Using the Cognitive, Affective, Linguistic, Motor and Social (CALMS) Assessment for School-Age Children Who Stutter with Males Diagnosed with autism spectrum disorder

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ABSTRACT

Breaks or disruptions that occur in the flow of speech are labeled as "disfluencies." In the school-aged population, students may present with a variety of disfluency types and require assessment by a speech-language pathologist (SLP) to determine if there is a negative impact on communication. Fluency disorders consist of stuttering, cluttering, and other disfluencies, including atypical disfluencies, which are the least studied in the literature. Such fluency disorders can be present alone or concomitant with another diagnosis such as autism spectrum disorder (ASD), which makes the assessment process significantly more complex. Previous studies have examined the types of disfluencies found in the ASD population but have not yet investigated all five components that are associated with fluency disorders including the cognitive, affective, linguistic, motor, and social areas. The current study aimed to identify the types of disfluencies found in four school-aged males with ASD in addition to obtain quantifiable ratings for the impact of disfluencies on the five components using the CALMS assessment.

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Glossary

Atypical Disfluencies: Stuttering that occurs outside the parameters for stutter-like disfluencies and non-stutter like disfluencies. For example, word-final disfluencies (WFD) such as “dog-og-og”.

Autism spectrum disorders (ASD): a neurodevelopmental disorder with severe impairments in the two domains of social communication and restrictive repetitive behaviors/interests (Bellinghausen et al., 2019).

Circumlocution: the use of an unnecessarily large number of words to express an idea.

Cluttering: fluency disorder characterized by a perceived rapid and/or irregular speech rate, atypical pauses, maze behaviors, pragmatic issues, decreased awareness of fluency problems or moments of disfluency, excessive disfluencies, collapsing or omitting syllables, and language formulation issues, which result in breakdowns in speech clarity and/or fluency (St. Louis & Schulte, 2011; van Zaalen-Opt Hof & Reichel, 2014).

Content words: words that carry the most meaning when speaking (e.g., nouns, verbs, adjectives, and adverbs) (Öz, 2014).

CWS: a child who stutters

Disfluencies: repetitions of sounds, syllables, words, and phrases; sound prolongations; blocks

Fluency disorders: an interruption in the flow of speaking characterized by atypical rate, rhythm, and disfluencies which may also be accompanied by excessive tension, speaking avoidance, struggle behaviors, and secondary mannerisms (American Speech-Language Hearing Association [ASHA], 1993).

Function words: words that have very little meaning (e.g., prepositions, articles, pronouns auxiliary verbs) (Öz, 2014).

Intelligence quotient (IQ): a standard measure of an individual's intelligence level based on psychological tests (APA, 2023).

Maze behaviors: fragments which do not contribute to meaning in the ongoing flow of language.

Morphology: the branch of linguistics that deals with the internal structure of complex words.

Non-stutter-like disfluencies (NSLDs): include multi-syllabic whole-word and phrase repetitions, revisions, and interjections.

Pragmatic language: refers to the social language skills that are used in daily interactions with others, including what we say, how we say it, non-verbal communication (eye contact, facial expressions, body language, etc.) and the appropriateness of social situations in a given situation.

Speech-language pathologist (SLP): a clinician who works to prevent, assess, diagnose, and treat speech, language, social communication, cognitive-communication, and swallowing disorders in children and adults (American Speech-Language Hearing Association [ASHA], 1993).

Stuttering: an interruption in the flow of speaking characterized by repetitions of sounds, syllables, and monosyllabic words (e.g., "b-b-baby"); prolongations of consonants when it isn't for emphasis (e.g., "ssssssssometimes"); and blocks (inaudible or silent fixation or inability to initiate sounds) (American Speech-Language Hearing Association [ASHA], 1993).

Stutter-like disfluencies (SLDs): core symptoms of stuttering that include part-word repetitions, single-syllable word repetitions, prolongations, and blocking (Ambrose et al., 1993).

Syntax: the study of how words combine to form larger units such as phrases and sentences.

Chapter I

INTRODUCTION

Fluent speech is the result of interaction and coordination of several speech production processes (Levelt, 1989; Lickley, 2017). Throughout connected speech, there are times speech is not fluent due to disfluencies. McAllister and Kingston (2005) discuss that "disfluencies might reflect cognitive processing difficulties at some stage in the speech production system" (p. 260). A speaker must structure the message for the listener, implement syntactic structure and retrieve words. A disorder of fluency is one in which there is an interruption in the flow of speaking characterized by irregular rate, rhythm, and disfluencies (e.g., repetitions of sounds, syllables, words, and phrases; sound prolongations; and blocks), which may also include excessive tension, speaking avoidance, struggle behaviors, and secondary mannerisms (American Speech-Language-Hearing Association [ASHA], 1993). Disfluencies can present as stutter-like disfluencies (SLDs), typical or non-stutter like disfluencies (NSLDs), and atypical disfluencies whose presentation can result in a fluency disorder such as stuttering, cluttering, and/or other disfluencies classified as atypical. These diagnoses can occur separately or together in a person and can be challenging for effective communication (Scaler Scott, 2018). In the school-aged population, students may present with a variety of disfluency types and require assessment by a speech-language pathologist (SLP) to determine if there is a negative impact on communication attributed to the fluency disorder. A fluency evaluation can provide information on how the cognitive, linguistic, and motoric

processes function together (Pirinen et al., 2023). According to Healey & Trautman (2004), comprehensive assessment should include five components associated with disfluency including cognitive, affective, linguistic, motor, and social. To aid in assessment of these areas, Healey (2012) created a criterion-referenced assessment, the CALMS which provides numerical data in the form of ratings on each of the five components.

Notably, assessment becomes significantly more complex when an additional diagnosis is present such as a learning disability or autism spectrum disorder (ASD). Studies regarding speakers with a fluency and concomitant disorder vary in their primary diagnoses, ranging from acquired neurological injuries to Down syndrome, attention deficit hyperactivity disorder, general learning disability and, most often, ASD (Evans & Owens, 2019; Lebrun & Van Borsel, 1990; Plexico et al., 2010; Scaler Scott et al., 2014; Sisskin, 2006; Sisskin & Wasilus, 2014; Stansfield, 1995; Van Borsel et al., 1996, 2005). Disfluencies have often been found in those with ASD, although previous research on school-aged children with ASD has primarily focused on pragmatics and language structure while less is known regarding their fluency skills (Pirinen et al., 2023). Various authors (Ferrier et al. 1991; Hietla & Spillers, 2005; Paul et al. 1987; Shriberg et al., 2001; Sisskin, 2006; Sisskin & Scaler-Scott, 2007; Stribling et al., 2007; Van Borsel & Tetnowski, 2007) have specifically identified stuttering, cluttering, and atypical disfluencies in the speech of persons with high-functioning ASD. Although all types of disfluencies have been found, studies vary in the types of disfluencies present in school-age, adolescents, and adults with ASD and atypical disfluencies are minimally studied. Additionally, there are no known studies that have provided quantifiable ratings of the

cognitive, affective, and social aspects of disfluency in the ASD population. The aim of this study is to analyze quantitative ratings obtained from the CALMS assessment to determine if there is a negative impact on the overall communication in the ASD population. Another aim is to qualitatively examine the types of disfluencies present in the school-aged male participants with ASD and determine if atypical disfluencies are among them. A further inspection and description of the types of fluency disorders and assessments of fluency will be provided.

Chapter II

Review of the Literature

Disfluent speech

Conversational speech has varying rates of disfluency for most individuals. Disfluencies reflect difficulties in planning and delivering speech and certain types of disfluencies (particularly fillers like "uh" or "um") make these difficulties apparent to listeners (Pirinen et al., 2023). Speakers may experience disfluencies when formulating ideas, such as phrase repetitions, revisions of thought and/or interjections (Scaler Scott, 2018). They are thought to account for delays in the speech planning process and are considered non-stutter like disfluencies (NSLDs) (Goldman-Eisler, 1961; Maclay & Osgood, 1959). In some circumstances, disfluencies can provide information to listeners regarding a speaker's confidence (Brennan & Williams, 1995), inform listeners about a speaker's planning difficulties (Brennan & Schober, 2001; Schacter et al., 1991) or potentially act as devices for the coordination of conversational interaction (e.g., fillers may help people manage turn-taking) (Brennan & Kipp, 1996; Maclay & Osgood, 1959; Shriberg, 1996; Wilkes-Gibbs, 1986). In typical speakers, Boomer (1965) found more fillers and silent pauses at the beginnings of sentences and Shriberg (1996) found more disfluencies during varying spontaneous speech tasks as well. Disfluencies are more likely near the beginning of sentences when planning effort is seemingly higher and thus there is an association of disfluencies with the load of planning (Boomer, 1965; Shriberg, 1996). Disfluencies, however, can be excessive and/or present in a manner that is not

considered typical. In these cases, this can lead to a diagnosis of a fluency disorder. Descriptions and assessment of fluency disorders is further discussed.

Cluttering

Cluttering is a fluency disorder that has changed numerous times throughout history (Scaler Scott, 2018). Deso Weiss produced the first published book on this topic in 1964 which provided a broad definition of difficulties with clarity of speech while also exhibiting other symptoms such as impulsivity, pragmatic and motor difficulties. Clinicians had difficulty definitively determining if a person presented with cluttering or whether their behaviors were linked to a concomitant disorder. For instance, certain pragmatic symptoms included in cluttering could also be linked to ASD (Scaler Scott, 2018). Following their research, St. Louis & Schulte (2011) proposed cluttering to be a fluency disorder wherein segments of conversation in the speaker's native language typically are perceived as too fast overall, too irregular, or both. However, the speaker does not need to exhibit the rapid or irregular rate in all situations (Scaler Scott, 2018). The segments of rapid and/or irregular speech rate must further be accompanied by one or more of the following: (a) excessive normal disfluencies; (b) excessive collapsing or deletion of syllables; and/or (c) abnormal pauses, syllable stress, or speech rhythm (Scaler Scott, 2018). The disfluencies that are considered normal refer to what is regularly known in the literature as NSLDs (St. Louis & Schulte, 2011; Yairi & Ambrose, 1992; Yairi & Ambrose, 1999). Regarding NSLDs, the definition does not indicate a minimum percentage to meet criteria for diagnosing cluttering, rather it only specifies "excessive". The research does not yet specify a specific percentage of what constitutes excessive for diagnosis; thus, clinicians are encouraged to consider

"excessive" as having a negative impact upon the speaker's ability to communicate "efficiently and effectively" (Scaler Scott, 2018, p. 18). Secondly, the abnormal pauses, syllable stress, and speech rhythm are different from the atypical prosodic patterns often exhibited by individuals with ASD. For example, the abnormal pauses appear in places where one would not expect them grammatically (Scaler Scott, 2018). Although there is limited research regarding prevalence of cluttering within the general population, experts estimate that between one-third and two-thirds of individuals who stutter also clutter and that the age of onset of cluttering appears to be similar to the age of onset of stuttering, which is between two and four years of age (Howell & Davis, 2011; Ward, 2006). Notably, because lack of awareness is common in cluttering (Scaler Scott, 2011, St. Louis et al., 2007; Weiss, 1964), many cases have gone unidentified. Individuals typically are not diagnosed or do not begin treatment until eight years of age or into adolescence/adulthood (Ward & Scaler Scott, 2011). Clinicians should also recognize that individuals can present with pure cluttering or cluttering with stuttering (Van Zaalen-Op't Hof et al., 2009). Cluttering must also be distinguished from language-related difficulties (e.g., word finding and organization of discourse) and other disorders that have an impact on speech intelligibility (e.g., apraxia of speech, other speech sound disorders, etc.). Pragmatically, cluttering may influence communication skills and awareness of moments of disruption (Teigland, 1996). For example, individuals who clutter may not be aware of communication breakdowns, therefore, they do not attempt to repair them (Scaler Scott, 2018). This may result in less effective social interactions.

