers.

Difficulty with social inference is a hallmark of AS. Both the theory of mind and the weak central coherence hypothesis help to explain these social inference difficulties. Although social inference difficulties appear to be a significant and widespread phenomena among individuals with AS, only two studies (Stichter, et al., 2010; Turner-Brown, Perry, Dichter, Bodfish, & Penn, 2008) were located that addressed intervention in the specific area of social inference with individuals with AS.

In a quasi-experimental designed study, Turner-Brown, et al. (2008) investigated the effectiveness of a social-cognitive intervention program for adults with high-functioning autism. Six adults received the Social-Cognition and Interaction Training over 18 weeks (50 minutes/once per week). Five comparison participants also with high-functioning autism received treatment as usual. The intervention program consisted of three phases. The first phase focused on teaching participants to become more aware of social cues. The second phase addressed how to distinguish socially-relevant facts from socially irrelevant facts. The final phase used videotaped interactions to allow the participants to apply the skills they learned. Four outcome measures were used to

determine the effectiveness of the intervention. The Face Emotion Identification Test (FEIT; Kerr & Neal, 1993) is a 19-item measure in which participants must indicate which of five emotions is depicted in each of the 19 photographs from a choice of 5 emotions. The Hinting Task (Corcoran, et al., 1995) measures theory of mind skills through the use of 10 short vignettes of social interactions between two characters. At the end of each vignette one character utters a hint requiring the participant to interpret what the character intended by the hint. The Social Communication Skills Questionnaire (SCSQ; McGann et al., 1997) is a 26-item measure that requires each participant to rate his/her social communication functioning using a 5-point scale. The final outcome measure, The Social Skills Performance Assessment (SSPA; Patterson et al., 2001), is a conversational role-play assessment. Each role-play by the participants was audiotaped and rated by independent blind-observers.

Findings indicated positive and significant results favoring the experimental group in emotional recognition as measured by the FEIT ($p < 0.05$). However, no other statistically significant results were found although a large within group treatment effect was found for the theory of mind task ($d = .84$) (confidence interval not reported). These results suggest that a social inference treatment program for adults may improve some areas of social cognition though future research is certainly warranted.

In a non-experimental pre-post design, Stichter et al. (2010) developed and implemented a social cognition intervention with 27 adolescents with the diagnosis of AS. The Social Competence Intervention used cognitive behavioral principles to address theory of mind, emotion recognition, and executive functioning. Participants received the intervention program in groups twice a week in one hour sessions over 10 weeks. The

intervention program consisted of the following curricular constructs taught in successive two-week increments, (a) recognition of facial expressions, (b) sharing ideas with others, (c) turn taking in conversation, (d) recognizing feelings of self and others, and (e) problem solving. Each session involved a similar structure of review of previous material, introduction of the new concept, skill modeling, practice, and review of the session.

An analysis of the results of the AS participants' performance yielded a statistically significant post intervention improved performance for theory of mind, problem solving, and facial expression recognition tasks. Due to the nature of the design of this study, the results do not allow for an interpretation of a causal effect of the intervention. Thus, further research is warranted to determine if these improvements may be attributed to the intervention program.

This section discussed social inference abilities of individuals with AS. Social inference deficits in AS may be attributed to difficulty in mentalizing and/or emotion recognition (Stichter, et al., 2010). Although individuals with AS demonstrate significant difficulty with the aforementioned social cognitive processes, there are some areas of social inference that remain intact, evidence to date points to similar levels of performance for AS and typical participants on measures of visuospatial perspective taking, judging social attributes of faces, and assigning character traits based on behaviors (David, et al., 2010; Dziobek, et al., 2008; Ramachandran, Mitchell, & Ropar, 2009; White, Hill, Winston, & Frith, 2006). However, these results were found using static types of tasks. It is unclear if individuals with AS perform similarly in these areas when the task requires an integration of competing stimuli. The Weak Central Coherence

Hypothesis suggests that it is the integration of information that individuals with AS have difficulty with (Frith, 1989). Although the deficits in social inference ability are well-known in AS, little research was located that investigated interventions addressing these difficulties.

As discussed previously, this deficit in social inference generation may be explained by deficits in theory of mind and difficulties with the integration of information for the purpose of generating meaning. An inability to conceive of other's mental states and even reflect on one's own thoughts and feelings may be a prerequisite for other metacognitive abilities (Bartsch & Estes, 1996). Metacognition refers to the knowledge of cognition and the ability to reflect on and regulate those thoughts (Campione, Brown, & Connell, 1989). In certain academic tasks, such as reading comprehension, skilled readers have been shown to be more metacognitive in their approach to comprehending text (Pressley, 2002; Pressley & Afflerbach, 1995). That is, skilled readers are actively engaged in the comprehension process and are strategic in their approach to reading (Pressley, 2002; Pressley & Afflerbach, 1995; Westby, 2004). Research also suggests that struggling readers can be taught how to approach reading metacognitively through the use of strategies (Fisher, Schumaker, Deshler, 2002; Lenz & Hughes, 1990; Schumaker & Deshler, 1992; Seybert, 1998). In the present study, the intervention program uses a language-focused approach to teaching an inference generation in reading strategy. However, it is unclear whether a metacognitive approach to inference generation will translate to effects in social inference generation.

Metacognition

Metacognition has been described as both appealing and confusing to psychologists, educators, and researchers (Brown, 1987; Borkowski, 1992; Borkowski, Carr, Rellinger, & Pressley, 1990). Since John Flavell first studied *metamemorial* processes in children (Flavell, Friedrichs, & Hoyt, 1970), researchers have been intrigued by the construct of metacognition because of its implications for understanding human development (Borkowski, 1988). However, the term metacognition has been used and interpreted differently in the literature. According to Brown (1987), one primary issue with metacognition is that the same term is used to refer to knowledge *about* and regulation *of* cognition,

As Brown (1987) suggested, the term metacognition means different things to different people and thus there is some confusion in the literature concerning what constructs are indeed metacognitive and what are not (Borkowski, 1992; Campione, Brown, & Connell, 1989). To clarify, Campione, et al. suggested that the term metacognition is used in the literature to mean one of two things; (a) one's knowledge about cognition, or (b) one's self-regulation of cognitive skills. For example, Flavell (1976) described metacognition as the ability to think about one's own thoughts and thought processes. This classic definition does not address the self-regulation of cognitive skills. However, in a later work, Flavell (1987) described the *strategy variables* of metacognitive knowledge. These strategy variables refer to an individual's knowledge and use of metacognitive strategies for monitoring the cognitive process; clearly implying

self-regulation of cognitive skills as metacognitive processes. Weinert (1987) discussed metacognition as simply, “thoughts about thoughts” (p. 8). This definition, like Flavell’s (1976) definition, does not address self-regulation of cognitive skills.

In contrast, many theorists and researchers have viewed metacognition as both the knowledge and self-regulation of cognitive skills (see Borkowski, 1996; Brown, 1987; Campione, 1987). For example, Kluwe (1987) described metacognition as declarative knowledge (one’s own cognitive activities and abilities) and procedural knowledge (the processes to control and regulate one’s own thinking). Pintrich, Wolters, and Baxter (2000) also classified metacognition into knowledge and self-regulation abilities. Within self-regulation, they distinguish metacognitive judgments and monitoring (the ability to reflect on ongoing behavior) from adapting cognitive strategies in response to task demands. This review will discuss metacognition as it relates to both the *knowledge* and *self-regulation* of cognition.

Metacognition and Social Inference

In considering metacognition, one might ask why this skill has developed in the human being. Flavell (1987) looked to the following unique traits of the human to provide an explanation:

- a. humans think excessively;
- b. this thinking is error-prone, and therefore requires monitoring and regulation;
- c. humans desire to justify this thinking to others and themselves;
- d. it is in the best interest of the human to plan ahead and evaluate those plans;

- e. for the human to survive and prosper he/she will need to make careful decisions
- f. humans have a need to infer and explain psychological events in him/herself, and others; in other words, the human requires *social inference* abilities.

Using this logic, it appears that social inference ability is a prerequisite skill to other types of metacognition. Other theorists and researchers have expressed a similar notion. According to Flavell (1987), the concept of metacognition as knowledge about cognition should be broadened to include knowledge about one's own or someone else's emotions and motives. This type of knowledge was discussed previously in this review as theory of mind and specifically social inference. Bartsch and Estes (1996) argued that developments in theory of mind provide a foundation for later metacognitive skills. In fact, several researchers contend that an understanding of the existence of one's own and other's mental states underlies complex thinking including metacognition (Astington, 1993; Bartsch & Wellman, 1995; Flavell, Miller & Miller, 1993; Perner 1991; Wellman, 1995). Bartsch and Estes suggest that an individual's comprehension of cognitive states arises from an understanding of emotions and desires. Additionally, these initial experiences in mentalizing foster the development of concepts of cognition.

These arguments have significant implications for individuals with AS. As discussed previously, individuals with AS have difficulties with social inference skills and thus it can be postulated that they might also have difficulties with metacognition. In fact, there is research to suggest individuals with AS demonstrate deficits in executive

functioning (Ozonoff, 1997; Rinehart, Bradshaw, Moss, Brereton, & Tonge, 2001).

According to Semrud-Clikeman, Walkowiak, Wilkinson, and Butcher (2010),

“Executive functions (EF) are those that allow one to plan, organize information in working memory, and develop and evaluate an appropriate action from this information. EF has been defined as those capacities that enable a person to engage successfully in independent, purposive, self-serving behavior” (p. 1017).

Executive functioning abilities must be preserved for an individual to be strategic in his/her approach to a problem. Metacognition includes the ability approach a learning task strategically, but what specific sets of skills are necessary to achieve this level of metacognition?

Strategic Approach to Learning

Successful students are metacognitive by both of Campione, Brown, and Connell’s (1989) previously discussed definitions; they are able to reflect on their problem-solving abilities, they have a repertoire of strategies to deal with new problems, they are able to regulate their use of these strategies, and can reflect on their performance (Brown, 1987; Campione et al; Duke, Pressley, & Hilden, 2004). Individuals who are strategic in their approach to learning possess certain skills and beliefs described by Borkowski and Muthukrishna (1992), they:

- a. know many learning strategies and why they are important
- b. select and monitor strategies carefully
- c. are reflective and planful

- d. understand that the mind grows in an incremental way
- e. believe in the effects of effort
- f. are intrinsically motivated
- g. are task-oriented
- h. have mastery goals
- i. do not fear failure
- j. have concrete and multiple images of possible selves
- k. possess knowledge of a variety of topics and can easily access that knowledge

Insights into the nature of metacognition have been provided through investigations of both skilled and unskilled learners. Borkowski, Estrada, Milstead, and Hale (1989) proposed a metacognitive theory to account for specific difficulties observed in individuals with a variety of learning disabilities. They suggest that self-regulation and the motivational beliefs associated with strategy use are the two major components of metacognition. Borkowski (1992) explained the way in which typically developing students acquire self-regulatory skills:

Initially, the function of self-regulation is to analyze and “size up” tasks in order to *select* an approach to problem solving (hopefully, through the choice of a viable strategy). Later, during the course of learning, the job of self-regulation is to *monitor* the course of learning and, perhaps, to *adjust* or *revise* the strategy. (p. 253)

As typically developing young learners accumulate these self-regulatory skills they begin to attribute their successes to their own effort as opposed to luck or ease of the task. They start to realize the importance of being strategic and develop feelings of self-efficacy. Borkowski (1992) suggested that successful experiences in problem-solving and an enjoyment of learning motivate students to continue to use a strategic approach to problem-solving. For those students who struggle academically, their consistent failures also motivate their future approaches to problem-solving. Instead of developing feelings of self-efficacy, weaker students are not convinced that they can control their performance (Campione, Brown, & Connell, 1989). In essence a “Matthew effect” is observed (i.e., the rich get richer and the poor get poorer, Stanovich, 1986). Successful students develop self-efficacy and increase and refine their repertoire of learning strategies, hence becoming more skilled at self-directed learning. Weaker students, in contrast, acquire fewer strategies because they are less aware of their utility. The few strategies they may use are not used flexibly and therefore these students continue to struggle to problem-solve and ultimately have difficulty learning on their own (Borkowski; Campione, et al.).

The question then arises, *can students who do not naturally acquire these metacognitive abilities become more strategic in their approach to learning through instruction?* Several research studies suggest the answer is, *yes*. Researchers at Kansas University’s Center for Research on Learning (KUCRL) have done extensive research on teaching students to improve their metacognitive abilities primarily through the use of learning strategies (e.g., Bui, Schumaker, Deshler, 2006; Hughes, Ruhl, Schumaker, & Deshler, 2002; Lancaster, Schumaker, Lancaster, & Deshler, 2009; Schumaker et al.,

1982). Ellis, Deshler, Lenz, Schumaker, and Clark (1991) developed an eight-stage instructional methodology designed to teach strategies to students. This instructional methodology has been empirically validated with both typically developing students as well as those with learning disabilities and is used in all of KU's Learning Strategy curricula.

Ellis Deshler, Lenz, Schumaker, and Clark (1991) based their instructional methodology on the two domains that highly impact the effect of strategy instruction; (a) individuals' knowledge of the skills and information that is related to strategy use, and (b) individuals' motivation to learn and use the strategy. Individuals' knowledge related to strategy use can be further divided into process, semantic, procedural, and conditional knowledge. Process knowledge includes the knowledge of how to perform specific parts of a strategy (e.g., how to determine the main idea when using a paraphrasing strategy) and also includes metacognitive knowledge (e.g., how to use self-regulatory processes and the awareness of one's own thinking style). Semantic knowledge refers to knowledge of key prerequisite skills necessary for strategy use (e.g., foundational syntactic knowledge to coherently express a main idea) and background knowledge application based on the given content area in which an individual applies a strategy.

Having process and semantic knowledge is not sufficient for an individual to successfully employ a strategy. They also need procedural knowledge; knowledge of the specific steps of a strategy and why each step is crucial to the strategy. To be strategic in their approach to a problem, individuals must recognize which strategy in their repertoire would be most useful in solving a problem. This type of knowledge is referred to as

conditional knowledge and also includes an individual's recognition of the need to adapt a strategy (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991).

The second domain critical to the success of individual's strategy use involves motivation. Individuals' beliefs about themselves, the value of the learning task, and their old learning habits impact their ability to learn a new strategy. Individuals who struggle academically and have a history of failure view themselves as incapable and are skeptical about learning new strategies. Individuals who do not see the value in the learning task are also less likely to be engaged in the learning process. Although individuals who struggle academically may not have experienced much success in the use of learning strategies, they may be unwilling to change their old habits (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991).

It is clear that individuals' beliefs affect their motivation to learn and use a new strategy. To independently employ learning strategies to meet the requirements of academic learning, individuals must also be sufficiently motivated across the school day (McCombs, 1984). Individuals who are strategic in their problem-solving use coping and affirmation statements, goal-setting, and self-reinforcement to sustain motivation (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991).

As previously mentioned, Ellis, Deshler, Lenz, Schumaker, and Clark's (1991) eight-stage instructional methodology is based on these critical domains of strategy instruction. Table 2 describes each stage of the instructional sequence. Each instructional stage incorporates the additional elements of organizer use and goal attainment not described in Table 2. At the beginning of each instructional session, an advance organizer is used to orient the students to the activities of the current session and

relate those activities to the overall goal of the mastering the strategy. The advance organizer also connects current learning goals to previous content, provides a rationale for the lesson, and describes the specific learning and performance expectations. A post organizer is presented at the end of each stage to summarize the lesson and determine if expectations of learning and performance were met. Each instructional stage also incorporates goal attainment. At the beginning of each stage each student sets his/her own performance goals for that lesson and evaluates his/her own performance at the end of the session.

Table 2: *Ellis, Deshler, Lenz, Schumaker, & Clark's (1991) Eight-Stage Instructional Sequence*

Eight-Stage Instructional Sequence		
Stage 1	Pretest and Make Commitments	Gather baseline data to increase individual's awareness of the necessity of strategy instruction and increase his/her motivation to learn the strategy.
Stage 2	Describe	Explicit instruction in each component of the strategy including overt and covert processes.
Stage 3	Model	Instructor uses a "think-aloud" procedure to walk students through each overt and covert process of each step of the strategy.
Stage 4	Verbal Practice	Students demonstrate an ability to automatically name each strategy step and explain key information.
Stage 5	Controlled Practice and Feedback	Students are provided with multiple opportunities to practice using the strategy with less demanding material to build their confidence and help them become independent in their use of the strategy.
Stage 6	Advanced Practice and Feedback	Students are provided with multiple opportunities to practice using the strategy with materials similar to those he/she encounters on a daily basis.
Stage 7	Posttest and Make Commitments	Gather data to demonstrate mastery of the strategy and make commitments to generalization of the strategy across settings, situations, and time.
Stage 8	Generalization	Students demonstrate the generalization of the use of the strategy across settings.

High-achieving students automatically approach learning tasks strategically (Pressley, 2002; Pressley & Afflerbach, 1995; Westby, 2004). Individuals who struggle academically can be taught to use strategies to effectively problem-solve (Bui,

Schumaker, Deshler, 2006; Hughes, Ruhl, Schumaker, & Deshler, 2002; Lancaster, Schumaker, Lancaster, & Deshler, 2009; Schumaker et al., 1982). Ellis Deshler, Lenz, Schumaker, and Clark's (1991) eight stage instructional sequence has been validated as an effective method of strategy instruction and focuses on the knowledge and skills necessary for an individual to approach a learning task strategically.

It is well-known that students who use a wide-array of strategies while reading understand the content (Pressley, 2002; Pressley & Afflerbach, 1995), but what specific aspects of metacognition do skilled readers employ?

Metacognition in Reading

Considering the constructivist model, it is difficult to discuss reading comprehension without accounting for the knowledge and skills the reader brings to the task. Donahue and Foster (2004) describe the active role of the reader,

Given that every author/speaker has presuppositions that are not made explicit, every text (oral or written) has gaps. The reader's task is to fill in those gaps to construct ideas that make personal sense, using prior knowledge and text structure. (p. 366).

Research has shown that proficient readers are active, strategic readers (Pressley, 2002; Pressley & Afflerbach, 1995). Westby (2004) provides a description of the variety of strategies proficient readers employ before, during, and after they read a text. Before reading, proficient readers identify a goal for their reading and browse through the text to get a sense of what to expect. They also activate prior knowledge based on the topic of

the text and make predictions about what will likely be discussed. During reading, proficient readers generally read from the beginning to end, but are flexible enough to look back for clarification or look ahead for information. Proficient readers monitor their comprehension during reading; noticing when they don't comprehend something and are able to resolve the issue. They also generate inferences as they read; integrating their background knowledge with information from the text. Proficient readers determine main ideas, evaluate the content and structure of the text, make judgments about the credibility of the text, reread difficult parts, and ask themselves questions during reading. After reading, proficient readers reflect on what they read. They are able to summarize and evaluate the ideas presented in the text.

Not all readers are strategic in their reading. As mentioned previously, poor comprehenders have fewer strategies in their repertoire and are unable to use them flexibly before, during, and after reading (Borkowski, 1992; Campione, Brown, & Connell, 1989). However, numerous research studies have shown that students with a variety of disabilities can be taught how to successfully use strategies during reading (Fisher, Schumaker, Deshler, 2002; Lenz & Hughes, 1990; Schumaker & Deshler, 1992; Seybert, 1998). While no research studies were located that addressed teaching individuals with AS how to use strategies during reading, a question remains, *do individuals with AS respond similarly to instruction in reading comprehension strategies?*

Summary

Individuals with AS demonstrate specific difficulties with both social inference generation (e.g., Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Dziobek, et al., 2008; David, et al., 2010) and inference generation in reading (e.g., Emerich, Creaghead, Grether, Murray, & Grasha, 2003; Happé, 1994a; Heavey, et al., 2000; Jolliffe & Baron-Cohen, 2000; Kaland, et al., 2002; Ozonoff & Miller, 1996). However, the relationship between these two language modalities of inference generation is not well understood. In fact, it appears that there are no studies that attempt to explain whether a relationship exists between inference generation in reading and social inference skills. It is clear that instruction in inference generation in reading improves abilities to comprehend text. It also appears that explicit instruction in pragmatic language, including social inference, positively affects individuals with AS's social functioning (Stichter, et al., 2010; Turner-Brown, Perry, Dichter, Bodfish, & Penn, 2008).

In addition, strategic instruction has been shown to improve individual's ability to learn on their own (e.g., Bui, Schumaker, Deshler, 2006; Hughes, Ruhl, Schumaker, & Deshler, 2002; Lancaster, Schumaker, Lancaster, & Deshler, 2009; Schumaker et al., 1982). Specifically, instruction in reading comprehension strategies has shown positive and significant effects on the reading comprehension abilities of struggling children and adolescents (Fisher, Schumaker, Deshler, 2002; Lenz & Hughes, 1990; Schumaker & Deshler, 1992; Seybert, 1998). Unfortunately, there is a dearth of literature investigating the use of reading comprehension strategies with individuals with AS. The role of

metacognition and theory of mind in the ability of individuals with AS to learn strategies for inference generation have yet to be explored. Considering the unique inference generation deficits seen in individuals with AS, it is important to investigate the effects of a language-focused reading inference generation strategy on both the reading inference generation and social inference abilities of individuals with AS. Both inference generation in reading and social inference generation require the integration of background knowledge and linguistic cues.

CHAPTER THREE: METHOD

Introduction

The purpose of this study was to assess the efficacy of a language-focused reading inference strategy intervention on the general reading comprehension, inference generation in reading, social inference, and metacognitive ability of adults with AS. The methodology employed to test these research questions is presented below. This chapter is organized into six sections: (a) research methodology, (b) selection of participants, (c) dependent variables, (d) intervention program, (e) general procedures, and (f) data analysis.

Design

This experimental research study employed a randomized controlled design. Participants meeting the inclusion criteria were randomly assigned to either a treatment or control group using a random numbers table.

Power Analysis for Projected Sample Size

Prior to identifying potential participants, a power analysis was conducted to determine appropriate sample sizes for this study. The results of this analysis revealed that a total of 40 participants (20 in each group) were desired to detect a difference of 0.8 in effect size with 80% power at a significance level of 5%. A minimum of 26 participants (13 in each group) was needed to detect a difference of 1.0 in effect size with 80% power at a significance level of 5% (Cohen, 1988).

Sampling Procedure

Participants were recruited from among the 1505 adult constituents registered with the University of Central Florida Center for Autism and Related Disorders (CARD) in Orlando, Florida. Coordinators of CARD were contacted to provide contact information of constituents they believed might be interested in participating in the study. Referred constituents were called and a recruitment email (Appendix B) was sent if email was available.

Intervention Program

The language-focused inference strategy intervention program (ACT & Check Strategy), along with all of Kansas University's Learning Strategies, was developed based on an empirically-validated instructional methodology used to teach strategies to

both typically developing students as well as those with learning disabilities (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991). This eight-stage instructional sequence was discussed in Chapter 2 and was adopted as a framework for developing the current language-focused inference intervention.

Content of the Intervention

The ACT & Check Strategy is a reading comprehension strategy designed to help participants generate inferences as they read. Participants are taught a four-step strategy that corresponds with the acronym of ACT & Check as presented in Figure 2.

- | |
|---|
| <ol style="list-style-type: none">1. Ask yourself a question2. Consider the text3. Think about what you know and take a good guess (infer)4. Check your guess |
|---|

Figure 1: ACT & Check Strategy Steps

Participants learn how to use the strategy only after learning about the language underpinnings of inferences and the types of reading inferences most related to social inferences. Each aspect of the intervention will be discussed in detail below and the complete ACT & Check Strategy Lessons used in this study are provided in Appendix C.

The ACT & Check Strategy Lessons provided explicit instructions for the instructor and a script to ensure that lesson content was consistent across groups. Although a script was available it was not read verbatim by the instructor. Instead it was used as a guide so that the instruction flowed naturally and allowed for an exchange among participants and the instructor. In addition to the instructions and script, a variety of visual aids were developed to support the content of each lesson. Cue cards describing key content of the lesson including the advance organizer and post organizer were created for each lesson.

Participants also were provided with structured note pages for many of the lessons. These structured notes provided participants with an outline of the lesson and were designed to encourage active participation in the intervention sessions. An Inference Graphic Organizer was also created to aid participants in integrating their background knowledge with text clues.

The majority of the passages used for instructional purposes were taken from Book Six of the *Jamestown Readers – Timed Readings in Literature* (Spargo, 1989). Each 400-word passage in Book Six is written at the 9th grade reading level. In addition, non-fiction passages were taken from various print and online magazines. An instructional procedure referred to as “Reading between the Lines” was developed by the researcher to allow participants to write between the lines of each passage. Participants initially used the space between the text lines to write down the inference category questions they asked themselves which were developed together in lessons three and four. This instructional strategy encouraged participants to become more strategic in their approach to reading.

Language Underpinnings of Intervention Program

To successfully comprehend difficult texts, readers must master certain linguistic and metacognitive skills that provide the foundation for complex skills such as generating inferences in text. Language foundations are introduced in Lesson two. Each of the following five language foundations are explained in detail and embedded throughout the lessons and activities of the intervention program;

- a. Awareness of making inferences
- b. Formulating your own questions about the text
- c. Integrating background knowledge with text cues
- d. Attending to language cues at each level of complexity
- e. Applying knowledge and skills strategically

To actively use a strategy similar to the ACT & Check Strategy, a reader must first be aware of the necessity of using the particular strategy and recognize the need to generate inferences while reading. This metacognitive skill is critical to actively engaging with the text for comprehension and also refers to the ability to apply knowledge and skills strategically.

The ability to ask questions as one reads is a language skill that is directly related to inference generation. The ability to formulate syntactically and semantically coherent questions related to a particular category of inference is crucial for using the ACT & Check Strategy. In addition, participants must be able to determine which textual cues are most important to answer a self-generated question and then be able to integrate the textual information with relevant background knowledge. This multi-step process relies

on an ability to determine which ideas may contribute to an inference and which are extraneous details. The instructional sequence of the ACT & Check Strategy begins with sentence comprehension, moves to the comprehension of paragraphs, and finally multiple paragraphs. Successful readers must be able to cope with the increasing language demands required to process exceedingly longer texts. They also must demonstrate an ability to integrate all of these linguistic and metacognitive skills while reading increasingly complex texts.

Types of Inference

To determine which categories of inference generation should be the focus of the intervention, a jury of six experts in the area of ASD from UCF CARD were consulted. Each expert works as a coordinator with CARD and has extensive experience working with people with ASD. Three of the experts hold a Ph.D. in psychology or education and three hold master's degrees in education or speech-language pathology

Each expert was asked to rank order the five inference categories described by Magliano, Baggett, and Graesser (1996) that they believed most related to a person's ability to generate social inferences (see Appendix D for the instructions given to each expert). The top five inference categories selected were: (a) theme or thesis, (b) author's intent, (c) character condition, (d) big goal, and (d) intended reader emotion. These inference categories were discussed in detail in lessons three and four. Participants were explicitly taught about each inference category and developed questions collaboratively to ask as they read. These questions addressed the first step of the ACT & Check

Strategy, “Ask yourself a question.” Although these inference categories were explicitly taught in only lessons three and four, the participants used their knowledge of inference categories throughout the remainder of the intervention program to use the ACT & Check Strategy as they read.

