Peer-Mediated Instruction and Interventions Supporting the Academic Engagement of Secondary Students with Autism Spectrum Disorder

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Abstract

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This study examined the use of a peer-mediated instruction and intervention model (PMI) in combination with priming and the use of a visual activity checklist as a way of supporting the academic engagement and social interactions of secondary students with autism spectrum disorder (ASD). This study employed the use of a multiple-baseline across participants design (Kazdin, 2011) to determine the effects of the multicomponent intervention on the academic engagement and social interactions of students with ASD enrolled in 10th grade, general education settings. Results showed positive outcomes for all three 10th grade students' academic engagement and in social interactions for two of the three participants. This study adds to the literature in supporting the academic engagement of students with ASD by incorporating the use of priming and activity schedules within a PMI model. Findings from this study address the call for multicomponent interventions supporting links between academic and social skills in adolescents with ASD.

Key words: autism spectrum disorder (ASD), secondary, peer-mediated instruction and interventions (PMI), activity schedules, academic engagement

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Dedication

To Mark, Ellen, Steven, Jennifer, Leah, and Caitlin.

Chapter One: Introduction

In the United States, one in 59 children are identified with autism spectrum disorder (CDC, 2018). Autism spectrum disorder (ASD) is a spectrum disorder indicating a range of abilities and challenges. ASD is associated with impairments in social communication and social interactions, as well as repetitive behaviors or restrictive interests (American Psychiatric Association, DSM-V, 2013). Under the Individuals with Disabilities Education Act (2004), students with ASD needing support accessing the general education curriculum, qualify for special education services. Furthermore, 44% of children with ASD are reported to have "average or above average intellectual ability", suggesting the least restrictive environment for these students will likely be general education classroom settings (CDC, 2018).

In classroom settings, students with ASD may have additional academic needs and difficulties. ASD is associated with deficits to central coherence, causing the individual to focus on exact details (local) rather than global details; that is, the overall gist of what is being presented (Frith & Hill, 2003). Students with ASD may also have difficulties engaging in social initiations, such as asking for help or requesting clarifications in classroom rules and expectations (Hume, Loftin, & Lantz, 2009). As a result, students with ASD may be dependent on teacher prompting and rely heavily on teacher-initiated instruction (Hume et al., 2009). Other challenges facing students diagnosed with ASD include difficulties processing information and comprehending auditory stimuli (Kaufman, 2002), difficulties resulting from a lack of tolerance for novel learning (Kaufman, 2002), and deficits in executive functioning (Fleury et al., 2014), deficits in working memory (Bebko & Ricciuti, 2000; Fleury et al., 2014; Jones et al., 2011), and a delayed theory of mind (Baron-Cohen, Leslie, & Frith, 1985; Fleury et al., 2014; Frith & Hill, 2003; Kaufman, 2002; Whitcomb-Marsh, 2015). For students with ASD who are enrolled in

secondary education settings, these deficits are further augmented by the "additional press for independent behaviors" that result from "multi-period, multi-teacher structures" and routines (Hume, Boyd, Hamm, & Kucharczyk, 2014, p. 103).

Executive Functioning, Working Memory, and Theory of Mind. Executive functioning is a broad term used to describe metacognitive functions such as managing tasks, planning actions, and controlling impulses (Kaufman, 2002; Whitcomb-Marsh, 2015). For adolescent students with ASD, deficits in executive functioning make it difficult to keep materials organized and follow multistep directions (Fleury et al., 2014). These difficulties might also look like inability to plan, organize, and attend to classroom tasks (Whitby, Travers, & Harnik, 2009; Whitcomb-Marsh, 2015).

Working memory, although a component of executive functioning, may also make successful functioning in secondary classrooms difficult. Working memory is the ability to retain short term information for processing at a later time. In a study of adolescents with ASD, Jones et al. (2011) compared "everyday memory" functioning in 94 adolescents with ASD to 55 adolescents without ASD and reported significant deficits in daily memorization skills such as remembering names, appointments, and where items belong. Additional deficits in memory, associated with ASD, include rote memory skills, short term recall, acoustic memory, and echoic memory (Bebko & Ricciuti, 2000).

Like increased demands in tasks related to increased independence, students in secondary classrooms are also expected to be at a point in development in which they can apply theory of mind to their general outlook. Theory of mind is the "ability to think about what another person is thinking and to realize that their thoughts may differ from one's own thoughts" (Whitcomb-Marsh, 2015, p. 68). Theory of mind affects an individual's ability to make inferences about

another person's beliefs and motives (Baron-Cohen, Leslie, & Frith, 1985). For example, when asked to read a passage of narrative text (e.g., The Lord of the Flies) students with deficits in the area of theory of mind may have difficulties understanding character motives and innuendo. Students with ASD may have difficulty with more complex text that require taking another person's view in fully understanding and comprehending or developing their own point of view or describe character motives. Because secondary classrooms tend to be more lecture oriented, teacher delivered instructions may be less explicit and rely on student understanding of the implied directions.