Stuttering

Despite decades of research, many scientists continue to struggle with understanding what stuttering is and how to define it. The World Health Organization (2018) defines stuttering as disorders in the rhythm of speech in which the individual knows specifically what he or she wants to say but is not able to say due to an involuntary repetition, prolongation, or cessation of a sound. Wingate (1964), Van Riper (1982) and Guitar (2006) have each also proposed definitions. They agree this disorder causes problems with normal fluency and limits speaking smoothly and naturally. More specifically, Guitar (2006) identifies stuttering as being "characterized by an abnormally high frequency and/or duration of repetitions of sounds, syllables, or one-syllable words, prolongations of sounds, or block of airflow or voicing in speech" (p. 13). SLDs are core symptoms of stuttering and include part-word repetitions, single-syllable word repetitions, prolongations, and blocking, which often occur with tension (Miyamoto & Tsuge, 2021). Secondary behaviors such as head jerking, blinking, facial grimacing, clenching fists, and other types of struggle behavior may also be present (Bloodstein & Bernstein-Ratner, 2008). These secondary characteristics result from the apparent difficulty producing sounds and words (Culatta & Leeper, 1987).

Children who stutter typically produce excessive and/or lengthy breaks in fluency during speech (Gillam et al., 2009). These breaks, or disfluencies, in speech can have a prominent negative effect on a child's participation in a variety of social and academic activities. For example, a child may feel ashamed of his or her stuttering, potentially leading to switching words to avoid stuttering or declining to participate in a class discussion (Scaler Scott, 2018). If he or she is very anxious about his or her stuttering, they may present as more severe than others who are not so anxious. Those who stutter

oftentimes also experience consequences from their stuttering, including anxiety around social situations, lacking control, and negative thoughts or feelings about themselves or communication. (Boyle, 2015; Craig & Tran, 2014; Iverach et al., 2016; Iverach & Rapee, 2014).

History of Stuttering

Stuttering is the most common fluency disorder that has been known for centuries with the earliest descriptions dating back to Biblical times, wherein which the disorder is described as having a "slowness of speech and tongue" (Buchel & Sommer, 2004, p. 0159). Aside from being recognized for thousands of years, this fluency disorder also exists in every language and culture. Stuttering is somewhat unique among communication disorders in that there is a history of vigorous debate surrounding cause and treatment of the disorder (Quesal & Yaruss, 2000). Although the exact cause is not definitely known, many experts believe that children who stutter have a predisposition for the disorder, likely inherited (Gillam et al., 2009). Roughly during the past 40 years, several studies have identified stuttering as "a neurophysiological impairment with genetic contributions." (Gillam et al., 2009, p. 2).

Three lines of evidence reinforce a genetic basis for childhood stuttering. First, children who stutter are substantially more likely to have other relatives who stutter compared to children with typical fluency (Ambrose et al., 1997; Ambrose et al., 1993). Second, a child who stutters is much more likely to have an identical twin who stutters than a fraternal twin who stutters (Dworzynski et al., 2007; Felsenfeld et al., 2000; Howie, 1981). Third, "specific chromosomal regions have been linked to stuttering in several recent gene mapping studies" (Riaz et al., 2005; Suresh et al., 2006, pp. 647-651).

There appear to be intrinsic and extrinsic factors that may also activate stuttering (Yairi & Ambrose, 1992). To determine specifically how speech functions are managed by these genes and the influence of environmental factors, further research is needed (Gillam et al., 2009). Among practicing clinicians, the multifactorial theory of stuttering is conceivably the most accepted theory (Smith, 1990a, 1990b; Smith & Kelly, 1997). This theory suggests that stuttering is likely caused by a mix of factors, including neurological, genetic, and environmental (Scaler Scott, 2018). Notably, these factors present differently in various individuals who stutter. For example, one individual may have mostly neurological factors while another may have a majority of genetic factors (Scaler Scott, 2018). Interaction of the variables is complex, and genetic predisposition may produce stuttering at some point in the individual's life. The stuttering may be brought about by a specific stressful event such as a move or birth of a sibling. The combination of the predisposition, neurological differences, and the stressful event at a specific time is suspected to cause the stuttering, rather than the stressful event alone (Yairi, Ambrose, & Cox, 1996).

Diagnosing Stuttering

All people present with NSLDs when formulating language, which can resemble stuttering. True stuttering, however, is an involuntary interruption of a word the speaker is attempting to say as opposed to what the listener hears and perceives (Perkins, 1990). Eichorn and Donnan, (2021) report "a key feature of stuttering is the internal sense of losing control, followed by overt behaviors, as well as emotional and cognitive reactions in response to the underlying sensation of feeling stuck" (p. 976). This is based on speaker-focused (versus listener-focused) definitions of stuttering. In Bloodstein's view

(Bloodstein, 1981; Perkins,1990), stuttering derives from the person's effort to speak and not from listener perceptions Along these lines, typically fluent speech is not effortful for the speaker.

In the assessment of a suspected child who stutters (CWS), assessments such as the Stuttering Severity Instrument 4th Edition (SSI-4) (Bakker & Riley, 2009) utilize a percentage of syllables stuttered during a conversation sample that equates to a score and severity equivalent. Proposed criterion for a diagnosis of stuttering is that three percent or greater of syllables are stuttered during a sample of connected speech (Conture, 2001). Additionally, certain signs and experiences must be included in their case history (Culatta & Leeper, 1987). This includes early onset (between two and four years of age), being more likely to have relatives who stutter, presenting with secondary behaviors, and responding to behavioral manipulations that can be utilized to elicit differential diagnosis. Behavioral manipulations such as those mentioned by Johnson and Knott (1937) are referred to as an "adaptation effect" where repeated readings of the same material usually cause a reduction in stuttering (Culatta & Leeper, 1987, p. 17). Additional research by Bloodstein (1981) on this effect indicates during the first five readings of a passage, stuttering can be decreased as much as 50 percent. Moreover, a distinguishing marker of a stuttering disorder is that temporary distractions (e.g., arm swings, finger tapping while talking, etc.) will cause momentary speech fluency (Culatta & Leeper, 1987). Of note, the presence of secondary behaviors is not mandatory for a diagnosis (Scaler Scott, 2018),

Part of the diagnostic process is also to distinguish between stuttering disfluencies and disfluencies that occur due to difficulties with language formulation or word-finding. Some children with language disorders may present with false starts, hesitations, use of

fillers such as “uh”, “um” and repetitions of words and phrases considered as maze behaviors. These disfluencies may initially appear as stuttering; however, they are not representative of true stuttering as they are considered NSLDs (Nippold, 1990). Additionally, NSLDs are typically rated by frequency alone while stuttering severity can also be measured by the duration of instances of stuttering (Lickley, 2017).

Stuttering typically emerges in early childhood (Yairi & Ambrose, 2013), more specifically, between the ages of two and four years (Yairi, 2004). At this age, there is accelerated development of syntax and morphology as children gain the ability to produce utterances that are progressively complex (Owens, 2012). The literature oscillates between using the terms stuttering and disfluencies interchangeably, which makes drawing conclusions regarding the relationship between language skills and stuttering difficult. There have been numerous studies that researched the potential correlation between disfluency and linguistic skills, although researchers disagree about how they correlate (Culatta & Leeper, 1987). The Demands Capacities (DC) model of stuttering (Adams, 1990; Starkweather & Gottwald, 1990), argues “when internal or external demands for fluency exceed a child’s capacities in one or more areas of development (e.g., linguistic, cognitive, motoric, emotional), stuttering is likely to occur” (Nippold, 2012, p. 183). As children pass through the developmental stages of learning language, they will be more disfluent at certain times than at others (Culatta & Leeper, 1987). Preschoolers and elementary-age children are more likely to be disfluent when saying syntactically complex utterances than when producing syntactically simple utterances (Bernstein-Ratner & Sih, 1987; Gordon & Luper, 1989; Gordon et al., 1986; Logan & Conture, 1995, 1997). Possibly longer and increasingly complex sentences tax a

weak speech production mechanism, resulting in stuttered speech (Gillam et al., 2009). Furthermore, Soderberg (1967) reported that "lexical and grammatical uncertainty" impacted stuttering in young children (p. 804).

Studies have also suggested that the demands of language therapy and complex language tasks can increase disfluent behaviors in that of children with language disorders (Culatta & Leeper, 1987). For example, a study by Hall (1977) examined two language-disordered children (age nine and ten) who were receiving therapy at the University of Iowa Speech and Hearing Clinic. When placed in an intensive six-week summer residential program that emphasized expressive language skills, researchers observed that the participants became excessively disfluent within a very short period (Hall, 1977). However, as they became increasingly proficient in their language skills, specifically expressive use of syntax, the disfluencies decreased or resolved. The occurrence of disfluencies appears to be a normal one which many children, with normal or abnormal language skills, pass through in the process of acquiring language (Hall, 1977).

Approximately 75 percent of the children who stutter during the preschool years spontaneously recover by age 10 and present with speech fluency skills that resemble those of typical children (Andrews, 1984; Yairi & Ambrose, 1999). This spontaneous recovery occurs when most of their language development has concluded, suggesting that they were struggling more with linguistic formulation of utterances (Perkins, 1990). In many cases, recovery occurs within 12-24 months following onset of the disorder but continuing to stutter more than two years from onset places one at risk for developing persistent stuttering (Yairi & Ambrose, 1999).

Similarly, clinicians must differentiate between stuttering disfluencies and disfluencies that occur when learning a new language. For example, English language learners may have difficulty with word-finding in the second language, and Tellis and Tellis (2003) advise clinicians not to mistake these word-finding problems for stuttering. Perhaps the best approach to measuring stuttering is to consider any of the following (which must also be effortful for the speaker) as representative of stuttering behavior: part-word repetitions that involve either the initial phoneme of a word as a unit or a syllable within the word as one-unit, multiple unit whole-word repetitions, audible or silent sound prolongations, a break in voicing within a word, and a long silent pause between words (Culatta & Leeper, 1987). Verification of a concomitant stuttering problem in a child with language impairment may be improved by considering the relative frequency of fluency breakdowns, their nature, the child's reaction to such breakdowns, positive family history and other typical features of developmental stuttering, such as relatively early onset (ages two to five) (Boscolo et al., 2002). In the absence of such confirmatory findings, clinicians may be witnessing disfluencies that stem more directly from problems in expressive language formulation (Boscolo et al., 2002).

Language Skills in Children Who Stutter

Currently, it is unclear if some CWS have language problems because of their stuttering, stutter because of their language problems, or have two unrelated problems (Nippold, 1990). Some researchers claim that CWS are more likely to present with a language disorder than children who do not stutter (CWNS); although this is not well supported by empirical evidence (Nippold, 2012). Rather, it appears that CWS are as

likely as CWNS to show a range of language abilities (including average, above average and below average levels) on norm-referenced receptive/expressive language assessments and conversation and narrative discourse samples. (Nippold, 2012). Ratner (1997), moreover, finds no convincing evidence that children who stutter have delayed language skills. While the findings are contradictory, studies that indicate CWS are more likely to have a language disorder have not controlled sufficiently for factors that knowingly influence language abilities, such as socioeconomic status, parental education, age, and ethnic and linguistic background (Nippold, 1990). Overall, published peer-reviewed studies that examined a connection between stuttering and language ability in preschool and school-age children do not provide adequate evidence supporting the view that stuttering and language ability are connected (Nippold, 2012). Another factor to consider is that diagnosing word-finding problems specifically can be difficult in this population since CWS often avoid words they fear will cause stuttering, use circumlocutions (use of excessive words to express an idea), hesitate, and/or block (Van Riper, 1982).

Stuttering and the CALMS Assessment

Norm-referenced assessments are commonly used for the assessment of stuttering in school-age children including the Stuttering Severity Index 4 (SSI4) and the Test of Childhood Stuttering (TOCS) (Riley & Bakker, 2009; Gillam et al., 2009). The SSI4 measures stuttering severity in both children (age 2 and older) and adults in the four areas of speech behavior: frequency, duration, physical concomitants, and naturalness of the individual's speech (Riley, 2009). The TOCS is for children between ages four and 12 years of age and has three components: the standardized Speech Fluency Measure, Observational Rating Scales and Supplemental Clinical Assessment Activities. The

Speech Fluency Measure contains four speech production tasks that are used to elicit speech from the child being examined (Gillam et al., 2009).