Organization of the Intervention

As mentioned above, the ACT & Check Strategy was developed using an eight-stage instructional sequence (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991). This instructional sequence was chosen because of its consistent use in KU’s Learning Strategies Curriculum and the research support for its effectiveness as an instructional methodology (see Chapter 2). Each stage of instruction follows a familiar pattern so that both the instructor and the students know what to expect. Each lesson begins with an advance organizer designed to set the stage for instruction by letting the participants know what they are going to be doing during that session and why they are going to do it. Each session also concludes with a post organizer which sums up the lesson’s activities and prepares the participants for the next lesson of instruction. Each stage of the instructional strategy described by Ellis et al. is provided below:

1. Pretest and make commitments
2. Describe the strategy
3. Model the strategy
4. Verbal practice
5. Controlled practice and feedback

6. Advanced practice and feedback
7. Confirm acquisition and make generalization commitments
8. Generalization

Pretest and Make Commitments

During the first instructional session, participants take the MIRI pretest. All other pretest measures were completed on previous pretesting session dates for each participant. Besides completing the pretest measure, participants learn about the ACT & Check Strategy and the rationale for participating in the intervention program. A goal of this initial session is to establish buy-in. At the end of the first session participants sign a commitment (see Appendix C) stating they will fully participate in all intervention sessions and support their peers. The researcher also signs a commitment stating she will follow her lesson plans and explicitly teach each targeted behavior to ensure participants get the most out of the intervention program.

Describe the Strategy

The second stage of the instructional sequence provides participants with a detailed explanation of each part of the ACT & Check Strategy. Prior to a discussion of the particular steps of the strategy, participants learn about the foundational language skills of the strategy and the categories of inferences the strategy uses. Explicit explanations of

the strategy, including the specific steps of the strategy are provided before the strategy is modeled by the researcher.

Model the Strategy

During the modeling phase, the researcher uses a think-aloud procedure to model the specific steps required to use the strategy to generate inferences during reading.

Verbal Practice

The verbal practice phase helps the participants commit the steps of the ACT & Check Strategy to memory. To be strategic, participants must learn to use the strategy automatically; therefore, memorization of the steps is critical. Participants work together to memorize the steps, test each other, and practice on their own as homework. Once participants feel confident in their knowledge of the ACT & Check Strategy steps they are quizzed by the researcher. Participants who are able to recall each step move to the next stage of instruction. Those participants who are unable to recall each step continue to practice until they can recall each step independently as tested by the researcher.

Controlled Practice and Feedback

During the controlled practice and feedback phase, the responsibility of using the strategy is gradually shifted to the participants. Initially, the researcher helps the

participants use the ACT & Check Strategy while reading the passage together in a large group. Then the participants work in small groups to practice using the strategy. Finally, they individually use the strategy while reading a novel passage. During the controlled practice phase, materials are used that allow for multiple inferences to be drawn without too much difficulty.

Advanced Practice and Feedback

During the next phase, advanced practice and feedback; participants continue to take more responsibility in using the strategy on their own with more difficult and diverse texts. However, the researcher is still available to review the process as a group or individually and provides feedback to participants as needed.

Confirm Acquisition and Make Commitments

Participants are then tested in their ability to use the ACT & Check Strategy independently with a novel passage. Participants' performance on the mastery test is judged by the researcher. If the researcher determines that a participant is able to use the ACT & Check Strategy independently and effectively, they move to the generalization phase. Effective use of the strategy is determined based on whether each participant is able to generate plausible and necessary inferences throughout the passage.

Generalization

Prior to the generalization phase participants learn about generalization and make commitments to themselves to use the strategy outside of the intervention setting. Buy-in is again critical to establish in this phase. During the generalization phase of this study, participants practice using the strategy independently at home with texts they would typically read. Participants report at the following session what reading material they chose and whether they were able to successfully use the ACT & Check Strategy. During the final intervention session, participants discuss how the generalization task went and complete the MIRI posttest.

Instructor

The researcher, an ASHA certified and state licensed speech-language pathologist (SLP), conducted all of the experimental intervention sessions to control for intervener effects. Control group participants were contacted at the conclusion of the research study to offer the same intervention as the intervention group received by the same interventionist. No control group participants elected to receive the intervention.

Materials

An Innovation Configuration (IC) Map (Hall & Hord, 2006)(Appendix E) was created based on the key elements of the Inference Strategy, the top five inference

categories as determined by the jury of experts, and elements of language. Based on the KUCRL Inference Strategy guidelines (Fritschmann, Deshler, & Schumaker, 2007) and the innovation configuration map, an instructional sequence was also developed (Appendix C). This instructional sequence served as the basis for developing the individual lesson plans for the intervention. Participant handouts including notes pages, graphic organizers, and passages are included in the instructional sequence (Appendix C). All intervention and assessment passages were written at the 9th grade reading level because most popular press print materials (e.g., newspaper, magazine) are written at or below the 9th grade level (Johns & Wheat, 1984; Razik, 1969).

Fidelity of Implementation

An IC Map (Hall & Hord, 2006) (Appendix E) was used to create the key elements for each phase of the intervention: Content and Process. This Content IC Map allowed the instructor to define exactly what the intervention was and what it was not. In addition to the Content IC Map, a Process IC Map (Appendix F) was created to define each component of the intervention in terms of the organization of each stage (e.g., advance organizer, purpose, description of behavior).

IC Maps can be used to aid instructors in delivering the intervention and can also be used to develop fidelity of implementation checks. A checklist developed from the IC Maps was created to score the primary researcher's implementation of the intervention as it was intended (Appendix G). Two independent research assistants were trained to complete fidelity checks. These research assistants watched Lesson 1 videos until they

met 100% inter-rater reliability with the primary researcher. A random sample of 20% of the 44 video-taped Lesson 2-12 intervention sessions (n=9) were used to determine the fidelity of instruction.

Inter-rater reliability was calculated for the nine videos analyzed by the research assistants ($K = .684, p = .000$). Table 4 describes the fidelity ratings of each aspect of the intervention assessed with the Fidelity Checklist (Appendix G). The percentage of “yes” responses is provided for each rater. Certain intervention procedures were not applicable at different stages of the intervention. Therefore, the percentages of “yes” responses are calculated using only the total possible opportunities to observe. As Table 4 shows, the researcher followed the intervention protocol with a high level of fidelity for checklist items 1-2 and 4-8 (75-100%). However, the researcher was found to have particular difficulty adequately describing the purpose of each session, meeting that criteria 56-67% of the time.

Table 3: *Fidelity of Implementation*

Checklist Item	Number of Opportunities to Observe	Percentage of “yes” responses: Rater 1	Percentage of “yes” responses: Rater 2
1. Did the researcher provide an advance organizer of the session?	9	100%	89%
2. Did the researcher review the last sessions (only for sessions 2-12)?	9	89%	78%
3. Did the researcher describe the purpose of the current session?	9	67%	56%
4. Did the researcher adequately describe the concept/behavior being taught?	9	100%	100%
5. Did the researcher model the concept/behavior being taught? (only for sessions 2 & 5)	3	100%	100%
6. Did the researcher provide scaffolded practice in which she helped any participants who needed help? (only for sessions 2, 5, 7, 8, 9, 10)	7	100%	86%
7. Did the researcher provide independent practice? (only for sessions 7, 8, 9, 10)	4	100%	75%
8. Did the researcher provide a post organizer?	9	100%	89%

Instrumentation

In order to be eligible to participate in the study, participants had to meet five inclusion criteria: (a) be diagnosed with AS or high-functioning autism; (b) speak English as their first language, (c) score at least at the 8th grade reading level; (d) score at least one standard deviation below the mean on at least one subtest of the social inference measure (The Awareness of Social Inference Test; McDonald, Flanagan, & Rollins, 2002). The following outcome measures were delivered as both pretests and posttests.

Social Inference Ability

The Awareness of Social Inference Test (TASIT) (McDonald, Flanagan, & Rollins, 2002) is a standardized and norm-referenced test designed to assess social perception abilities. The TASIT is appropriate to use with individuals 14-60 years of age who have a diagnosis of traumatic brain injuries, autism, schizophrenia, or learning disabilities. Social perception is assessed using three subtests: *Emotion Evaluation*, *Social Inference-Minimal*, and *Social Inference-Enriched*. Each subtest uses videotaped vignettes and standardized response probes to assess each area of social perception. Raw scores for each subtest were used in the analyses.

The *Emotion Evaluation* subtest is comprised of 28 items. Each item is accompanied by a vignette in which actors engaged in everyday situations experience one of seven emotional states (happy, surprised, angry, sad, disgusted, anxious, or neutral). The scripts of each vignette are ambiguous in nature. Participants are asked to watch the

vignette and then indicate the one emotion that best represents how the actor was feeling. The total number of correct items is counted to determine the overall score for this subtest. A total score for the number of positive emotion items versus negative emotion items can also be calculated. Only the total items correct score out of 28 was used in this study.

Both the *Social Inference-Minimal* and the *Social Inference-Enriched* subtests assess whether participants are sensitive to conversational inferences by demonstrating they:

- a. understand that people can say one thing and mean another,
- b. can make judgments about the speakers' intentions, feelings, beliefs and the meaning of their utterances.

The *Social Inference-Minimal* subtest is comprised of 15 vignettes in which actors are engaged in conversation that is either sincere or sarcastic. The *Social Inference-Enriched* test is comprised of 16 vignettes in which the speaker is attempting to either conceal the truth in a diplomatic lie or amplify the truth by giving the same script a sarcastic twist. Following each vignette, participants are asked to answer four questions related to:

- a. what a person in the scene was trying to do.
- b. what he/she was trying to say.
- c. what he/she was thinking
- d. what he/she was feeling

Each subtest takes between 15-25 minutes to administer and includes alternate forms that are statistically equivalent. The TASIT has been shown to demonstrate strong

reliability: test-retest (0.74-0.88), and alternate forms (0.62-0.83) (McDonald, Bornhofen, Shum, Long, Saunders, & Neulinger, 2006). The TASIT also demonstrates evidence of validity. Specifically, it has been found to demonstrate construct validity as significant associations were found between the TASIT and social perception tasks (McDonald, et al., 2006). In addition, the TASIT has been found to demonstrate ecological validity as poor performance on the TASIT correlates with observable deficits in spontaneous social interactions (McDonald, Flanagan, Martin, & Saunders, 2004).

Reading Inference Generation Ability

Group Reading Assessment and Diagnostic Evaluation

The *Passage Comprehension* and the *Sentence Comprehension* subtests of the Group Reading Assessment and Diagnostic Evaluation (GRADE) (Williams, 2001a) comprise the *Comprehension Composite Score* used in the present experiment. The GRADE is a standardized and norm-referenced measure designed to assess reading comprehension. It is appropriate to use with preschool children through adults. The entire test takes 45-90 minutes to administer and includes alternate forms that have been shown to exhibit statistical equivalency (Williams, 2001b). The Comprehension Composite is calculated by adding the raw scores from the *Passage Comprehension* and *Sentence Comprehension* subtests.

The *Passage Comprehension* subtest is comprised of 6 passages with 5 comprehension questions following each passage for a total of 30 questions. Participants

read each paragraph and answer the corresponding multiple-choice comprehension questions by bubbling in an answer sheet. Four types of comprehension questions comprise this subtest and include questioning, clarifying, summarizing, and predicting.

Questioning questions require the participant to ask themselves “wh” questions such as *who*, *what*, *where*, *when*, or *why* to answer a question. These types of questions focus on the comprehension of directly stated details. Form A of the *Passage Comprehension* subtest has seven questioning type questions while Form B has four questions.

Clarifying questions require participants to identify important information from unimportant detail or identify story grammar to help comprehend a narrative passage. Form A of the subtest has 13 clarifying type questions while Form B has 16.

Summarizing questions require the participant to identify the main idea of the passage. Form A has seven summarizing type questions while Form B has eight.

Predicting questions require participants to read and comprehend information in the text and also predict information that is not explicitly stated. Form A of the subtest has three predicting type questions while Form B has two.

The *Sentence Comprehension* subtest of the GRADE is comprised of 19 items. Participants are required to determine the single word that is missing in a sentence from five choices. Participants must use context clues, along with morphological, syntactic, and semantic knowledge to choose the correct word. Four different types of sentences are used as stimuli:

- a. *simple*: A simple sentence is comprised of one independent clause and no dependent clause. Form A contains one simple sentence and Form B contains three.
- b. *compound*: A compound sentence consists of two or more independent clauses joined by either a conjunction or a semicolon. Form A contains two compound sentences and Form B does not contain any compound sentences.
- c. *complex*: A complex sentence is comprised of one independent clause and one or more dependent clauses. There are 12 complex sentences in Form A and 15 in Form B.
- d. *complicated*: A complicated sentence is essentially a simple sentence but is complicated by the addition of structures such as participial structures, infinitives, or multiple prepositional phrases. Form A contains four complicated sentences and Form B contains 1.

Reliability and validity data are well-documented in the GRADE Technical Manual (Williams, 2001b). The GRADE Adult level demonstrates strong internal reliability (0.89-0.99), subtest, composite, total test alpha, and split-half reliabilities for the *Sentence Comprehension* and *Passage Comprehension* subtests (0.66-0.92), and alternate form reliabilities (0.81-0.93). The GRADE Adult level also demonstrates evidence that it measures what it claims to measure. The Technical Manual provides data supporting the GRADE's content, criterion-related, and construct validity (Williams, 2001b). Specifically, evidence for concurrent validity was supported as the GRADE

correlated highly with the California Achievement Test (.82 and .87) and the Gates-MacGinitie Reading Tests (.86 to .90) (Williams, 2001b). In addition, the GRADE has been shown to demonstrate predictive validity as GRADE scores in the fall are predictive of TerraNova reading scores in the spring (Williams, 2001b).

Researcher-Created Comprehension Test

The researcher created an assessment measure designed specifically to test participant's ability to generate inferences when reading excerpts from literature (Researcher-Created Comprehension Test). Twelve passages were randomly selected from the 50th grade-level passages comprising the *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989). Twelve passages were chosen in order to ensure sufficient stimulus material to generate a reliable picture of participants' inference generation abilities without adversely impacting their attention to the task. The researcher developed four corresponding comprehension questions designed to reflect those types of questions the Inference Strategy procedure taught (i.e., factual, clarifying, main idea/summarization, and prediction questions) (Fritschmann, Deshler, & Schumaker, 2007). Although the current intervention did not explicitly teach how to answer these types of questions, these categories of questions were used as a framework for assessing the different inference skills of the participants as they reflect the different categories of inferences one can generate during reading. The questions from each passage were randomly ordered using a random numbers table. Six of the passages were randomly

assigned as a part of the pretest measure and the other six as a part of the posttest measure. Raw scores were used in the analyses.

Because this assessment measure was designed specifically for this study by the researcher, there is no previous reliability or validity evidence available. However, as is shown in Table 4 and Table 5 in chapter 4, significant relationships were found between this measure and the *Inference* subtest of the Watson-Glaser Critical Thinking Appraisal (Watson, Glaser, 1964) and the GRADE Comprehension Composite scores (Williams, 2001a). This suggests the Researcher-Created Comprehension Test may measure similar constructs as both the GRADE and the Watson-Glaser. As mentioned previously, the author developed questions based on the question types designed for the Inference Strategy procedure (Fritschmann, Deshler, & Schumaker, 2007) providing some evidence of face validity of the Researcher-Created Comprehension test.

Watson-Glaser Critical Thinking Appraisal

In addition to the Researcher-Created Comprehension Test described above, the participants' inference ability in reading was also assessed using the *Inference* subtest of the Watson-Glaser Critical Thinking Appraisal (Watson, Glaser, 1964). The *Inference* subtest is a standardized and norm-referenced assessment tool designed to assess how well a person can generate accurate inferences requiring critical thinking skills. The entire assessment measure is often used by employers to assess the critical thinking abilities of potential employees. The complete test takes 40-60 minutes to administer

with the Inference subtest requiring 10-20 minutes. Statistically equivalent alternate forms are also available for the Watson-Glaser. Raw scores were used in the analyses.

There are 16 items in the *Inference* subtest requiring participants to read three short passages and judge the degree of truth or falsity of inferences generated from the given passages. Participants must choose among: true, probably true, insufficient data, probably false, and false.

Reliability of the Watson-Glaser Critical Thinking Appraisal is well-documented in the test manual (Watson & Glaser, 1964); split-half (.69-.85) and alternate form (.75). The Watson-Glaser Critical Thinking Appraisal also demonstrates evidence that it measures what it claims to measure. The Technical Manual provides data supporting the Watson-Glaser Critical Thinking Appraisal's content, criterion-related, and construct validity (Watson & Glaser, 1964).

Metacognitive Ability

Assessing metacognition in reading is challenging in that typically used methods of evaluation (e.g., interviews, think-alouds, error detection) require individuals to possess sufficient language skills to report what they are doing as they read (Westby, 2004). Because metacognitive ability cannot be overtly observed, assessment measures are reliant on the self-reporting of the individual tested. The Metacognition in Reading Inventory (MIRI) (Ehren, 2008) also relies on self-reporting to assess metacognition ability during reading. The MIRI is an informal measure designed to determine what, if any, strategies students use as they read. The MIRI also measures what, if any, questions

students ask themselves as they read. Participants are instructed to read two short non-fiction passages and write down any strategies they use or questions they ask themselves before, during, and after they read. Participants are awarded one to two points for each strategy and/or question they document if it is appropriate to the section. Scoring guidelines including examples of acceptable responses are provided in the MIRI Scoring Instructions. Although this measure allows for multiple subset scores (i.e., questioning, strategy-use, before, during, and after), a total raw score was used for the present study. This measure did not have alternate forms; therefore, participants completed the same assessment at pretest and posttest evaluations. Validity data is not available for the MIRI; however, the test does demonstrate strong inter-rater reliability (.90).

General Procedures

All participants completed an availability form (Appendix I), intake form (Appendix J), and the consent document (Appendix K) at the pretesting session. Each participant had the opportunity to review each document prior to the pretesting session. All pre- and posttest assessments were conducted by the author or trained graduate student clinicians at either the University of Central Florida's Communication Disorders Clinic or in a private room at a local library. Participants had the option of completing all assessment tasks in one day or coming back at another time to finish. Testing for all participants was completed within two months prior to the start of the intervention and within one month of the intervention's completion.

Those participants randomly assigned to the experimental group were divided into groups of 3-4 based on their availability and preferred location for treatment resulting in a total of 4 groups. Each group met in 1-hour sessions twice a week for a total of 6 weeks for a total of 12 sessions. This 12 sessions over a 6 week intervention time frame was chosen in order to increase the likelihood of consistent attendance and participation as well as instructor fidelity of the program delivery. Each experimental participant was provided with a schedule of research activities prior to the start of the treatment program (see Appendix L).

Participant Compensation

The 31 participants who agreed to participate in the study were compensated for all study activities they completed. Participants were provided with \$30.00 for completing the pretest and \$30.00 for completing the posttest. Participants in the experimental group also received \$10.00 for each treatment session attended. Participants in the control group, therefore, had the opportunity to earn \$60.00 for their participation in the testing conditions. Those in the experimental group had the opportunity to earn \$180.00 for their participation in the testing and intervention conditions. Those participants who did not meet the inclusion criteria but did complete the pretesting received \$30.00 for their participation. Compensation was provided by a grant from the Providing Autism Links and Supports Foundation.

Data Analysis

Data were inputted into and analyzed using SPSS v 17.0.

Research questions

1. Is there a difference in ability to generate inferences in reading between adults with AS who receive a reading inference strategy intervention and those who do not?

Three analysis of covariance (ANCOVA) models (one for each of the three outcome measures including the Watson-Glaser Critical Thinking Appraisal, GRADE, Researcher-Created Comprehension Test) were generated. The independent variable was group (treatment or control) and the covariate was the pretest score for the respective outcome variable.

2. Is there a difference in ability to generate social inferences between adults with AS who receive a reading inference strategy intervention and those who do not?

A single composite score is not available for the TASIT, therefore, three ANCOVA models (one for each of the three subtests including the *Emotion Evaluation*, *Social Inference-Minimal* and *Social Inference-Enriched*) were generated. The independent variable was group (treatment or control) and the covariate was the pretest score for the respective outcome variable.

3. Is there a difference in metacognitive ability between adults with AS who receive a reading inference strategy intervention and those who do not?

One ANCOVA model was generated. The independent variable was group (treatment or control) and the covariate was the pretest score for the MIRI.

Summary

This chapter presented the research methodology for conducting this experiment. A randomized control group design was employed to investigate the research questions. A discussion of the participants and how they were selected and randomly assigned to the treatment or control group was presented. The six dependent variables were also discussed. A summary of the intervention program was given along with the general procedures of the experiment and the data analysis. Results of the data analysis are presented in the following chapter.

CHAPTER FOUR: RESULTS

Introduction

The purpose of this study was to determine the effects of a reading inference intervention on the ability of adults with AS to generate inferences in reading, generate social inferences, and use metacognitive strategies when reading. This chapter presents characteristics of the dependent variables and the participants and the results related to the three research questions presented previously as tested by of Covariance (ANCOVA).

Dependent Variables

To examine the relationships among the dependent variables data from each pre- and posttest outcome measure were analyzed using bivariate correlations. Table 4 presents the data as analyzed using only the treatment group participants. Correlations found to be significant at the .05 and .01 *p*-value levels are indicated. Table 5 presents the data as analyzed using only the control group participants. Again, significant correlations are indicated at both the .05 and the .01 *p*-value levels.

Table 4: *Bivariate Correlations for the Treatment Group*

	TEPr ^a	TEPo ^b	TMPrc ^c	TMPo ^d	TEPr ^e	TEPo ^f	WGPr ^g	WGPo ^h	GPr ⁱ	GPo ^j	RCPr ^k	RCPo ^l	MPr ^m	MPo ⁿ
TEPr ^a	--	.582 [*]	.075	.268	.265	.343	.685 ^{**}	.278	.550	.450	.199	.382	.111	-.039
TEPo ^b		--	.174	.274	.036	.544	.654 [*]	-.179	.180	.177	-.362	.073	.181	-.183
TMPrc ^c			--	.727 ^{**}	.635 [*]	.367	.489	.394	.677 [*]	.708 ^{**}	.440	.476	.239	.484
TMPo ^d				--	.719 ^{**}	.429	.577 [*]	.336	.783 ^{**}	.711 [*]	.312	.579 [*]	.327	.553 [*]
TEPr ^e					--	.102	.478	.533	.783 ^{**}	.604 [*]	.458	.291	.329	.419
TEPo ^f						--	.446	-.174	.253	.248	-.186	.388	-.383	-.073
WGPr ^g							--	.051	.550	.471	.145	.257	.080	-.066
WGPo ^h								--	.777 ^{**}	.765 ^{**}	.601 [*]	.503	.214	.682 [*]
GPr ⁱ									--	.907 ^{**}	.595 [*]	.684 ^{**}	.305	.657 [*]
GPo ^j										--	.495	.556 [*]	.232	.723 ^{**}
RCPr ^k											--	.645 [*]	.290	.515
RCPo ^l												--	.134	.480
MPr ^m													--	.462
MPo ⁿ														--

^a=TASIT Emotion Evaluation Pretest; ^b=TASIT Emotion Evaluation Posttest; ^c=TASIT Social Inference Minimal Pretest; ^d=TASIT Social Inference Minimal Posttest; ^e=TASIT Social Inference Enriched Pretest; ^f=TASIT Social Inference Enriched Posttest; ^g=Watson-Glaser Pretest; ^h=Watson-Glaser Posttest; ⁱ=GRADE Pretest; ^j=GRADE Posttest; ^k=Researcher-Created Pretest; ^l=Researcher-Created Posttest; ^m=MIRI Pretest; ⁿ=MIRI Posttest; * $p < .05$; ** $p < .01$

Table 5: *Bivariate Correlations for the Control Group*

	TEPr ^a	TEPo ^b	TMPPr ^c	TMPo ^d	TEPr ^e	TEPo ^f	WGPr ^g	WGPo ^h	GPr ⁱ	GPo ^j	RCPr ^k	RCPo ^l	MPr ^m	MPo ⁿ
TEPr ^a	--	.701*	.304	.224	.018	.533	-.170	.460	-.054	.845**	.615*	.495	-.247	.301
TEPo ^b		--	.317	.366	.395	.604*	-.053	.282	-.168	.601*	.371	.130	.041	.097
TMPPr ^c			--	.208	.152	.608*	.137	.103	-.332	.496	.481	.212	.269	-.084
TMPo ^d				--	-.456	.710**	-.391	.333	-.266	.281	-.064	.379	.436	.474
TEPr ^e					--	-.169	.329	-.381	.169	.068	.274	-.414	.017	-.401
TEPo ^f						--	-.094	.409	-.136	.684*	.440	.587*	.362	.321
WGPr ^g							--	.201	-.096	.018	.086	.007	-.227	-.305
WGPo ^h								--	-.212	.472	.182	.663*	-.333	-.002
GPr ⁱ									--	.134	.456	.245	-.029	.090
GPo ^j										--	.840**	.754**	-.129	.141
RCPr ^k											--	.630*	.040	.126
RCPo ^l												--	-.034	.226
MPr ^m													--	.484
MPo ⁿ														--

^a=TASIT Emotion Evaluation Pretest; ^b=TASIT Emotion Evaluation Posttest; ^c=TASIT Social Inference Minimal Pretest; ^d=TASIT Social Inference Minimal Posttest; ^e=TASIT Social Inference Enriched Pretest; ^f=TASIT Social Inference Enriched Posttest; ^g=Watson-Glaser Pretest; ^h=Watson-Glaser Posttest; ⁱ=GRADE Pretest; ^j=GRADE Posttest; ^k=Researcher-Created Pretest; ^l=Researcher-Created Posttest; ^m=MIRI Pretest; ⁿ=MIRI Posttest; * $p < .05$; ** $p < .01$

Participants

Participant Selection Procedure

As described in chapter three, participants were recruited from among the 1505 adult constituents registered with UCF CARD. A total of 81 adult constituents were referred and contacted by the author to participate in the study. Participants were called and a recruitment email (Appendix B) was sent if email was available during September, 2010. The author reached 53 (65%) of the referred participants by phone or email. The recruitment process yielded 31 constituents who agreed to participate in the study and understood the commitment to 12 intervention sessions over 6 weeks.

Participant Pretest Performance

Results of the participants' pretest performance on the measures described in chapter three revealed that three of the 31 participants did not meet the inclusion criteria because they scored within the normal range on all subtests of the TASIT (Emotion Evaluation 22.75-26.97; Social Inference-Minimal 49.82-58.40; Social Inference-Enriched 50.82-60.46). Two additional participants did not meet the inclusion criteria because they scored below an 8th grade reading level. The remaining 26 participants were randomly assigned using a random number generator by a third party not involved in the study and blind to the participants' names (participants were assigned numbers prior to the randomization). Participants were then notified of their assignment (treatment or control group) by phone by the author.

It should be noted that an error in calculating a participant's scores on the TASIT was discovered after the randomization process. This participant, assigned to the control group, was found to score within the normal range on all TASIT subtests when the scores were correctly calculated and therefore should not have been included in the randomization process. This participant's test scores were not included in any of the results. See Figure 1 for a flow chart of participants throughout the research process.