These deficits in executive functioning, working memory, and delayed theory of mind become more evident when students with ASD mature and face demands within social and academic settings. Typical middle and high school classrooms are not always predictable and consistent in structure (Humphry & Lewis, 2008). Higher student to teacher ratios, a reliance on verbal instructions and content delivery, and the variations in secondary class structures (i.e., transition between classes, multiple instructors and class routines) within secondary general education classrooms are among the numerous challenges for students with ASD. In addition to larger schools and class sizes, students in secondary classroom settings are expected to navigate multiple class periods throughout the school day. The complex tasks in secondary settings require students to shift through multiple class structures and routines each day. Without explicitly identifying evidence-based, specially designed instruction for the student with ASD, the difficulties in performing many of these tasks result in a lack of academic and behavioral success for students in the classroom.

Interventions supporting the academic achievement of students with ASD. Along with the increased prevalence in diagnosis for students with ASD, the field continues to develop

and validate several instructional strategies to support student independence and the academic achievement of students with ASD (Griffin, Griffin, Fitch, Albera, & Gingras, 2006; Harrower & Dunlap, 2001; Hume et al., 2014). These strategies include, but are not limited to, providing predictable classroom routines (Griffin et al., 2006; Ivannone, Dunlap, Huber, & Kincaid, 2003), antecedent-based instruction (i.e., priming) (Gengoux, 2015; Zanolli, Daggett, & Adams, 1996), and the incorporation of visual supports (Bryan & Gast, 2000; Schmit, Raschke & Ryndak, 2000).

Providing students with predictable schedules and classroom routines (Crosland & Dunlap, 2012; Deris & DiCarlo, 2013; Harrower & Dunlap, 2001) and the use of visual supports and activity schedules (MacDuff, Krantz, & Mclannahan, 1993; Bryan & Gast, 2000) have been found to increase the on-task engagement of students with ASD while reducing the amount of adult prompting needed in the completion of tasks. Providing students with predictable routines and the use of visual support activity schedules create structure and predictability in classrooms (Crosland & Dunlap, 2012; Whitby et al., 2009). In addition, visual activity schedules further support classroom structures by providing a concrete presentation of potentially abstract information (Griffin et al., 2006).

Antecedent-based instruction such as priming has also been found to increase academic responding while simultaneously decreasing problem behaviors in young children and adolescents with ASD (Koegel, Koegel, Frea, & Green-Hopkins, 2003). Providing clear expectations at the beginning of an assignment assists students in becoming familiar with academic material, and as a result, teachers will better establish assignment predictability, increasing the likelihood of academic success (Griffin et al., 2006).

While these strategies support the academic achievement of students with ASD, the implementation in the use of these strategies within large secondary classrooms can be difficult. Furthermore, additional supports (i.e., prompting) may be needed for students with ASD and additional academic needs. Secondary teachers, who are responsible for six to eight different classes, with class sizes averaging upward of 30 to 40 students, are often left with "little opportunity (for teachers) to monitor their students' academic, social, or behavioral progress" (Baker et al., 2001, as cited by Hume et al., 2014, p. 103).

Implementing academic strategies through the use of PMI. Given the academic challenges and needs of adolescents with ASD in formal, inclusive learning environments, as well as the identified barriers for secondary teachers to provide individualized supports and to monitor progress given higher student to teacher ratios and class sizes, one approach to addressing these issues in general education classrooms is peer-mediated instruction and interventions (PMIs). PMI is an evidenced-based strategy where peers support the social development and academic achievement of peers with a specific learning need. "(PMI) arrangements provide students with more opportunities to respond in which students with and without disabilities can use teacher-student discussions, worksheets, workbooks or other written tasks, computer tasks, or structured projects as contexts for enhancing academic and social skills" (Bene, Banda, & Brown, 2014, p. 136). PMIs promote learning by providing students with increases in opportunities to respond and learn through peer observation and modeling (Bene et al., 2014; Verkamp, Kamps, & Cooper, 2007). In inclusive classroom settings, PMIs have been used to support elementary students in reading development (Fuchs & Fuchs, 2005), assist in the development of mathematical concepts in both elementary and secondary students identified with specific learning needs (Calhoon & Fuchs, 2003; Fuchs, Fuchs, Phillips, &

Hamlett, 1995), and to promote access to general education curriculum for both elementary and secondary students with significant disabilities (Carter et al., 2016; Carter, Sisco, Brown, Brickham, & Al-Khabbaz, 2008). However, to date, there is currently limited research on the effects of PMIs in supporting the academic achievement of secondary students with ASD in general education classroom settings (Carter et al., 2017).