Criterion-referenced assessments include the Overall Assessment of the Speaker's Experience of Stuttering (OASES) (Quesal & Yaruss, 2006) and the Cognitive, Affective, Linguistic, Motor, and Social Assessment for School-age Children who Stutter (CALMS) (Healey, 2012). The OASES provides clinicians and researchers with an "impact rating" and "impact score", which depict the level of adverse impact for a person who stutters. The impact score incorporates information regarding (a) perceptions about stuttering; (b) the negative affective, behavioral (actions), and cognitive reactions that the speaker has to stuttering; (c) the functional communication difficulties a speaker may have in a variety of speaking environments; and (d) how stuttering impacts the speaker's overall quality of life (Yaruss & Quesal, 2006). The feelings a client experiences are known as the affective components of stuttering, and the thoughts are known as the cognitive components of stuttering (Yaruss & Quesal, 2006).

The CALMS also follows the principle of criterion-referenced testing in that the data acquired from the CALMS assessment for each child reflect their current level of performance (Healey, 2012). This assessment is designed to be a supplement to the standardized tests available and examines a broad range of factors that are commonly linked to stuttering (Healey, 2012). Healey (2012) developed the CALMS for school-age children who stutter because several studies have demonstrated that SLPs do not feel comfortable or competent to work with CWS (Brisk et al., 1997; Cooper & Cooper, 1996; Kelly et al., 1997; Tellis et al., 2008). Thus, this assessment was developed to aid clinicians in feeling more confident and comfortable evaluating stuttering in addition to

providing guidelines on translating assessment results into therapy goals and objectives. The CALMS can be used alone or in combination with other standardized measures of stuttering. Mainly, this assessment can be used to comprehensively view stuttering in each child, design appropriate therapy activities and materials and monitor progress made in therapy (Healey, 2012). SLPs can use the CALMS assessment to gather information regarding five factors thought to accompany stuttering. This includes the cognitive, affective, linguistic, motor, and social areas.

There are twenty-three items which assess the five areas mentioned (cognitive, affective, linguistic, motor, and social). While some item ratings are more objective than others, field testing of the CALMS has been conducted to ensure the rating criteria are as clear and objective as possible (Healey, 2012). The assessment does not provide normed scores; rather, it rates each area on a severity scale of 1-5 (1 = normal, no concern, high ability; 2 = borderline, slight concern, good ability; 3 = mild impairment, some concern, variable ability; 4 = moderate impairment, significant concern, poor ability; 5 = severe impairment, extreme concern, very poor ability). In addition, the assessment compares a student's strengths, while highlighting their needs.

Cognitive Component

The cognitive component is designed to determine what a student knows about stuttering in general (facts) as well as what they know about their own stuttering (identification, strategies). Five separate cognitive component items were developed to assess a child's awareness, knowledge, and understanding of stuttering. The first three items focus on an assessment of the child's awareness of stuttering. The fourth item assesses a child's basic knowledge of general facts about stuttering and the fifth item

addresses a child's understanding of the techniques or strategies he/she has been taught in treatment. When evaluating thoughts and perceptions, a rating of "1" refers to positive thoughts/no concerns about being a person who stutters and positive perceptions of how others view stuttering. A rating of "5" reflects extremely negative thoughts, reactions, and perceptions.

Affective Component

The items in the affective component were developed to assess a child's feelings, attitudes and emotions associated with stuttering. All ratings for this component come from student responses to short questionnaires. Examples include, "How often do you feel ___ about your stuttering?" and yes/no questions regarding attitudes about talking.

Linguistic Component

One of the main goals of the linguistic assessment is to determine how much the linguistic complexity of the message contributes to the frequency and severity of stuttering (Scott et al., 1995). Two other items are provided for determining the child's level of language and speech sound production abilities depending on the need to conduct a speech sound and/or language assessment. Assessment of language and speech sound production is important because these skills could coexist with stuttering (Ardnt & Healey, 2001). The testing begins with simple, automatic speech and ends with an expository narrative. The use of narratives provides an efficient way of eliciting stuttering-like behaviors (Byrd et al., 2012). Language ability and speech sound production ability are rated based on scores on a standardized assessment.

Motor Component

The motor component of a child's stuttering is viewed as the factor that is directly associated with the disruptions in the motor production of speech (Healey, 2012). Disruptions within the motor system contribute to various types, forms, and frequencies of disfluent speech. The measures of this component are used to determine the current form, frequency, duration, and severity of stuttering. A speech sample from the child's connected speech of approximately 200-300 words is used to evaluate the typical form of the child's stuttering (Healey, 2012). From the speech sample, the types of disfluencies, a measure of the number of units produced per repetition, the speed and regularity of any repeated units, and an evaluation of the degree of struggle and/or effort the child displays during stuttering events are obtained.

Social Component

The final component of the CALMS assessment is social and is concerned with how various speaking situations impact a child's stuttering. This component focuses on the measures of avoidance that occur in words or people, how often stuttering occurs in various types of speaking situations, how interactions with other people in the child's life impacts stuttering, and questions about how stuttering impacts the child's school performance.

Atypical Disfluencies

There is a growing literature that reports children who display impaired fluency and behaviors similar to stuttering, but who present differently from those with developmental stuttering and cluttering (Sisskin & Wasilus, 2014). Unlike developmental stuttering, wherein which disfluencies occur primarily at the beginning of words or occur over the entire word, atypical disfluencies include both word-final and word-medial

disfluencies. Unfortunately, this clinical problem is minimally addressed (Sisskin & Wasilus, 2014). Sisskin and Wasilus (2014) were the first to define the term atypical disfluencies formally in the literature. Their definition includes word-medial repetitions (e.g., "ba-a-a-a-ck"), prolongations (e.g., "hassss"), sound insertions (e.g., "ri-uh-ce") and word final repetitions (e.g., "boy-oy"). Prior to this formal definition, one type of atypical disfluency, word-final disfluency (WFD), had been documented in the literature since 1984 (Scaler Scott, 2018). In case studies by Sisskin (2006) and Plexico et al., (2010), WFDs tended to co-occur with frequent vowel breaks, sometimes referred to as mid-syllable insertions (e.g., "we-he") or within-word breaks (e.g., "o_p_en"). WFDs also appeared more frequently on multisyllabic versus monosyllabic words, content versus function words, and at the end of phrases or clauses (Evans & Owens, 2019; Van Borsel et al., 1996, 2005). A review of case studies examining atypical disfluencies reveals the age of onset may not be until eight years or older and spontaneous recovery has often been reported in those with previous presentation (Tetnowski et al., 2012). A lack of clarity regarding this form of disfluency and its appropriate diagnostic classification exists due to two reasons: the amount and types of objective data and focus of analysis varying considerably across case studies (Eichorn & Donnan, 2021). Clinical decision making must aid in determining if atypical disfluencies are impacting a child's ability to communicate in their speaking environments.

Characterizing Atypical Disfluencies

Several reports describe a specific type of atypical disfluency (WFD) in the literature, published research and clinical practice are not clear on how to characterize these behaviors and whether to give them their own classification (Brejon Teitler et al.,

2016). Alternative classifications include palilalia (Van Borsel et al., 1996), a type of motor stereotypy or compulsive repetitive behavior (Alm, 2004), or an inability to terminate syllables (MacMillan et al., 2014). Palilalia, a neurogenic speech disorder in which fluency is disrupted, is described by Lapointe and Horner (1981) as being characterized by compulsive repetition of words and phrases. Part of these repetitive behaviors may relate to increased repetitions among some with ASD and/or increased ability to terminate a final sound when speaking (Scaler Scott et al., 2014). According to Sisskin (2006), in palilalia, the repetitions of final phrases often increase in rate and decrease in intensity as they move through the utterance. However, these same features are not seen with the atypical disfluency, final phrase repetition; thus, this is not likely to adequately explain this phenomenon. Based on their analysis of a single male child with ASD, Sisskin and Wasilus (2014) speculated that WFDs may be a verbal form of perseveration because these disfluencies were reduced through learning of self-regulation skills. Such skills included identification to increase awareness and self-monitoring followed by correction. Another possible explanation is that the effects of word length and function, language complexity and task difficulty stress the language operating system (Tetnowski, 1998). Healey et al.'s (2015) data analysis of a school-age boy with ASD suggests there is a higher percentage of WFDs present when the c-units were complex, longer in length, of high interest, and initiated by the participant. A c-unit is defined as a main clause (subject and predicate) with all subordinate clauses attached and increased demand on any of these variables can cause disfluency. Additionally, WFDs have been described in the literature as difficulties with termination of sounds and it has

been proposed that perhaps this difficulty with the termination of a sound relates to an individual seeking sensory feedback (Scaler Scott et al., 2014).

Researchers have not yet ruled out the possibility that word-final repetition is a subtype of developmental stuttering (Sisskin & Wasilus, 2014). In addition to the documentation of spontaneous recovery in stuttering, spontaneous recovery has been documented with WFDs in both preschool years and later school-age years (McAllister & Kingston, 2005; Mowrer, 1987). Additional data are needed to clarify whether this clinical profile represents a separate disorder, a subtype of stuttering disorders, or simply a less common form of developmental stuttering.

Eichorn and Donnan (2021) completed a case study involving a school-aged monolingual English speaker with an unremarkable medical history who exhibited WFDs as the most notable form of disfluency with an onset of age three. Combined results of subjective measures indicated he was aware of his disfluencies and showed negative reactions based on a high impact score on a self-rating. Findings from this study highlighted the need for integrated assessments that consider stuttering behaviors as well as attitudes and perceptions of children with atypical disfluencies to fully understand the impact of these disfluencies and select appropriate interventions (Eichorn & Donnan, 2021). Knowledge of the varying fluency disorders is critical to ensure that children with atypical disfluencies are "readily identified, accurately diagnosed, and able to access appropriate interventions" (Eichorn & Donnan, 2021, p. 973).

Awareness of Atypical Disfluencies

Although negative reactions tend to emerge in most children who continue to stutter beyond the preschool years (Bloodstein, 1960; DeNil & Brutten, 1991; Yaruss et

al., 2010; Yaruss & Quesal, 2006), the negative reactions are not reported consistently in speakers with atypical disfluencies. Most published accounts of WFDs describe a lack of awareness and concern (Eichron & Donnan, 2021). However, with WFDs, the level of associated awareness or speech-related concern in the speaker has been on a continuum ranging from no awareness to negative feelings (Eichorn & Donnan, 2021). Sisskin and Wasilus (2014) found that an undisclosed amount of clinical reports and case studies of children with atypical disfluencies have reported them to display various levels of awareness, frustration, and secondary behavior. Most of the children with atypical disfluencies, however, displayed few affective or cognitive components or secondary behaviors during moments of disfluency. Overall, it has been documented that clients with atypical disfluencies present as unaware of their condition. Possibly, the previously reported absence of negative reactions is influenced by the fact that many available studies of WFDs involve children with ASD (Plexico et al., 2010; Scaler Scott et al, 2014; Sisskin, 2006; Sisskin & Wasilus, 2014), who tend to have more limited self-awareness than typically developing children.

Autism spectrum disorder

According to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) released by the American Psychiatric Association (APA, 2013), ASD is a pervasive neurodevelopmental disorder characterized by impairments in social communication and restricted, repetitive patterns of behavior, interests, and activities. To receive a diagnosis of ASD, such deficits must be observed in childhood in multiple environments and have a negative impact upon daily functioning (Scaler Scott, 2015). The DSM-5 (APA, 2013) used an all-encompassing term, autism

spectrum disorder, to describe a combination of the previous diagnoses of Asperger's disorder, autistic disorder, childhood disintegrative disorder and pervasive developmental disorder not otherwise specified (PDD-NOS) (Hiller et al., 2014). Individuals on this spectrum are classified by varying degrees of severity including a broad range of ability levels (Lord & Bishop, 2015). Classification by severity depicts a more definite description of similarities and differences between individuals and aids in discussions on prognosis (Peters, 2022). Mehling and Tassé (2016) found that classification of severity levels has often varied. ASD severity has been informally assigned based on IQ, language acquisition/functioning levels and severity of behavior problems noted in multiple studies (Gotham, et al., 2012; Weitlauf et al., 2014). Other researchers have classified severity level based on direct measures of ASD symptomology such as the Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 2012) and the Autism Diagnostic Interview, Revised (ADI-R) (Le Couteur et al., 2003). Multiple studies have additionally classified severity levels of individuals based primarily on intellectual functioning (Di Rezze et al., 2012; Nicholas et al., 2008). However, solely using IQ may not sufficiently depict variability across the intricate domains of ASD such as core ASD symptomology, cognitive functioning, adaptive functioning, and expressive language levels (Di Rezze et al., 2012).