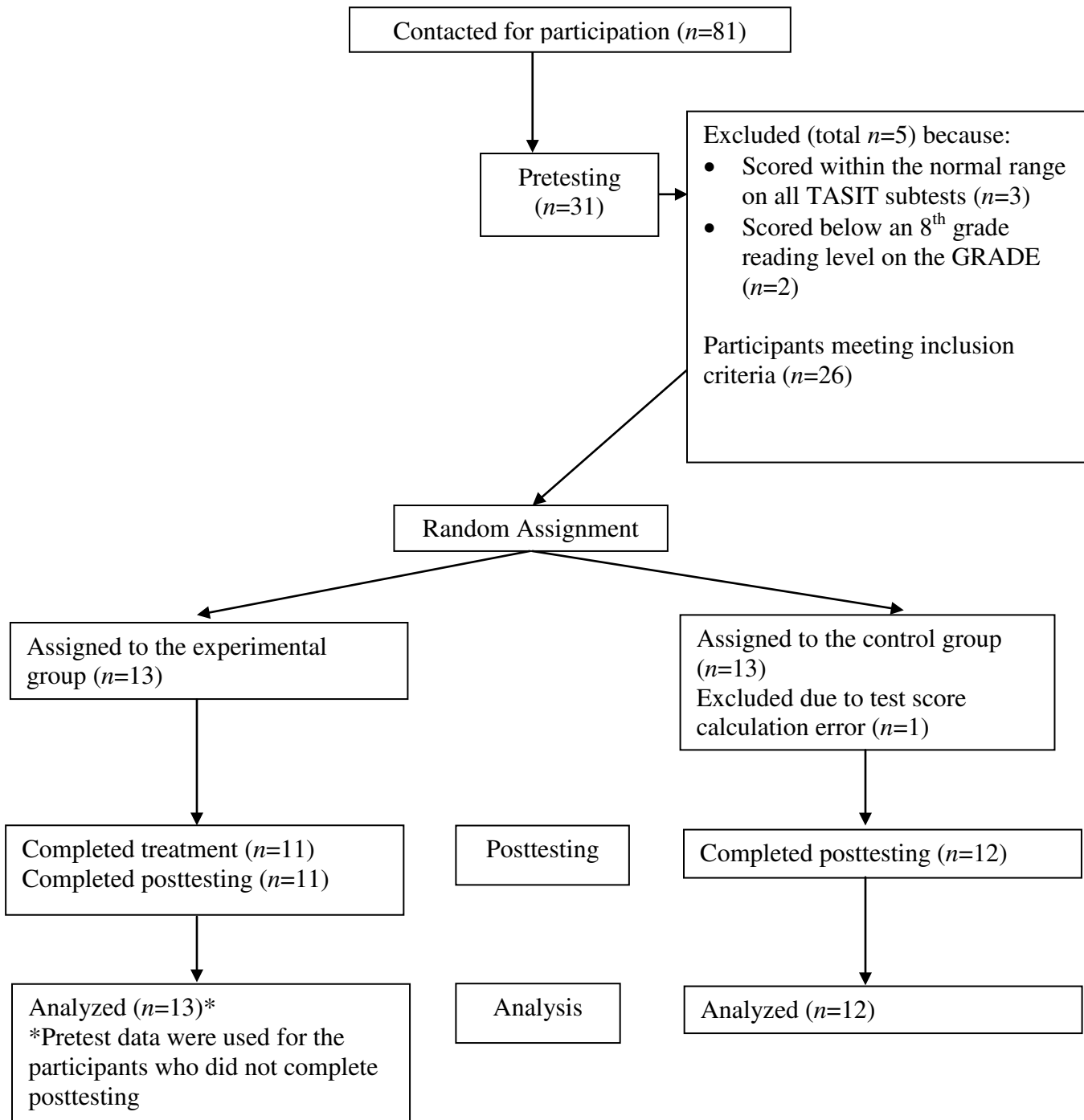


Figure 2: Participant Flow Chart

Participant Characteristics

Certain demographic information was collected at the start of the study. The treatment group's average age was 28 years 1 month ($sd = 6.08$). The control group's average age was 24 years 2 months ($sd = 4.27$). Other descriptive data is presented in Table 3 below. Many attributes of the groups were very similar (e.g., gender, educational history, relationship status). The majority of the treatment group, however, was employed whereas the majority of the control group was unemployed. As discussed in Chapter 2, social interaction deficits are a hallmark of AS. This may explain the fact that all of the participants in the study, except one, reported that they were single. A number of the treatment and control group participants reported that they enrolled in the study to potentially improve their social inference ability so that they might be able to establish and maintain a romantic relationship. Other participants reported that they wished to improve their social inference ability to help them succeed in searching for a job or aid in maintaining their current employment. A few participants indicated that they enrolled in the study primarily because they would be compensated for their time.

Table 6: *Individual Characteristics of the Sample: Frequency Data*

Characteristic	Experimental	%	Control	%
Gender				
Female	1	7.70	2	16.67
Male	12	92.31	10	83.33
Highest educational level completed				
High school	2	15.38	5	41.67
Some college	9	69.23	6	50
Bachelor's degree	1	7.70	1	8.33
Master's degree	1	7.70	0	0
Employment status				
Unemployed	6	46.15	8	66.67
Employed part-time	4	30.77	4	33.33
Employed full-time	3	23.08	0	0
Relationship status				
Single	12	92.31	12	100
Dating	0	0	0	0
Married	1	7.70	0	0

Treatment Participant Attendance

Every effort was made to encourage each participant to come to every treatment session; however, due to sickness or schedule conflicts some participants did not attend all sessions.

Table 5 shows the attendance records of the experimental group with 7 of the 13 participants attending all treatment sessions. However, two experimental participants decided to withdraw from the study prematurely (participants 2 and 9). One of these participants agreed to complete

the posttesting (participant 2) but one did not (participant 9). Participant 7 completed the intervention sessions but did not complete the posttesting sessions.

Table 7: *Experimental Group Attendance*

Participant	# of Treatment Sessions Attended	Total Treatment Time in Minutes
1	9	540
2*	7	420
3	12	720
4	11	630
5	12	720
6	12	690
7*	9	540
8	12	720
9* **	9	540
10	12	720
11	12	720
12	11	630
13	12	720

* Participant did not complete the intervention program

** Participant did not complete posttesting

Results of Data Analysis

As depicted in Figure 2 of the previous section, data was lost due to participant attrition. One treatment participant withdrew from the study prior to the completion of the intervention program and elected not to complete the posttest assessments. Another treatment participant withdrew prior to the completion of the intervention program but elected to return to complete all posttesting measures. One treatment participant completed the intervention program but elected not to complete any of the posttest assessments.

An intention to treat analysis (ITT) was used for all analyses. The ITT analysis makes use of all data for all participants in both the experimental and control groups regardless of participant attrition. For those participants not completing the posttest assessments, this ITT analysis used the dropout participants' pretest scores as their posttest score (Torgerson & Torgerson, 2008). This approach is considered the most conservative method of analysis that addresses participant attrition (Hollis & Campbell, 1999). All control participants completed all pre- and posttest assessment measures, thus no imputation of scores was required.

ANCOVA statistics were used to analyze the results of all the dependent measures with the pretest scores of each measure serving as the covariate for each dependent measure. An alpha level of .05 was used for all analyses. Assumptions of the ANCOVA procedure were tested for all dependent measures where required. A detailed description of each of the following eight assumptions is presented here; (a) independence of observations, (b) homogeneity of variance, (c) normality, (d) linearity, (e) fixed independent variable, (f) independence of the covariate and the independent variable, (g) covariate measured without error, and (h) homogeneity of regression slopes.

Independence of Observations

The ANCOVA procedure is sensitive to violations of the independence assumption resulting in increased likelihood of a Type I and/or a Type II error (Lomax & Hahs-Vaughn, in press). The assumption of independence can be met through random assignment and ensuring that individuals are separated so that scores on the dependent variable are independent across participants. Since this study randomly assigned participants to groups and the participants were kept separate during testing, the assumption of independence has been met and will not be discussed further.

Homogeneity of Variance

The second assumption is that the variance of the populations is the same. A violation of the homogeneity of variance assumption may result in bias in the SS_{within} term and an increased likelihood of a Type I error and possibly Type II error (Lomax & Hahs-Vaughn, in press). With equal or nearly equal n 's across the groups, as in the case of the current study (treatment $n=13$; control $n=12$), the effect of a violation of the homogeneity of variance assumption is negligible. Levene's test was used to test this assumption and will be reported for each dependent measure.

Normality

The ANCOVA is relatively robust to violations in the assumption that each of the populations follows the normal distribution (Lomax & Hahs-Vaughn, in press). The assumption of normality is tested in this study using the following techniques: (a) review of box plots and

histograms, (b) skewness and kurtosis statistics, and (c) the Shapiro Wilk test. Results of normality testing will also be presented in a table for each dependent measure.

Linearity

The next assumption is that the regression of the dependent measure on the pretest (covariate) is linear. Violations to the assumption of linearity will result in a reduced magnitude of the linear correlation, biased estimates of group effects, and smaller adjustments in SS_{within} and SS_{between} (Lomax & Hahs-Vaughn, in press). A review of scatterplots for overall X versus Y and for each group were used to detect violations in linearity.

Fixed Independent Variable

Since the groups were fixed by the researcher, the assumption of a fixed independent variable was met and will not be discussed further.

Independence of the Covariate and the Independent Variable

A condition of the ANCOVA procedure is that the covariate and independent variable are independent (Lomax & Hahs-Vaughn, in press). Because this study used random assignment and the covariate was the pretest scores, and thus not influenced by the treatment, this condition has been met and was not tested.

Covariate Measured Without Error

In random experiments, a violation of the assumption that the covariate is measured without error can have the several effects on the ANCOVA procedure. First, the within groups regression slope from the regression of the dependent variable on the covariate (b_w) will be underestimated resulting in smaller adjustments. The F test will also not be as powerful because the reduction in the unexplained variation will not be as great. Also, there is a reduced likelihood of a Type I error. Violations of this assumption can be avoided through the use of measures that are both reliable and valid (Lomax & Hahs-Vaughn, in press). Two measures in this study, the Researcher-Created Comprehension Test and the MIRI lack adequate reliability and/or validity evidence and thus it is unclear if this assumption has been met.

Homogeneity of Regression Slopes

The assumption of homogeneity of regression slopes states that the regression line between the dependent variable and the covariate is the same for each category of the independent variable. Homogeneity of regression slopes is necessary in ANCOVA because it allows the researcher to test for group intercept differences. Violations of this assumption in studies with unequal n 's, such as the present study, have modest effects. Effects of violating the homogeneity of regression slopes assumption may result in biased adjusted means and can ultimately affect the F test (Lomax & Hahs-Vaughn, in press). This assumption was tested in two ways. First the scatterplots of the dependent variable and covariates by group were reviewed. An ANCOVA procedure was also used to determine the interaction of the covariate

and the independent variable. A non-significant interaction suggests that this assumption was met.

Descriptive Data

Table 8 presents the means, standard deviations, adjusted means (controlling for pretest score), standard error, and *F*-value statistics on each of the dependent measures of both the treatment and control groups. Across all dependent measures (except TASIT: Social Inference-Enriched Subtest), the treatment group scored higher than the control group. When controlling for the pretest scores, the treatment group scored higher on all dependent measures except the TASIT: Social Inference-Minimal and Social Inference-Enriched subtests. It should be noted that this difference was only significant on the Watson-Glaser and the MIRI.

Table 8: *Descriptive Statistics*

<i>Dependent Measure</i>	Treatment Group (<i>n</i> = 13)			Control Group (<i>n</i> = 12)			F_{group}	p_{group}	<i>Maximum Score</i>
	M(Adj M)	SD	SE	M(Adj M)	SD	SE			
GRADE Comprehension Composite	41.77 (40.79)	6.22	1.16	38.55 (39.75)	5.47	1.27	.33	.58	49
Inference Subtest of the Watson-Glaser Critical Thinking Appraisal	9.85 (9.74)	3.02	.85	6.92 (7.03)	2.81	.89	4.60	.04	16
Researcher-Created Comprehension Test	16.69 (15.92)	3.64	.94	12.67 (13.50)	4.72	.98	3.05	.10	24
TASIT: Emotion Evaluation Subtest	23.08 (23.29)	2.60	.61	22.67 (22.44)	3.06	.64	.92	.35	28
TASIT: Social Inference-Minimal Subtest	47.23 (46.40)	9.21	2.00	45.75 (46.65)	7.07	2.08	.01	.93	60
TASIT: Social Inference-Enriched Subtest	46.38 (46.46)	8.76	2.42	47.33 (47.26)	8.09	2.53	.05	.82	64
MIRI	13.38 (13.14)	6.90	1.49	4.75 (5.01)	4.62	1.55	14.21	.001	unlimited

Testing the Research Question

Research Question One

Question 1: Is there a difference in ability to generate inferences in reading between adults with AS who receive a reading inference strategy intervention and those who do not?

Three ANCOVA models (one for each of the three outcome measures) were generated. The independent variable was group (treatment or control) and the covariate was the pretest score for the respective outcome variable. Each outcome measure will be discussed separately beginning with an analysis of the raw scores of the GRADE Comprehension Composite (GRADE). Analysis of raw scores from the Watson-Glaser Critical Thinking Appraisal and the Researcher-Created Comprehension Test will then be presented.

GRADE Comprehension Composite

An ANCOVA was conducted to determine if the mean GRADE score differed based on group assignment (treatment versus control). The assumption of normality was not satisfied via examination of residuals. Review of the Shapiro-Wilk test for normality ($SW = .88$, $df = 25$, $p = .006$) and skewness (-1.62) and kurtosis (3.61) statistics suggested that normality was not a reasonable assumption. A review of the boxplot revealed a

potential outlier. Specifically, a control participant’s pretest score of 43 was within one standard deviation above the mean; however, his posttest score of 22 was two standard deviations below the mean. With the removal of this case, the assumption of normality was satisfied via examination of skewness (-1.06) and kurtosis (-.04) statistics. However, the Shapiro-Wilk test for normality ($SW = .85$, $df = 24$, $p = .002$) still suggested non-normality. The boxplot and histogram suggested a relatively normal distributional shape (with no outliers) of the residuals. The Q-Q plot suggested normality was reasonable. Considering these tests, there is ample evidence that normality has been met. The remaining statistical procedures were conducted with the removal of the outlier case. In addition, the assumption of homogeneity of variance was not met (see Table 9). However, with equal or nearly equal n ’s across the groups, as in the case of the current study (treatment $n=13$; control $n=12$), the effect of a violation of the homogeneity of variance assumption is negligible. Table 9 provides additional data on the tests of assumptions.

Table 9: *Results of Assumptions Testing for the GRADE Comprehension Composite*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene’s Test	$F(1, 22) = 4.97, p = .04$	No
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 20) = 1.69, p = .21$	Yes

As indicated in Table 10, the results of the ANCOVA suggest a statistically significant effect of the covariate, GRADE pretest, on the dependent variable, GRADE posttest ($F_{\text{pretest}} = 27.33$; $df = 1,9$; $p = .000$). However, there is not a statistically significant effect for group ($F_{\text{group}} = .33$; $df = 1,9$; $p = .58$), yielding a small effect (Cohen, 1988) and weak power (partial $\eta^2_{\text{group}} = .02$, observed power = .09) suggesting that only about 2% of the variance in GRADE scores can be accounted for by group performance when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a moderate, though non-significant effect size ($g = .53$, $p = .18$, 95% CI - .24 to 1.30). The Comprehensive Meta-Analysis software program (Borenstein, Hedges, Higgins, & Rothstein, 2005) was used for all calculations of Hedge's g .

Table 10: ANCOVA Results for the GRADE Comprehension Composite

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	463.39	1	463.39	27.33	.000	.57	1.00
Group	5.52	1	5.52	.33	.58	.02	.09
Error	356.05	21	16.96				
Corrected Total	824.96	23					

Watson-Glaser Critical Thinking Appraisal

An ANCOVA was conducted to determine if the mean Watson-Glaser Inference subtest score differed based on group assignment (treatment versus control), while controlling for pretest. Table 11 provides the data on the tests of assumptions.

Table 11: *Results of Assumptions Testing for the Inference Subtest of the Watson-Glaser Critical Thinking Appraisal*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .01, p = .91$	Yes
Normality	Shapiro Wilk	$SW = .95, df = 25, p = .26$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	.39	Yes
	Kurtosis	-.09	Yes
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .14, p = .71$	Yes

As indicated in Table 12, the results of the ANCOVA do not suggest a statistically significant effect of the covariate, Watson Glaser pretest, on the dependent variable, Watson Glaser posttest ($F_{\text{pretest}} = 1.75; df = 1,22; p = .20$). However, there is a statistically significant effect for group ($F_{\text{group}} = 4.60; df = 1,22; p = .04$), yielding a large (Cohen, 1988) effect and moderate power (partial $\eta^2_{\text{group}} = .17$, observed power = .54)

suggesting that about 17% of the variance in Watson Glaser Inference subtest scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a large and statistically significant effect size ($g=.97, p = .000, 95\% \text{ CI } .17 \text{ to } 1.76$) in favor of the experimental group on the Watson Glaser measure.

Table 12: *ANCOVA Results for the Inference Subtest of the Watson-Glaser Critical Thinking Appraisal*

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	15.45	1	15.45	1.75	.20	.07	.24
Group	40.61	1	40.61	4.60	.04	.17	.54
Error	194.10	23	8.82				
Corrected Total	250.16	24					

Researcher-Created Comprehension Test

An ANCOVA was conducted to determine if the mean Researcher-Created Comprehension Test score differed based on group assignment (treatment versus control), while controlling for pretest. Table 13 provides the data on the tests of assumptions.

Table 13: *Results of Assumptions Testing for the Researcher-Created Comprehension Test*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .95, p = .34$	Yes
Normality	Shapiro Wilk	$SW = .97, df = 25, p = .53$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	.15	Yes
	Kurtosis	-.18	Yes
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .03, p = .87$	Yes

As indicated in Table 14, the results of the ANCOVA suggest a statistically significant effect of the covariate, Researcher-Created Comprehension Test pretest, on the dependent variable, Researcher-Created Comprehension Test posttest ($F_{\text{pretest}} = 21.097; df = 1,22; p = .000$). However, there is not a statistically significant effect for group ($F_{\text{group}} = 3.05; df = 1,22; p = .10$), yielding a large effect (Cohen, 1988) and power (partial $\eta^2_{\text{group}} = .12$, observed power = .37) suggesting that about 12% of the variance in Researcher-Created Comprehension Test scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a large and statistically significant effect size ($g = .93, p = .02$, 95% CI .13 to 1.73) in favor of the experimental group performance on the Researcher-Created Comprehension Test.

Table 14: ANCOVA Results for the Researcher-Created Comprehension Test

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	230.67	1	230.67	21.10	.000	.49	.99
Group	33.36	1	33.36	3.05	.10	.12	.39
Error	240.54	23	10.93				
Corrected Total		24					

Subset analyses

As described in Chapter 3, the Researcher-Created Comprehension Test was comprised of six pretest and six posttest literature excerpts; each with four corresponding questions one of each of the following types: (a) factual, (b) clarifying, (c) main idea/summarization, and (d) prediction. An ANCOVA was conducted to determine if the mean score (number of items correct) differed based on group assignment (treatment versus control) while controlling for pretest for each question type. The results of these analyses are presented below.

Factual questions

An ANCOVA was conducted to determine if the mean factual question score differed based on group assignment (treatment versus control), while controlling for pretest. Review of the scatterplots did not suggest linearity was a reasonable assumption. Therefore, a curve estimation analysis was conducted to see what type of line would best fit the data. Results indicated that linearity was in fact a reasonable assumption ($B = .72$; $p = .006$). Table 15 presents the data on all the tests of assumptions.

Table 15: *Results of Assumptions Testing for the Factual Questions of the Researcher-Created Comprehension Test*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .85, p = .37$	Yes
Normality	Shapiro Wilk	$SW = .97, df = 25, p = .53$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	-.27	Yes
	Kurtosis	-.21	Yes
Linearity	Scatterplots	No evidence of a positive linear relationship	No
	Curve estimation analyses	$B = .72, p = .006$	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .29, p = .60$	Yes

As indicated in Table 16, the results of the ANCOVA suggest a statistically significant effect of the covariate, factual question pretest, on the dependent variable, factual question posttest ($F_{\text{pretest}}=9.53$; $df = 1,22$; $p = .005$). However, there is not a statistically significant effect for group ($F_{\text{group}} = 1.88$; $df = 1, 22$; $p = .18$) yielding a medium effect (Cohen, 1988) and power (partial $\eta^2_{\text{group}} = .08$, observed power = .26) suggesting that only about 8% of the variance in factual question scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a large and statistically significant effect size ($g=1.20$, $p = .004$, 95% CI .37 to 2.03) on the factual questions of the Researcher-Created Comprehension Test when controlling for pretest.

Table 16: ANCOVA Results for the Factual Questions of the Researcher-Created Comprehension Test

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	20.53	1	20.53	9.53	.005	.30	.84
Group	4.06	1	4.06	1.88	.18	.08	.26
Error	47.41	23	2.16				
Corrected Total	72.00	24					

Clarifying questions

An ANCOVA was conducted to determine if the mean clarifying question score differed based on group assignment (treatment versus control), while controlling for pretest. Review of the scatterplots did not suggest linearity was a reasonable assumption. Therefore, a curve estimation analysis was conducted to see what type of line would best fit the data. Results did not support the assumption of linearity ($B = .21; p = .27$). Violations to the assumption of linearity may result in biased estimates of the group effects and smaller adjustments in SS_{within} and SS_{between} . Table 17 presents the data on all the tests of assumptions.

Table 17: Results of Assumptions Testing for the Clarifying Questions of the Researcher-Created Comprehension Test

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .24, p = .63$	Yes
Normality	Shapiro Wilk	$SW = .97, df = 25, p = .61$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	.13	Yes
	Kurtosis	-.33	Yes
Linearity	Scatterplots	No evidence of a positive linear relationship	No
	Curve estimation analyses	$B = .21, p = .27$	No
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .11, p = .74$	Yes

As indicated in Table 18, the results of the ANCOVA do not suggest a statistically significant effect of the covariate, clarifying question pretest, on the dependent variable, factual question posttest ($F_{\text{pretest}} = 1.25; df = 1, 22; p = .28$). There is also not a statistically significant effect for group ($F_{\text{group}} = .28; df = 1, 22; p = .60$), with a small effect (Cohen, 1988) and power (partial $\eta^2_{\text{group}} = .01$, observed power = .08) suggesting that only about 1% of the variance in clarifying question scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a small and non-significant effect size ($g = .21, p = .60, 95\% \text{ CI } -.56 \text{ to } .97$) when comparing the two groups performance on the Clarifying Questions of the Researcher-Created Comprehension Test.

Table 18: ANCOVA Results for the Clarifying Questions of the Researcher-Created Comprehension Test

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	2.55	1	2.55	1.25	.28	.05	.19
Group	.58	1	.58	.28	.60	.01	.08
Error	45.11	23	2.05				
Corrected Total	48.24	24					

Main idea questions

An ANCOVA was conducted to determine if the mean main idea question score differed based on group assignment (treatment versus control), while controlling for pretest. Table 19 presents the data on the tests of assumptions.

Table 19: Results of Assumptions Testing for the Main Idea Questions of the Researcher-Created Comprehension Test

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .23, p = .64$	Yes
Normality	Shapiro Wilk	$SW = .94, df = 25, p = .15$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	-.86	Yes
	Kurtosis	.91	Yes
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .30, p = .59$	Yes

As indicated in Table 20, the results of the ANCOVA do not suggest a statistically significant effect of the covariate, main idea question pretest, on the dependent variable, main idea question posttest ($F_{\text{pretest}} = 3.43; df = 1, 22; p = .08$). However, there is a statistically significant effect for group ($F_{\text{group}} = 8.74; df = 1, 22; p = .007$), with a large effect (Cohen, 1988) and large power (partial $\eta^2_{\text{group}} = .28$, observed power = .81) suggesting that about 28% of the variance in factual question scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a large and statistically significant effect size ($g = 1.15, p = .006, 95\% \text{ CI } .32 \text{ to } 1.97$) in favor of the treated group performance on the Main Idea performance of the Researcher-Created Comprehension measure.

Table 20: ANCOVA Results for the Main Idea Questions of the Researcher-Created Comprehension Test

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	5.08	1	5.08	3.43	.08	.14	.43
Group	12.93	1	12.93	8.74	.007	.28	.81
Error	32.55	23	1.48				
Corrected Total	50.56	24					

Predicting questions

An ANCOVA was conducted to determine if the mean predicting question score differed based on group assignment (treatment versus control), while controlling for pretest. The assumption of homogeneity of variance was not met (see Table 21). However, with equal or nearly equal *n*'s across the groups, as in the case of the current study (treatment *n*=13; control *n*=12), the effect of a violation of the homogeneity of variance assumption is negligible. Table 21 presents the data on the tests of assumptions.

Table 21: *Results of Assumptions Testing for the Predicting Questions of the Researcher-Created Comprehension Test*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = 5.87, p = .02$	No
Normality	Shapiro Wilk	$SW = .98, df = 25, p = .95$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	.12	Yes
	Kurtosis	.03	Yes
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .01, p = .95$	Yes

As indicated in Table 22, the results of the ANCOVA do not suggest a statistically significant effect of the covariate, main idea question pretest, on the dependent variable, main idea question posttest ($F_{\text{pretest}} = 2.16; df = 1, 22; p = .16$). However, there is a statistically significant effect for group ($F_{\text{group}} = 4.37; df = 1, 22; p = .05$), with a large effect (Cohen, 1988) and medium power (partial $\eta^2_{\text{group}} = .17$, observed power = .52) suggesting that about 17% of the variance in predicting question scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a large and statistically significant effect size ($g = .80, p = .047, 95\% \text{ CI } .01 \text{ to } 1.59$) in favor of the treated group performance on the Predicting Questions performance of the Researcher-Created Comprehension Test.

Table 22: ANCOVA Results for the Predicting Questions of the Researcher-Created Comprehension Test

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	2.23	1	2.23	2.16	.16	.09	.29
Group	4.51	1	4.51	4.37	.05	.17	.52
Error	22.70	23	1.03				
Corrected Total	29.44	24					

Research Question Two

Question 2: Is there a difference in ability to generate social inferences between adults with AS who receive a reading inference strategy intervention and those who do not?

The TASIT provides raw scores for three subtests; Emotion Evaluation, Social Inference Minimal, and Social Inference Enriched. Composite scores are not provided by the author/publisher for the TASIT.

TASIT: Emotion Evaluation

An ANCOVA was conducted to determine if the mean Emotion Evaluation score differed based on group assignment (treatment versus control), while controlling for pretest. Review of the scatterplots did not suggest linearity was a reasonable assumption.

Therefore, a curve estimation analysis was conducted to see what type of line would best fit the data. Results indicated that linearity was in fact a reasonable assumption ($B = .66$; $p = .001$). Table 23 presents the data on all the tests of assumptions.

Table 23: *Results of Assumptions Testing for the TASIT: Emotion Evaluation Subtest*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .11, p = .75$	Yes
Normality	Shapiro Wilk	$SW = .97, df = 25, p = .54$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	-.25	Yes
	Kurtosis	-.58	Yes
Linearity	Scatterplots	No evidence of a positive linear relationship	No
	Curve estimation analyses	$B = .66, p = .001$	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .21, p = .65$	Yes

As indicated in Table 24, the results of the ANCOVA suggest a statistically significant effect of the covariate, Emotion Evaluation pretest, on the dependent variable, Emotion Evaluation posttest ($F_{\text{pretest}} = 15.12$; $df = 1,22$; $p = .002$). However, there is not a statistically significant effect for group ($F_{\text{group}} = .92$; $df = 1,22$; $p = .35$), yielding a moderate effect (Cohen, 1988) and power (partial $\eta^2_{\text{group}} = .04$, observed power = .15) suggesting that only about 4% of the variance in Emotion Evaluation scores can be

accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a small and non-significant effect size ($g=.14$, $p = .72$, 95% CI $-.62$ to $.90$).

Table 24: *ANCOVA Results for the Emotion Evaluation subtest of the TASIT*

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	73.38	1	73.38	15.12	.001	.41	.96
Group	4.48	1	4.48	.92	.35	.04	.15
Error	106.78	23	4.85				
Corrected Total	184.64	24					

TASIT: Social Inference Minimal

An ANCOVA was conducted to determine if the mean Social Inference Minimal score differed based on group assignment (treatment versus control), while controlling for pretest. Table 25 presents the data on the tests of assumptions.