Because of the high prevalence of secondary students that receive special education services within general education classroom settings, it is necessary to develop PMI strategies to support secondary students with ASD in large, general education classroom settings. It is the intent of this study to: (a) extend the research in PMIs applied specifically to secondary students with ASD and (b) to understand if PMIs combined with additional EBPs support the academic achievement as well as the social development of students with ASD and specific learning needs within secondary, general education classroom settings.

Research Questions

This study aims to further add to the research in the use of PMIs in supporting students with ASD and specific learning needs by incorporating evidence-based practices that are unique to supporting the academic achievement and social behavior of students with ASD in inclusive secondary classrooms. Research indicates that PMIs are an effective practice in supporting student achievement and social development, including students with ASD and specific learning needs. Incorporating practices such as the use of PMI will support classroom structure without modifying assignments or asking secondary teachers to change the way they provide instruction. However, research in the use of PMIs to support the inclusion of secondary students with ASD is limited. This paper seeks to identify a multi-component intervention consisting of PMI as an

approach to deliver other evidenced-based practices, particularly antecedent-based instruction (i.e., priming) and visual supports. Therefore, the following research questions will be addressed:

R1: What are the effects of combining two evidence-based practices focused on academic outcomes (i.e., priming, visual activity schedules) with PMIs on the academic achievement and engagement of students with ASD and specific learning needs in secondary general education classroom settings?

R2: What are the effects of PMIs on the social behavior of students with ASD and specific learning needs at the intervention setting?

Chapter Two: Review of the Literature

Classroom settings pose particular challenges for students with ASD in the areas of executive functioning, working memory, and theory of mind (Fluery et al., 2014; Frith & Hill, 2003; Kaufman, 2002). These deficits may be further compounded in secondary classroom settings as a result of larger class sizes, higher student to teacher ratios, and variations to classroom structures given enrollment in multiple class periods. One approach in supporting students with specific learning needs within inclusive classroom settings is Peer-Mediated Instruction and Intervention (PMI). PMIs incorporate the use of peers to promote learning through systems of prompting, initiations, and increased opportunities to respond and receive feedback. This chapter seeks to review the literature in PMIs in supporting secondary students with ASD and specific learning needs within inclusive secondary classroom settings.

Peer-Mediated Instruction and Intervention

PMI is an evidenced-based practice that employs the use of typically developing peers who are trained to initiate social interactions to specific target students (NAC, 2015; Wong, et al., 2015). "Peer-mediated approaches - in which students assume instructional or other support roles with their classmates - have been a staple intervention strategy in classrooms for as long as there have been schools" (Carter, Cushing, & Kennedy, 2009, p. 10). PMIs increase opportunities for students to practice and respond to social and academic material by providing a format where peers supplement and support instructional material within the classroom. For students with disabilities, including students with ASD, PMIs can be used to embed individualized supports through the use of peers in large classroom settings. PMIs are not limited in scope and have been used to support students of all abilities in both academic and social skill development.

Social learning theory and cooperative learning theory. The theoretical basis of peer-mediated instruction can be applied using the frameworks of both social learning theory (Bandura, 1977) and cooperative learning theory (Johnson & Johnson, 1999). According to social learning theory, learned behaviors are acquired through the observation of a model performing a desired task. "By observing a model of the desired behavior, an individual forms an idea of how response components must be combined and sequenced to produce the new behavior" (Bandura, 1977, p. 35). Bower & Hilgard (1981) further describe social learning as a construct of learning combining individual experience with the observation of others. "In contrast to the learning-by-doing emphasis, social learning theory holds that a large amount of human learning is done vicariously, through observing another person making the skilled responses ...and then by trying to imitate the response of the model" (p. 600). Given social learning theory as a lens to understanding PMIs, the academic achievement of students with ASD will be supported by the observation and modeling of peers in the engagement and completion of academic tasks in the classroom.

A second learning theory that can be applied to PMI is cooperative learning theory. Cooperative learning theory is based on social constructivism, which theorizes that higher orders of comprehension will develop when students work together to accomplish a shared or common goal (Johnson & Johnson, 1999). Cooperative learning theory suggests that compared to working alone, students who work together will develop "higher level reasoning strategies" (Yager, Johnson, & Johnson, 1985, p. 62). Cooperative learning techniques are reinforced through group contingency structures in which students work together to complete tasks as a group and as a result, earn credit for the completion of assignments together (Artz & Newman, 1990; Cosden & Haring, 1992; Slavin, 1980). Cooperative learning structures involve a systematic approach to

task and assignment completion and are specifically utilized to accommodate individual differences and multiple student educational goals within the classroom.