Neurocognitive functions also play an important role in the core behaviors of ASD (Demetriou et al., 2018). Executive functioning (EF) deficits specifically are proposed by some researchers as a core issue in ASD (Ozonoff et al., 1991). Individuals with a diagnosis of ASD performed on average significantly worse on EF tasks in comparison with neurotypical controls in their meta-analyses that conducted an

evaluation of the role of EF in ASD (Demetriou et al., 2018). Executive functioning is an umbrella term that refers to capacities needed to manage and allocate one's cognitive resources during cognitively challenging activities (Diamond, 2013). This may include deficits in attention to task, self-awareness and self-monitoring, goal setting, inhibiting responses, retrieval, working memory, phonological encoding, cognitive flexibility, problem solving and task persistence (Scaler Scott, 2018). EF has long been of interest given its proposed role in contributing to specific impairments in ASD in the areas of theory of mind and social cognition, social impairment, restricted and repetitive behavior patterns as well as broader impacts on quality of life (Demetriou et al., 2018). Despite extensive research, however, including several meta-analyses and reviews, the role of EF in ASD remains unclear (Demetriou et al., 2018).

Working Memory in autism spectrum disorder and its Impact on Disfluency

While disfluent speech has been found to be a common characteristic in case studies of school-aged children with ASD, there is limited research regarding specifically if and/or how executive functioning deficits impact disfluency (Scaler Scott et al., 2014). Scaler Scott (2018) proposes that working memory plays an important role in fluent conversation as this function is suspected to be required in conversation or monologue contexts. Working memory specifically includes the skill of holding information in one's mind to carry out a task and is pivotal in advancing the conversation (Scaler Scott, 2015). Interruptions in the functioning of the working memory can lead to the loss of one's train of thought and in such cases, conversational speech can be highly disfluent (including NSLDs like revisions and interjections) (Scaler Scott, 2015). Furthermore, a role of working memory in disfluency has been supported by a case study by Scaler Scott et al.,

(2014). The case study found an increase of WFDs in a small school-age group with atypical disfluencies when they were interrupted, and their working memory was taxed. Although this has minimally been investigated, it is also possible that those with ASD who exhibit WFDs may use excessive NSLDs as placeholders to regain their trains of thought (Ozonoff et al., 1991). The disfluencies may be excessive due to deficits in working memory, which is considered to be an executive functioning deficit in ASD (Ozonoff et al., 1991). In pilot studies, some individuals with ASD who produce WFDs have decreased their use of WFDs with increased pausing (Scaler Scott et al., 2014). This suggests that perhaps WFDs also function as an atypical way to accommodate for an overload on working memory (Scaler Scott, 2015).

Disfluency in autism spectrum disorder

At present, there remains limited research on fluency disorders with ASD, and not much is known about the various types of stuttering associated with this disorder (Miyamoto & Tsuge, 2021). However, previous studies have demonstrated that many speakers with ASD produce disfluent speech and have discovered disfluent patterns in those with ASD at both the linguistic level (i.e., cohesiveness of the message) and at the speech level (i.e., fluency of production of speech sounds and syllables) (Scaler Scott et al., 2014; Shriberg et al., 2001). Most of these studies are case studies since it is difficult to obtain information regarding disfluency in ASD through random, quantitative data collection (Miyamoto & Tsuge, 2021). SLDs, NSLDs, and atypical disfluencies have been reported in children and adults with ASD through analysis of small sample or single subject case studies. Plexico et al. (2010) evaluated 8 verbal children with ASD between the ages of three and five. In addition to administering a battery of standardized

assessments and participating in a structured play sample, the researchers administered the Stuttering Severity Instrument Third Edition (SSI-3; Riley, 1994). Although they did not have a clinical diagnosis of stuttering, all the young children with ASD in this study produced disfluencies. Four of the participants received a disfluency severity rating of "very mild", three were rated as "mild", and one was rated as "moderate". In addition to SLDs and NSLDs, the children with ASD also produced atypical disfluencies such as final sound and syllable repetition (e.g., 'football-ball') with an average of .36% of syllables.

Although all children and adults with ASD may have a fluency disorder in terms of fluency of speech, many ASD individuals have difficulty expressing their messages fluently (Ochs & Solomon, 2004). Difficulties with verbal organization may be the cause and may result in multiple revisions (Scaler Scott, 2018). Since revision is closely related to linguistic ability, it is predicted that syntactic errors may be the reason for the high incidence of revision in individuals with ASD (Miyamoto & Tsuge, 2021). Impairments in language formulation are offered as alternative explanations for disfluencies in those with ASD.

Disfluency is merely one of many potential communication difficulties for a child with ASD. This area can easily be placed low on the list of priorities when there may be several communication deficits with students with ASD that require intervention (Scaler Scott et al., 2014). The majority of SLPs would likely agree that pragmatic language is a high priority treatment goal for a child with ASD (Prizant et al., 2003). As has been discussed in the literature, because of the many other socio-pragmatic challenges and communication issues in those with ASD, speech disfluency and its role in overall

communication may not have received the needed attention (Scaler Scott et al., 2014; Smith et al., 2017). However, if one considers factors related to disfluency that may exacerbate weak pragmatic communication skills, such as secondary behaviors or lack of clarity in communication due to excessive revisions, the importance of understanding disfluency in this population becomes more apparent (Scaler Scott et al., 2014).

Both fluency disorders and ASD can make communication challenging and can result in negative psychosocial consequences (Conture, 1999; Whitehouse et al., 2009). With SLDs, excessive NSLDs, atypical disfluencies and cluttering being identified in individuals who are in preschool, school-age and adults with ASD, evaluation of fluency should be considered by SLPs when completing speech-language evaluations with this population (Scaler Scott, 2015). Individuals with fluency disorders also frequently experience behavioral, emotional, and social impacts because of their communication disorder (Tichenor & Yaruss, 2019). Thus, regardless of the type of fluency disorder present, the affective and cognitive components should be explored, especially since awareness and response to disfluencies varies (Scaler Scott, 2015). "SLPs need to examine the potential impact of the disfluency patterns (including stuttering and non-stuttering like, and atypical disfluencies) upon each individual's overall effectiveness and efficiency of communication." (Scaler Scott et al., 2014, p. 85). In cases of individuals with ASD, the students may be minimally concerned about their disfluencies. If they are not embarrassed by their difficulty producing fluent speech, they will be able to speak positively in all classroom activities without feeling awkward (Miyamoto & Tsuge, 2021). However, those with ASD have also been found to present with disfluencies characterized by affective, cognitive, and behavioral components, as well as secondary

behaviors and avoidance (Scaler Scott et al., 2014). Therefore, not all are lacking in awareness, and not all are unaffected by their difficulties with fluency.

Atypical Disfluencies and autism spectrum disorder

Notably, atypical disfluencies are not usually observed in children with typically developing speech or developmental stuttering (Yairi & Ambrose, 2005). Atypical disfluencies have been identified in several small case studies as an additional characteristic and unique disfluency type in the speech of children and adolescents with ASD (Hietla & Spillers, 2005; Plexico et al., 2010; Scott et al., 2007; Sisskin, 2006). While all disfluencies have been documented in children and adults with ASD, (Hietla & Spillers, 2005; Scaler Scott & Sisskin, 2007; Shriberg et al., 2001; Sisskin, 2006) research on this topic is rather limited and atypical disfluencies are the least studied in the literature. A case study by Scaler Scott et al. (2014) includes all the disfluency types in comparing the fluency of children with ASD with CWS and children with no diagnosis. The total sample consisted of 33 males in grades four through seven and were divided into three groups of 11 (children with ASD, CWS, and children with no diagnosis). The authors reported that atypical disfluencies were considerably more prevalent in ASD children (found in 72% of the group with ASD) when compared with typically developing peers or CWS. In this case study, the atypical disfluencies among the group of children with ASD appeared differently than moments of stuttering. For example, during moments of production, the repetition appeared following a delay and there was minimal to no apparent tension occurring with the atypical disfluencies (Scaler Scott et al., 2014). Such characteristics were not noted among the other two participant groups, suggesting that WFDs may embody a type of disfluency different from stuttering which is seen more

often in the ASD population than in CWS and children with no diagnosis (Scaler Scott et al., 2014).

Purpose of the Study

While prior studies have examined types of disfluencies present in individuals with ASD, there is a paucity of research regarding atypical disfluencies in ASD and assessment of the five components that accompany fluency disorders in this population. A comprehensive and criterion-referenced assessment that addresses all components associated with disfluency is necessary to provide specific information on the types of disfluencies with which the child presents, in addition to the impact on their overall communication. Due to the serious negative impact the affective and cognitive components can have upon overall communication, fluency evaluations are incomplete if the affective, behavioral, and cognitive components are not all thoroughly explored (Scaler Scott, 2018). The CALMS model assesses all these components by providing numerical ratings that equate to a level of severity and has not been documented as being used for the assessment of fluency disorders in those with ASD and/or atypical disfluencies. The current study aims to determine the types of disfluencies present during numerous verbal tasks aligned with the CALMS assessment (SLDs, NSLDs, atypical disfluencies) in four school-aged males diagnosed with ASD and the total score the participants will receive based on ratings from the CALMS assessment. The research questions are:

1. With what types of disfluencies will the participants present in the study during a conversation sample of at least 300 words?

2. Will there be a determined negative impact of these disfluencies on communication for each participant revealed by their total score on the CALMS (a total score of 3 or higher on the CALMS)?

It is hypothesized that the students will 1) present with a higher percentage of atypical disfluencies versus SLDs and NSLDs as atypical disfluencies have been found to be more common in participants with ASD than in both neurotypical controls and controls who only had a fluency disorder diagnosis (Scaler Scott et al., 2014). Additionally, the participants have not been previously referred, evaluated, or treated for a fluency disorder, and stuttering speech patterns are often easily identifiable by clinicians and caregivers (Prasse & Kikano, 2008). It is additionally hypothesized that 2) the participants will not be determined to have an overall negative impact on communication as determined by the CALMS assessment given many students with ASD present as unaware of their disfluencies.

Chapter III

METHODOLOGY

Research Design

This is a case study that included four elementary-aged male students. This methodology was chosen because case studies intensely focus on a single phenomenon within contexts of real-life (Yin 1994; Yin 1999). Fluency disorders in the ASD population represents the single phenomenon and the CALMS assessment represents a variety of real-life contexts. The methodology used tools from the CALMS assessment to collect quantitative and qualitative data.

Recruitment and Informed Consent Procedures

Approval from the Valdosta State University Internal Review Board (Appendix A) in addition to permission from Gwinnett County Public Schools via the Local School Research Form (Appendix B) was obtained preceding initiation of participant enrollment. Participation in the study was voluntary and parents/caregivers were provided informed consent in their native language and required their signature to confirm their child's participation. Two of the participants are currently on the researcher's caseload at the

elementary school and the subsequent two are on an additional SLP's caseload at the same school. Thus, the researcher has access to the district wide Gwinnett County Public School database entitled Synergy which contains participant data such as their demographics, previous evaluations, individualized education plans, etc.

Participant Criteria

This study included four verbal elementary school-aged male students with a primary diagnosis of ASD and a secondary diagnosis of speech/language impairment. The participants vary in their racial and cultural backgrounds, with ages ranging from seven to 11 and grades two to five at the same elementary school. These participants were chosen due to teacher, parent, and/or SLP concern regarding their fluency skills during conversation. While all four have a secondary diagnosis of speech/language impairment, none of the four students have fluency goals/objectives, nor have they been formally assessed for fluency.