Table 25: *Results of Assumptions Testing for the TASIT: Social Inference Minimal Subtest*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .38, p = .54$	Yes
Normality	Shapiro Wilk	$SW = .96, df = 25, p = .41$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	-.61	Yes
	Kurtosis	.80	Yes
Linearity	Scatterplots	Positive linear relationship	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = 2.31, p = .14$	Yes

As indicated in Table 26, the results of the ANCOVA suggest a statistically significant effect of the covariate, Social Inference Minimal pretest, on the dependent variable, Social Inference Minimal posttest ($F_{\text{pretest}} = 9.17; df = 1,22; p = .006$). However, there is not a statistically significant effect for group ($F_{\text{group}} = .01; df = 1,22; p = .93$), with a non-existent effect (Cohen, 1988) and very small power (partial $\eta^2_{\text{group}} = .000$, observed power = .05) suggesting that none of the Social Inference Minimal scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a small and non-significant effect size ($g = .17, p = .66, 95\% \text{ CI } -.59 \text{ to } .93$).

Table 26: ANCOVA Results for the Social Inference Minimal subtest of the TASIT

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	465.34	1	465.34	9.17	.006	.29	.83
Group	.36	1	.36	.01	.93	.00	.05
Error	1116.54	23	50.75				
Corrected Total	1582.24	24					

TASIT: Social Inference Enriched

An ANCOVA was conducted to determine if the mean Social Inference Enriched score differed based on group assignment (treatment versus control), while controlling for pretest. Review of the scatterplots did not suggest linearity was a reasonable assumption. Therefore, a curve estimation analysis was conducted to see what type of line would best fit the data. Results did not support the assumption of linearity ($B = -.07$; $p = .81$). Violations to the assumption of linearity may result in biased estimates of the group effects and smaller adjustments in SS_{within} and SS_{between} . Table 27 presents the data on all the tests of assumptions.

Table 27: Results of Assumptions Testing for the TASIT: Social Inference Enriched Subtest

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = .02, p = .88$	Yes
Normality	Shapiro Wilk	$SW = .95, df = 25, p = .24$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	-.79	Yes
	Kurtosis	.58	Yes
Linearity	Scatterplots	No evidence of a positive linear relationship	No
	Curve estimation analyses	$B = -.07, p = .81$	No
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .36, p = .56$	Yes

As indicated in Table 28, the results of the ANCOVA do not suggest a statistically significant effect of the covariate, Social Inference Enriched pretest, on the dependent variable, Social Inference Enriched posttest ($F_{\text{pretest}} = .06; df = 1,22; p = .81$). There is also not a statistically significant effect for group ($F_{\text{group}} = .05; df = 1,22; p = .82$), with an extremely small effect (Cohen, 1988) and very small power (partial $\eta^2_{\text{group}} = .002$, observed power = .06) suggesting that only about 0.2% of the variance in Social Inference Enriched scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a small and non-significant effect size ($g = .11, p = .78, 95\% \text{ CI } -.65 \text{ to } .87$).

Table 28: *Posttest Results for the Social Inference Enriched subtest of the TASIT*

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	4.45	1	4.45	.06	.81	.00	.06
Group	3.82	1	3.82	.05	.82	.00	.06
Error	1639.10	23	74.50				
Corrected Total	1647.36	24					

Taken together, these results indicate that the intervention does not appear to be beneficial in improving participants' social inference ability as measured by the TASIT.

Research Question Three

Question 3: Is there a difference in metacognitive ability between adults with AS who receive a reading inference strategy intervention and those who do not?

The Metacognition in Reading Inventory (MIRI) was the only dependent measure used to answer this research question. Results from the MIRI follow.

An ANCOVA was conducted to determine if the mean MIRI score differed based on group assignment (treatment versus control), while controlling for pretest. Review of the scatterplots did not suggest linearity was a reasonable assumption. Therefore, a curve estimation analysis was conducted to see what type of line would best fit the data.

Results indicated that linearity was in fact a reasonable assumption ($B = .59$; $p = .03$).

Table 29 presents the data on all the tests of assumptions.

Table 29: *Results of Assumptions Testing for the MIRI*

Assumption	Test	Evidence	Assumption Satisfied?
Homogeneity of Variance	Levene's Test	$F(1, 23) = 1.11, p = .30$	Yes
Normality	Shapiro Wilk	$SW = .97, df = 25, p = .75$	Yes
	Boxplot/Histogram	relatively normal distributional shape	Yes
	Skewness	.14	Yes
	Kurtosis	.07	Yes
Linearity	Scatterplots	No evidence of a positive linear relationship	No
	Curve estimation analyses	$B = .59, p = .03$	Yes
Homogeneity of Regression Slopes	Scatterplots	Similar regression lines	Yes
	Interaction of Covariate and Independent Variable	$F(1, 21) = .12, p = .74$	Yes

As indicated in Table 30, the results of the ANCOVA suggest a statistically significant effect of the covariate, MIRI pretest, on the dependent variable, MIRI posttest ($F_{\text{pretest}} = 8.01; df = 1,22; p = .01$). There is also a statistically significant effect for group ($F_{\text{group}} = 14.21; df = 1,22; p = .001$), with a very large effect (Cohen, 1988) and very large power (partial $\eta^2_{\text{group}} = .39$, observed power = .95) suggesting that about 39% of the variance in MIRI scores can be accounted for by group when controlling for pretest. Additionally a Hedges' g was calculated for treatment impact yielding a statistically significant large effect size ($g = 1.41, p = .001, 95\% \text{ CI } .56 \text{ to } 2.26$) in favor of the treated group's performance on the Metacognition in Reading Inventory.

Table 30: *Posttest Results for the MIRI*

Analysis of Covariance: Test of Between-Subjects Effects							
Source	Type I Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial Eta Squared	Observed Power
Pretest Scores	230.03	1	230.03	8.01	.01	.27	.77
Group	408.36	1	408.36	14.21	.001	.39	.95
Error	632.17	23	28.74				
Corrected Total	1270.56	24					

Summary

In this chapter, the results of the experiment were presented. Results from the first question revealed statistically significant differences on the *Inference subtest* of the Watson-Glaser Critical Thinking Appraisal. However, significant results were not found on other outcome measures used to answer the first question (i.e., GRADE Comprehension Composite, and Researcher-Created Comprehension Test). Treatment participants performed better in inference generation in reading when compared to the control group on one outcome measure only (Watson-Glaser Critical Thinking Appraisal). Statistically significant results were not found for the second research question. Treatment group participants did not differ significantly from control group participants in their social inference ability as measured by the three subtests of the TASIT when controlling for pretest. Finally, results from the third research question

were presented. Treatment participants performed significantly better in their metacognitive reading ability as measured by the MIRI when compared to the control group participants.

The next chapter will present a discussion of these results including any conclusions that can be drawn as well as the implications to future treatment in inference with this population.

CHAPTER FIVE: DISCUSSION

Introduction

The purpose of this study was to determine the effects of a reading inference strategy on the social inference, reading inference, and metacognitive abilities of adults with AS. The results of the ANCOVA analyses suggest that the language-focused reading inference strategy is effective in improving participants' ability to generate inferences as they read and their ability to use metacognitive skills while reading. However, the results do not indicate significant differences between the two groups in overall reading comprehension skills or social inference ability. A discussion of the findings organized by the research questions will follow. Study limitations, implications for practitioners and future research directions will also be presented. Finally, the conclusions from the study will be discussed.

Discussion of the Findings

Research Question One

Is there a difference in ability to generate inferences in reading between adults with AS who receive a reading inference strategy intervention and those who do not?

The findings from research question one did not support previous research (e.g., Fisher, Schumaker, Deshler, 2002; Seybert, 1998) Participants in the treatment group of the present study scored significantly higher on the Inference subtest of the Watson-Glaser Critical Thinking Appraisal than the control group. However, no significant differences were found between the groups on the GRADE or the total score of the Researcher-Created Comprehension Test. Fisher, Schumaker, Deshler (2002); Lenz & Hughes (1990); Schumaker & Deshler (1992); and Seybert (1998) all reported positive and significant effects supporting explicit instruction in reading comprehension strategies. Similarly, several studies investigating explicit instruction in inference generation showed positive and significant results favoring the treatment group (Carnine, Kameenui, & Wolfson 1982; Carr, Dewitz, & Patburg, 1983; Dewitz, Carr, & Patburg, 1987; Reutzel and Hollingsworth, 1988) Thus, the non-significant findings in the present study for GRADE and the Researcher-Created Comprehension Test performance were unexpected. A possible explanation for these findings may reflect a difference in participant characteristics. Each of the aforementioned studies included participants that were younger and either typically developing or individuals with disabilities other than

AS. However, it is interesting that the present study reported here yielded significant effects in one measure and not the two others used to test this research question .

Another possible explanation for this lack of supportive findings in the present study centers around differences in the dependent measures themselves that were used to assess the intervention impact. The non-significant results on the Researcher-Created Comprehension Test were surprising particularly because the literature passages used were similar to ones used during the intervention program. The test required participants to answer the following question-types: factual, clarifying, main idea, and predicting. Although participants did not practice answering comprehension questions during the intervention, they did engage in generating inferences about themes and theses and predicted plausible behaviors of characters in passages.

A closer look at the results by question type revealed some interesting findings. Participants in the treatment group scored significantly better than the control group when answering main idea and predicting questions, controlling for pretest. No significant differences were found on the clarifying and factual type questions. This suggests that the participants were able to use the ACT & Check Strategy to generate inferences about theme and character motivation and also infer information not explicitly stated in the text.

The non-significant results of the factual questions might be expected since the ACT & Check Strategy did not target explicitly stated textual information. Conversely, the intervention program did address the skill of distinguishing important information

from unimportant information in text. The clarifying questions assessed this reading skill, therefore, it is not clear why the treatment participants did not improve.

Similar question types were used in the Paragraph Comprehension subtest of the GRADE. As discussed in Chapter Three, both forms of the subtest contained twice as many factual and clarifying questions as summarizing and predicting type questions (20, 10, respectively). As the results of the Researcher-Created Comprehension Test suggest, treatment participants improved in their ability to answer summarizing and predicting questions but not factual and clarifying questions. Since the focus of the Paragraph Comprehension subtest was on factual and clarifying questions, the non-significant findings were not as surprising considering the subset analyses of the Researcher-Created Comprehension Test.

In light of these findings, it is interesting that positive and statistically significant results were found on the *Inference* subtest of the Watson-Glaser Critical Thinking Appraisal. This measure evaluates inference ability in a different manner than was addressed during the intervention. That is, each *Inference* subtest passage is expository. The ACT & Check Strategy used in the intervention addressed expository writing to some degree, but mainly focused on narrative texts. The most significant difference relates to the performance task on each subtest. For example, on the *Inference* subtest, participants are asked to read a short factual passage followed by possible inferences someone may generate based on the passage. The participant then has to make a decision

related to the degree of the inferences' truth or falsity (i.e., true, probably true, insufficient data, probably false, false).

This task is very different from the activities the participants engaged in during intervention. Participants worked primarily on determining questions they could ask at particular points in their reading to trigger an inference. Part of the ACT & Check Strategy included "Check your guess" in which the participant would try to determine if their inference was true or false based on additional information gleaned from the reading. However, participants were not required to determine the *degree* to which their guess may be true or false. This suggests that the intervention helped improve the treatment participants' general understanding of inference generation and allowed them to more accurately judge the plausibility of a generated inference based on given facts.

Another possible explanation for the lack of the group main effect on the Researcher-Created Comprehension Test and the GRADE may be ceiling effects. Although variation existed among the participants; a majority of participants in the treatment group and in the control group scored at least 17 out of 24 on the Researcher-Created Comprehension pretest. Given the relatively high performance of participants on the pre-test measurement, the resulting non-significant performance may be as much a reflection of a ceiling test effect as it is actual intervention effect.

Similar patterns were seen when examining the Comprehension Composite pretest standard scores of the GRADE. A majority of the treatment participants (n = 11) scored at or above average, while only two participants scored below average. A

majority of the control participants also scored at or above the average range (n = 8), while only three scored below the average range. The majority of the participants in the treatment group were already functioning within the average or higher range and therefore did not have as much opportunity to demonstrate improvement as those participants scoring below the average range.

In addition, an intention-to-treat analysis was used by including two participants that did not complete the posttest measures. The use of their pretest scores as posttest scores measures as recommended by Hollis and Campbell (1999) may not have been reflective of their reading comprehension ability after receiving part of the ACT & Check Strategy Intervention.

Research Question Two

Is there a difference in ability to generate social inferences between adults with AS who receive a reading inference strategy intervention and those who do not?

Results from the posttest scores of each of the three subtests of the TASIT did not indicate a positive or significant intervention effect. This suggests that targeting reading inference does not transfer to social inference skills. This finding was also unexpected considering that the reciprocity of the four components of literacy (reading, writing, listening, and speaking) has been established in the literature (Bradley & Bryant, 1983; Catts & Kamhi, 2005; Englert & Thomas, 1987; Gillon & Dodd, 1995; Hiebert, 1980; Kroll, 1981; Ruddell & Ruddell, 1994). However, there are a number of plausible

explanations for these results. First, the nature of the intervention did not explicitly address social inference skills. Although the inference categories targeted were determined to be most related to making social inferences, the process of actually generating social inferences was not addressed during the intervention. It is also unclear as to whether pragmatic language skills including social inference are sensitive to instruction in metacognition. Typically, when approaching a reading task, an individual can employ a strategy in a linear fashion and review information provided in text to problem-solve. However, when engaged in a dynamic social interaction, one has to interpret competing stimuli very rapidly. Therefore, knowing what to do in social situations or what to look for when making a social inference may not transfer readily to social inference generation. In addition, as discussed earlier, an intention-to-treat analysis was used for two participants that did not complete the posttest measures which may not have been reflective of their social inference ability after receiving part of the ACT & Check Strategy Intervention.

Perhaps the most plausible explanation for the results relates to the dependent measure itself. Inclusion criteria were determined prior to the start of the experimental procedures. To be included in the study, participants had to score below the average range on at least one of the TASIT's three subtests. This criterion was developed to include as many participants as possible but to also ensure that the participants exhibited a degree of difficulty with some type of social inference skill. As shown in Table 30, although there was great variety in the subtest scores, many participants scored within or

above the average range on at least one of the three subtests. Participants scoring in or above the range of normal may have been susceptible to a ceiling test effect that restricted the magnitude of the intervention effect.

Table 31: *Number of Participants Scoring Within or Above the Average Range on TASIT Subtests*

	Treatment Group	Control Group
Emotion Evaluation Subtest	2	5
Social Inference – Minimal Subtest	6	2
Social Inference – Enriched Subtest	8	5

Another potential intervening factor that resulted in the absence of group differences was the intensity of intervention. Treatment participants received a total of 12 hours of instruction if they attended all treatment sessions. Treatment sessions were held twice a week for six weeks. Perhaps a more intensive intervention or longer program would have resulted in significant group differences for the intervention effects on the social inference outcomes.

Research Question Three

Is there a difference in metacognitive ability between adults with AS who receive a reading inference strategy intervention and those who do not?

Based on the participants' performance on the MIRI, it can be concluded that the treatment group was more strategic in their approach to the reading tasks than were participants in the control group. This result compared favorably to previous findings suggesting that instruction in strategy use positively affects one's metacognitive ability (e.g., Bui, Schumaker, Deshler, 2006; Hughes, Ruhl, Schumaker, & Deshler, 2002; Lancaster, Schumaker, Lancaster, & Deshler, 2009; Schumaker et al., 1982). The MIRI asked participants to read two expository passages and record the questions they ask themselves and the strategies they use before, during, and after reading. Evidence that treatment participants were using the ACT & Check Strategy was apparent. Treatment participants often wrote the steps of the ACT & Check Strategy and asked themselves questions generated during the intervention program. This test directly measured the skills that were taught in the intervention program but required participants to use those skills with two expository passages. As mentioned before, the majority of the intervention sessions used narrative passages in instruction. This suggests that participants were able to generalize what they learned to different types of texts.

Fidelity of Implementation

The results of the fidelity measure (see Table 3) indicated that the author followed the intervention protocol with a high degree of fidelity for checklist items 1-2 and 4-8 (75-100%). As noted in the Table 3, the author had most difficulty adequately describing the purpose of each session. The author was judged to meet that criterion only 56-67% of

the time. Upon reflection, it appears that the author was not explicit enough in the explanation of the purpose of each session. At times, the author would describe the specific concept being taught in great detail but not tie that concept to the session purpose. Thus, the intervention protocol (Appendix C) will be adjusted for future use to reflect the need for a more explicit description of the session's purpose by the intervener.

Participant Variability

It is well well known that AS manifests differently in different individuals (American Psychological Association, 2011; Church, Alisanski, Amunullah, 2000). Thus, the results of this study can better inform the interpretation of those data when couched within a discussion of the unique characteristics of the participant population. This variation among participants was observed in the present investigation by the study author.

Some treatment group participants were extremely motivated and participated actively during each session. Other treatment participants were not as motivated to improve their inference skills and needed consistent redirection and encouragement to participate in the group discussions and activities. It was apparent that some of the treatment group participants completed the assessment and intervention tasks to earn payment and were otherwise uninterested in the intervention. Others were not as interested in getting paid; in fact, one treatment participant declined payment completely.

Participants were assigned to groups of three or four individuals based on availability and preference for treatment location. Because of this, the dynamics of each group were different and this may have influenced some participants' performance. Although this type of anecdotal data was not used in the analyses, it is important to discuss the differences in each group as these differences shed light of the variability of individuals with AS. A brief discussion of each group follows.

Group one was composed of three individuals, one female and two males. Two of the participants were college students and one held a master's degree and was employed. All three participants were highly motivated to participate in the intervention as they felt they struggled in both social and reading inference generation. All members in group one expressed a desire to make new friends and begin dating. Two of the group members caught on very quickly to the ACT & Check Strategy and supported the other member who had more difficulty. All group members actively participated in intervention discussions and completed each task asked of them.

Group two consisted of three males. Two of the participants were college students and the other earned a high school diploma and was employed full-time. One of the participants was very motivated to participate in the intervention specifically because he enjoyed reading literature and felt the inference strategy intervention allowed him to comprehend the material more fully. He completed all tasks and participated readily in group discussions. Another participant felt that he did not need to learn the intervention because he believed he was already able to easily generate inferences while reading,

although he struggled with social inference generation. Although this participant completed all tasks, he often did so grudgingly. He also seemed very annoyed with the other two participants and often spoke in a condescending tone of voice. The other two participants did not appear to detect his condescending attitude and also seemed to overlook his behavior. The final participant had significant difficulty focusing during the intervention. He often needed redirection and was not motivated to participate. The researcher had to consistently encourage him to add to the group discussion and help him remain on task. Ultimately, this participant withdrew from the intervention although he did return for posttesting.

Four males comprised group three. All received high school diplomas though none were enrolled in or graduated from college. Two of the participants worked part-time, while the others were unemployed. This group had very different ability levels but worked very well together. The first participant had the most trouble with both reading and social inference generation. He was motivated to participate but needed significant scaffolding from the researcher and other group members. The second participant did not feel that he had difficulty in either reading inference generation or social inference generation though his pretesting indicated otherwise. He demonstrated with significant pragmatic deficits but was oblivious to these difficulties. He was very talkative and participated in all discussions, though at times needed to be cued to allow other participants to speak. The next participant caught on to the inference strategy very easily and was able to help the other participants. The final participant appeared most

competent in social inference and pragmatic ability but struggled tremendously with generating inferences during reading. He reported that he never read fiction because he couldn't understand it. Ultimately, this participant withdrew from the intervention and did not complete the posttesting.

Group four was composed of three males. Two of the participants were enrolled in college and caught on quickly to the strategy, while the other participant earned a high-school diploma, worked full-time, and had more trouble with the study tasks. This participant was not motivated to participate in the intervention sessions, though he indicated that he desperately wanted a girlfriend and hoped the intervention would help achieve that goal. This participant often needed significant cueing from the researcher to remain on task and was never able to fully grasp the ACT & Check Strategy. This participant completed the intervention program but elected not to complete the posttesting. The other two participants demonstrated a similar reading ability and were able to engage each other in thoughtful discussions around the intervention materials and tasks.

As indicated previously, group discussion and group work were integrated throughout the intervention. Thus, group dynamics may have played a significant role in individual participants' abilities to learn the ACT & Check Strategy and ultimately generate reading inferences. Despite the variability in both individual and group characteristics, the treatment group participants, as a whole, out-performed the control participants in several outcome measures (positive and statistically significant effect sizes

for three of the five outcome measures and three of the four subset analyses of the Researcher-Created Comprehension Test).

Implications for Practice

With the prevalence of ASD now 1 in 110, (Centers for Disease Control and Prevention, 2009) there is an increased need to identify effective strategies for all ages diagnosed with an ASD. Although research investigating the efficacy of early interventions is warranted, there needs to be an increased emphasis on interventions for adults with AS. As we know, AS is a life-long condition and therefore research efforts across the lifespan are warranted especially considering the challenges individuals with AS face in securing and maintaining employment (Goode, Rutter, & Howlin, 1994; Howlin & Mawhood, 1996; Nesbitt, 2000). The present study has implications for an underserved subgroup of the ASD population, adults with AS. The findings of this study suggest that adults with AS can learn a strategy to help them generate inferences more easily as they read. These results are important for adults with AS who have found reading to be difficult or unsatisfying. As we know, daily life requires levels of literacy beyond simple decoding. For example, many jobs require employees to use critical thinking to draw conclusions about what they read. This requires the employee to comprehend more than just the words of a text; it requires an ability to synthesize sources of information and draw conclusions based on the facts and the person's own experiences

(Ehren & Murza, 2010; Langer, 2001). Practitioners interested in helping adults with AS improve their ability to generate inferences during reading and metacognitive skills in reading may wish to follow a similar treatment program that includes explicit instruction in: (a) the language and metacognitive underpinnings of inference generation, (b) those categories of inferences most related to social inference generation, and (c) the ACT & Check Strategy to expect similar results.

Recommendations for Further Research

A fundamental characteristic of the nature of ASD is its heterogeneity. Although all participants were diagnosed with AS, there was a wide range of strengths and weaknesses present in the areas of social and reading inference ability. The variability of the population suggests that 25 participants may not have been enough to account for these differences. Additionally, the power for all outcome measures was generally low. In addition to securing more participants in future research, an investigation of the characteristics of the participants that foster success with interventions similar to the ACT & Check Strategy would be useful. For example, what participant characteristics correlate with statistically significant gains in areas such as general reading comprehension, inference generation in reading, social inference, and metacognitive ability.

Future research is also warranted to investigate whether similar results can be achieved with different populations of AS participants. Would adolescents with AS also benefit? Does the severity of the disorder impact success? Would adults or adolescents with language and literacy deficits but without ASD also benefit from the ACT & Check Strategy? Because the strategy used an empirically validated instructional methodology for teaching students with learning disabilities, it seems reasonable to expect similar results with this population. However, this assumption and the aforementioned questions can only be addressed with future high-quality research.

Another fruitful area of research involves the social inference aspect of this study. Although significant results were not found in this area, the fact remains that social competency is critical to life success and future research is warranted to investigate what works in helping people with ASD improve their social inference ability as one of the skills of social competency. Additional questions for further inquiry include, would the ACT & Check Strategy remain effective in improving participants' reading inference ability if a more explicit social inference program was integrated with it? What types of lessons/activities would be beneficial in helping people with ASD improve their social inference ability? Is a metacognitive approach a valid way to address social inference generation and pragmatic language ability in general? Would some kind of cognitive processing intervention have more utility in aiding individuals with AS in their ability to process, integrate, and draw conclusions about competing linguistic, paralinguistic, and extralinguistic information?

Conclusions

The findings of this study revealed that the ACT & Check Strategy intervention was effective in improving participants' ability to generate inferences as they read and their metacognitive reading ability. This study adds to previous work in the area of inference instruction and is the only research of its kind that investigates an inference strategy for adults with AS. Although significant results were found in some reading measures, no significant results were found in social inference measures. This suggests that the ACT & Check strategy is not effective in improving adults with AS's ability to generate social inferences. The research on AS suggests some significant difficulties with both social inference and reading inference skills. This research provides support for an intervention addressing the reading inference deficit area. Further research is warranted to investigate potential interventions to address social inference skills for the ASD population.

**APPENDIX A: ELECTRONIC SEARCH BY TOPIC, SEARCH TERMS AND
CITATIONS RETRIEVED**

Topic	Search Terms	Number of Citations	
		ERIC & PsycINFO	Dissertation & Theses: Full Text
Reading inference intervention	<i>infer</i> OR <i>inference</i> (subject terms) AND <i>read</i> OR <i>reading</i> AND <i>intervene</i> OR <i>intervention</i> OR <i>treat</i> OR <i>treatment</i> OR <i>teach</i> OR <i>teaching</i> OR <i>therapy</i>	289	153
ASD and social skills	<i>Asperger</i> OR <i>Asperger's</i> OR <i>high-functioning autism</i> OR <i>high functioning autism</i> (subject terms) AND <i>intervene</i> OR <i>intervention</i> OR <i>treat</i> OR <i>treatment</i> OR <i>teach</i> OR <i>teaching</i> OR <i>therapy</i> AND <i>social</i> OR <i>pragmatic</i> AND <i>adolescent</i> OR <i>adult</i>	199	137
Social inference	<i>Asperger</i> OR <i>Asperger's</i> OR <i>high-functioning autism</i> OR <i>high functioning autism</i> (subject terms) AND <i>infer*</i> OR <i>social cognition</i> AND <i>adolescent</i> OR <i>adult</i>	72	22
Reading and ASD	<i>Asperger</i> OR <i>Asperger's</i> OR <i>high-functioning autism</i> OR <i>high functioning autism</i> (subject terms) AND <i>intervene</i> OR <i>intervention</i> OR <i>treat</i> OR <i>treatment</i> OR <i>teach</i> OR <i>teaching</i> OR <i>therapy</i> AND <i>read</i> OR <i>reading</i>	71	123
Metacognition	<i>Metacognition</i> OR metacognitive (subject terms) AND <i>read</i> OR <i>reading</i> OR <i>infer*</i> OR <i>social cognition</i> (subject terms)AND <i>intervene</i> OR <i>intervention</i> OR <i>treat</i> OR <i>treatment</i> OR <i>teach</i> OR <i>teaching</i> OR <i>therapy</i> (subject terms)	427	195
Key author	<i>Baron-Cohen</i> (author term) AND <i>Asperger</i> OR <i>Asperger's</i> OR <i>high-functioning autism</i> OR <i>high functioning autism</i>	95	0
Key author	Kintsch (author term) AND <i>infer</i> OR <i>inference</i>	25	0

APPENDIX B: PARTICIPANT RECRUITMENT EMAIL

Department of Communication Sciences and Disorders
University of Central Florida
HPA2-109
4000 Central Florida Blvd.
Orlando, Florida 32826
Phone: (407) 823-4793

Dear CARD Constituent:

My name is Kim Murza and I am a Doctoral Student at the University of Central Florida. I am asking for your participation in an intervention study investigating an inference strategy.

The study's purpose is to answer the following research questions:

1. Is there a difference in ability to make inferences in reading between adults with AS or high-functioning autism who receive a reading inference strategy intervention and those who do not?
2. Is there a difference in ability to make social inferences between adults with AS or high-functioning autism who receive a reading inference strategy intervention and those who do not?

You must be 18 years of age or older to participate in this study. Participants will be randomly assigned to an intervention or control group. Both groups will participate in a free assessment of their reading comprehension, reading inference, and social inference abilities before the intervention phase and after. All participants will receive reports summarizing their performance on the assessments. Participants in the control group will have the option of participating in the same intervention program after the assessment period. The intervention group will meet twice a week for 60 minute sessions over 6 weeks.