Antil, Jenkins, Wayne, and Vadasy (1998) describe the appeal of cooperative learning and how cooperative learning adds to the literature and use of PMIs in the classroom:

> Contemporary ideas on the nature of human learning also contribute to cooperative learning's appeal. The once hegemonious conceptualization of learning as a simple case of knowledge transmission from expert to novice has begun to yield to a radically different paradigm that emphasizes the social construction of knowledge (Vygotsky, 1978). With this paradigm shift, rationales for classroom approaches that encourage increased dialogue among students have garnered new respect, servicing to spawn new ideas and reinvigorate older ideas about peer-mediated instruction, including communities of learners (Brown, 1994; Gamson, 1984), collaborative learning (Palincsar, Stevens, & Gavelek, 1988), reciprocal teaching (Palincsar & Brown, 1984), peer tutoring (Greenwood, Delquadri, & Hall, 1989; Simmons, Fuchs, Fuchs, Hodge, & Mathes, 1994), as well as cooperative learning. (p. 420)

Within cooperative learning structures, students are assigned individualized roles within a small group (e.g., 3-5 students). Each student is responsible for completing a task within the group and subsequently, larger assignments are completed together. Using cooperative learning theory as a lens for understanding PMI in the classroom, students working together will construct a deeper understanding of instructional content through feedback and support from peers within small group classroom structures.

Classroom Models of PMI

In classroom settings, the effects of PMIs on academic achievement have been studied for over 30 years (Delquadri, Greenwood, Whorton, Carta, & Hall, 1986; Johnson & Johnson, 1987). Based on the theoretical frameworks of social learning and cooperative learning, PMIs can be categorized into one of two models: 1) peer tutoring models, or 2) cooperative learning models. The structure of a PMI peer tutoring model involves two students working together with one student serving as the "tutor" providing direct instruction to the "tutee". Within a cooperative learning model, multiple students cooperate to complete tasks or assignments together.

The following section will provide an overview of the various PMI models categorized into 1) peer tutoring and 2) cooperative learning frameworks. These models encourage the academic achievement of students in general education classroom settings, including but not limited to, students with a range of specific learning disabilities, as well as students with ASD. A more specific application involving students with ASD will be discussed following the introduction of these models; however, it is important to note that there is limited research in the use of these models applied to the academic achievement of students with ASD in general education classrooms.

Peer tutoring models of PMI. A peer tutoring format uses a direct (i.e., one-on-one) reciprocal approach to instruction to increase opportunities for students to respond and receive feedback. In the classroom, peer tutoring models are structured so that students are paired together with both students taking turns interacting with previously taught material. Both participating peers practice academic content and learn from one another through the observation and modeling of the student identified as the "tutor". Variations in peer tutoring models include:

1) classwide tutoring and peer-assisted learning strategies, 2) same-age and cross-age peer tutoring, and 3) peer support arrangements.

Classwide peer tutoring and peer assisted learning strategy models. Classwide Peer Tutoring (CWPT) is the "oldest and most widely researched classwide tutoring model" (Maheady & Gard, 2010, p. 72). CWPT was first developed by Delquadri, Greenwood, Stretton, & Hall (1983) for the inclusion of students with learning disabilities and specific learning needs in general education classroom settings (Delquadri et al., 1986; Scruggs & Mastropieri, 2012). CWPT uses a reciprocal tutoring structure in which a designated peer provides content instruction to the target student to increase student opportunities to respond and provide feedback (Kamps et al., 2008; Verkamp et al., 2007). CWPT begins with the teacher intentionally pairing all students within the class together and assigning each pair of students to one of two classwide teams. Teachers select peers based on the academic strength of individual students (i.e., higher and lower academic achievement) or goodness of fit (i.e., peers who work well together). Teachers provide each student pair with a set of questions created from previously taught material (e.g., math equations, spelling words, etc.). Each pair of students take short turns as both the tutor and tutee (e.g., 10 minutes in each role). CWPT utilizes a classwide "games" format where peer groups work together to earn points for a team. In this format, "tutees" earn points for correct answers and "tutors" provide corrections for incorrect responses. After each student pair has served as both the tutor and tutee, both sets of points earned by peers are added together. Teams combine all points earned by each peer dyad and the classwide team with the most points wins (earns) the reinforcer (e.g., free time class activity).