Participant One

Participant one is an eight-year-old, second grade student of Asian race/ethnicity given the pseudonym, Ryan. He has been exposed to both Mandarin and English; however, Yi Hwang Academy of Language found him ineligible for English Language Learning services in March of 2021. The scores from the assessment that determined him ineligible were not provided or available. Ryan was diagnosed with ASD by Gwinnett County Public Schools in May of 2022 at the age of seven. For this evaluation, he was administered the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-5) (Wechsler, 2014) and received a full-scale IQ of 112 (100 is average). He is currently

served in a GCPS Autism Level 4 program where he receives all academics in the general education setting with paraprofessional support. He additionally receives social skills support from a special education teacher in a separate small group classroom.

Participant Two

Participant two is a nine-year-old, third grade student of Hispanic race/ethnicity given the pseudonym, Sean. He has been exposed to both Spanish and English; however, assessment using the Woodcock Johnson IV Test of Oral Language (Schrank et al., 2014) administered by a school psychologist in February of 2020 indicated that the participant's proficiency in English is significantly higher than Spanish. In English, the Oral Language score was an 86, Picture vocabulary an 89, and Oral Comprehension an 84. In Spanish, the Oral Language, Picture Vocabulary and Oral Comprehension scores were all less than 40 indicating the very low range. The assessment team determined his primary language is English. Sean was diagnosed with ASD by Gwinnett County Public Schools on May 8th of 2020 at the age of six. For this evaluation, he was administered the WISC-5 (Wechsler, 2014) and received a full-scale IQ of 109 (average is 100). He is currently served in a GCPS Autism Level 4 program where he receives academic instruction for Reading, Writing and Math in a resource classroom instructed by a special education teacher and instruction in Science and Social Studies in the general education classroom with paraprofessional support. He additionally receives social skills instruction from a subsequent special education teacher in a separate small group classroom.

Participant Three

Participant three is a nine-year-old, fourth grade student of African American race/ethnicity given the pseudonym Kyle, who solely speaks English. He was diagnosed

with ASD on May 24th of 2018 by the School District of Palm Beach County at age five. Kyle was further evaluated by GCPS in April of 2022 and was administered the Reynolds Intellectual Assessment Scales (RIAS-2) (Reynolds & Kamphaus, 2015). He received a Composite Intelligence Index of 80. Kyle is currently served in a GCPS Level 3 program where he receives instruction in all academic areas and social skills in a self-contained special education classroom with a special education teacher and paraprofessionals. Students in the ASD Level 3 program receive grade-level academic instruction along with social skill and behavioral training throughout the school day.

Participant Four

Participant four is an 11-year-old, fifth grade student of Asian race/ethnicity given the pseudonym, Marty, who solely speaks English. He was diagnosed with ASD in 2016 (an exact date is not provided or available) by a licensed clinical psychologist. He was further evaluated by a GCPS school psychologist in March 2022 where he was administered the WISC-5 (Wechsler, 2014) and received a full-scale IQ of 84 (average is 100). Marty is currently served in a GCPS Level 3 program where he receives instruction in all academic areas and social skills in a self-contained special education classroom with a special education teacher and paraprofessionals.

CALMS Administration

Tables 1-5 depict individual numerical values for the rating scales in each component of which there are five overall components (Cognitive, Affective, Linguistic, Motor, Social). A rating of 1 indicates function is considered within normal limits in terms of behavior, performance, ability, attitude, or perception. Formal assessment data are well within normal limits. A score of 2 indicates slight variation or some concern

about behaviors, performance, abilities, attitudes, or perceptions. Formal assessment data show standard score of .5-1.4 standard deviations below normal level. A score of 3 indicates clinical judgment suggests a "mild" degree of difficulty or deficit in certain functions. This score also suggests that behaviors, performances, abilities, attitudes, or perceptions are just below expected levels of function. Formal assessment data show standard score of 1.5-1.9 standard deviations below normal level. A score of 4 indicates clinical judgment suggests a "moderate" degree of difficulty in certain functions and suggests that behaviors, performances, abilities, attitudes, or perceptions are consistently below expected levels of function. Formal assessment data show standard score of 2.0-2.4 standard deviations below normal level. A score of 5 indicates clinical judgment suggests a "severe" degree of difficulty in certain functions and additionally suggests that behaviors, performances, abilities, attitudes, or perceptions are substantially below expected levels of function. Formal assessment data show standard score of greater than 2.5 standard deviations below normal level.

The CALMS assessment was administered to each of the four participants individually in the researcher's therapy room. The area initially assessed was the cognitive component, involving five separate items all of which were audio recorded. Audio recordings were obtained on the researcher's iPhone which is secured via a code known only to the researcher. The recordings were subsequently downloaded from the iPhone onto a password protected computer.

Cognitive Component

The first task of the cognitive component was to explore the participant's awareness of stuttering during reading. For this item, a reading passage that is at least one

grade level below their current reading ability was provided to the participant and the examiner kept a subsequent copy. The reading level of the participants was determined by their special or general education teacher. The participant read one sentence at a time and after each sentence was read, the examiner asked them, "How many times did you stutter while reading that sentence?" As the participant read each sentence, the examiner placed a check mark above the word that was stuttered and wrote down how many stuttering events the participant reported on their copy of the passage. This was done for all sentences in the passage. Then the examiner added up the total number of stuttering events the participant identified and divided that number by the total number of stuttering events produced.

For inter-rater reliability, a second elementary speech language pathologist was utilized. She was provided the instructions prior to listening to the participants read the passage and was provided her own copy to write down how many stuttering events occurred and how many the participant identified. She listened to the participants read the passage live and simultaneously with the examiner. The second SLP has worked in the elementary setting for 20 years and is familiar with fluency disorders and students with ASD. The definitions and examples of stutter-like, typical, and atypical disfluencies were provided to the second SLP. A score of one to five was given based on the percentage of identified stuttering events (e.g., "100-80% events identified was rated a one and 19-0% events identified was rated a five).

The next item was to determine the participant's awareness of stuttering in spontaneous speech. The participant was given the following directions, "I want you to talk a lot about something you do at school. While you are telling me the information,

I'm going to stop you by putting up my hand and ask you a question about your stuttering. So, think about all that you want to tell me and start when you are ready." While listening to the story, the examiner (and second SLP) made a dash on a piece of paper to indicate when a stuttering event (stutter-like, typical, and atypical disfluency) occurred. After each utterance, the examiner held up her hand and asked how many times the participant stuttered in that utterance. The examiner wrote down the number the participant said and placed it next to their count for that segment. The examiner told the participant to continue, and a new section of marks was given for each utterance as the participant continued, until they reached at least 300 words which is advocated as the minimum amount for a conversation fluency sample (Manning & DiLollo, 2018; Yairi & Seery, 2015). If the student ceased spontaneously conversing on this topic, verbal cues such as "What's your favorite subject?" "What do you do during recess?" and/or "Who has been your favorite teacher and why?" were provided to elicit further conversation. The examiner then calculated the number of stuttering events identified by the participant and divided that number by the number of marks on the piece of paper they made while listening to the participant's speech. The average percentage converts into a rating on the CALMS scale.

The third item was to determine a participant's awareness of stuttering when produced by another speaker. The script for this task was an adaptation of the standard reading passage called the Rainbow Passage (Fairbanks, 1960) where the examiner imitates types of stuttering on specific parts of the passage. The participant is provided the following directions, "I am going to read you a story and I will stutter on certain words. I'm going to read one sentence at a time and then I will ask you how many times I

stuttered while reading a sentence." Once all four sentences were produced with the target stuttering events, the examiner (and second SLP) added up the total number of stuttering moments the participant correctly identified and converted that number to a percentage (e.g., seven out of 10 would be 70%). This percentage converted into a rating on the CALMS assessment scale.

The last item was to determine the participant's knowledge of stuttering by having them complete a quiz containing questions true/false or yes/no questions regarding stuttering. The child was given a copy of the quiz and the examiner stated, "Let's find out what you know about stuttering. Do your best to come up with a yes or no answer". The examiner read 10 questions, one at a time and the participant answered yes or no. The number of correct answers was converted to a CALMS rating (e.g., nine-10 correct answers was a one whereas two or fewer correct answers was a five).

Table 1

Items and Ratings of the Cognitive Component

Item	1	2	3	4	5
1. The participant identified stuttering __% of the time during oral reading	100-80%	79-60%	59-40%	39-20%	19-0%
2. The participant identified stuttering __% of the time in spontaneous speech	100-80%	79-60%	59-40%	39-20%	19-0%
3. The participant identified stuttering __% of the time from researcher's model	100-80%	79-60%	59-40%	39-20%	19-0%
4. Determine the participant's knowledge of general facts about stuttering	9-10 correct answers	7-8 correct answers	5-6 correct answers	3-4 correct answers	2 or less correct answers

Affective Component

The second area assessed was the affective component which was developed to assess feelings, attitudes and emotions associated with stuttering. All ratings for this component come from four short questionnaires that the participant completed and were

given a score based on the responses. The more points the participant scored, the more negative the attitude toward communication. The participant was provided a copy of all questionnaires and the examiner read aloud each question for the participant to answer.

Table 2

Items and Ratings of the Affective Component

Item	1	2	3	4	5
1. Rating based on average score of marked categories for Section A "How often participant feels bad about…"	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)
2. Rating based on average score of marked categories for Section B "How often participant feels ___ about stuttering."	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)
3. Determine participant's attitudes and feelings about communication for Section C "Attitudes About Talking."	Total Score 0-2	Total Score 3-4	Total Score 5-6	Total Score 7-8	Total Score 9-10

Linguistic Component

The third area for assessment was the linguistic component to determine how much the linguistic complexity of the message contributes to the frequency and severity of stuttering (Healey, 2012). The testing began with simple, automatic speech (i.e., counting from 1-10), then to sentence repetition, followed by picture description (each participant was shown the same picture that depicted some type of action, and the participant was told, "Tell me what's going on in this picture". Subsequently, the participant was shown a series of pictures that tell a story from a written script which was provided with the CALMS assessment, the participants were provided the following instructions: "Here are some pictures that tell a story about a little girl who has a cat that gets stuck up in a tree and her father tries to help get the cat down. I'm going to tell you the story only one time, then I want you to tell me the story again as you look at the pictures. Ready?". Next, the participant listened to a story and retold it in their own words

(the story was provided with the CALMS assessment), which was followed with a script narrative during which the participant discussed the typical sequence that takes place during an event. They were asked, “Tell me what you do when you go to a restaurant.” The final step was an expository story retell, which is the most complex linguistic task, during which the participant retold an expository passage based on their reading level. They were told the following, “I am going to read you a passage and here is a copy for you to follow along”. The examiner read the expository passage aloud to the participant, then took the passage from the participant and stated, “I just read the passage (name of passage) and now I’m going to take your copy back. Please tell me everything you remember about what you just heard.”

The examiner administered all tasks and marked on which task they heard a substantial (double the % of syllables stuttered from the previous task) increase in frequency of stuttering. Each area was recorded via an iPhone and percent syllables stuttered calculated using the Computerized Scoring of Stuttering Severity, Second Edition (CSSS-2.0) (Riley & Bakker, 2009). This software facilitates the calculation of frequency and duration by producing a record of the percentage of syllables stuttered (frequency) and duration of the three longest stuttering events. The rating associated with the specific task that had the substantial increase in frequency of stuttering was entered in the CALMS Linguistic Component section of the assessment.

Assessment of language and speech sound production is additionally significant because these skills could coexist with stuttering (Ardnt & Healey, 2001); thus, each participant was administered the Goldman Fristoe Test of Articulation, third edition (GFTA-3) to assess their speech sound production and were administered the Oral and

Written Language Scales, second edition (OWLS II) to assess receptive and expressive language skills (Goldman & Fristoe, 2015; Carrow-Woofolk, 2011). In the linguistic portion of the CALMS, the level of impairment is rated between 1 (normal limits) to 5 (severe impairment) based on the severity of the deviation from an average standard score of 100. For example, a rating of 5 would include test data that had a standard score greater than 2.5 standard deviations below 100.