Participants meeting the inclusion criteria will be compensated. Participants in the control and treatment group will be paid \$30.00 for completing the pretest assessments and \$30.00 for completing the posttest assessments. Participants randomly selected to be in the treatment group will receive \$10.00 for each treatment session they attend. They will have the opportunity to earn \$120.00 for attending all of the treatment sessions. This compensation averages to about \$10.00 per hour of commitment to the study. Participants have the option of withdrawing from the study at any time but will only be compensated for activities they take part in.

Participation in this research study is voluntary. If you have any questions about this research study please feel free to contact the researcher, Kim Murza (407-782-5009; kimberly.murza@gmail.com) or her faculty advisor Dr. Chad Nye (407-823-6003; cnye@mail.ucf.edu).

Thank you,
Kim Murza

APPENDIX C: ACT & CHECK STRATEGY LESSONS

Stage 1: Pretest, Review Other Assessment Report, Introduce ACT & Check, and Make Commitments

Purpose: To motivate students to learn a new strategy; to establish and discuss baseline performance

Advance Organizer (display Advanced Organizer Lesson 1) and explain: *Today we're going to begin learning a new strategy that will help you make inferences as you read and possibly help you make social inferences. An inference is an educated guess you make based on knowledge you have and clues you pick up. In social situations we are always picking up on nonverbal clues people give us such as their facial expressions and body position as well as verbal clues like what they are actually saying and how they say it to figure out a person's intent. Each session we're going to look at an Advance Organizer like this one so that you know what you'll be doing over the hour session so let's take a look. We're going to start this session by introducing ourselves to each other really quickly. You can tell us if you're currently working or going to school and what you like to do in your free time. Then we're going to continue by taking a brief pretest to help me understand what you do while you read. Then we're going to review how you all did on the pretest assessments. We're going to do this so that you understand your strengths and weaknesses and so you can compare how you did on the pretest to your performance on the posttest when we finish this intervention program. Throughout today's session I need you to listen and follow along. I will also provide you with a note-taking sheet and I will be asking you to take notes on what we are doing. After we review your report we're going to begin to discuss the ACT & Check strategy you're going to be learning. I'm going to tell you what's in it for you if you learn this strategy and how it might help you with making social inferences. Then we're going to talk about the commitment I am going to make to all of you and this program and I'm going to explain the commitment I'd like all of you to make to this program. At the end of each session we review what we have done with a Post Organizer. Does anyone have any questions?*

Modified MIRI Pretest: *You have three pages. I want you to go ahead and write your name at the top of the first page. This pretest is looking at what, if anything, you are currently doing in reference to making inferences while you read. In the left hand column you'll see three sections, before you read, during reading, and after reading. I'd like you to answer the questions at the top of the middle and right hand column next to each section. Try to answer the questions as honestly as possible, if you are not asking yourself anything or using any strategies, please write that in the columns. Once you're finished turn your paper over. I'll then give you your report to read over while we wait for everyone else. Once everyone's done, we'll discuss the report. Any questions?*

Review Pretest Performance: *You all should now have a copy of your pretest report. I know that if you are just now receiving your report you haven't had a chance to read it but I still want you to follow with me as I explain the different sections so you understand your performance on the pretest assessments. I do want to explain that the purpose of this activity is not to have you share your results with the others in this group. If you have specific questions about your performance, please write them down on the scratch paper in your folder and I'll be more than happy to meet with you privately to answer them.*

The first paragraph of the report gives a little introduction and summarizes your current employment situation and why you participated in the assessment. If you haven't done so I'm going to ask that you read that later. I want you to look under the "Evaluation" heading. This lists all of the tests that you completed on the first day of the pretest assessments and when you did the group assessments. The first test the report discusses is the TASIT. That's the one in which you watched the videos. On the second page you'll see a lot of tables. It's really important that you understand what's in these tables because they explain how you did on the test. The first table gives your scores on the Emotion Evaluation subtest. If you remember, this is the subtest that asked you whether you thought the person in the video was feeling happy or sad etc. The first box gives the mean or average of the normative sample of people who took the same subtest. The next box gives the standard deviation. If you add the standard deviation to the mean and also subtract it from the mean you'll get a range of 22.75-26.97. This is an important range because it tells you the average performance range on this subtest. In the next box you'll see your raw score and next to it you'll see whether your performance was in the average range or not. All we did was see if your score fell within the average range of 22.75-26.97. In the next box we tell you how many standard deviations above or below that range your score fell. Does that make sense? Does anyone have any questions? The next table shows your performance on the second subtest that looked at your ability to distinguish different types of sarcasm from sincerity. The bottom row gives you your total performance score and the rows above give you your scores in each area. You might notice that you did better in one area than another. What I've found is that a lot of participants either understood sarcasm really well but thought people who were being sincere were being sarcastic or understood when people were being sincere but thought people who were using sarcasm were being sincere. The next table goes with the second subtest. Do you remember with the last two subtests how you were asked four questions for each video you watched? Well, this table shows you how you performed with each of the four question types. Some of the questions were focused on you inferring what the actor was trying to do, others what the actor was trying to say, what they were thinking and finally what they were feeling.

The fourth table shows how you did on the last subtest that looked at your ability to distinguish between sarcasm and lies. Just like with the last subtest there's a row with

your total score and then it also splits it up by item types. The last table breaks down your performance by question type again. Does anyone have any questions about how we reported your scores on the TASIT?

The next paragraph discusses how you did on the Watson-Glaser Inference subtest. This was the test that asked you to read a passage and then corresponding statements and decided whether they were true, probably true, insufficient data, probably false, or false. There are only raw scores for this test so you can see how many of the questions you answered correctly out of the total 16.

After that section we discuss how you performed on the GRADE, this was the reading comprehension measure. What you should be interested in is the column that says standard score. This tells you how you performed when compared to other people your age. It uses a mean of 100 and a standard deviation of 15. You can figure out if your score was within the average range by adding or subtracting it from the mean. Does everyone understand that piece? The next columns lists your grade equivalent. Even though most of you are not in school anymore it can give you an idea of the grade level you are reading at. This intervention will primarily use materials at the 9th grade reading level so you can gauge how difficult those materials might be for you.

The next section of the report discusses your pragmatic language abilities. We assessed your pragmatic language abilities when you did the mock interview and the conversation. Although we're not going to be directly working on these skills in this intervention program it will give you some valuable information about your strengths and weaknesses and could provide information to Vocational Rehabilitation when they decide what kinds of services you might need to be better prepared for employment.

The final sections summarize your overall performance and then you'll see our recommendations. The purpose of these recommendations is to provide VR with information they need about what types of services you could benefit from.

Does anyone have any questions about the report? After our session today make sure you read through the entire report and write down any questions you might have about it. I'll be more than happy to talk to you about your questions before or after one of our sessions or over the phone if you prefer.

Discuss the ACT & Check Strategy: *Okay, now we're going to talk about what exactly you're going to be learning in these intervention sessions. (Pass out the note-taking sheet for Lesson 1). I would like you to take notes as we discuss the strategy.*

The ACT & Check strategy is a strategy to help you make inferences as you read. There are many different reasons that you read as an adult. Can anyone tell me a reason you

read? (Elicit responses) *Right, many of you read for enjoyment, and at work you will definitely have to read a variety of texts, for information, when you read emails, etc.. Looks at the word inferences it has the word infer in it. Can anyone tell me what it means to infer? (elicit a responses).*

Yes to infer means to come to a conclusion about something based on two things; your own background knowledge and clues from the text. In fact we can use a formula to describe what it means to infer (Show cue card #1). So let's think through this formula a little bit more. Can anyone tell me what I mean by background knowledge? (elicit responses).

Yes, background knowledge means what you the reader bring to the passage. For example, if I had to read a passage from a novel in which the characters were a part of a rugby team I wouldn't be able to bring as much background knowledge to the passage as I would if it was about rowing because I have a lot of background knowledge about rowing since I was a part of the UCF crew in college. Every reader has different background knowledge about topics. Even though I don't know a lot about rugby I do know some things like it is popular in a lot of countries outside of the US like Australia and South Africa and it is played on a football like field with a ball that kind of resembles a football. I also know that it's a very rough sport so that would tell me a little bit about the characters in the story. Can anyone tell me what I might know about the characters that play rugby without even reading the text? (elicit responses such as, "They would also have to be tough," "They are probably physically fit" "They are probably not from the US", etc.).

Great, so that's one piece of the formula for making inferences. The other piece is getting clues from the text. To make a passage or novel interesting to read, authors don't usually tell you everything explicitly. Can anyone tell me what I mean by explicitly? (elicit responses).

*Right, explicitly means with a lot of detail so that you don't have to make any inferences. Instead narrative authors typically write knowing that they are leaving a lot of the details out because they expect their readers to make inferences. Even authors who write expository types of texts expect their readers to make inferences. We are going to learn about five types of inference you can make as you read. We are also going to learn about the language clues we can look for in the text when we want to make each of the inferences. Ultimately we're going to put this all together so that we can use a strategy called ACT & Check to help us make more accurate inferences as we read. (Show Cue Card #2). The ACT & Check Strategy uses something called a mnemonic, does anyone know what a mnemonic is? (Elicit responses) *Right, a mnemonic is device used to help you remember something. The first letter of a word is used to create a new word. For example have you ever heard of the mnemonic ROY G BIV? ROY G BIV is a mnemonic**

used to help remember the order of the colors in the rainbow; red, orange, yellow, green, blue, indigo, violet.

As you can see, ACT & Check stands for:

- *Ask yourself a question*
- *Consider the text*
- *Think about what you know and take a good guess (infer)*
- *Check your guess*

We are going to learn how to use the ACT & Check strategy when we need to make different types of inferences with different levels of complex texts.

Give Rationales for the Strategy: *As I mentioned before, you are going to learn this strategy so that you can use it as you're reading all different kinds of materials. How many of you are currently in school? Well if you are in school or considering going back to school, this strategy will help you better understand what you have to read for your classes. It's also important to know that you don't have to be in school or taking tests anymore for you to benefit from learning this strategy. Skilled readers who read for enjoyment are constantly making inferences as they read to understand what they are reading. It is important for you to improve your ability to make inferences so that you might enjoy reading for pleasure more than you do now. If you already read for pleasure, this strategy will help you do so more efficiently and effectively.*

In addition, how many of you are currently working or looking for a job? (Elicit responses) Okay, well whether you're working now or going to be working in the future you're going to have to do some kind of reading. When you're reading at work whether it be an email or technical information you're going to have to make inferences. In fact, there's a lot of reading we do in our everyday life that requires us to make inferences.

I also want to tell you how this strategy is related to autism. One of the key features of autism spectrum disorder is difficulty in making inferences about other people. For example, the ability to read nonverbal cues such as facial expressions and body language to draw conclusions is a type of social inference skill. In addition, research has shown that some higher level language processes such as the ability to make inferences in text are more difficult for people with ASD. There is also a lot of research that shows that oral language skills are related to written language skills. This means that making social inferences may be related to making inferences in text. We are going to be learning about the types of inferences in text that are most related to social inferences because we believe that working on one may impact the other. Does anyone have any thoughts or questions about why we are learning the ACT & Check strategy?

Commitments: *As you know, you have volunteered to participate in this intervention program and you're being compensated for your participation. I want to reiterate that your participation is completely voluntary and you can withdraw at any time. However, if you withdraw you will only be paid for what you have completed. We're going to talk about making a commitment to this intervention program, to your peers here today, and to me. (Pass out commitment forms). Go ahead and take a minute to read over this form.*

It's really important that we all understand the expectations of this intervention program up front. I am asking for your signature to indicate that you understand the expectations. I am also going to sign a commitment form in front of all of you today. I want to read what it says to you all. (Read researcher commitment form aloud). Does anyone have any questions about the commitment forms? If no one has any questions I'm going to ask that you sign the form and hand them to me. I will make a copy of your form for you to put in your folder.

Post Organizer: (display the post organizer) *Today we went over a lot for our first session. First we reviewed your pretest assessment reports. Make sure you read over the entire report and please let me know if you have any questions. Next we talked about the ACT & Check Strategy. Can anyone tell me what it means to make an inference? (elicit responses).*

Right inferring or making inferences means to come to a conclusion about something based on two things; your own background knowledge and clues from the text. That's where the inference formula comes in. We talked a little bit about background knowledge and text clues. How is this different from making social inferences? (Elicit responses) We're going to learn more about each of these in the next few sessions. All right, can anyone remind us of what the ACT & Check Strategy stands for? (elicit responses). Exactly!

After we discussed the ACT & Check Strategy we talked about some of the reasons it's important to learn the strategy. Can anyone tell me one of the reasons? (elicit responses).

Finally we made commitments in writing to this intervention program. During the next session we are going to start learning about the different types of inferences we can make in text and we'll start learning how to use the strategy to actually infer.

Lesson 2: Language Underpinnings & Inference Category Types

Purpose: To present a clear picture of the types of inference categories and to provide practice in identifying them.

Advance Organizer (display Advanced Organizer Lesson 2) and explain: *Last time we met we reviewed your reports, briefly talked about the ACT & Check Strategy, and we each made commitments to this intervention program. Today we're going to start laying the groundwork for using the ACT & Check Strategy. Before we learn how to use the strategy we need to talk about language and how it plays a key role in our ability to be strategic readers. Does anyone know what I mean when I say strategic reader? (Elicit responses) Right, effective and expert readers are strategic when they read. That means that they have a purpose for their reading and they constantly monitor their understanding as they read. To be a strategic reader means to have a plan and to follow the plan and then to review how you did with your plan. Strategic readers use a variety of strategies to help them comprehend different texts. The ACT & Check strategy is one kind of strategy that can help you become a more strategic reader.*

We're going to start by talking about the language foundation of making inferences and then we're going to learn about the five inference categories that are most related to social inference. Just like you did during the last session, you're going to take notes on this note-taking sheet (pass out Lesson 2 note-taking sheet).

Language Foundations (display Cue Card #3) and explain: *Whenever you are reading, writing, listening, or speaking you are using language. Before you can make inferences in text you have to master certain higher-level language skills. We're going to talk about these skills and they are incorporated in the activities we will be doing and the ACT & CHECK Strategy itself. Take a look at this Cue Card. Why do you think the language foundations are at the bottom of the house? (elicit responses). Right, they form the foundation for making inferences, just like the foundation of the house allows one to build a house on top.*

Now we're going to talk about each one of these language foundations. Does anyone know what it might mean to be aware of making inferences? (elicit responses)

Awareness of making inferences is talking about thinking about your own thinking. This is a part of being strategic. For example, if you were driving down the road and all of a sudden your car stopped and you noticed your gas light was on you would probably come to the conclusion that you ran out of gas. Say you pulled over to the side of the road but now you have to problem solve how to get out of this situation. That's an example of thinking about thinking. Problem solving is a big part of becoming aware of your

reading. We are going to become aware of making inferences as we read. Why might it be important to actively think about making inferences? (elicit responses).

Right, we need to consciously think about inferences so we can make sure we're not missing anything important that the author is trying to tell us. Increasing awareness is a big part of becoming a strategic reader.

Okay, the next language foundation is formulating your own questions about the text. This is a part of increasing our awareness of making inferences. If you know what types of inference categories there are you will learn what types of questions you should ask yourself as you read. Why is it important to ask yourself questions as you read? (elicit responses). Right, you should be asking yourself questions as you read to get to a deeper understanding of the passage. Remember from last time we met, authors usually don't explicitly tell you everything you need to know to understand their text as they intended. They expect the reader to make inferences and to do that we're going to learn how to ask questions related to the inference categories we're going to learn about today.

We kind of talked about the next language foundation last time: integrating background knowledge with text knowledge. We talked about what each one of them is but we didn't get into how we integrate them to make inferences. This is a complex language skill that you'll learn how to do with the ACT & Check Strategy.

The next language foundation, attending to language clues at each level of complexity is something we're going to spend a lot of time working on. What do you think could be an example of a language clue? (elicit responses). Yes a language clue is a clue that is in the text and can help the reader make accurate inferences. We're going to work on attending to language clues first at the sentence level, then the paragraph level and finally at the passage level. This is what I'm referring to when I say different levels of complexity.

Finally, applying knowledge and skills strategically is directly related to how you use the ACT & Check Strategy.

I have incorporated these language foundations into the lessons I have created to teach you how to more easily and accurately make inferences in text.

Inference Category Types *Now we're going to talk about the different types of inference categories. There are many different types of inferences that you can make as you read texts. We are only going to focus on the inference categories that are most related to making social inferences. Does anyone remember from last session what I mean when I talk about social inferences? (elicit responses). Right, social inferences are conclusions you make about people's intent based on their nonverbal and verbal cues. For example if someone's facial expressions look like this and then they say, "I'm having so much fun*

today” (say with sarcasm) you should read the nonverbal cues, the facial expressions, and the verbal cues, the way I emphasized certain words to know that I was using sarcasm. If I’m being sarcastic does that mean I wanted to tell you that I really was having fun? (elicit no responses).

We’re going to focus on how to make the five types of inferences most related to making social inferences. (Display Cue Card #4 and read through explaining each type).

Model how to make inferences (I do it). Now we’re going to see how these inferences can be made with a real passage. I’m going to model how to figure out which inferences can be made and what parts of the text help me make those inferences with a real passage (Pass out “How Leisure Came” by Ambrose Bierce) Okay now let’s look at the passage together. (Display double-spaced passage). When we make an inference there are two things we use to help us. Does anyone remember what they are? (elicit responses) Right, last time we talked about the formula: background knowledge + text clues = inference. Let’s see how I use both of these to draw inferences about this passage.

Over the next few weeks you’re going to learn how to make inferences with an activity called Reading Between the Lines. This will be somewhat similar to what I’m going to do right now. Remember the author wants us to know things that he doesn’t explicitly tell us so we need to infer them.

Okay, the first part of this passage reads, “A man to whom time was money” remember the five categories of inferences that we just learned about, use your notes if you need them. I’m thinking to myself is there anything that the author wants me to infer just from that short piece of text. Hmmm, I’m thinking about the five types of inference categories and with only reading this part there are two inference categories that deal with the character. Hmmm, I think the big goal and the character’s condition definitely deal with the character. Since I’ve only read this short piece of text I can’t make any accurate inferences about his goal but I could infer something about his emotional state. I’m going to really have to use my background knowledge for this one. I have met people who felt the same way as this character so I’m going to ask myself how they behaved and what traits they had. I know that people who believe time is money tend to get really stressed out if they are late or if someone else is late that they’re counting on, they also don’t like to waste time doing things that they might feel are unproductive. So I might be able to make the inference that this character has a life that is scheduled and centered around his work. I’m going to call him a workaholic. I’m going to write that inference here. (Write character condition: scheduled life, workaholic). Since I’ve only read just that piece I’m not sure how accurate that inference is yet but when we learn the ACT & Check strategy we’ll learn how to check after we’ve read more to see if there any text clues that can confirm our inference.

All right, now I'm going to keep reading to see if I can make any other inferences. (Read aloud, "A Man to Whom Time Was Money, and who was bolting his breakfast in order to catch a train...") Okay, with this information I can make another inference about the character. I think this has something to do with the big goal of the character. Since the man thought time was money and he was rushing his breakfast to catch the train I have an idea about what he was trying to make happen. He wanted to get to work on time. I'm going to write that down on this line (Write big goal: He wanted to get to work on time). Does everyone understand what I'm doing? Can anyone tell me why this might be a worthwhile exercise for us? (elicit responses). Yes, this helps us become more aware about the types of inferences, helps us integrate our own background knowledge with text clues and forces us to pay attention to those text clues.

Let's continue. (Read aloud, "A Man to Whom Time Was Money, and who was bolting his breakfast in order to catch a train, had leaned his newspaper against the sugar bowl and was reading as he ate."). I don't think this new information will help me make any new inferences so I'm going to keep reading. (Read aloud, "In his haste and abstraction he stuck a pickle-fork into his right eye, and on removing the fork the eye came with it.") Whoa, that's disgusting! I think the author wants me the reader to be shocked and disgusted after reading that so I'm going to write that down next to the inference category intended reader emotion. (Write that on the page) I'm thinking to myself that the author must have a reason for writing something that extreme, he's trying to make a point but I think I need to read more to find out exactly what his intent is and see if this passage has a theme. I'm going to keep reading, (Read aloud, "In buying spectacles the needless outlay for the right lens soon reduced him to poverty"). Okay, the author helped us with more information about the condition of the man, he's now broke, but since it's written right there for us we don't need to write that one down.

I'm going to finish the passage and see what conclusions I can draw. (Read aloud, "...and the Man to Whom Time Was Money had to sustain life by fishing from the end of a wharf."). First, I noticed that I can make another inference about the condition of the character. Since we know that the character became very poor after the incident it tells me something about his new occupation of fishing at the end of the wharf, it tells me that fishermen must be poor. At least fisherman who fish in the same way this character fishes. I know that other types of fisherman like snow crab or king crab fisherman have the potential of making a lot of money because I've seen that show on Discovery Channel called the Deadliest Catch. Still I'm going to write this new inference down here. (Write condition: fishermen are poor).

Okay, let's think about the inference categories we have. One is theme. This is a really important kind of inference because it helps us understand the big picture. I think this passage does have a message but I didn't quite know what it was until I finished reading

it. That's often what happens with theme. You need more information than a sentence can typically give you. Sometimes passages won't have a theme or it might require you to read an entire chapter or the entire novel to really understand it. This short passage does have a message and I think it's telling the reader that haste sometimes makes waste; in this case the man's life was definitely made worse because he was rushing. I'm going to write that here. (Write it down).

The last inference category I want to consider is the author's intent. Based on the theme of the passage I don't think the author agrees with people who feel that time is money. I think he wants to criticize workaholics and people who rush through life. I'm going to write that down here at the bottom too. (Write it down).

All right, that's just one way we're going to learn to become more aware of inferences. Now to give you a kind of key for these inferences I want us to complete this sheet I'm passing out. (Pass out Inference Categories Key). Think about what we just did and see if you can write down the inference category in the left column and the actual inference we made in the right column next to the text. (Circulate to answer questions and monitor each participant's work).

Review Key. *Okay, now I want to make sure we all have the same information written down on our key. Work through the key with input from each participant. Elicit discussion around each type of inference and ensure that everyone understands the different types.*

Additional Practice (We do it). *Okay, now we're going to use our key and what you learned from watching me work through the passage, "How Leisure Came" to complete another Reading Between the Lines Activity together. (Pass out "Grandfather's Death") This time I'm going to ask for your help as we complete this activity and you're going to write in the inferences we make on this paper I just gave to you.*

All right, (name of participant) could you read aloud the first sentence of this passage for us? Okay now we have to think about the five inference categories and make a decision about whether this sentence gives us any clues related to any of them. Does anyone have any ideas? (Elicit responses and have them think aloud through their thought process shaping the discussion to character condition). Okay great, now we talked about the fact that we know something about Jane, she's just had something tragic happen to her, this is related to two of our inference categories, character condition and theme. We should probably keep reading to see if we get any other text clues from the rest of the passage before we start considering if this passage has a theme but we have a nice clue here since something big has happened to the character. But we can infer something about the character's emotional condition can't we. We will have to use both text clues and our background knowledge though. What is an inference you think we could make about the

character's emotional condition? (Elicit responses, shaping the discussion to get to an inference similar to: Jane is distraught, depressed, sad, etc.).

All right, is there another inference category that we should consider after reading just that first sentence? (Elicit responses) Yes, I agree, I think the author wants us, the readers, to empathize with Jane, maybe he's trying to make us think about a time when we have lost someone close to us and he wants us to remember how that felt. What kind of inference can we add to this line? (Elicit responses to create an inference similar to Intended Reader emotion: sadness, empathy).

Okay, (participant name) can you read the next two sentences aloud please? All right, I'm thinking about a certain inference category, is anyone else thinking about an inference category? Would you share your thoughts with us? (Elicit response and discussion around big goal). I agree, I think that we know something about the motivation for Jane not wanted to be comforted by other people, this has to do with the big goal. What is an inference that we can make and write under those sentences? (Elicit responses, shaping discussion to write an inference similar to: big goal: Jane wants to deal with her grandfather's death in her own way).

All right, I'm going to read the rest of the passage and I want us all to think about any other types of inferences we can make. (Read rest of the passage aloud). Who has a thought about an inference category? (Elicit a discussion around the two other inference category types theme and author intent and a possible additional character condition inference. Shape the discussion to add the inferences similar to the following: author intent: the author wants me to understand what Jane is going through and realize that her life perspective might be changing; character condition: questioning herself, she might feel bad about being somewhat selfish during this time; theme: sometimes tragedies help to put things in perspective).

Organizer: (display the post organizer) *Today we did a lot. We started by talking about language and how it provides the foundation for making inferences as we read and when we inferences in social situations. Who can tell me a language underpinning and what it means? (Elicit responses until all five language underpinnings are discussed). Next we talked about the specific categories of inferences that are most related to making social inferences. Let's talk through each one again. Can somebody tell me one category and explain what it means? (Elicit responses until all five inference categories are discussed). We also created a key for these inferences that you're going to keep in your folder that will help you as we move through this program.*

Next time we're going to talk about the language clues that can help us know when we should make the different types of inferences. We're also going to learn about the first

step of the ACT & Check strategy: Ask Yourself Questions. We'll practice asking questions related to the inferences to continue to help us become aware of language!

Lesson 3: Ask Yourself Questions

Purpose: To present a clear picture of the first step of the ACT & Check strategy and to demonstrate the cognitive processes and overt physical acts involved in using that part of the strategy.

Advance Organizer (display Advanced Organizer Lesson 3) and explain: *Last time we met we learned about the language foundation necessary for making inferences and we discussed the five categories of inferences most related to making social inferences. Today we're going to learn about the first step of the ACT & Check strategy: Ask yourself questions. You will once again be taking notes as we work through the lesson. I'm going to ask you questions as we move along and we will discuss what we learn as a group. I will also model how to use the first step of the strategy with a passage and then I will ask you to use the first step of the strategy on your own.*

Ask Yourself Questions (Display Cue Card #2). *The first time we met I introduced these ACT & Check Strategy steps. As I mentioned before we're going to learn about how to use this strategy as we learn the language foundation skills necessary to make inferences strategically. We're going to start by learning more about each inference category and determining what types of questions we would need to ask ourselves as we read to make each type of inference.*

Theme or Thesis: *First we're going to start with theme or thesis. Can anyone remember how we defined theme or thesis last time? (Elicit responses) Right, we defined theme as the message of the passage. The theme is the underlying philosophical idea that the passage or story conveys. Narrative passages have themes while expository passages have theses. A narrative passage is fiction and an expository passage is nonfiction.*

Let's start with narrative passages. Do you think all stories have themes? (Elicit responses). You're right, not all stories have themes. What are some other reasons an author might write a piece of fiction other than to illustrate a theme? (Elicit responses such as to study a character, to illustrate a historical event (historical fiction, etc.). When an author does want to convey a theme in her story she doesn't do it by simply stating the theme. Instead she will try to appeal to our emotions, intellect, background, and imagination to help us discover and explore the themes within her story.

Does anyone know what a moral is? (Elicit responses). Okay, so is it a synonym for theme? (Elicit responses) Right, they are a little different. A moral is a life lesson and is too narrow of a definition for the word theme. We know that a theme is simply a message that the story conveys it could be a moral but it might be something more like the theme: life is full of surprises.

It is much more common to find themes in most fiction than morals, why do you think that is? (Elicit responses). Right, first the objective of most fiction is to provide enjoyment not to preach about some moral lesson. The purpose is not to describe a set of moral rules but instead to observe life events and provoke thought in the reader.