The Peer-Assisted Learning Strategies (PALS) model of PMI, a variation of CWPT, was originally developed as a reading intervention for students in grades two through six (Fuchs,

Fuchs, Mathes, & Simmons, 1997; McMaster, Fuchs, & Fuchs, 2006). Teachers begin by ranking students based on reading performance and pair higher performing students with lower performing students (McMaster et al., 2006). Teachers then train student pairs to engage in a set of structured activities (e.g., reading retell, summarization, prediction). Similar to CWPT, PALS utilizes a reciprocal method of tutoring where peers take turns acting as both the tutor and tutee. PALS also includes the use of a games-based method of teaching where peers complete activities together and student pairs work together to earn points for correct responses. The PALS model of instruction has been studied for 20 years and has been adapted to support elementary students in reading acquisition (Fuchs et al., 2001; Fuchs & Fuchs, 2005; Mathes, Howard, Allen, & Fuchs, 1998; McMaster, Fuchs, & Fuchs, 2007), as well as mathematics development in both elementary and secondary settings (Calhoon & Fuchs, 2003; Fuchs, Fuchs, & Karns, 2001; Fuchs, Fuchs, Phillips, & Hamlett, 1995). The PALS model has also been applied specifically to support students identified with learning disabilities (Fuchs, Fuchs, Mathes, & Martinez, 2002; Rafdal, McMaster, McConnell, Fuchs, & Fuchs, 2011), and students identified as English language learners in general education settings (McMaster, Kung, Han, & Cao, 2008; Saenz, Fuchs, & Fuchs, 2005).

Same-age and cross-age peer tutoring models. Unlike classwide peer tutoring models, same-age tutoring and cross-age peer tutoring models are individually structured and do not include classwide involvement. In same-age and cross-age peer tutoring, the tutor (usually more knowledgeable in a particular content area) provides direct academic instruction to a peer (i.e., tutee). Peer tutoring can occur in the classroom or in an outside setting such as a school hallway. Cross-age tutoring uses the same instructional format as same-age peer tutoring, but older students provide instruction to younger students (Kamps, Dugan, Potucek, & Collins, 1999). The

use of cross-age peer tutoring has been used primarily with elementary students to support cognitive gains in science concepts (Topping, Peter, Shephen, & Whale, 2004), to promote mathematics vocabulary (Topping, Campbell, Douglas, & Smith, 2003), to increase reading fluency (Van Keer & Vanderlinde, 2010; Wright & Cleary, 2006), to promote reading strategy use and reading comprehension (Van Keer & Vanderlinde, 2010), and to increase overall student attitudes toward reading with students with learning disabilities serving as tutors to kindergarteners (Davenport, Arnold, & Lassman, 2004).

Peer Support Arrangements. Peer Support Arrangements are a unique variation of same-age peer tutoring as they are individually tailored to promote the inclusion of students with significant disabilities in general education classroom settings (Carter, Cushing, Clark, & Kennedy, 2005; Carter et al., 2009). In a Peer Support Arrangement, one or more peers provide academic, social, and other supports to classmates with disabilities (Brock & Carter, 2016; Carter et al., 2005, Carter et al., 2016). Peer Support Arrangements are based on individual student needs included within the student's Individualized Education Plan (IEP) and modifications to the general education curriculum (Brock & Carter, 2016). In a Peer Support Arrangement, special education and general education teachers work together to create a Peer Support Plan. The Peer Support Plan is designed to promote social and academic achievement in general education classrooms (Carter et al., 2009). Components of peer supports and Peer Support Arrangements include: (a) selecting an individual goal based on student need, (b) recruiting peers from within the classroom or instructional setting, (c) training peers on designated roles, and (d) providing ongoing adult facilitation and support (Brock & Carter, 2016; Carter et al., 2009; Carter et al., 2016). Specifically, Peer Support Arrangements have been used to promote the acquisition of science vocabulary for secondary students with intellectual disability in general education

classrooms (Jimenez, Browder, Spooner, & Dibiase, 2012). Peer Support Arrangements have also been used to support the academic engagement and social interactions of high school students (ages 15-18 years) with developmental disabilities in general education and elective classroom settings (Carter et al., 2008; Carter, Sisco, Melekoglu, & Kurkowski, 2007). Components of peer supports include one-on-one peers working together and small groups of students sitting together in the classroom. In a study on Peer Support Arrangements, Carter and colleagues (2005) found groups of three peers working together were more effective in supporting the on-task engagement of student participants compared to two peers (one-on-one) working alone.