Table 3
Items and Ratings of the Linguistic Component

Item	1	2	3	4	5
1. Determine the level of linguistic complexity at which the participant begins to display a high frequency of stuttering	When the participant produces an expository narrative	When the participant produces a script narrative	When the participant retells a story that was read to them	When describing a picture or retelling a story from a sequence of pictures	When performing an automatic speech task or a sentence repetition task
2. Rate language ability from formal assessment	Within normal limits	Borderline performance	Mild impairment	Moderate impairment	Severe Impairment
3. Rate speech sound production ability from formal assessment	Within normal limits	Borderline performance	Mild impairment	Moderate impairment	Severe Impairment

Motor Component

The fourth area for assessment was the motor component. The measure of this component is used to determine the current types and percentage of syllables stuttered. The same 300-word conversation sample from the cognitive component was used to determine the types of disfluencies, a measure of the number of units produced per whole or part-word repetitions, the speed and regularity of any repeated units, and the degree of struggle the participant displays during stuttering events. The examiner then determined the percentage of stuttering from the oral reading passage. A licensed SLP was utilized for inter-rater reliability for the percentage of syllables stuttered from the conversation

sample and oral reading passage in addition to determining the majority types of disfluencies (NSLDs, SLDs, and atypical).

Table 4

Items and Ratings of the Motor Component

Item	1	2	3	4	5
1. Determine the majority types of disfluencies	Single syllable-word repetitions, phrase repetitions, revisions, and/or interjections	Single syllabic-word repetitions accompanied by a few part-word repetitions	Interjections, and relatively equal numbers of whole-word (single or multi-syllabic) and part-word repetitions	Part-word repetitions, some whole-word repetitions (single syllable and/or multi-syllabic) and some sound prolongations	Part-word repetitions, sound prolongations, tense pauses, and/or dysrhythmic phonations (broken words)
2. What is the average number of units per whole-or part-word repetition?	1 per unit	2 per unit	3 per unit	4 to 5 per unit	More than 5 per unit
3. Rate the overall tempo and regularity of repeated units	Slow and rhythmic	Fast but rhythmic	Slow and fast but mostly non-rhythmic	Fast and non-rhythmic	Very fast, non-rhythmic, and with tension
4. What is the average degree of struggle, effort, tension produced during stuttered moments?	Absent	Minimal	Mild	Moderate	Severe
5. Determine percentage of stuttering from spontaneous speech sample	0-1%	2-4%	5-8%	9-13%	14% or more
6. Determine percentage of stuttering from oral reading passage	0-1%	2-4%	5-8%	9-13%	14% or more
7. Duration of typical stuttering moment	.5 seconds or less	.6-1.0 seconds	1.1-2.9 seconds	3-4.9 seconds	More than 5 seconds
8. Presence of Secondary Coping	None	Infrequent or minimally visible	Frequent-not uncomfortable for the listener to	Frequent-somewhat uncomfortable for the listener to watch	Frequent- highly uncomfortable for the listener to

Behaviors (e.g., tense jaw postures, speaking on low air supply, etc.)	watch		watch

Social Component

The final area assessed was the social component which focuses on situational aspects of stuttering. The participant completed four self-rating scales and an average score for each converted into a rating on the CALMS assessment. The participant was provided a copy of all questionnaires and the examiner read aloud each question for the child to answer.

Table 5
Items and Ratings of the Social Component

Item	1	2	3	4	5
1. How often does the participant avoid words, people, and speaking situations? See participant's self-ratings in Section 1 of "How My Stuttering Affects Me Socially	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)
2. How often does stuttering occur with various people and in various social speaking situations? See participant's self-ratings in Section 2 of "How My Stuttering Affects Me Socially"	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)
3. How often does the participant's stuttering affect friendships or interactions with peers? See participant's self-ratings in Section 3 of "How My Stuttering Affects Me Socially"	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)
4. How often is the participant afraid to speak in various situations? See participant's self-ratings in Section 4 of "How My	Never (1.0-1.9)	A little (2.0-2.9)	Sometimes (3.0-3.9)	A lot (4.0-4.9)	Always (5.0)

Analysis of CALMS results

A total CALMS score was obtained for each participant by adding the average component scores for each section and dividing by five for the five components. Following administration of all items in each component, the conversation samples of the participants were each transcribed verbatim from the audio-recordings. A total word count and syllable count for each sample was calculated to ensure the sample was at least 300 words. Disfluencies were coded as they occurred throughout the sample into SLDs, NSLDs, and atypical disfluencies according to the following criteria: 1) SLDs: part-word repetitions (e.g., d-d-dog), single-syllable word repetitions (e.g., I-I-I), prolongations (e.g., ssssso), and blocks (e.g., audible or inaudible pauses with tension); 2) NSLDs: interjections (e.g., “uh” and “um”), multiple-syllable word and phrase repetitions (e.g., “many-many”, “I want I want”) and revisions (e.g., The red- the yellow ball); 3) atypical disfluencies: final sound and syllable repetitions (e.g., “boy-oy”), between-syllable insertions (e.g., “we-h-ee”), mid-word breaks (e.g., “op_e_n”) and final sound prolongations (e.g., (mississss”). The interrater was provided a copy of the transcription and both the researcher and interrater wrote each disfluency type on their copy as they occurred in the recording. The number of each type of disfluency was tallied by both the interrater and researcher and the percentage of syllables stuttered was calculated for each participant. This data equated to ratings for determining the majority types of disfluencies and percentage of stuttering.

The researcher obtained the average number of units per whole or part-word repetition by tallying the occurrence of each number of repeated units (e.g., “w-when” is

a one-unit part word repetition and “w-w-when” is a two-unit part word repetition) and dividing by the total number of instances of repeated units. For example, if the participant produced a two-unit part-word repetition on one occurrence and a three-unit part-word repetition on four occurrences, the participant’s average number of units per part-word repetition would be three units (4/5). The researcher analyzed to the audio-recordings a second time to rate the overall tempo and regularity of repeated units. Notations were made regarding the presence of any secondary behaviors as well as the degree of effort observed during disfluent moments. Utilizing the description from the CALMS assessment (e.g., absent, minimal, mild, etc.), the researcher determined the level of effort based on observation.

Chapter IV

RESULTS

Participant One

Ryan received a total CALMS score of 2.27 as seen in Figure 1. This score rates his abilities between borderline and mild impairment. His ratings in each component are displayed by item in Table 6. The ratings of the researcher and interrater for items in the cognitive and motor component are displayed in Table 7 and indicate a level of 100% agreement for his obtained ratings. He received standard scores within normal limits on both the articulation and receptive/expressive language standardized assessment. In his 325-word conversation sample, Ryan presented with stutter-like disfluencies characterized by two instances of prolongations (not in the medial or final position), four initial part-word repetitions and 14 single-syllable whole word repetitions; typical disfluencies characterized by six instances of interjections, nine revisions and two phrase repetitions; and atypical disfluencies characterized by two final sound or syllable repetitions. The majority types of disfluencies were SLDs. He received a severe impairment rating when identifying stuttering during spontaneous speech and a moderate impairment rating for the level of linguistic complexity at which the participant began to display a high frequency of stuttering. Ryan was noted to produce audible inhalations between words and during unexpected moments in his utterances (i.e., audibly inhaling after the second word or more in a five-to-six-word utterance). The degree of struggle,

effort, and/or tension produced was rated minimal. While completing the self-ratings in the affective component, he also spontaneously commented that he did not think he stuttered. Nevertheless, he rated "a lot" for "how often do you feel bad about being made fun of when you stutter" and "how often do you feel anxious or nervous, guilty, and worried about your stuttering". He also marked "yes" for "it is difficult for me to say what I want to say".

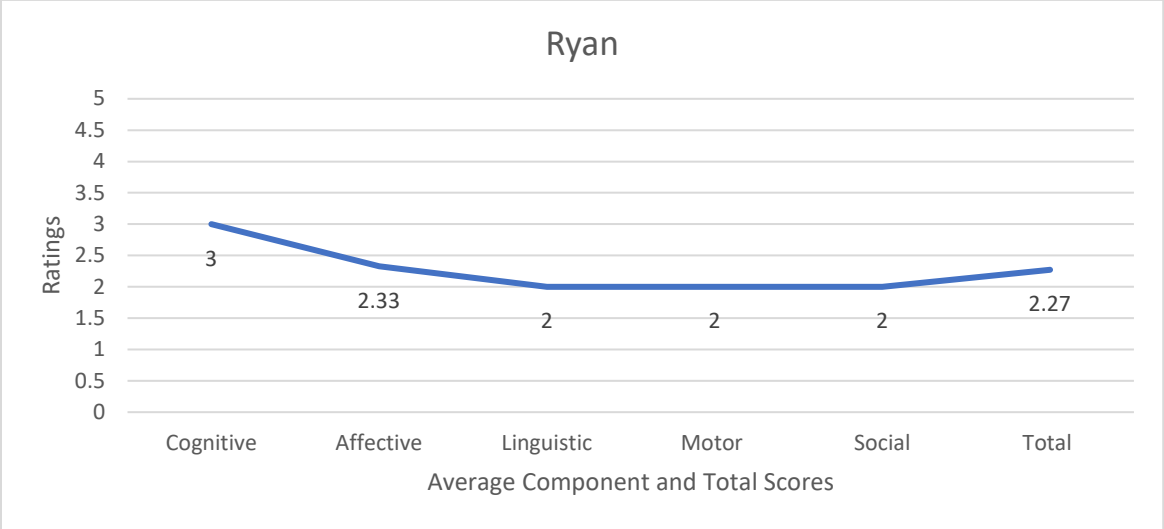
Table 6
Ryan's Overall Component Ratings by Item

Item	Cognitive	Affective	Linguistic	Motor	Social
1.	3	3	4	1	2
2.	5	3	1	1	1
3.	1	1	1	2	3
4.	3			2	2
5.				3	
6.				2	
7.				2	
8.				3	

Table 7
Ryan's Interrater and Researcher Ratings

		Interrater	Agree
		3	1
2.	5	5	1
3.	1	1	1
Motor Items			
1.	1	1	1
5.	3	3	1
6.	2	2	1

Figure 1
Ryan's Overall Component Ratings



Participant Two

Sean received a total CALMS score of 2.63 as seen in Figure 2, which rates his abilities between borderline and mild impairment. His ratings in each component are displayed by item in Table 8. The ratings of the researcher and interrater for items in the cognitive and motor component are displayed in Table 9 and indicate a level of 100% agreement for his obtained ratings. Sean received a standard score within normal limits on the articulation assessment and below average (between 1 and 1.5 standard deviations below the norm) on the language assessment, receiving a standard score of 79 for both the receptive and expressive portions. In his 326-word conversation sample, Sean presented with stutter-like disfluencies characterized by 20 instances of single-syllable whole word repetitions and three initial part-word repetitions; typical disfluencies

characterized by five instances of phrase repetitions and six revisions; and atypical disfluencies characterized by five word-medial breaks and 23 final sound or syllable repetitions. The majority types of disfluencies were atypical. He received a severe impairment rating when identifying stuttering during oral reading and spontaneous speech and a moderate impairment rating for the level of linguistic complexity at which the participant began to display a high frequency of stuttering, percentage of stuttering from the spontaneous speech sample, duration of typical stuttering moment, and presence of secondary behaviors. The degree of struggle, effort, and/or tension produced was mild. Also of note, Sean rated "always" for "how often do you feel anxious or nervous about your stuttering".