Why do you think it's important to understand the theme of a passage? (Elicit responses) Right, it reveals what the story is all about and it reveals something about the author. You don't have to agree with the theme to understand it and it's worthy of considering because it is someone else's point of view. This is very much related to social inferences. We are definitely not going to agree with what everyone around us has to say about life, society or human nature but what they say about those things reveals something about them that allows us to make inferences about them. Does that make sense?

Okay, so if we want to figure out if a passage has a theme what kind of question or questions could we ask ourselves as we read? (Elicit responses) We need to ask a question that gets to the heart of what theme is so what about asking ourselves, "What does this story reveal?" Do you think that accurately reflects our concept of theme? (Elicit responses) Should we ask, "What does this story teach?" (Elicit responses). No we shouldn't because that speaks more to the moral. Remember some themes may be moral but if we only look for morals we are going to miss a lot.

So how are we going to figure out what a story or passage reveals? Well there are a number of things we can look for. First we can look for any changes that happen to the main character. The main character central to the passage or story is also called the protagonist. Have any of you heard of that term before? We can also look for what the protagonist learned and the nature of any conflicts that occur in the passage.

Okay, if those things can help us figure out what the theme is I think it would be a good idea to make them into questions too. Can anyone think of a question for one of those three things I just mentioned? (Elicit responses) Right, one could be, "What kinds of changes did the main character go through?" another could be, "What did the main character learn" and another, "What is the nature of the conflict?" Why don't we write these down now on our notes sheet.

Okay, do you think there could be more than one theme in a passage or story? (Elicit responses) Definitely, there could be more than one theme because the character may go through many changes in a novel and may learn more than one thing. There could also be more than one conflict. That's what makes fiction interesting! When we're reading short passages we won't find as many themes as when we're reading novels. But, we should pause to ask ourselves those questions periodically as we're reading longer novels so that we can be sure we're not missing something really important in the story.

All right, now let's talk a little more about theme. Before we practice answering these questions with a real passage we need to learn about the other inference categories and come up with questions for them. Over the next few sessions we'll learn about the next step of the ACT & Check strategy and practice putting it together.

Okay, when I answer the questions we created I'll need to answer them in complete sentences because a single word such as isolated or angry doesn't give enough information about the theme. Also the theme we come up with needs to be a generalization about life, society, or human nature. A generalization is a type of summary statement that we can make based on what we know. If we're generalizing about those topics, then we don't need to talk about the characters in the story. We're also going to have to consider the text clues and our background knowledge and experiences. But remember, we might disagree with a theme in a passage and that's okay we can still identify it so that we can understand the passage better. Does anyone have any questions about theme and the questions we're going to ask ourselves?

Okay, let's talk about expository passages and the thesis. A thesis summarizes the main idea or ideas of a passage, that's how it's similar to theme in narrative text, it's like the big picture of the passage. Do you think every expository passage has a thesis? (Elicit responses) Right, every expository passage has a thesis because every expository passage has a main idea. What are some purposes authors write expository passages? (Elicit responses) Exactly, authors might write an expository piece to persuade, explain, or analyze. This means that there are different types of theses that we will need to come up with: argumentative thesis statement, explanatory thesis statement, and analytical thesis statement. Let's talk about each one.

An argumentative thesis statement explains what the author's argument or position is on a topic and might include some of the evidence he presented. For example, "Smoking should be banned in all public places" is an argumentative thesis statement.

An explanatory thesis statement explains the topic the author explains and may include the specific aspects of the topic being considered. For example, "The Allied forces won World War II because of collaboration, something Hitler thought would be their downfall" is an explanatory thesis statement.

An analytical thesis statement describes the findings of the author's analysis and sometimes includes the various aspects or parts of the issue or ideas being analyzed. For example, "An analysis of reading outcomes reveals two significant predictors: language ability and instructional experiences" is an analytical thesis statement.

Okay, so if we want to figure out what the thesis is of an expository passage what kind of question or questions could we ask ourselves as we read? (Elicit responses) We need to

ask a question that gets to the big picture of the passage so what about asking ourselves, “What is the main idea of this passage?” Do you think that accurately reflects our concept of thesis? (Elicit responses) Right, all three types of thesis statements, argumentative, explanatory, and analytical describe the main idea of the passage. Understanding the three different types can help us as we look for and write the thesis statement though.

Author’s Intent: *Okay, now you have learned how to ask yourself questions to figure out the theme or thesis of a passage but we have four more inference types we need to discuss. We’re going to learn about author’s intent today and focus on the other three the next time we meet. Who can tell me what author’s intent means? (Elicit responses) Right, author’s intent basically means what the author wants the reader to come away with. It is different than the author’s purpose for writing. Does anyone remember learning about author’s purpose when you were in high school? What are some purposes authors might have for writing? (Elicit responses) Yes, to entertain, inform, persuade, etc. How do you think that’s different from our definition of author’s intent? (Elicit responses). Exactly, an author’s purpose is their overall reason for writing the passage or story; but when we talk about author’s intent we’re talking about his intent for writing something specific in the text. We could also think of it as the impression the author wants to make upon the reader. For example, an author’s purpose for writing a novel is usually to entertain. But if we’re reading a particular paragraph in that novel and it gives a really negative picture of a character who smokes we could infer that the author’s reason for writing that part was to portray the character in a bad light and maybe even portray smoker’s in general negatively to possibly discourage readers from picking up the bad habit. Does that make sense?*

Okay, so if the author’s intent is what the author wants the reader to come away from with, what is a question or questions that could help us figure that out as we read? (Elicit responses) Those were all great, what about something like, “What is the author trying to tell me?” Do you think that will help us figure out the author’s intent of their writing? (Elicit discussion). All right, we’re going to make sure we write that on our notes sheet as well.

Do you think you’d be able to answer the question “What is the author trying to tell me?” with only one word? (Elicit responses) No, just like with theme we’re going to need to answer with a sentence one word such as smokers for example won’t help us.

Post Organizer: *(display the post organizer) Today we started learning about the first step of the ACT & Check Strategy. Who can tell me what that step is? (Elicit response) Right, the A in ACT & Check stands for ask yourself questions. We talked about the questions we can ask ourselves to help us make two types of inferences; theme or thesis and author’s intent. What was the broad question we came up with for theme? (Elicit*

responses) What were the three more specific questions? (Elicit responses). What was the question we came up with for thesis? (Elicit responses) Okay, what about author's intent, what was the question we came up with? (Elicit responses). Next time we're going to talk about the three other inference categories and come up with questions for each of them. If we have time, we'll start to discuss the second step in the ACT & Check strategy.

Lesson 4: Ask Yourself Questions

Purpose: To present a clear picture of the first step of the ACT & Check strategy and to demonstrate the cognitive processes and overt physical acts involved in using that part of the strategy.

Advance Organizer (display Advanced Organizer Lesson 4) and explain: *Last time we met we learned more about theme or thesis and author's intent and we came up with questions that we can ask ourselves to help figure each out. You took notes on what we talked about so you have each of the questions. Today we're going to talk more about the other three inference categories and come up with questions we can ask ourselves to help figure those out. If we have time we'll start discussing the second step in the ACT & Check strategy: Check the text. Once again your job today is to take notes and participate in the discussion by answering questions and commenting. (Hand out the notes sheet)*

Character Condition: *All right, we're going to start by talking about character condition. What was our definition of character condition that we talked about two sessions ago? (Elicit responses) Right, we defined character condition as the character's physical or emotional state. This is another important inference category that's very much related to making social inferences. Why do you think that is? (Elicit responses) Right, when we make social inferences we consider a person's verbal and nonverbal cues to make a judgment about how they are feeling or about what they are trying to communicate. When we're reading we're doing a similar kind of thing but instead of using verbal and nonverbal cues we're using text cues. Does that make sense?*

Okay, now if we want to try to figure out the emotional and physical state of a character what kinds of questions do you think we should ask? I want you to take a couple minutes and write down some possible questions. (Give everyone time to write down questions and then engage in a discussion about their questions. Using a think aloud strategy come up with a few questions similar to the following that will help determine state: How have the character's emotions changed? What is this character up to now? Did this event significantly change this character's life, how so?)

Big Goal: *All right, now we're going to talk about the category of inference, big goal. Someone refresh my memory, what is this one all about? (Elicit responses) Right the big goal has to do with figuring out what the character's main goal or motivation for an action is. This has a lot to do with trying to figure out someone's intent. We have to do this all the time when we make social inferences. Just like we mentioned when we talked about character condition, we are constantly using verbal and nonverbal cues to try to figure out what someone's intent is, what they're really trying to tell us. Remember the*

example I used last time we met? (say “I’m having so much fun today” with sarcasm and matching facial expressions). When I say that in that way you should pick up on sarcasm in my voice because I’m emphasizing the word so and my facial expressions don’t match with the message. If I was really having a lot of fun you’d expect me to say the same phrase like this (say phrase aloud with enthusiasm and matching facial expressions). I didn’t have to tell you how I was feeling you knew because of the way I said that phrase. When we are trying to figure out what a character’s main goal or motivation for an action is we’re going to have to use similar clues but instead of watching and listening for them we’re going to be reading the text for them.

But first we need to think of questions we could ask ourselves as we read if we want to try to figure out what the big goal of the character is. Again, why don’t you take a minute and jot down some ideas about possible questions. (Give everyone time to write down questions and then engage in a discussion about their questions. Using a think aloud strategy come up with a few questions similar to the following that will help determine big goal: “Why did the character just do that? What does the character want to happen now? etc.)

Intended Reader Emotion: *Okay, now we’re ready to talk about the last of the inference categories we learned about, intended reader emotion. Remember, we defined it as the emotion the author wants the reader to feel after reading a portion of the text. Since you are the reader you will have to become more aware of how you are feeling while you are reading. But that’s not enough, we want to know about what the author’s trying to make you feel. There are certain points in a passage or novel that are very emotional and other times when the author is not trying to make the reader feel any particular emotion at all. How are we going to figure out when those emotional points are occurring in the text? (Elicit responses) Right, we will have to watch out for events that really affect the characters in the story and we’ll have to take note of our own feelings.*

Let’s talk about some possible questions for figuring this one out. Does anyone have any ideas? (Elicit responses) All right, those were great, what if we came up with a question like, “What is the author trying to make me feel by writing that?” do you think that would help us figure out reader’s emotion?

Review: *Okay, now that we’ve come up with questions for all of our inference categories I want us to review them by completing this question key (Hand out question key). I’d like you to use your notes to complete this key. This key will help you at first as you’re learning the ACT & Check Strategy. But eventually you’re going to remember to ask yourself these questions on your own. (Circulate as each participant completes the question key).*

Now we're going to take a few minutes to consider the questions we've come up with a passage we worked on earlier, "Grandfather's Death." Go ahead and take out that passage and follow along with me. (Work backwards by taking each inference and deciding as a group whether one of the inference category questions would have allowed the inference to be made).

Consider the Text: *All right, since we still have some time left we're going to start to talk about the second step in the ACT & Check Strategy: Consider the text. After we ask ourselves questions as we read we're going to need to consider the text to figure out if there are any clues that can help us answer our questions. Is the text the only thing we need to consider though? (Elicit responses) No, you're right, remember our inference formula (Display Cue Card # 1) we have to integrate our background knowledge with the clues in the text. So how are we going to do that? Remember that the integration of background knowledge and text clues is a higher level language skill that forms the foundation of making inferences. It's really tough to do so we're going to use a graphic organizer to help us. Has anyone heard of a graphic organizer before? (Elicit responses) Right a graphic organizer is a tool that helps organizes concepts visually so that they are easier to understand. Using graphic organizers as a learning tool is supported by extensive research which is why we're going to use this. (Pass out the Inference Graphic Organizer). During the next session I'm going to model how we can use this along with our questions to make inferences. Does anyone have any questions at this point?*

Post Organizer: *Today we finished discussing the remaining three categories of inferences and came up with corresponding questions we can ask ourselves as we read to make those inferences. We put what we did today and last time together on an Inference Question Key that you now have in your folder. We also introduced the second step of the ACT & Check Strategy, consider the text and I showed you the graphic organizer we're going to use to help integrate our background knowledge with text clues. I have a question for you, if the goal of this intervention is to read for enjoyment and for daily life including work while comprehending more easily why am I having you complete a graphic organizer if that's not something you'll want to end up doing when you're reading in the real world? (Elicit responses) Exactly, remember we're working on increasing your awareness of making inferences. Right now we need tools to help us master the ACT & Check Strategy but our ultimate goal is for you to be able to use the strategy without any of these tools.*

Next time we're going to put it all together and work with some passages. Anybody have any questions?

Lesson 5: Model the Strategy

Purpose: To present a clear picture of the ACT & Check strategy and to demonstrate the cognitive processes and overt physical acts involved in using that part of the strategy.

Advance Organizer (display Advanced Organizer Lesson 5) and explain: *Last time we met we learned about the first step of the ACT & Check Strategy, ask yourself questions. We also looked at the Inference Graphic Organizer that will help us with the second and third steps of the strategy. You took notes on what we talked about and you created a question key to help you as you learn the strategy. Today we're going to put it all together. I'm going to show you how to use what we have learned to make inferences as we read a real passage. Then we're going to practice using the ACT & Check strategy together.*

ACT & Check Strategy: (display Cue Card #2) *By now you should be getting pretty used to what the ACT & Check Strategy stands for. You will begin to learn each of the steps as we use the strategy with real passages. Let's review again each of the steps* (Discuss each of the steps).

Model the ACT & Check Strategy (I do): (use Rebecca) *Okay, now I want you to pay close attention to what I'm going to show you because eventually you will need to do this on your own. I'm going to go through each step of the ACT & Check Strategy using our tools, the Question Key and the Inference Graphic Organizer to make inferences as I read. I'm going to explain what I'm doing and thinking about as I move through the steps of the strategy so that you understand the process. We're going to start with just a paragraph from a passage and then work with an entire passage. Any questions?*

Ask Yourself a Question: *All right, the first thing I'm going to do is review the inference categories and questions we created so that they're fresh in my mind before I start reading. (Display Question Key and read through each one) Okay, now I'm going to read the first part of the passage to see if there are any questions I should ask myself. (Read first couple sentences and use a think aloud procedure to work through the first part of the passage writing down questions between the lines as appropriate). Okay, I'm going to continue reading now while I think about additional questions that might be appropriate to ask (Work through the rest of the passage using a think aloud procedure and documenting the questions between the lines)*

Consider the text: *Okay, now I'm going to need to use the Inference Graphic Organizer to help me consider the text and also with the next step Think about what you know and take a good guess. (Talk through each question and write down the text clues appropriate to each one in the left-hand column).*

Think about what you know and take a good guess (infer): *Okay, I'm not done yet, now I need to think about my background knowledge so that I can use the inference formula (Show Cue Card #1 and discuss; use a think aloud procedure to work through this stage of the strategy including the infer part)*

Check your guess: *Even though we've done a lot so far and made a few inferences we're not done. We're going to read the next part of the text and check our guesses. Maybe this new part of the text will give us more clues so that we can either confirm our guess or change it. (Again work through this part of the strategy, reading the rest of the passage aloud after handing out copies to everyone. Make a decision about the inferences made making sure the decisions are thought through explicitly).*

Additional Practice (We do it): *(Use Pain and Pleasure) Now we're going to use the ACT & Check Strategy with a new passage together. This will help you practice the strategy with my support. Over the next few sessions you're going to have a chance to practice the strategy with each other and individually so it's really important that you understand exactly what to do. (Use a think aloud procedure with the new paragraph while enlisting the participants to help by answering questions and demonstrating the parts of the strategy so that the procedure is completed collaboratively)*

Post Organizer: *Today we practiced using the ACT & Check Strategy with passages. You watched as I modeled how to use the strategy first and then we used the strategy collaboratively. Can anyone remind all of us of the steps of the ACT & Check Strategy? (Elicit Responses and show Cue Card #2). Great, next time we meet we're going to spend time memorizing the steps of the strategy so they can come more automatically to each of us. Does anyone have any questions?*

Lesson 6: Verbal Practice

Purpose: To ensure comprehension of the ACT & Check Strategy and help students commit the steps to memory.

Advance Organizer (display Advanced Organizer Lesson 6) and explain: *Last time we met we practiced using the ACT & Check Strategy with passages. Today we're going to review the purpose of the strategy and then we're going to help you memorize the steps of the strategy so that you can tell yourself what to do as your reading without your cue cards. It is very important that you are ready to participate today. I'm going to need all of your help to make this session work. When I ask you a question I expect you to try to answer it. When you're working a group I expect you to participate fully. Any questions?*

Verbal Practice Exercise: (Split the group into two teams and put the following questions on cards. Team members take turns randomly selecting a card and answering it. One point is awarded to each team for a correct answer. If a team member doesn't know an answer the other team can try to steal the point. If both teams don't know the answer, take time to explain the answer and return to that question later in the game.

Sample questions below:

- *What is the first step of the ACT & Check Strategy?*
- *What is the second step of the ACT & Check Strategy?*
- *What is the third step of the ACT & Check Strategy?*
- *What is the fourth step of the ACT & Check Strategy?*
- *What is the broad question we came up with for theme?*
- *Name one of the more specific questions we came up with for theme. Can you name all three?*
- *What is the question we came up with for thesis?*
- *What question did we come up with for author's intent?*
- *Name two of the three questions we came up with for character condition.*
- *Name the two questions we created for big goal.*
- *What question did we create for intended reader emotion?*
- *What types of texts have a theme?*
- *What types of texts have a thesis?*
- *What are the three types of thesis statements we could write?*
- *When we use the reading between the lines activity, what do we write between the lines?*

- *When we use the inference graphic organizer, what do we write under the “Known” column?*
- *When we use the inference graphic organizer, what do we write under the “Unknown” column?*
- *What is the inference formula?*
- *When should I infer if I’m using the ACT & Check Strategy?*
- *Why are we practicing with the reading between the lines activities and the inference graphic organizer if the goal is for us to make inferences without those tools?*

Rapid-Fire Verbal Rehearsal Practice: Model the exercise with a couple participants. *Now we’re going to do what’s called a rapid-fire exercise to help you commit the steps of the ACT & Check Strategy to memory. You will work in groups. I’m going to act like the leader of this group and model how I want you to run this exercise in your groups. The leader will point to each group member in order at first and that group member has to name the next step of the ACT & Check Strategy. I have written ACT & Check on the board so if you need to take a look you may do so but I’ll be erasing that after a couple rounds so you should get used to relying on your memory. Your group will rotate leaders so that everyone has a turn and eventually the leaders can randomly pick the group member to name the next step. (Demonstrate with some of the participants).*

All right, does everyone understand what you are going to do? (Split the participants into groups). Okay, let’s see how quickly your group can name and memorize the steps. This should be pretty easy since we’ve talking about the strategy for a couple weeks now. All right, let’s start.

Group Rapid-Fire Practice without cues: *All right, now that you’ve all had some time practicing naming the steps we’re going to practice this rapid-fire exercise without the clues on the board and all together. I’ll act as the leader. (Practice the rapid-fire exercise until you feel confident that most of the participants can name the steps automatically).*

Group Practice: *Okay now we’re going to step it up a bit. You’re going to work in pairs to practice explaining the steps of the ACT & Check Strategy along with answering other questions we went over. You need to take this time to help each other learn the answers automatically. (Split group into pairs). Okay, one of you in your group go ahead and write down the things you should be practicing. (Name off the following things: a) the 4 steps of the ACT & Check Strategy, b) explain in your own words what you will do when you use the ACT & Check Strategy, c) Name the questions that correspond with the inference categories, d) explain each of the inference categories, d) explain exactly what you do at each step in the strategy and why you do it)*

Administer the Oral Quiz to those who are ready: (Explain to the participants that they will be doing an oral quiz. They have the option of completing the oral quiz outside of the room at this time or before the next session. Explain that the goal is to earn 100% and they will have to practice more on their own if they are not able to earn 100% the first time they take it. When they feel more comfortable they will take the quiz again until they have earned the 100%. Explain the rationale behind giving an oral quiz: to ensure that the participants can automatically recite the steps to the ACT & Check Strategy and the corresponding questions).

Post Organizer: *The purpose of this session was to help you commit the steps of the ACT & Check Strategy to memory. We also made sure you understood the inference categories and questions we created along with the rationale behind using the strategy. You practiced with each other and then you took an oral quiz. Now that you've committed the strategy to memory you are ready to do some group and independent practice next time. Anyone have any questions?*

Lesson 7: Controlled Practice

Purpose: To provide practice in controlled materials; to build confidence and fluency; to shift responsibility for strategy use to students.

Advance Organizer (display Advanced Organizer Lesson 7) and explain: Last time we met we spent the entire session verbally practicing committing the steps of the ACT & Check Strategy to memory. We also practiced answering questions about the strategy. We ended with you taking an oral quiz. (If you have any participants who didn't recite the steps with 100% accuracy explain that they will be doing that first). Today we're going to practice using the ACT & Check Strategy first as a group then in small groups and if we have time individually. I expect you to follow along and complete the strategy at your seat as we do it together. If I call on you, I expect you to answer as best as you can. When you are working with a partner you will need to contribute equally. When you are working alone, I expect you to stay on task and complete the activity. Any questions?

Guided Practice: (Lead the group through the steps of the ACT & Check Strategy with a new passage *Life on the Edge: Four Visions for Inhabiting a Transformed World*). Rotate asking participants to explain the next step of the strategy and lead the group in completing it. Ask them to use the think aloud process so that everyone can follow along. Provide scaffolding as needed to make sure that appropriate inferences are generated.)

Small Group Practice: (Split the group into pairs or small groups) (Use *The Adventures of Joseph Andrews*) Now you're going to work with a partner to complete the ACT & Check Strategy with a new passage. I'm going to give you only one sentence of the passage first and you're going to see if any inferences can be made. We'll discuss what you came up with as a group. Then I'll give you the rest of the paragraph from the passage and we'll do the same thing. Finally, you'll get the entire passage and use the strategy to make inferences. When everyone's done we'll talk about your inferences as a group. It is really important that everyone contributes to the group as we do this. Do you have any questions? (Circulate providing help as needed).

Independent Practice: Now that you've had a lot of time to practice using the ACT & Check Strategy together you're going to try to use it with a passage on your own. I'm going to hand out a passage and I want you to use the strategy on your own to make inferences. Turn your paper over when you're done and then we'll discuss as a group. (Pass out the passages and circulate to help as needed, use *On the Road* and if another is needed use *Can "Brain Freeze" Cause Long-Term Brain Damage?*)

Post Organizer: *Today you practiced using the ACT & Check Strategy in a large group, a small group and by yourself. Using this strategy should be getting easier at this point. Our goal is for you to ask yourself questions and make inferences automatically. To do this we need to continue practicing the strategy with the supports we've been using, the Question Key and the Inference Graphic Organizer. Next time we're going to continue using the strategy independently and eventually you're going to practice without the Question Key and Inference Graphic Organizer. Any questions?*

Lesson 8: Controlled Practice

Purpose: To provide practice in controlled materials; to build confidence and fluency; to shift responsibility for strategy use to students.

Advance Organizer (display Advanced Organizer Lesson 8) and explain: Last time we met we spent the session practicing using the ACT & Check Strategy together then in a small group and then individually. Today you're going to practice using the strategy in a group and then individually. (If you have any participants who didn't recite the steps with 100% accuracy explain that they will be doing that first). I will be listening to your small group discussion so that I can provide help if you need it. If you have any questions please make sure to ask me. I expect everyone to contribute equally in the group and I expect you to try your hardest when you practice the strategy by yourself. Any questions?

Small Group Practice: (Split the group into pairs or small groups) Now you're going to work with a partner to complete the ACT & Check Strategy with a new passage. I'm going to give you only one paragraph of the passage first and you're going to see if any inferences can be made. We'll discuss what you came up with as a group. Then I'll give you the rest of passage and we'll do the same thing. When everyone's done we'll talk about your inferences as a group. It is really important that everyone contributes to the group as we do this. Do you have any questions? (Circulate providing help as needed).

Independent Practice: Now that you've had a lot of time to practice using the ACT & Check Strategy together you're going to try to use it with a passage on your own. I'm going to hand out a passage and I want you to use the strategy on your own to make inferences. Turn your paper over when you're done and then we'll discuss as a group. (Pass out the passages and circulate to help as needed). If there is time you might use the ACT & Check Strategy with another passage.

Post Organizer: Today you practiced using the ACT & Check Strategy in a small group and by yourself. Using this strategy should be getting easier at this point. Our goal is for you to ask yourself questions and make inferences automatically. To do this we need to continue practicing the strategy with the supports we've been using, the Question Key and the Inference Graphic Organizer. Next time we're going to continue using the strategy independently but without the Question Key and Inference Graphic Organizer. You will also need to bring two texts with you for next time. You will need to bring something you'd like to read that is nonfiction and something that is fiction. You can bring in a book, a magazine, or a passage from the internet. Does anyone have any ideas of things you'd like to bring?" [Elicit discussion to give the students ideas]. We're going

to use these texts to help us generalize the ACT & Check Strategy to different kinds of materials. Any questions?

Lesson 9: Advanced Practice & Feedback

Purpose: To provide practice in advanced materials (materials brought from home, work-type materials); to shift responsibility for strategy use to students.

Advance Organizer (display Advanced Organizer Lesson 9) and explain: Last time we met we spent the session practicing using the ACT & Check Strategy in a small group and then individually. You were asked to bring two types of materials with you for today's session. Can anyone tell me what you were asked to bring? (Elicit responses) I brought some materials with me as well. Today you're going to practice using the strategy in a large group, then in a small group and then individually with the materials you brought. The purpose of this session is for us to use the strategy with the types of things we all read on a daily basis. We are also going to try to use the strategy without the Question Key or the Inference Graphic Organizer. If you want you can use the scratch paper in your folder to write notes. If I call on you, I expect you to answer as best as you can. When you are working with a partner you will need to contribute equally. When you are working alone, I expect you to stay on task and complete the activity. Any questions?

Guided Practice: (Lead the group through the steps of the ACT & Check Strategy with a new passage you brought from home. Rotate asking participants to explain the next step of the strategy and lead the group in completing it. Ask them to use the think aloud process so that everyone can follow along. Provide scaffolding as needed to make sure that appropriate inferences are generated.)

Small Group Practice: (Split the group into pairs or small groups) *Now you're going to work with a partner to complete the ACT & Check Strategy with a passage from something one of you brought today. I can help you choose a passage or a few paragraphs from the materials you brought if you want help. You and your partner are going to use the ACT & Check Strategy to see if any inferences can be made. We'll discuss what you came up with as a group. It is really important that everyone contributes to the group as we do this. Do you have any questions?* (Circulate providing help as needed).

Independent Practice: *Now that you've had a lot of time to practice using the ACT & Check Strategy together you're going to try to use it with a passage on your own. Choose something that you brought with you today and pick out a passage or a few paragraphs to read. I want you to use the strategy on your own to make inferences. Turn*

your paper over when you're done and then we'll discuss as a group. (Circulate to help as needed)

Post Organizer: Today you practiced using the ACT & Check Strategy in a large group, a small group and by yourself. Using this strategy should be getting easier at this point. Our goal is for you to ask yourself questions and make inferences automatically. To do this we need to continue practicing the strategy without the supports we've been using, the Question Key and the Inference Graphic Organizer. Next time we're going to continue using the strategy independently. I'd like you to bring two more readings from home, again one fiction and one non-fiction. They could be books, magazines, or something you find online. Any questions?

Lesson 10: Advanced Practice & Feedback

Purpose: To provide practice in advanced materials (materials brought from home, work-type materials); to shift responsibility for strategy use to students.