Cooperative learning models of PMI. Cooperative learning models also employ the use of classroom peers but are more heavily grounded in the theoretical framework of cooperative (i.e., constructive) learning (Johnson & Johnson, 1999). Cooperative learning is a concept defined as, "small groups of learners working together to solve a problem, complete a task, or accomplish a common goal" (Artzt & Newman, 1990, cited by Dugan et al., 1995, p. 175). Components of cooperative learning models include: (a) positive interdependence, (b) individual accountability, (c) face-to-face promotive interactions, (d) social skills, and (e) group processing (Johnson & Johnson, 1999). Cooperative learning models are particularly effective in the classroom because they provide students with the opportunity to give help and receive help from peers in a private and nonthreatening manner while building a cooperative relationship rather than a tutoring relationship (Artz & Newman, 1990).

Cooperative learning models are a unique form of PMI where peers are intentionally placed into heterogeneous groups based on student strengths and needs (Cosden & Haring, 1992). Cooperative learning models are structured to promote constructive knowledge. That is,

students will develop comprehension and knowledge by working together. According to Johnson, Johnson, and Holubec (1994), cooperative learning formats can be categorized into one of three models: 1) informal cooperative learning, 2) formal cooperative learning, and 3) cooperative based groups.

Informal cooperative learning models. Johnson et al. (1994), describe informal cooperative learning structures as temporal strategies used by teachers to support learning within direct instructional methods of teaching. Compared to other cooperative learning models, informal cooperative learning is not formal in structure (i.e., students are not assigned specific roles). Informal cooperative learning simply occurs when two or more individuals discuss an academic concept together (i.e., joint learning). During a direct lecture or demonstration, informal cooperative learning is used to focus student attention, ensure cognitive processing, and provide closure to instructional sessions (Johnson & Johnson, 1999). An example of informal cooperative learning in the classroom is a teacher instructing students to turn and talk to a peer about a topic for several minutes and calling on pairs to subsequently add to a large group discussion.

Formal cooperative learning models. Compared to informal cooperative learning, formal cooperative learning and cooperative based groups are more officially structured. Formal cooperative learning structures can last from one class period to up to several weeks (Johnson et al., 1994). According to Johnson and Johnson (1999), formal cooperative learning structures consist of four teacher-led components: 1) making pre-instructional decisions, 2) explaining the task, 3) monitoring student's learning, and 4) assessing student's learning. An example of a formal cooperative learning structure is the use of a jigsaw method in task completion (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978; Lai & Wu, 2006). Jigsaw methods formally assign each

student a section of a group task (e.g., delegating a section of an assigned report to each group member). In formal cooperative learning structures, each student is held responsible for completing his or her task, and the assignment is completed together as a group. In formal cooperative learning structures, teachers monitor individual student progress and provide feedback to both individual students and cooperative groups.

Cooperative-based group models. Cooperative-based groups are the most structured of the cooperative learning models (Johnson et al., 1994). Cooperative-based groups are a way of formally structuring the entire classroom. Cooperative-based groups incorporate learning scripts that are used repetitively to structure classroom routines and lessons (Johnson et al., 1994). The most common variation of a cooperative-based group is Cooperative Learning Group (CLG) models (Hunt, Staub, Alwell, & Goetz, 1995).

CLGs were first developed by Johnson, Johnson, Holubec, and Roy in 1984. Structures of CLGs place students into groups of three to five peers and assign students to specific individualized roles (e.g., facilitator, recorder, time-keeper). Students are held accountable for completing independent roles and groups of students work together to complete academic tasks such as the completion of worksheets, flashcards, and the defining of key terms (Dugan et al., 1995). CLGs have intentionally been applied to promote the inclusion of students with specific learning needs (Cushing, Kennedy, Shukla, Davis, & Myer, 1997; Dugan et al., 1995; Hunt et al., 1995; Kamps, Barbetta, Leonard, & Delquadri 1994). In particular, CLGs have been used to support the academic engagement of middle school students with moderate to severe disabilities in general education language arts classrooms (Cushing et al., 1997) and to train middle school students with learning disabilities to recruit peer assistance with the completion of assignments in general education math and social studies classes (Wolford, Heward, & Alber, 2001). CLGs

have also been used to support the on-task academic and cooperative behaviors of high school students ages 15 to 18 years with emotional and behavioral disorders in self-contained (i.e., special education) classrooms (Salend & Sonnenschein, 1989). CLGs hold students accountable for completing individual tasks within the group. Within CLG structures, modifications to individual group member responsibilities may be further developed to include students with individual learning needs.