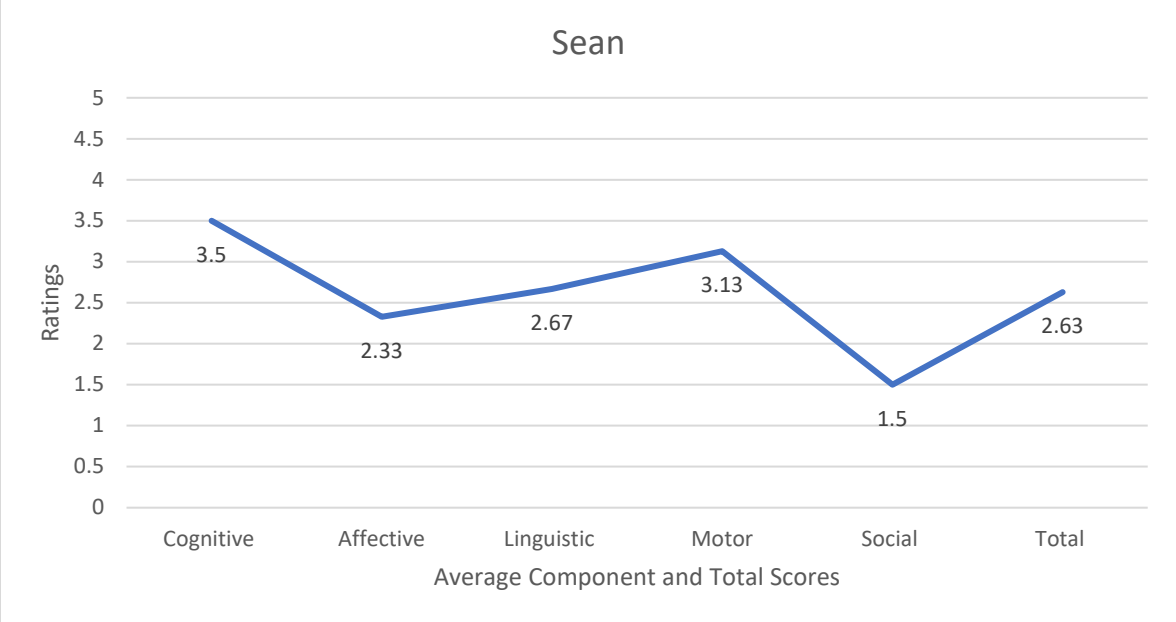
Table 8
Sean's Overall Component Ratings by Item

Item	Cognitive	Affective	Linguistic	Motor	Social
1.	5	2	4	3	2
2.	5	3	3	2	2
3.	1	2	1	3	1
4.	3			3	1
5.				4	
6.				2	
7.				4	
8.				4	

Table 9
Sean's Interrater and Researcher Ratings

Cognitive Items	Researcher	Interrater	Agree
1.	5	5	1
2.	5	5	1
3.	1	1	1
Motor Items			
1.	3	3	1
5.	4	4	1
6.	2	2	1

Figure 2
Sean's Overall Component Ratings



Participant Three

Kyle received a total CALMS score of 2.5 as seen in Figure 3 which rates his abilities between borderline and mild impairment. His ratings in each component are displayed by item in Table 10. The ratings of the researcher and interrater for items in the cognitive and motor component are displayed in Table 11 and indicate a level of 100% agreement for his obtained ratings. He received standard scores within normal limits on the articulation and receptive language assessment and low average on the expressive language assessment with a standard score of 85. In his 383-word conversation sample, Kyle presented with stutter-like disfluencies characterized by seven single-syllable whole word repetitions, two prolongations (not in the medial or final position), and one initial part-word repetition; typical disfluencies characterized by 19 instances of interjections, eight revisions, and four phrase repetitions; and atypical disfluencies characterized by two word-medial breaks and five final sound or syllable repetitions. The majority types of disfluencies were NSLDs. He received a severe impairment rating when identifying stuttering during oral reading and spontaneous speech and a moderate impairment rating for the level of linguistic complexity at which the participant began to display a high frequency of stuttering and the percentage of stuttering from the spontaneous speech sample. The degree of struggle, effort, and/or tension produced was rated absent, given he did not present with any apparent effort and/or tension.

Item	Cognitive	Affective	Linguistic	Motor	Social
1.	5	2	4	1	2
2.	5	2	2	2	3
3.	1	1	1	3	3
4.	4			1	2

Cognitive Items	Researcher	I	
1.	5		
2.	5		
3.	1	1	1
Motor Items			
1.	1	1	1
5.	4	4	1
6.	3	3	1

Table 10
Kyle's Overall Component Ratings by Item

Table 11
Kyle's Interrater and Researcher Ratings

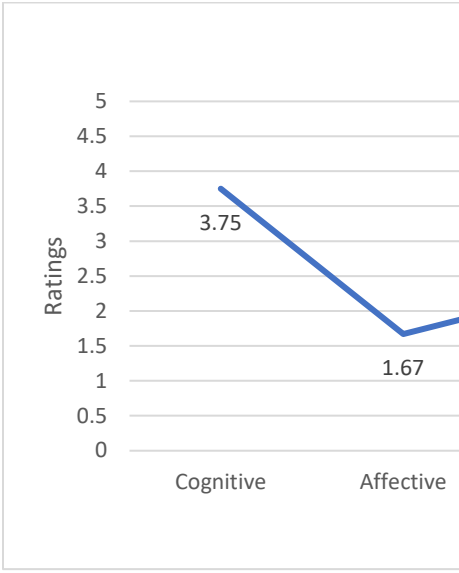


Figure 3
Kyle's Overall Component Ratings

Participant Four

Marty received a total CALMS score of 2.41 as seen in Figure 4 which rates his abilities between borderline and mild impairment. His ratings in each component are displayed by item in Table 12. The ratings of the researcher and interrater for items in the cognitive and motor component are displayed in Table 13 and indicate a level of 83% agreement for his obtained ratings. The researcher and interrater obtained different ratings for the types of disfluencies which were the majority. The researcher rated Marty

as predominantly presenting with part-word repetitions and broken words while the interrater rated him as predominantly presenting with part-word repetitions and whole-word repetitions. His standard scores were within normal limits on the articulation assessment and below average on the receptive language assessment (more than 1.5 standard deviations below the norm) with a standard score of 71 and below average on the expressive language assessment (more than 2 standard deviations below the norm) with a standard score of 68. In his 349-word conversation sample, Marty presented with stutter-like disfluencies characterized by seven initial part-word repetitions, one prolongation (not in the medial or final position), and seven single-syllable whole word repetitions; typical disfluencies characterized by five interjections, six revisions and five phrase repetitions; and atypical disfluencies characterized by six word-medial breaks and three final sound or syllable repetitions. The majority types of disfluencies were NSLDs, closely followed by SLDs. He received a severe impairment rating when identifying stuttering during oral reading and spontaneous speech and a moderate impairment rating for the level of linguistic complexity at which the participant began to display a high frequency of stuttering, language ability from formal assessment, percentage of stuttering from the spontaneous speech sample and from oral reading. The degree of struggle, effort, and/or tension produced was minimal.

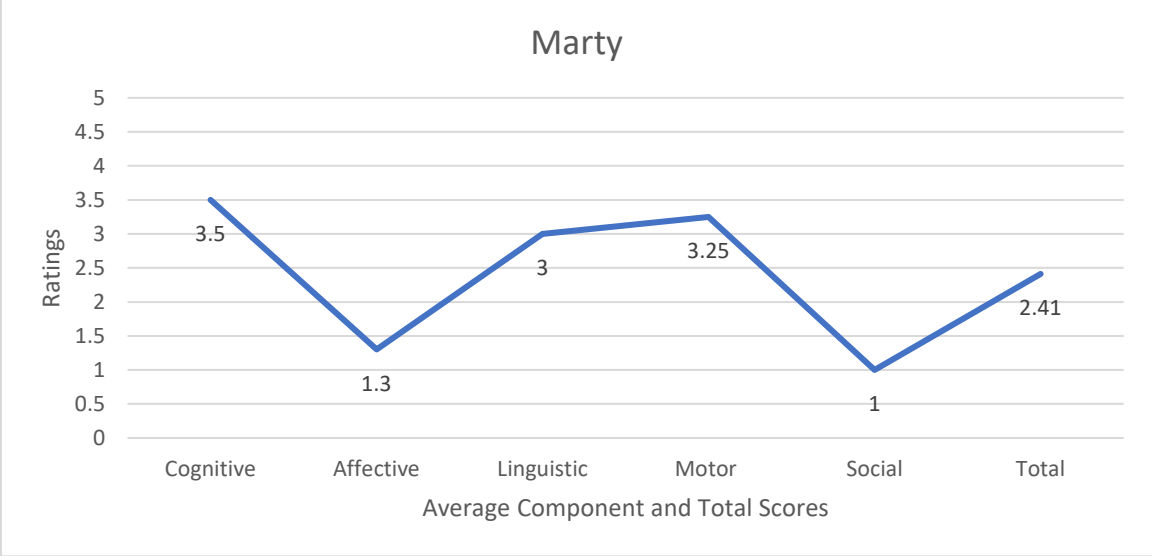
Table 12
Marty's Overall Component Ratings by Item

Item	Cognitive	Affective	Linguistic	Motor	Social
1.	5	2	4	5	1
2.	5	1	4	2	1
3.	1	1	1	4	1
4.	3			2	1
5.				4	
6.				4	
7.				2	
8.				3	

Table 13
Marty's Interrater and Researcher Ratings

Cognitive Items	Researcher	Interrater	Agree
1.	5	5	1
2.	5	5	1
3.	1	1	1
Motor Items			
1.	5	4	0
5.	4	4	1
6.	4	4	1

Figure 4
Marty's Overall Component Ratings



Participants as a group

All four participants received total CALMS scores under 3 and all presented with a combination of SLDs, NSLDs, and atypical disfluencies during their conversation sample. Each participant received a rating of 5 (severe impairment) for "participant's ability to identify moments of stuttering in spontaneous speech" in the cognitive component and a rating of 4 (moderate impairment) for the level of linguistic complexity at which the participant began to display a high frequency of stuttering. Participants in total identified stuttering from the researcher's model 100% of the time.

Statistical Analyses

Statistical analyses consisted of a series of three independent samples *t*-tests in order to make comparisons across the three stuttering types. No statistically significant differences were found between the number of productions of the different types of disfluencies.

Results of Interrater and Researcher Ratings

The interrater and researcher simultaneously obtained ratings in the cognitive component for the percentage of stuttering identified during oral reading, spontaneous speech, and from the examiner's model for each participant. Additionally, both obtained ratings in the motor component for the types of disfluencies that were the majority, percentage of stuttering from spontaneous speech sample and percentage of stuttering from oral reading passage. The researcher and the interrater obtained an overall agreement of 96% (agreed on 23/24 of the ratings), which indicates an acceptable level of agreement.

Chapter V

DISCUSSION

Current research is limited on the disfluency types found in children with ASD as well as information regarding their awareness of and thoughts/feelings surrounding the disfluency. This study aimed to determine the types of disfluencies present during numerous verbal tasks aligned with the CALMS assessment (SLDs, NSLDs, atypical disfluencies) in four school-aged males diagnosed with ASD and the total score the participants received based on ratings from the CALMS assessment. The results of this study provide some insight into the cognitive, affective, linguistic, motor, and social components of disfluency in school-aged males with ASD. This chapter discusses the interpretations of the results, their implications, limitations of the study and recommendations for future research.

Interpretations

It was hypothesized that the participants would present with disfluencies of which the majority were atypical and that the participants would each receive a total CALMS score that did not indicate a negative impact on communication.

Research Question 1: With what types of disfluencies will the participants present in the study during a conversation sample of at least 300 words?

Each participant presented with atypical disfluencies during their conversation sample. These results build on existing evidence of atypical disfluencies being present in those with ASD (Sisskin & Wasilus, 2014). Particularly, just one participant's majority of

disfluencies were atypical, which did not support the hypothesis that the participants each would present with atypical disfluencies as the majority. All participants also presented with SLDs and NSLDs. It was not expected that the participants would each present with SLDs, as the participants had not been previously evaluated or treated for a fluency disorder and SLDs are more readily recognized amongst clinicians and/or parents. Notably, there was minimal to no tension or struggle for the participants when producing these disfluencies which is often present in developmental stuttering. The lack of tension or struggle may be why they were not referred for SLDs previously.