Advance Organizer (display Advanced Organizer Lesson 10) and explain: Last time we met we spent the session practicing using the ACT & Check Strategy in a large group, small groups, and then individually. We used the materials you brought from home to practice using the strategy to make inferences. You were asked to bring more materials for today's session. Today you're going to continue to practice using the strategy in a small group and then individually with the materials you brought and with materials others brought. Once again you're not going to have the question key or the inference graphic organizer to refer to but you may use scratch paper to take notes. When you are working with a partner you will need to contribute equally. When you are working alone, I expect you to stay on task and complete the activity. Any questions?

Verbal Practice Review: (Lead the group through a verbal review of the steps of the ACT & Check Strategy along with the inference question key. Rotate asking participants to explain the next step of the strategy and the inference questions. Provide scaffolding as needed)

Small Group Practice: (Split the group into pairs or small groups) *Now you're going to work with a partner to complete the ACT & Check Strategy with a passage from something one of you brought today. I can help you choose a passage or a few paragraphs from the materials you brought if you want help. You and your partner are going to use the ACT & Check Strategy to see if any inferences can be made. We'll discuss what you came up with as a group. It is really important that everyone contributes to the group as we do this. Do you have any questions?* (Circulate providing help as needed).

Independent Practice: *Now that you've had a lot of time to practice using the ACT & Check Strategy together you're going to try to use it with a passage on your own. Choose something that you brought with you today and pick out a passage or a few paragraphs to read. I want you to use the strategy on your own to make inferences. Turn your paper over when you're done and then we'll discuss individually. Once we have discussed your inferences you may be given another passage to practice with.* (Circulate to help as needed)

Post Organizer: *Today you practiced using the ACT & Check Strategy in a small group and by yourself. Using this strategy should be getting easier at this point. Our goal is for you to ask yourself questions and make inferences automatically. To do this we need to continue practicing the strategy without the supports we've been using, the Question Key and the Inference Graphic Organizer. Next time we're going to confirm your mastery of the strategy and make generalization commitments. You do not need to bring any materials from home. Any questions?*

Lesson 11: Confirm Acquisition and Make Generalization Commitments

Purpose: To document mastery and build a rationale for generalization.

Advance Organizer (display Advanced Organizer Lesson 11) and explain: *Last time we met we spent the session practicing using the ACT & Check Strategy in small groups, and then individually. We used the materials you brought from home to practice using the strategy to make inferences. Today we're going to check your mastery of the strategy with a passage I'm going to provide. You're going to do this task individually and then we're going to discuss as a group. Then we're going to talk about how to generalize what we've done during our sessions to your daily life. Can anyone tell me what I mean by generalize?* (Elicit responses). *Does anyone have any questions at this point?*

Mastery Check: *Okay, now you're going to show me what you've learned. I'm going to give each of you a passage and I want you to use what you've learned to make inferences. Once you're done, I'd like you to turn your passage over. If you get done quickly I might give you another passage to work on. Once everyone's finished we're going to talk about your inferences and how you used the ACT & Check Strategy as a group. If you demonstrate that you have reached mastery then we will move on, if not we will need to practice more. I'm not going to be able to help you with this task so just try your best. Any questions?* (Pass out passages and monitor, once everyone's done discuss the plausible inferences as a group, taking note of each participant's inferences; how many they get correct, how many they miss. Make a decision whether the group as a whole needs more practice or if you feel you can move on with the generalization commitments. If only one or two participants do not meet mastery, assign them work to do at home, one passage using with the question key and inference graphic organizer and one without. Discuss their responses individually at another scheduled time)

Generalization Commitments: *All right, now that you've demonstrated mastery of the ACT & Check Strategy you are ready to use it outside of our intervention groups. This is what I mean by generalizing the strategy. Often, people are taught something in a class and they are able to demonstrate that they can use the skill in that environment but never use it outside of the class. You have already spent a lot of time and effort learning this strategy so I want to spend some time discussing why you should use it outside of our class. As we discuss generalization, I expect you to take notes on the notes sheet I'm handing out now and participate in our discussion.*

Okay, who can tell me why it might be useful to you to use this strategy outside of this class and even when we are done meeting? (Elicit responses) *Right, the ACT & Check Strategy is designed to help you make inferences as you read. Making inferences will help you better understand what you're reading, whether you're reading something for*

pleasure, for work, or just as a necessity in your daily life. There's another reason you should want to continue using the strategy. Remember, the types of inferences we have been making are very much related to the types of inferences that you make in social situations. We think that if you become more aware of making inferences when you read, it might help you make social inferences more easily.

Now, who can tell me a situation when it might be in your benefit to use the ACT & Check Strategy (Elicit responses, making sure participants take notes).

Do you remember at one of our first sessions how we signed a commitment to learning the ACT & Check Strategy? Well, now I'd like all of us to sign a commitment to using the strategy outside of this class. (Pass out the commitments and choose one participant to read aloud, elicit questions and ask for their signatures. Then read your commitment aloud and sign in front of participants)

Cue Cards: *Okay, to help you remember to use the ACT & Check Strategy outside of this class we're going to create some cue cards. I'd like you to create one that can act as a bookmark for when you're reading a novel or a magazine and one you can possibly hang up in your office, or your room or even put somewhere at work. What are some of the most important things you think should be on your cue card? (Elicit responses) Right, we definitely want the steps of the ACT & Check Strategy on the cue card and maybe even the Question Key. Each of you now has a bookmark and a piece of cardstock. I would like you to take your time creating both of your cue cards for the remainder of today's session. The act of making the cue card will reinforce the Strategy and I believe will be more valuable to you than something I could create and just give to you.*

Post Organizer: *Today we checked your mastery of the ACT & Check Strategy. You have all worked extremely hard to get to this point and should be proud of yourselves (Discuss the next step for those who need more practice if necessary). Since you have met mastery, we moved on to discuss generalization. Who can tell me one example of a situation in which you could see yourself using the ACT & Check Strategy? (Elicit responses). Great, finally we worked on creating cue cards for generalization. I would like each of you to use the ACT & Check Strategy at least once when you are at home or at work with a text that you find either at home or work or online, something that you'd likely read in your daily life. I would like you to reflect on how using the strategy at home with your cue card went. Immediately after you use the strategy, I'd like you to complete the reflection activity I'm handing out. Please bring this with you to our next session. Our next session is our final session. We're going to continue to talk a little about generalization and then complete part of the posttest assessment. Does anyone have any questions?*

Lesson 12: Generalization

Purpose: To transfer the use of the strategy to other settings and provide the rationale and

Advance Organizer (display Advanced Organizer Lesson 12) and explain: *Last time we met we confirmed your mastery of the ACT & Check Strategy with a passage. Then we spent the rest of the session discussing generalization and making commitments to generalization. We ended the session with creating cue cards for our use outside of this group. For homework I asked you to use your cue card and the ACT & Check Strategy with something you wanted to read at home or at work and then reflect on how it went using the reflection activity sheet. Today we're going to start by discussing the homework with the group. We're going to continue to discuss generalization and then we're going to take one part of the posttest assessment. Once again, I need you to pay attention and participate in the discussion.*

Reflection Activity: *Okay, we're going to start by talking about the activity I asked you to complete on your own. Would anyone like to start by discussing what you read and how it went using your reflection sheet?* (Elicit volunteers and then shape the discussion ensuring everyone has a chance to discuss their homework).

ACT & Check Graphic Organizer Creation: *Great, now we're going to go through some of the things you've learned about the ACT & Check Strategy and generalization by completing a graphic organizer in a small group. (Pass out the graphic organizer, can use large poster board) I'd like you to discuss in your group the ACT & Check Strategy, the big ideas, including the rationale, how you use it and why we should care about generalization. I've given you a blank piece of poster board and I'd like you to work together to figure out how to best visually display the big ideas of the ACT & Check Strategy. Feel free to get creative and use the markers on the table. You will have 20 minutes to complete this activity. Once we're done one person from the group will explain to everyone your graphic organizer, you will only have a maximum of 5 minutes to explain your work to us. Anyone have any questions?* (Circulate the room providing scaffolding as needed. Then have each group present their graphic organizer eliciting discussion as suitable)

Posttest MIRI: **All right, now we're going to spend the last part of this session completing one part of your posttest assessment. You'll probably remember this from the first session. Remember, this pretest is looking at what, if anything, you are currently doing in reference to making inferences while you read. In the left hand column you'll see three sections, before you read, during reading, and after reading. I'd like you to answer the questions at the top of the middle and right hand**

column next to each section. Try to answer the questions as honestly as possible, if you are not asking yourself anything or using any strategies, please write that in the columns. Once you're finished turn your paper over. Any questions?

Post Organizer: During this last session we discussed how you did when you used the ACT & Check Strategy on your own, then we created a graphic organizer of the big ideas of the ACT & Check Strategy. We ended the session by completing one part of the posttest assessment. Remember that you have made a commitment to use the ACT & Check Strategy outside of this class and I have made a commitment to be here for you through phone or email if you have any questions or if you are having any trouble. I'm ready to honor my commitment and I hope you are too. Remember you have spent a lot of time and energy learning this strategy and it is in your benefit to use it!

Advance Organizer

Lesson 1

- Take the pretest MIRI
- Review your report
- Discuss the ACT & Check Strategy
- Discuss how learning the ACT & Check Strategy will help you
- Commitments
- Post Organizer

The ACT & Check Lesson

1

Notes Sheet

To infer means to come to a _____ about something based on two things: _____ and _____.

The Inference Formula looks like this:

_____ + _____ = _____

Background knowledge means what the _____ brings to the _____.

Authors usually don't tell the reader everything _____.

The steps to the ACT & Check Strategy are:

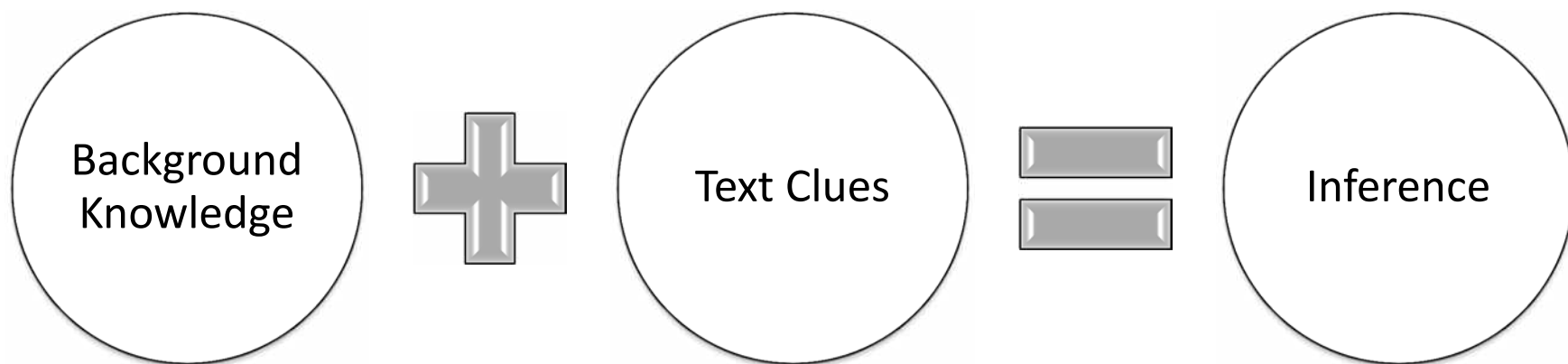
A= _____

C= _____

T= _____

Check= _____

Cue Card #1



Steps for the ACT & Check Strategy

Ask yourself a question

Consider the text

Think about what you know
and take a good guess (infer)

Check your guess

Participant Commitment Form

As long as I am participating in this intervention program, I will fully participate in all intervention activities and discussions. I will ask questions if I have them and support my peers. I understand that my full participation is necessary to ensure that I get the most out of this program.

Signature

Date

Researcher Commitment Form

I am committed to teaching my participants how to use the ACT & Check strategy to the best of my abilities. I will follow my lessons plans to make sure all elements of the intervention program are targeted. I will work to ensure that my participants get the most out of the intervention program by teaching with explicitness, teaching through modeling, and ensuring that everyone has plenty of time to practice. It is my responsibility to keep all participant data confidential and follow the guidelines of conducting ethical research.

Signature

Date

Post Organizer

Lesson 1

- We reviewed your pretest reports so that you understand your strengths and weaknesses
- We introduced the ACT & Check Strategy and discussed why it's important to learn
- We signed commitments to the intervention program

Advance Organizer

Lesson 2

- Review what we did last session
- Identify the language underpinning of making inferences
- Describe the 5 inference categories most related to social inference

The ACT & Check Lesson 2

Notes Sheet

Language provides the _____ to make inferences when reading and when making inferences in social situations.

Being aware of making inferences means _____.

It is important to ask questions as you read because _____
_____.

Another language foundation _____ is directly related to the Inference Formula we learned about last time.

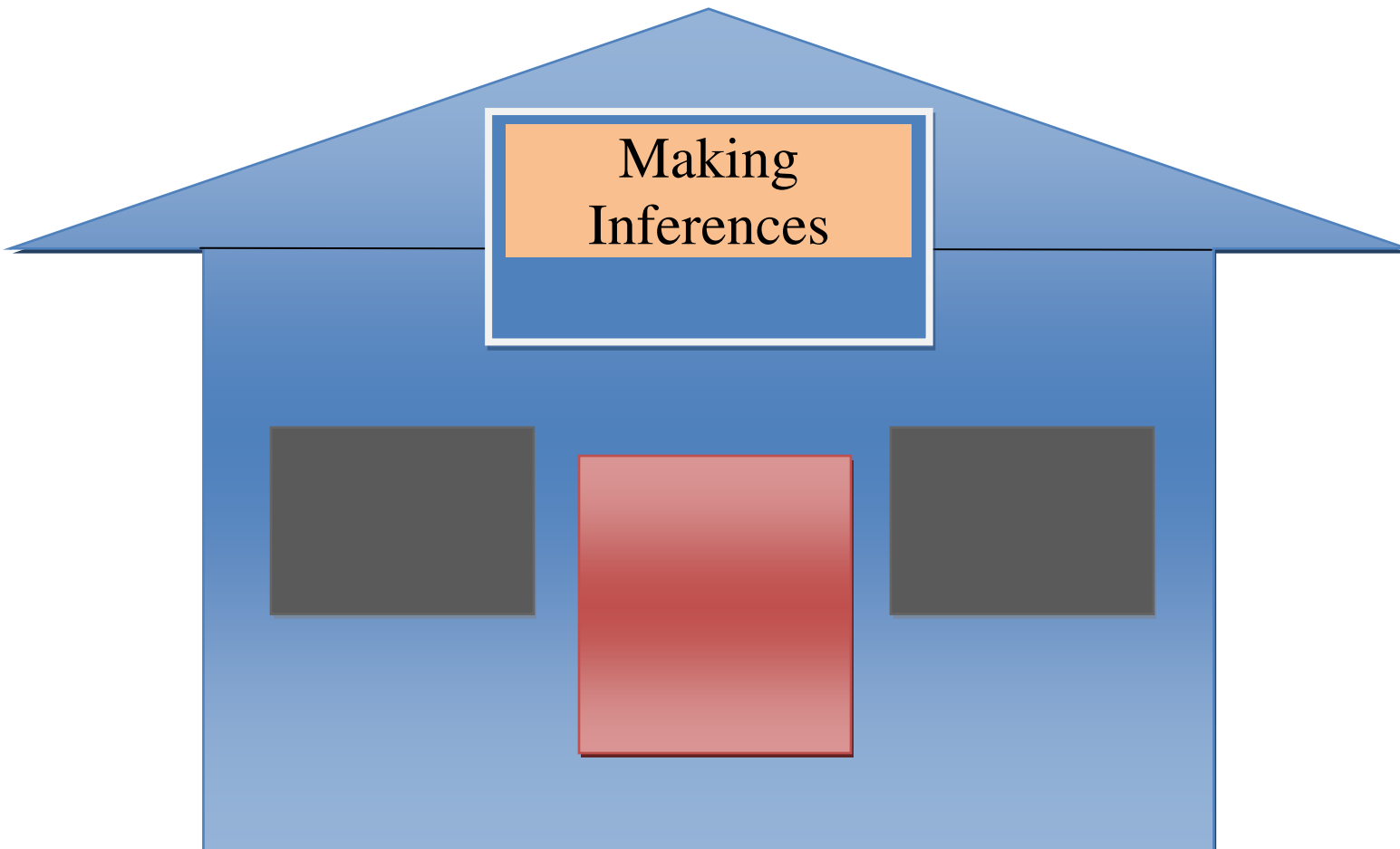
We also will learn how to _____ at each level of complexity (sentence, paragraph, and passage).

The last language foundation _____ has to do with learning the ACT & Check Strategy.

The Five Categories of Inferences most related to making social inferences are:

1. Theme or thesis: _____
2. Author's Intent: _____
3. Character Condition: _____
4. Big Goal: _____
5. Intended Reader Emotion: _____

The Language Foundations of Making inferences



Awareness of making inferences

Formulating your own questions about text

Integrating background knowledge with text knowledge

Attending to language clues at each level of complexity

Applying knowledge and skills strategically

Inference Categories Most Related to Social Inferences

- Theme or Thesis: message of the passage
- Author's Intent: what the author wants the reader to come away with
- Character Condition: the character's physical or emotional state
- Big Goal: the character's main goal or motivation for an action
- Intended Reader Emotion: the emotion the author wants the reader to feel as he/she reads the text

“How Leisure Came”
by Ambrose Bierce
From Graesser & Kreuz, 1993

(Include a typed copy of this passage for participants to view)

“How Leisure Came”
by Ambrose Bierce
From Graesser & Kreuz, 1993

(Include a typed copy of this passage with lines inserted between each line of the text for participants to write questions)

Inference Category Key

Inference Category	Text Eliciting the Inference	Inference
	“A Man to Whom Time Was Money...”	
	“A Man to Whom Time Was Money, and who was bolting his breakfast in order to catch a train...”	
	“...on removing the fork the eye came with it.”	
	“...the Man to Whom Time Was Money had to sustain a life by fishing from the end of a wharf.”	
	The entire passage	
	The entire passage	

“Grandfather’s Death”

By Kimberly Murza, 2011

Jane’s grandfather had just passed away suddenly the night before. Nothing anyone could say or do could help ease her pain of his loss. She knew she needed to deal with this in her own way. Though the tragedy was only a fresh wound, Jane had time to already consider its implications to her life. She asked herself, “How am *I* going to deal with this?” and, “How am *I* going to act like myself tomorrow at school?” She wondered if she was a selfish person to think those thoughts, but she couldn’t help it. Darker thoughts crossed her mind too and she abruptly stopped thinking about those trivial teenage worries and started to consider her own mortality.

Post Organizer

Lesson 2

- We talked about the language foundations that provide the basis for making inferences
- We discussed the five inference categories most related to making social inferences
- I modeled how to make inferences with a passage
- We created a key for the inference categories
- We worked together to make inferences with another passage

Advance Organizer

Lesson 3

- Review last session
- Discuss the first step of the ACT & Check strategy: ask yourself questions as you read
- Discuss theme or thesis and come up with question(s) to help us figure it out as we read
- Discuss author's intent and come up with question(s) to help us figure it out as we read

The ACT & Check Lesson 3

Notes Sheet

I want to ask myself questions as I read because it will _____

A theme is related to _____ types of texts while a thesis is related to _____ types of texts.

A theme is different from a moral because a theme _____
_____ and a moral _____

The main question I should ask myself to figure out the theme of a passage or story is _____

The following three questions can help me answer the previous big theme question:

1. _____

2. _____

3. _____

There are three basic purposes authors write expository passages and they are:

There are three different types of thesis statements I can write depending on the author's purpose:

1. Argumentative thesis statement: _____

Example: "Smoking should be banned in all public places"

2. Explanatory thesis statement: _____

Example: "The Allied forces won World War II because of collaboration, something Hitler thought would be their downfall"

3. Analytical thesis statement: _____

Example: "An analysis of reading outcomes reveals two significant predictors: language ability and instructional experiences"

The main question I should ask myself to figure out the thesis of an expository passage is _____

Author's intent is different from author's purpose because author's intent means _____

and author's purpose is something broader and can include reasons such as to _____

To figure out the author's intent I can ask myself the following question:

1. _____

Post Organizer

Lesson 3

- We talked about the first step of the ACT & Check Strategy: Ask yourself a question
- We discussed theme or thesis and came up with one broad question to ask for both and three more specific questions to ask to help determine theme
- We discussed author's intent and created a question to help us figure it out

Advance Organizer

Lesson 4

- Review last session
- Discuss character condition and come up with question(s) to help us figure it out as we read
- Discuss big goal and come up with question(s) to help us figure it out as we read
- Discuss intended reader emotion and come up with question(s) to help us figure it out as we read
- Introduce the next step in the ACT & Check strategy: Consider the text

The ACT & Check Lesson 4

Notes Sheet

The inference categories _____ and _____
are also very much related to making social inferences because
_____ requires the reader to use cues to figure out what's going
on emotionally and physically with a character and _____
asks the reader to use cues to figure out a person's intent.

The following three questions can help me figure out character
condition:

1. _____
2. _____
3. _____

The following two questions can help me figure out big goal:

1. _____
2. _____

To figure out the intended reader emotion I'm going to need to become
more

_____ of my own emotions as I read.

The following question can help me figure out the intended reader emotion:

1. _____

Inference Category Question Key

Inference Category	Question(s)
Theme or Thesis	
Author's Intent	
Character Condition	
Big Goal	
Intended Reader Emotion	

Inference Category Question Key

Inference Category	Question(s)
Theme or Thesis	<p>Theme</p> <ul style="list-style-type: none"> • What does the story reveal (if anything)? • What kinds of changes did the main character go through? (what happens to the main character?) • What did the main character learn? • What is the nature of the conflict? <p>Thesis</p> <ul style="list-style-type: none"> • What is the main idea of this passage?
Author's Intent	<ul style="list-style-type: none"> • What is the author trying to tell me? Or how is the author trying to influence me? Or...what impression is the author trying to make upon me?
Character Condition	<ul style="list-style-type: none"> • How have the character's emotions changed? • What is this character up to now? • Did this event significantly change this character's life, how so? • Does this information tell me anything new about the character?
Big Goal	<ul style="list-style-type: none"> • Why did the character just do that? • What does the character want to happen now?
Intended Reader Emotion	<ul style="list-style-type: none"> • What is the author trying to make me feel by writing that?

Inference Graphic Organizer

Known (the author tells me)	Unknown (the author doesn't tell me)

Post Organizer

Lesson 4

- We discussed the other three inference categories and came up with corresponding questions for each.
- We created a key of all of our inference category questions
- We introduced the second step of the ACT & Check Strategy: Consider the text
- We introduced the Inference Graphic Organizer

Advance Organizer

Lesson 5

- Model the ACT & Check Strategy with a passage using our Question Key and Inference Graphic Organizer
- Use the ACT & Check Strategy together to make inferences with a passage

(Include a typed copy of the first paragraph of this excerpt with lines inserted between each line of the text for participants to write questions)

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“I want to go home,” I said, my voice perilously near to trembling...”

Seems like the narrator wants to get away from where they are in the car, I know when people's voices tremble they are either scared or about to cry from sadness

“Without a word he started up the engine, let in the clutch and turned the car round the way that we had come.”

Whoever “he” is he obeyed her wishes, maybe because he wants to help her feel better?

“Swiftly we covered the ground, far too swiftly, I thought...”

Sounds like the narrator might be frightened now by the speed of the car

“We came to the bend in the road that I had wished to imprison as a memory, and the peasant girl was gone, and the color was flat, and it was no more after all than any bend in any road passed by a hundred motorists.”

This bend sounds significant to the narrator, and because she wants to “imprison it as a memory” I'm thinking that something awful happened here. Maybe recently since she was expecting to see the peasant girl. I'm guessing that the author wants me to put the pieces together. I can think of some bad things that can happen at a bend in the road, maybe they hit the peasant girl as they came around the bend too quickly

“My adult pride was lost, and those despicable tears rejoicing at their conquest welled into my eyes and strayed upon my cheeks.”

The narrator seems to be very sad to be crying uncontrollably, but I'm also thinking that if she's calling the tears despicable and if she thinks her pride is lost she is embarrassed to cry in front of the man

“But suddenly he put out his hand and took hold of mine, and kissed it, still saying nothing.”

The author is trying to make me like the man, if I were in the narrator's shoes I'd want someone to try to console me like the man is doing

“I had to lunch with Mrs. Van Hopper in her room...and afterwards she would make me play bezique with all the tireless energy of the

The narrator is dreading her afternoon with Mrs. Van Hopper, clues “had” “make”, “stifle in that room”

convalescent. I knew I should stifle in that room.”

From *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989)
Passage 7 excerpt from *Pain and Pleasure*
Lesson 5 “we do it” Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“Americans of all ages are using drugs in greater variety and in greater numbers than ever before. Almost every kind of prescription drug that has some sort of effect on mood is being misused at this time.”

“The use of all sorts of drugs in high schools and even elementary schools is still prevalent.”

“What is new is the thoughtlessness with which people use drugs.”

“In materialistic, modern society, people often do not get the emotional support they need from their families and communities.”

“This peer pressure is probably the most important single factor in the beginning of drug use.”

“Unfortunately, illegal drugs are widely available, and many people would rather alleviate their pain right now, regardless of the consequences.”

Entire passage

The author wants me to believe that drug use is a bigger problem than ever before

The author is trying to shock the reader his statement about drug use in elementary schools being prevalent. Not something I usually think of when I think of K-5 graders

The author wants me to take his position that drug use is not something that should be socially or legally acceptable

The author wants to make a point that our materialistic society is fostering a breakdown in family structure and dynamics and is partially to blame for the current drug problem

People who use drugs initially are doing so because they want to be cool or fit in with a crowd

Drug users are weak

Drug abuse is a huge problem stemming from a number of complicated factors

Post Organizer

Lesson 5

- We reviewed the steps of the ACT & Check Strategy
- You watched as I modeled the strategy with a passage
- We used the strategy collaboratively to make inferences with another passage

Advance Organizer

Lesson 6

- Review the rationale for using the ACT & Check Strategy
- Review the purpose of each step of the strategy
- Rapid-fire practice
- Group practice
- Oral quiz

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

"Most jobs related to the industry are done by Hispanic farm workers."

Does the author mean that many of these Hispanic farm workers are illegal immigrants? Or is it because of cultural reasons that many Hispanic Americans do this type of work?

"The jobs provide scant income, little security, and major risks. The workers earn about six to eight dollars an hour, and few receive medical insurance."

The cons to this type of lifestyle are huge, I think this is why many legal workers don't do it. Illegal immigrants might consider this a lot of money compared to what they might make in their home country. Even so, I would think that they would be very tired, overworked, possibly scared of being deported or maybe they feel fortunate to have a job?

"Between 13,000 and 15,000 workers depend on the winter citrus harvest in the San Joaquin Valley. Some entire communities in the Central Valley also depend on the orange crop for their livelihood."

I think the author uses depend twice to in these two sentences to make the point that the harvest is very crucial to these people's lives. I'm starting to imagine the impact of a bad harvest year.

The entire passage

I think the thesis statement has to do with the hardships that orange harvesters have to endure to provide oranges to Americans.

From *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989)
Passage 40 excerpt from *A Journey to the Centre of the Earth*
Lesson 5 “you do it” Small Group Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

"To my notion the best part of his possessions was his goddaughter."

"To me there was nothing like pebbles – and if my uncle had been in a little less of a fury, we should have been the happiest of families."

"...if my uncle had been in a little less of a fury..."
"...my uncle, apparently oblivious to the fact that he had summoned me..."

"On the contrary, I professed considerable interest in the subject, and asked him what it was about."

Entire passage, clues about the narrator's feelings about his uncle and the uncle's personality

The narrator is telling us that he didn't care for the fine things his uncle had collected
He also is suggesting that he really likes, maybe even loves the goddaughter?