PMI Models Supporting Students with ASD

Although PMI has widely been used to support students of all abilities in general education classrooms, to date, there is limited research in the application of PMI in support of the academic achievement of secondary students with ASD. Given that the most prominent features of ASD are associated with impairments in social communication, it is not surprising that the majority (88%) of studies employing the use of PMI to support children and students with ASD have been in the areas of communication and social skill development and not academic achievement (Chan et al., 2009). Although limited in its application to academics, PMIs have been widely used to promote the social development of children with ASD for over 30 years (Odom & Strain, 1984; Odom & Strain, 1986). Several reviews of the literature have been conducted on the effects of PMI models with individuals with ASD (Bene et al., 2014; Chan et al., 2009; Chang & Locke, 2016; Watkins et al., 2015). These literature reviews identify a variety of trends such as: (a) the majority of the studies were conducted in elementary schools or preschool settings, (b) participants were primarily of early elementary or preschool school age (mean age of participants was 7.6 years), and (c) these studies particularly examined dependent variables including social skill development, academic instruction, and challenging classroom behaviors (e.g., inappropriate talking, engagement in stereotypy, difficulties in times of

transitioning). However, to date, there is very limited research on the use of PMIs to support the academic achievement of secondary students with ASD in inclusive classroom settings (Brock & Carter, 2016; Carter et al., 2005; Carter et al., 2017). Furthermore, of these three studies, only one addressed students with ASD without comorbid intellectual disability (Carter et al., 2017).

PMI models applied to support the academic achievement of students with ASD. Although the majority of PMI studies have been used to support social behaviors, to date 11 studies have been conducted using PMI models to support the academic achievement (i.e., language arts, math, science, history/social studies) of students with ASD and specific learning needs. For a complete review of the literature, see Appendix A. To better understand the gaps in the literature when examining PMI strategies, the results of these studies are presented in the following subsections: (a) demographics of student participants, (b) settings of intervention, (c) areas of academic achievement, (d) types of PMI model used in promoting academic achievement, (e) description of additional evidence-based practices included in the study, and (f) reported measures of social validity.

***Demographics of student participants*.** A total of 21 participants were included in these studies (16 males). Of the 21 students, 13 student participants were described as diagnosed with ASD without an intellectual disability (Brock & Carter, 2016; Carter et al., 2017; Dugan et al., 1995; Kamps et al., 1994; Kamps et al., 1999; Kamps, Leonard, Potucek, & Garrison-Harrell, 1995; McCurdy & Cole, 2014; Murphy, Grey, & Honan, 2004), two student participants were described as diagnosed with moderate autism (Dugan et al., 1995; Kamps et al., 1995), and six student participants were described as diagnosed with ASD and an intellectual disability (Carter et al., 2005; Hunt et al., 1994; Kamps, Locke, & Delquadri, 1989; Kamps, 1995). Participants were listed between seven and 18 years in age. Only three studies reported demographic

information on student participant's race or ethnicity (Brock & Carter, 2016; Carter et al., 2005; Carter et al., 2017).

***Setting of intervention*.** The setting for all 11 studies was conducted in traditional (e.g., non-clinical) school settings. While most of the studies (eight) were conducted in elementary schools (kindergarten through 5th grade; Dugan et al., 1995; Hunt et al., 1994; Kamps et al., 1989; Kamps et al., 1994; Kamps et al., 1995; McCurdy & Cole, 2013; Murphy et al., 2004), two studies were conducted in middle school classrooms (Brock & Carter, 2016; Carter et al., 2005) and, of particular note, only one study was conducted in high school classrooms (Carter et al, 2017). As one would hope given the nature of the intervention, eight of the studies were conducted in general education classroom settings (Brock & Carter, 2016; Carter et al, 2005; Carter et al., 2017; Dugan et al., 1995; Hunt et al., 1994; Kamps et al., 1995; Kamps et al., 1995; McCurdy & Cole, 2013), two studies were conducted in self-contained special education elementary classrooms (Kamps et al., 1989; Murphy et al., 2004), and only one study was conducted in an elementary hallway outside of a classroom setting (Kamps, Dugan, Potucek & Collins, 1999). For the studies that were conducted outside of the general education classroom, two studies were conducted within a self-contained special education classroom (Kamps et al., 1989; Murphy, Grey, & Honan, 2004). Referred to as "reverse mainstream," these two studies recruited the use of same-age typically developing peers that were academically placed in general education classrooms to provide intervention in the self-contained special education classroom during instruction. For the single study conducted in the elementary school hallway setting (Kamps et al., 1999), student participants were enrolled in the general education setting and the hallway setting was selected due to a reduction in noise level, distractibility, and lack of an available room within the given elementary school setting.

Measures of academic achievement. As mentioned previously, of all the studies examining PMIs with students with ASD, only 11 of them icluded academic achievement as the primary dependent variable. Areas of academic content supported by peer-mediated interventions included math (Carter et al., 2017; Hunt et al., 1994; Kamps et al., 1989), language arts (Kamps et al, 1994; Kamps et al., 1995; Kamps et al., 1999; McCurdy & Cole, 2014), science (Brock & Carter, 2016; Carter et al., 2005; Carter et al., 2017; Murphy et al., 2004), and history/social sciences (Dugan et al., 1995).