Receptive and expressive language deficits may have negatively impacted Sean and Marty's fluency when describing a picture, retelling a story, and formulating language during spontaneous speech. Both participants received below average standard scores on the receptive and expressive language assessment. Given these language weaknesses, NSLDs would be more likely expected as these disfluencies can be evident of language dysfunction. SLDs and atypical disfluencies would not typically be expected. While normally fluent children could exhibit an increase in some NSLDs (word and/or phrase repetitions, revisions, false starts, etc.) during complex and unfamiliar topic discussion (Trautman et al., 2001), the topic for the conversation samples was contextualized and not unfamiliar to the participants as it centered on school experiences. Excessive NSLDs are also a characteristic of cluttering when accompanied by segments of rapid and/or irregular speech rate. Kyle presented with a majority of NSLDs during his conversation sample and was also rated to have a slow and fast but mostly non-rhythmic overall tempo and regularly of repeated units. This indicates that he meets criteria for cluttering as he presented with an irregular speech rate in addition to excessive NSLDs.

The excessive NSLDs could also be argued to have been used as placeholders for him to regain and/or organize his thoughts during a conversation due to NSLDs being thought to account for delays in the speech planning process (Goldman-Eisler, 1961; Maclay & Osgood, 1959).

Ryan and Kyle scored within the average range on a norm-referenced receptive and expressive language assessment, yet both presented with all three types of disfluencies and Kyle, presented with excessive NSLDs, which could also be evident of language dysfunction. It remains unclear if one can present with disfluencies predominantly caused by language dysfunction despite having average scores on a norm-referenced assessment or if this presentation is mainly attributed to executive functioning and working memory deficits as both have been found to be weaknesses in ASD.

Disfluencies reflect specific types of processing breakdowns that may be attributed to structural and pragmatic language difficulties associated with ASD (Scaler Scott, 2018). The presentation of the disfluencies in these participants may have been partially due to their pragmatic deficits and difficulties with social communication. However, given that pragmatic weaknesses are characteristic of all diagnosed with ASD, it would be expected that all persons with ASD would present with similar disfluencies if pragmatic weaknesses were the sole reason for their disfluencies.

Research Question 2: Will there be a determined negative impact of these disfluencies on communication for each participant revealed by their total score on the CALMS (a total score of 3 or higher on the CALMS)?

The results indicated that each participant received a total score between borderline and mild impairment. These results build on existing evidence of atypical

disfluencies being present in those with ASD and this population tending to have limited self-awareness (Scaler-Scott, 2018). The results also displayed that the participants presented with no impairment in identifying a stuttering moment from the researcher's model. In contrast, all participants presented with a mild to severe impairment in the identification of stuttering moments during their own oral reading and spontaneous speech. The researcher's model contained only SLDs (e.g., single-syllable whole word repetitions, prolongations, and part-word repetitions) as guided by the CALMS instructions. This suggests the participants may not have considered all their disfluencies as a stutter, and thus, did not identify the moments of disfluency. A formal definition of disfluencies was not provided to the participants prior to administering the CALMS assessment to determine if they are independently aware of their disfluencies during oral reading and speech and furthermore to determine if they consider these disfluencies a stutter. It can also be argued that participants with ASD identify SLDs in the speaker more readily than in themselves.

Unlike previous studies, this research provided quantitative data for the cognitive, affective, linguistic, motor, and social aspects that accompany fluency disorders. While the overall affective and social components indicated less than mild impairment for all participants, there were items within these components for some participants that were rated as impaired. For example, Sean rated "a lot" for "how often do you feel bad about being made fun of when you stutter" and "how often do you feel anxious or nervous, guilty, and worried about your stuttering".

A specific pragmatic weakness common in persons with ASD is limited eye contact. Loss of eye contact was not considered a secondary behavior in this study due to

it being difficult to differentiate between this being a pragmatic weakness or a result of the disfluency. Frequent eye blinks and speaking on low air volume were the most noted secondary characteristics among the participants.

Due to deficits in social communication, those with ASD can have difficulties identifying and comprehending feelings/emotions and nonverbal cues. This, paired with executive functioning deficits such as difficulties with self-awareness, may have impacted the identification items and self-ratings of feelings and attitudes of the participants regarding their fluency. The literature also describes a lack of awareness and concern of atypical disfluencies.

In the CALMS motor component, a rated item was the presence of secondary coping behaviors with provided examples such as loss of eye contact, tense jaw postures, and flaring of nostrils. Loss of eye contact was not considered a secondary behavior in this study, as limited eye contact is common in persons with ASD and is difficult to differentiate between a pragmatic weakness or a result of the disfluency.

Implications

The participant's total scores on the CALMS assessment did not represent a negative impact on their overall communication. Based on their overall scores for the affective and social components, the participants were not found to be impaired for these two components and results indicated they were unaware of their disfluencies. There were, however, items within the components in which the participants received moderate-severe ratings. This leads to the question of how fluency treatment should be addressed for clients with disfluencies and ASD such as the participants in this study. According to Perkins (1990), regardless of the clinical approach, the goal of treatment is to improve

communication as interpreted by the speaker versus that which is interpreted by the listener. However, the participants were referred by their teachers and/or parents which demonstrates that listeners are aware of these disfluencies and consider them an area of concern. Additionally, the frequency, as well as type of disfluencies, were very noticeable to the researcher while conversing with the participants. This may be interpreted as a listener-oriented concern rather than a speaker-oriented one. Nevertheless, listeners may have difficulty following the message of the speaker with such disfluencies.

Limitations

A limitation to this study is that the sample size was small with four participants and consisted of solely elementary-school aged males, making generalization difficult. Only select items in the cognitive and motor components were rated by the interrater rather than every item in each component. Another limitation is that the participants were audio-recorded versus video-recorded, and the researcher had to make notes live regarding presence of secondary behaviors, as these cannot be observed when listening to the audio-recording.

Recommendations for Future Research

Future fluency research should aim to include females with ASD and larger cohort studies. How to categorize audible inhalations between words and whether it represents a disfluency should also be investigated. If reduplicating the study using the CALMS assessment with participants with ASD, researchers may initially administer all components as this researcher did to obtain total scores. Then re-administer the components to the same participants after: 1) disfluencies have been appropriately defined, 2) the CALMS instructions are adapted to use the word “disfluency” versus

"stutter" as the participant may present with a variety of disfluency types that are not necessarily considered true stuttering, and 3) a level of comprehension of the emotion/feeling words used in the assessment is obtained (e.g., 90% accuracy or greater matching pictures to the emotions). After subsequent scores are obtained, researchers should compare scores from first administration to second administration to determine if having a definition of disfluencies alters the scores.

Further research should also be conducted to determine if there is an impact of working memory on excessive NSLDs, as there is a possibility that those with ASD who exhibit atypical disfluencies may be using excessive NSLDs as a placeholder to regain their train of thought (Scaler Scott, 2015). Furthermore, research is needed to determine if one can present with disfluencies caused by language dysfunction despite having average receptive and expressive language scores on norm-referenced assessments. A parent interview would also be beneficial to obtain the age of onset of the disfluencies and their specific concerns or reactions to the disfluencies.

Chapter VI

CONCLUSION

The CALMS assessment has not been documented in the literature as being used with school-aged males with ASD who also present with disfluencies other than SLDs. Using the assessment by Healey (2012), this study provided quantifiable data regarding the cognitive, affective, linguistic, motor, and social components of fluency disorders in four school-aged male participants diagnosed with ASD. The results indicated that no participants received a total CALMS score equating to a negative impact on communication (a score of 3 or higher) and each participant additionally presented with the three types of disfluencies: NSLDs, SLDs, and atypical disfluencies. All participants were unaware of their disfluencies during both oral reading and spontaneous speech but identified SLDs in the researcher with 100% accuracy. Further fluency research is recommended with school-aged children who are diagnosed with ASD to obtain additional information regarding the presentation of fluency disorders in this population and how to go about treating them.

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Appendix A:

Institutional Review Board Approval

Institutional Review Board (IRB)

for the Protection of Human Research Participants

Protocol Number: 04367-2022 **Responsible Researcher:** Britiany Hudson **Supervising Faculty:** Dr. Katherine Lamb

Department: Communication Sciences & Disorders

Project Title: *Fluency and autism spectrum disorders.*

EXPEDITED REVIEW PROCESS:

1. Team members review the protocol independently.

2. Lead Reviewer initiates email or voice contact with Second Reviewer to discuss questions/concerns.

3. Lead Reviewer emails any questions/revision requests to IRB Administrator at irb@valdosta.edu.

4. IRB Administrator secures response from researcher and shares it with team members.

5. Steps 2-4 continue until all issues/concerns are addressed and the team has sufficient information to act.

6. Lead Reviewer records team's determination and signs report by typing his/her name, and forwards report to Second Reviewer.

7. Second Reviewer signs report by typing his/her name and forwards report to IRB Administrator.

Note: Although not required, it is recommended that team members copy the IRB Administrator on all electronic communication to facilitate protocol tracking.

EXPEDITING TEAM DETERMINATION *(check one)***:**

☒ This research protocol is **approved** for **36** months as presented.

☐ This research protocol is **approved** for twelve (or) months **contingent** on the following minor clarification(s)/corrections(s)/changes **to be accepted by the IRB Administrator:**

☐ This protocol is **referred for convened review** because *(check one)*;

- ☐ The proposed modification increases risk to more than minimal
- ☐ Expedited Review Category(ies) no longer apply
- ☐ Additional input from other IRB members is requested (please explain reason):

TEAM SIGNATURES:

Steven Kohn	12/1/2022	Elizabeth Ann Olphie	12.01.2022
Lead Reviewer *(Type Name)*	***(Type Date)***	**Second Reviewer *(Type Name)***	***(Type Date)***

Appendix B:

Local Research Request Form

GWINNE r-r COUNTY SCHOOLS

(Revised 10/7/2022

LOCAL SCHOOL RESEARCH REQUEST FORM

Name of School: Freeman's Mill Elementary

Name of Researcher: Britiany Hudson

Position or Grade: Speech-Language Pathologist

A. Research Project

a. Title: Fluency and autism spectrum disorders

b. Statement of Problem and research question: It has been documented in the literature that clients with atypical disfluencies have mostly been associated with another diagnosis such as autism spectrum disorders. The CALMS assessment has not been documented as being used in the assessment of fluency disorders in those with autism spectrum disorders.

What types of disfluencies will be present in 4 school-age male students with a primary diagnosis of autism spectrum disorder during the CALMS assessment?

Additionally, will these students receive a score of 3 or higher on the CALMS assessment, indicating a negative impact on communication?

C. Subjects or population for the study: 4 male elementary school-aged students diagnosed with autism spectrum disorder and Speech/Language Impairment.

d. Reason for doing this research:

SLPD

Graduate Study at Valdosta State University Un

Publication/Presentation

Other (please specify)

e. Dates research will be conducted: December 2022 to May 2023

B. All research and researchers must a) Protect the rights and welfare of all human subjects, b) Inform students and/ or parents that they have the right not to participate in the study, c) Adhere to board policies and applicable laws which govern the privacy and confidentiality of students records. Researchers requesting to conduct research across our school district must complete a GCPS

Research Proposal to be reviewed by the Gwinnett IRB. Please visit our GCPS Research & Evaluation website for details and instructions.

C. This form must be completed by school employees requesting to conduct research only at the school where they work. Co-researchers participating in this request must also be employed at the same school as the researcher. Principals ONLY need to approve/sign Local School Research Requests from their school employees.

D. This form may also be completed by principals requesting to conduct research only at the school where they work. The assistant superintendent assigned to the principal must approve/sign the request form.

E. A copy of all Local School Research Requests must be forwarded to the Research & Evaluation Office - ISC
for our files. Please send via the information below.

Via Email:
Dr. Shanna Ricketts, Shanna.Ricketts@gcpsk12.org & Ms. April Dennard, April.Dennard@gcpsk12.org

Angie Pacholke — 11/17/2022

Principal's Signature **Date of Approval**

Date f Appr val

Assistant Supt. Signature (only if principal is the researcher) Date of Approval