Does his uncle also enjoy geology, it sounds like it since everything should have been great if his uncle wasn't so uptight

Some clues have been given so far that the narrator dislikes his uncle, maybe even resents him

I guess the narrator doesn't dislike like his uncle so much that he makes fun of his interest in the old book. Or maybe he has another motive, maybe he feels he has to be very agreeable with his uncle since he's living with him? (*Example of a polite lie...discuss*)

The purpose of this passage seems to be to examine the nature of the uncle and explore how the narrator feels about him

Post Organizer

Lesson 6

- We reviewed the steps of the ACT & Check Strategy
- We discussed why learning the ACT & Check Strategy is important
- We talked about each step of the strategy and how it is related to making inferences
- We verbally practiced reciting each step of the strategy to help us commit it to memory
- We verbally practiced answering questions about the strategy including the types of inference categories
- You took an oral quiz

Advance Organizer

Lesson 7

- Practice using the ACT & Check Strategy in a large group
- Practice using the strategy in a small group
- Practice using the strategy by yourself

From *Popular Science* (October 2010)
Page 44 excerpt from *Life on the Edge: Four Visions for inhabiting a Transformed World:*
Problem: Rising Seas: Solution: City [E]Scape, Designers: Mustafa Bulgar and Sinan Gunay
Lesson 7 “We do it” Large Group Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“Environmental disruptions and technological advances have always influenced where and how people live.”

“Early humans *may* have left Africa...”

“In the decades ahead, a warming planet and a booming population will again alter where we live and how we construct our homes.”

“A coalition of scientists from Denmark, England and Finland predicted last year that by the end of this century, melting ice and thermal expansion will drive up the world's sea levels by more than three feet.”

“It would be possible, *they say*, to safely house up to 2.5 million people.”

Last paragraph

Thesis: first paragraph

This sounds like a thesis statement to me. The rest of the paragraph gives examples of support too. I will have to check as I read.

The word *may* tells me that this is a speculation. In fact, I know that there are a few theories about why early humans left Africa, though from what I know humans first evolved in Africa

This statement at the end of the paragraph may also be a part of the thesis statement. I bet the author is going to give examples as he continues.

This seems crazy to me. I'm shocked by how much 3 feet is and only by the end of this century. I think the author put this in here to make his case and in particular instill a sense of urgency of this issue in the reader

This is like the word *may* in the first paragraph, I know that by adding *they say* to this statement it might not be a fact. The author wants me to know that he's just citing someone else's work and not necessarily vouching for it.

This seems to be some seriously technical information. I think the author is trying to show that this idea is not something out of a science fiction novel but in theory it could work.

Environmental disruptions and technological advances have always influenced where and how people live, in the decades ahead, a warming planet and a booming population will again alter where we live and how we construct our homes

(Include a typed copy of the first sentence of this excerpt with lines inserted between each line of the text for participants to write questions.)

(Include a typed copy of the first paragraph of this excerpt with lines inserted between each line of the text for participants to write questions.)

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“Joseph had not gone above two miles, charmed with the hope of shortly seeing his beloved Fanny...”

“...when he was met by two fellows in a narrow lane, and ordered to stand and deliver.”

“...told them he hoped they would be so generous as to return him a few shillings, to defray his charges on his way home.”

“...replied that he hoped they would not insist on his clothes.”

“...damning his eyes, snapped a pistol at his head.”

“...and together both hit Joseph with their sticks, till they were convinced they had put an end to his miserable being; they then stripped him entirely naked, threw him into a ditch...”

“A lady who heard the groan, called eagerly to the coachman to stop and see what was the matter.”

If he was on his way to see her. The passage says “shortly” which makes me believe he was actually on his way. Typically, people get excited when they're on their way to see someone they love

“Ordered” makes me think that this was not a pleasant meeting and I can infer that Joseph's hope was changed to fear because they sound like robbers and I would be afraid if robbers approached me when I was walking alone

This takes some guts, maybe Joseph isn't scared though I think he should be. I'm thinking he is pushing his luck

Again, I'm thinking Joseph is not scared and maybe a little naïve with this type of situation because I would just obey the robbers in hopes that they would take what they wanted and leave me alone

I think the robbers must have gotten too annoyed with Joseph's requests and wanted to let him know who was in charge

Since the author is giving me all this detail I think he wants me to feel sympathy for Joseph and feel disgusted with what the robbers have done to an innocent man

Even though we don't get to read any more, I'm thinking this might be a good thing, maybe Joseph will get the help he needs

From *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989)
Passage 41 excerpt from *On the Road* by Anton Chekhov
Lesson 7 Independent Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“...freshly scrubbed floors...”
“...a little lamp was burning...”
“...cheap paintings...”
“A sleeping man could be seen first the Elder Seraphim, then the Shah Nasir-ed-Din, then a fat, brown baby with goggle eyes, whispering in the ear of a young girl...”

2nd paragraph

“But all at once the door creaked and the potboy, in a new print shirt, came in. Limping on one leg, and blinking his sleepy eyes, and went out.”

Clean, but not extravagant. Dark, quiet not too many people. Not really a happening place.

Starts off with saying a storm was raging outside but then it seems to be talking about some kind of wild animal or crazy person trying to get into the travelers room. Is the author trying to give a nice metaphor for the weather or is this really something else?

I think the author wants me to wonder about this, he's trying to create suspense through this kind of detail and by not just saying it was really windy outside.

Since the boy was really sleepy and just came in and out in this kind of weather I'm guessing that it was his job to put more fire on the stove.

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“But...milkshake. Tasty. Must. Drink.”

I can hear myself saying that in my head like I'm in some kind of milkshake trance. I think the author wants me to laugh, to think this is funny

“It's a very technical term.”

SARCASM! I know there are three different kinds of sarcasm people can use. One definition of sarcasm is insincerely saying something that's the opposite of one's intended meaning. You can also use vocal overemphasis, or clear exaggeration. Which kind do you think this is? I think it's clearly the opposite of the scientist's intended meaning. Ice cream headache doesn't sound very technical to me!

“Or perhaps it touches off a branch of the trigeminal nerve in your mouth...”

Just like in the *Life on the Edge* article, the word perhaps signals to me that this is not a fact. The author cites two schools of thought but it doesn't appear that either has been shown to be the true explanation

Entire 5th paragraph

Wow! That's a significant drop in temperature, I'm amazed that they can do that and the brain can just bounce back. There's no way that an ice-cream headache could make the brain drop to that temperature even if it was impacted by it. I'm feeling better about coming to a conclusion about the ice-cream headache question.

“So whether your brain is frozen or not, if you can handle a little pain, slurp away.”

This is part of the thesis statement I think. The purpose of this article was to answer the question whether a brain freeze was actually harmful to your brain: Although formal experimental research has not been conducted to determine if a brain freeze is actually harmful to the brain, there is enough scientific evidence that suggests that it is not.

Post Organizer

Lesson 7

- We practiced using the ACT & Check Strategy together, in a small group and individually
- You practiced using it with only a sentence, then a paragraph, and then an entire passage
- We discussed the inferences everyone made and came to a conclusion about the best inferences for each passage

Advance Organizer

Lesson 8

- Practice using the ACT & Check strategy in a small group
- Practice using the strategy by yourself

From *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989)
Passage 44 excerpt from *A Christmas Carol* by Charles Dickens
Lesson 8 Small Group Practice: 1st paragraph

(Include a typed copy of the first paragraph of this excerpt with lines inserted between each line of the text for participants to write questions.)

From *Jamestown Readers – Timed Readings in Literature Series* (Spargo, 1989)
Passage 44 excerpt from *A Christmas Carol* by Charles Dickens
Lesson 8 Small Group Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

"Once upon a time – of all the good days in the year, on Christmas Eve – old Scrooge sat busy in his countinghouse."

Entire 1st paragraph

"...that he might keep his eyes upon his clerk..."

"...the master predicted it would be necessary for them to part."

"A Merry Christmas, uncle! God save you!...
"Bah!" said Scrooge. "Humbug!"

"What right have you to be merry? What reason have you to be merry? You're poor enough."

Last two paragraphs

If you celebrate Christmas, most people don't work on Christmas Eve, especially if they own their own business as it seems that Scrooge does by the use of "his countinghouse"

If he does celebrate Christmas, then he seems like a workaholic.

The author is painting a picture of a cold, dreary day. It's 3:00 in the afternoon and still there is fog! I believe this story is set in London which would make sense because I've often heard of the notorious London fog.

Scrooge doesn't trust his clerk. I wonder if it's this particular clerk or people in general?

More evidence that Scrooge doesn't trust his clerk and he doesn't care for his well-being. It sounds miserably cold and it seems like Scrooge is being cheap and greedy with the coal. It's seems really cruel to me that he keeps the box of coal in his office just waiting for his employee to get cold enough to try and make a move for it only to know that he'll fire him if he does.

If Scrooge was miserable before his nephew's cheerful visit didn't seem to change Scrooge's feelings about Christmas.

It seems by this statement that money is very important to Scrooge and perhaps one of his big goals in life is to be rich!

The author is painting Scrooge to be a miserly man even on a usually happy holiday

A rich man seems miserable while a poor man seems happy...a theme of this story might be that money can't buy happiness.

From *The New Yorker* – (September 27, 2010)
excerpt from *The Warm Fuzzies* by Chris Adrian
Lesson 8: Independent Practice

(Include a typed copy of this entire excerpt with lines inserted between each line of the text for participants to write questions.)

Inference Graphic Organizer

Known
(the author tells me)

Unknown
(the author doesn't
tell me)

“The music started without her; she had missed her father’s cue. She came in late, and settled down into an unthinking rhythm.”

““Don’t you miss him?” Mellissa kept asking. Molly could swear that she did not, but now she thought she might cry.”

“Her family were moving all around her, and she didn’t know why...”

“Molly spoke again, louder this time and clearer, so it might have been heard over the music if it hadn’t been lost under the noise of the crowd. “Bitch!””

Theme: Entire passage

The words music and cue tell me that she’s involved in some kind of performance.

Unthinking rhythm makes me think that she’s somewhere else mentally. I know when you practice something over and over again like dance or singing or playing an instrument you can perform without thinking much about it. It’s like when I’m lost in my thoughts on the way home from work and pull into my driveway and wonder how I got there!

She seems to be really distracted from her performance by sadness, she seems to really miss Peabo or she probably wouldn’t feel like crying.

Another clue that she’s really distracted. If she is really performing she should know the routine well enough to know why her family was moving around her in the routine.

Wow! That’s pretty harsh, but this gives me a clue about where Molly is at mentally. I know that she’s distracted and it seems like she’s fed up with the performance because she wants to focus on more important things to her at this point, like the loss of Peabo.

Loss helps put things into perspective

Lesson 8

- We practiced using the ACT & Check Strategy in a small group and individually
- You practiced using it with only a paragraph, then with the entire passage

Advance Organizer

Lesson 9

- Practice using the ACT & Check Strategy independently without the use of the Question Key or the Inference Graphic Organizer
- Practice using the ACT & Check Strategy with materials you brought from home and materials others brought from home

Post Organizer

Lesson 9

- Today we practiced using the ACT & Check Strategy without help from the Question Key or the Inference Graphic Organizer
- You used the strategy with materials you and your peers brought from home

Advance Organizer

Lesson 10

- Practice using the ACT & Check Strategy independently without the use of the Question Key or the
- Practice using the ACT & Check Strategy with materials you brought from home and materials others brought from home

Post Organizer

Lesson 10

- Today we practiced using the ACT & Check Strategy without help from the Question Key or the Inference Graphic Organizer
- You used the strategy with materials you and your peers brought from home

Advance Organizer

Lesson 11

- Complete mastery task
- Discuss performance as a group
- Determine whether mastery was achieved
 - Create plan of action if not
- Discuss generalization of the ACT & Check Strategy
- Make commitments to generalization
- Create cue cards

The ACT & Check

Lesson 11

Notes Sheet

Some reasons it is important that I continue to use the ACT & Check Strategy outside of this class include: _____

I can see myself using the ACT & Check Strategy in the following situation:

1. _____
2. _____
3. _____
4. _____
5. _____

Participant Commitment to Generalization Form

I have spent a significant amount of time and effort learning how to use the ACT & Check Strategy. It is in my benefit to continue to use the strategy outside of this class. I am committed to using this strategy outside of the class and can contact Kim Murza for support if I need it.

Signature

Date

Researcher Commitment to Generalization Form

I have spent a significant amount of time and effort teaching my study participants how to use the ACT & Check Strategy. I believe in its utility and will continue to support my participants as they use the strategy outside of our class. I am committed to helping my participants in any way I can.

Signature

Date

Post Organizer

Lesson 11

- Today we completed a mastery task and we determined whether or not you have reached mastery with the ACT & Check Strategy
- We discussed the importance of generalization
- We made commitments to generalization
- We created cue cards for generalization

Advance Organizer

Lesson 12

- Today we begin by discussing your homework generalization activity
- We will continue to discuss the importance of generalization
- We will create a graphic organizer explaining the big ideas of the ACT & Check Strategy
- We will complete one part of the posttest assessment

Post Organizer

Lesson 12

- We discussed your homework
- We continued to talk about the importance of generalization
- We created an ACT & Check Graphic Organizer of big ideas
- We completed one part of the posttest assessment

APPENDIX D: SELECTION OF INFERENCE CATEGORIES

Thank you for agreeing to participate in my dissertation preparation. We have asked for your help because of your expertise in the area of ASD.

We would like you to review the following categories of inferences and rank the top 5 categories that you feel are most related to a person's ability to make social inferences (i.e., the ability to infer what another individual is thinking or feeling based on their verbal and/or non-verbal cues). Please rank your top 5 choices using the following rating scale: 1(most related to social inferencing)-5(least related to social inferencing). Please only rank your top 5 choices.

Thank you!
Kim Murza

*Experts were given Tables 12.1 and 12.2 from Magliano, Baggett, and Graesser (1996). Table 12.1 provided a passage and Table 12.2 listed the categories of inferences with examples from the passage. Experts were asked to rank the categories of inferences listed in Table 12.2.

APPENDIX E: CONTENT INNOVATION CONFIGURATION MAP

Act & Check Innovation Configuration Map: Content

Key Elements	Ideal Implementation (3)	In Process (1)	No Implementation (0)
<ul style="list-style-type: none"> Elements of the ACT & Check Strategy 	<p>The researcher provides explicit instruction in all elements of the ACT & Check Strategy. During each lesson, the researcher reviews the elements and/or has the participants demonstrate their knowledge of the strategy individually or in groups.</p>	<p>The researcher provides explicit instruction in all elements of the ACT & Check Strategy. However, the researcher does not provide the opportunity during each lesson to review the elements or allow the participants to demonstrate their knowledge of the strategy individually or in groups.</p>	<p>The researcher does not provide explicit instruction in the elements of the ACT & Check Strategy.</p>
<ul style="list-style-type: none"> Language underpinnings 	<p>The researcher provides explicit instruction in the language underpinnings of inference generation.</p>	<p>The researcher discusses the language underpinnings of inference generation but not explicitly enough for some participants.</p>	<p>The researcher does not provide explicit instruction in the language underpinnings of inference generation.</p>
<ul style="list-style-type: none"> Inference categories 	<p>The researcher provides explicit instruction in the types of textual inferences most related to social inferences.</p>	<p>The researcher discusses the different types of textual inferences but not explicitly enough for some participants.</p>	<p>The researcher does not provide explicit instruction in the types of inference categories most related to social inferences.</p>
<ul style="list-style-type: none"> Asking questions 	<p>The researcher provides explicit instruction in the types of questions a reader may ask him/herself to make inferences related to the inference categories presented previously. The researcher also provides a model for the participants so that they can further understand the process of asking questions during reading.</p>	<p>The researcher discusses the different types of questions readers ask but not explicitly enough for some participants. The researcher might not provide sufficient time to model asking questions or does not do so explicitly enough.</p>	<p>The researcher does not provide explicit instruction in asking questions.</p>

APPENDIX F: PROCESS INNOVATION CONFIGURATION MAP

Act & Check Innovation Configuration Map: Process

Key Elements Process	Ideal Implementation (3)	In Process (1)	No Implementation (0)
<ul style="list-style-type: none"> • Advance organizer (1-12) and review (2-12) 	The researcher provides an advance organizer to participants and reviews what occurred during the previous intervention session.	Researcher provides an advance organizer or reviews the previous intervention session but does not do both.	Researcher does not provide an advance organizer or review.
<ul style="list-style-type: none"> • Purpose (1-12) 	The researcher explicitly provides participants with the purpose for the current session to build buy-in.	Although the researcher suggests the rationale of the session, she does not do so explicitly.	Researcher does not provide participants with the purpose for the intervention session.
<ul style="list-style-type: none"> • Description of behavior (1-12) 	The researcher adequately describes the concept or behavior being taught.	The researcher describes the behavior being taught, however the description is not explicit enough for all participants to understand.	The researcher does not adequately describe the concept or behavior being taught.
<ul style="list-style-type: none"> • Model of behavior (2 & 5) 	The researcher models the target behavior through a think aloud activity.	The researcher models the target behavior but does not use the think aloud process for each step of the behavior.	The researcher does not model the target behavior through a think aloud activity.
<ul style="list-style-type: none"> • Scaffolded practice (2, 5, & 7-10) 	The researcher provides time in the session for participants to practice the target behavior. The researcher provides help to those participants who need it through the technique of scaffolding. Each passage is thoroughly discussed following completion of the task by each participant.	The researcher may not provide adequate time for practice or does not provide help through scaffolding to those participants who need it. A complete discussion of the passage and task also may not have occurred.	The researcher does not provide scaffolded practice.
<ul style="list-style-type: none"> • Independent practice (7-10) 	The researcher provides time in the session for participants to practice the target behavior independently. Each passage is thoroughly discussed following completion of the task by each participant.	The researcher may not provide adequate time for independent practice or does not discuss the passage and task following participants' completion.	The researcher does not provide independent practice.
<ul style="list-style-type: none"> • Post organizer (1-12) 	The researcher provides a post organizer to participants and discusses each activity of the completed session.	The researcher may provide a post organizer but does not discuss each of the session's activities.	The researcher does not provide a post organizer.

APPENDIX G: FIDELITY OF IMPLEMENTATION CHECKLIST

Date: _____ Group: _____ Lesson # _____

Fidelity of Implementation Checklist

Question	Yes/No
9. Did the researcher provide an advance organizer of the session?	
10. Did the researcher review the last sessions (only for sessions 2-12)?	
11. Did the researcher describe the purpose of the current session?	
12. Did the researcher adequately describe the concept/behavior being taught?	
13. Did the researcher model the concept/behavior being taught? (only for sessions 2 & 5)	
14. Did the researcher provide scaffolded practice in which she helped any participants who needed help? (only for sessions 2, 5, 7, 8, 9, 10)	
15. Did the researcher provide independent practice? (only for sessions 7, 8, 9, 10)	
16. Did the researcher provide a post organizer?	

APPENDIX H: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Kimberly A. Murza**

Date: **September 09, 2010**

Dear Researcher:

On 9/9/2010, the IRB approved the following human participant research until 9/8/2011 inclusive:

Type of Review: UCF Initial Review Submission Form
Project Title: Effects of a Reading Inference Strategy Intervention on the Reading and Social Inference Abilities of Adults with Asperger Syndrome and High-Functioning Autism
Investigator: Kimberly A Murza
IRB Number: SBE-10-07100
Funding Agency: Providing Autism Links & Supports(PALS)
Grant Title: N/A
Research ID: N/A

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 9/8/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 09/09/2010 11:30:54 AM EDT

IRB Coordinator

APPENDIX I: PARTICIPANT AVAILABILITY

Name _____

If I am randomly selected to take part in the treatment group I will need to attend treatment sessions twice a week for 60 minutes each session. Availability to participate in these treatment sessions is necessary and I may not be able to participate if I am not available at the same times as other participants.

Please complete the following weekly calendar with the days/times you are available. You can do this by either printing out the form and highlighting the days/times you are available and then bringing on your pretest date or you can complete this on the computer and email to Kim Murza at kimberly.murza@gmail.com. To complete on the computer you will need to also shade in times each day when you are available. You can do this by highlighting the days/times you are available and then selecting the shading icon under the paragraph menu. It looks like a paint bucket.

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8 am							
9 am							
10 am							
11 am							
12 pm							
1 pm							
2 pm							
3 pm							
4 pm							
5 pm							
6 pm							
7 pm							
8 pm							

APPENDIX J: PARTICIPANT INTAKE FORM

Name _____ Date of Birth _____

Address _____ City _____

State and Zip _____ Home Phone _____

Cell Phone _____ Preferred Phone _____

Email address _____

Occupation _____ Employer _____

Are you a student? Yes _____ No _____

School Name _____

Major _____ Year _____

Please Circle Highest Level of Degree Earned:

High School Some College BA/BS Masters Degree Doctoral Degree

Diagnosis _____

Are you receiving any therapy services at this time? Yes _____ No _____

If yes please describe _____

Please list family members and contact information

Name/Relationship _____ Phone _____

Name/Relationship _____ Phone _____

Name/Relationship _____ Phone _____

Name/Relationship _____ Phone _____

Please Circle:

I do I do not give my permission for Kim Murza to disclose information about my progress in this study to the following family member(s):
(list any family members)

Signature of Participant

Date

Printed Name of Participant

APPENDIX K: CONSENT DOCUMENT



Effects of a Reading Inference Strategy Intervention on the Reading and Social Inference Abilities of Adults with Asperger Syndrome and High-Functioning Autism

Informed Consent

Principal Investigator: Kimberly A. Murza, M.A., CCC-SLP

Research Associates: Karen Wesley, M. Ed. Shelly Spencer, B.S.
Kimberly Stewart, B.S. Ariel Egan, B.A.
Rebecca Rankin, B.S. Laura Schwartz, B.A.
Claudia Nunez, B.A. Barbara Hancock, B.A.
Joy Hahn, B.S. Shrish Datto
Lauren Ogden, B.S. Jessica Lincoln, B.A.
Jaqualine Fort, B.S. Frances Silvers, B.A.
Adam Lloyd, M.M. Ali Goldstein, B.S.
Sarah Faroqi, B.S. Kaly Williams, B.S.

Faculty Supervisor: Chad Nye, PhD

Investigational Site(s): University of Central Florida
Greater Orlando area

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 26-40 people. You can ask questions about the research. You can read this form and agree to take part right now, or take the form home with you to study before you decide. You will be told if any new information is learned which may affect your willingness to continue taking part in this study. You must be 18 years of age or older to be included in the research study.

The five people doing this research are Kim Murza, M.A., CCC-SLP, Chad Nye, PhD, Barbara Ehren, EdD, and Jaime Schwartz of UCF's Communication Sciences and Disorders Department, and Debbie Hahs-Vaughn, PhD of UCF's Educational Research Department. In addition Karen Wesley, M. Ed of CARD, and the follow Graduate Student Assistants of UCF's Communication

Sciences and Disorders Department will be helping with the assessment process: Kimberly Stewart, B.S., Rebecca Rankin, B.S., Claudia Nunez, B.A., Joy Hahn, B.S., Lauren Ogden, B.S., Jaqualine Fort, B.S., Adam Lloyd, M.M., Sarah Faroqi, B.S., Shelly Spencer, B.S., Ariel Egan, B.A., Lauren Schwartz, B.A., Barbara Hancock, B.A., Sehrish Dato, Jessica Lincoln, B.A., Frances Silvers, B.A., and Ali Goldstein, B.S.. Because the primary researcher is a doctoral student, she is being guided by Dr. Chad Nye, a UCF faculty supervisor in the Communication Sciences and Disorders Department.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to determine the effectiveness of a pragmatic language intervention program. Specifically, we are interested in answering the following questions:

1. Is there a difference in ability to make inferences in reading between adults with Asperger syndrome and high-functioning autism who receive a reading inference strategy intervention and those who do not?
2. Is there a difference in ability to make social inferences between adults with Asperger syndrome and high-functioning autism who receive a reading inference strategy intervention and those who do not?

What you will be asked to do in the study: Because this is a randomized controlled study, you will be randomly selected to participate in the intervention or the control group. Those participants randomly selected to participate in the intervention group will be asked to:

- Participate in an assessment of your reading comprehension, reading inference and social inference skills before the intervention phase and after
- Participate in a group assessment of your reading inference skills on a different date from the above assessment dates
- Meet twice a week for a 60 minute group inference strategy intervention session over 6 weeks

Participants randomly selected to participate in the control group will be asked to:

- Participate in an assessment of your reading comprehension, reading inference and social inference skills before the intervention phase and after
- Participate in a group assessment of your reading inference skills on a different date from the above assessment dates

In addition, control group participants will have the option of participating in the intervention following the completion of the post-assessment sessions.

Location: You and the researcher will agree on a time and place convenient to you to complete the assessment. You and the researcher and other group intervention members will agree on a time and place convenient for everyone to conduct the group intervention sessions if you are in the intervention group.

Time required: The first assessment sessions should take between 90-180 minutes to complete. The group assessment sessions should take between 45-90 minutes to complete. The intervention sessions will last for 60 minutes and will be conducted twice a week for 6 weeks.

Audio or video taping:

You will be videotaped during this study. If you do not want to be videotaped, you will not be able to be in the study. Videotaping is necessary to conduct intervention fidelity measures. The video file will be transferred from the video camera to a folder on a password protected computer. The video files will be erased when the study is completed.

Risks: There are no expected risks for taking part in this study. You do not have to answer every question or complete every task. You do not have to answer any questions that make you feel uncomfortable.

Benefits:

As a participant you have the potential to increase your inference skills in reading that may also impact your social inference abilities.

Compensation or payment: There is compensation for taking part in this study. Participants in the control and treatment group will be paid \$30.00 for completing the pre-test assessments and \$30.00 for completing the post-test assessments. Participants randomly selected to be in the treatment group will receive \$10.00 for each treatment session they attend. They will have the opportunity to earn \$120.00 for attending all of the treatment sessions. This compensation averages to about \$10.00 per hour of commitment to the study. Participants have the option of withdrawing from the study at any time but will only be compensated for activities they take part in.

Confidentiality: We will limit your personal data collected in this study to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research has hurt you talk to Kim Murza, Doctoral Student, Communication Sciences and Disorders Track, College of Education, (407) 782-5009 or by email at kimberly.murza@gmail.com, or Dr. Chad Nye, Faculty Supervisor, Department of Communication Sciences and Disorders at (407) 823-6003 or by email at cnye@mail.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Your signature below indicates your permission to take part in this research.

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

Name of participant

Signature of participant

Date

APPENDIX L: SCHEDULE OF ACTIVITIES EXAMPLE

Effects of a Reading Inference Strategy Intervention on the Reading and Social Inference Abilities of Adults with AS and High-Functioning Autism

Schedule of Research Activities

By agreeing to take part in this research study, I agree to participate in a pre- and posttesting individual session and a pre- and posttesting group session. If I am randomly selected to be in the intervention group I agree to take part in a 6 week intervention. Intervention groups will occur twice a week for 60 minutes each session. Participation in this study is completely voluntary. I am free to withdraw from this study at any time. However, I will only be compensated for research activities I take part in.

- I have been selected to participate in the treatment group
- My intervention group will meet on Tuesdays from 3:00-4:00 and Thursdays from 3:30-4:30 at the Institute for Simulation and Training (IST) in Research Park 3280 Progress Drive Orlando, FL 32826
- My intervention group will meet on the following dates: 10/12, 10/14, 10/19, 10/21, 10/26, 10/28, 11/2, 11/4, 11/9, 11/11, 11/16 & 11/18
- I have been scheduled for a posttest individual & group session on Tuesday November 23th at 3:00 at the UCF Clinic

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