More importantly is how academic achievement was measured. Hunt et al. (1994) and Kamps et al. (1989) measured academic achievement using percentages of correct responses through the use of math manipulatives (i.e., counting coins and tangrams). Kamps et al. (1994) and Kamps et al. (1999) compared rates of words read correctly per minute at baseline and at intervention. In addition, three studies measured academic responses to comprehension questions (Kamps et al., 1994) and weekly pretest and posttest quizzes (Kamps et al., 1995; Dugan et al., 1995). Kamps et al. (1994) measured percentages of correct responses to comprehension questions as well as rates of words read correctly per minute with three elementary school students ages 8, 8, and 9 years. Kamps et al. (1995) created weekly reading passages as well as measured academic engagement in one elementary student age 8 years and two middle school students with ASD ages 13 and 12 years. Dugan et al. (1995) also conducted weekly pretest and posttest quizzes on social studies curriculum content using correct responses in both sight word vocabulary and content comprehension in two students ages 9 and 10 years.

Rather than measuring correct responses, Brock and Carter (2016), Carter et al. (2005), Carter et al. (2017), McCurdy and Cole (2013), and Murphy et al. (2004) measured academic achievement using percentages of academic engagement. Given variation in the response rates of

students identified with significant disabilities, percentages of academic engagement were used to signify learning. The use of engagement as a parameter of academic achievement is of particular interest, as this use of measurement may be a more viable alternative in the assessment of learning within inclusive general education classroom settings.

Types of PMI models used in supporting the academic achievement of students with ASD. Four studies were conducted measuring the effects of a peer support arrangement model on the academic engagement of students with ASD and specific learning needs in general education settings (Brock & Carter, 2016, Carter et al., 2005; Carter et al., 2017; McCurdy & Cole, 2013). In addition, four studies measured the effects of cooperative learning groups on the academic achievement of students with ASD and specific learning needs (Dugan et al., 1995; Hunt et al., 1994; Kamps et al., 1995; Murphy et al., 2004). Two studies were conducted measuring the effects of same-age peer tutors on elementary students with ASD (Kamps et al., 1989; Kamps et al., 1999). Kamps and colleagues (1989) studied the effects of same-age peer tutoring in a self-contained classroom in the areas of money counting, expressive language, oral reading, and comprehension. In a similar study, Kamps et al. (1999) studied the effects of peer tutors providing sight word instruction in a school hallway setting and on student participant's sight word recognition. Only one study was conducted measuring the effects of a classwide peer tutoring model (Kamps et al., 1994). In their study, Kamps et al. (1994) studied reading rates and comprehension responses in three elementary students with ASD.

Description of additional evidence-based strategies in PMI models. All 11 studies examined the effects of the PMI models outlined in this paper. However, all 11 studies also included interventions beyond the descriptions of the PMI models. For example, four studies described the additional use of visual supports (Dugan et al., 1995; Hunt et al., 1994; Kamps et

al., 1989; Kamps et al., 1995). Visual supports in these studies were listed as math manipulatives in both peer tutoring (Kamps et al., 1989) and cooperative learning group models (Hunt et al., 1994). Other visual supports were listed as graphic organizers and flashcards and were included in cooperative learning group models to support language arts (Kamps et al., 1995) and social studies (Dugan et al., 1995). Seven studies incorporated peer reinforcement, listed as peer praise (Brock & Carter, 2016; Kamps et al., 1989; Kamps, 1994; Kamps et al., 1999; McCurdy & Cole, 2014; Murphy et al., 2004) tangible reinforcement (Dugan et al., 1995), and a preferred group contingency activity (Murphy et al., 2004). Lastly, four studies included descriptions of peer-delivered prompting strategies, used within same-age peer tutoring (Kamps et al., 1989), cross-age peer tutoring (Kamps et al., 1995) and peer support model interventions (Carter et al., 2005; Carter et al., 2017). Kamps et al. (1989) and Kamps et al. (1995) trained fourth and fifth grade students in the use of verbal prompts to initiate academic responses in peer tutoring and cross-age peer tutoring models (e.g., "How much is this worth?" "What story did you read?"). Brock and Carter (2016) utilized paraprofessional educators to teach typically developing peers ways to support and verbally prompt and reinforce the academic behaviors of students with ASD. Carter et al (2005) and Carter et al. (2017) also trained typically developing peers in the use of verbal prompting as a method of reengaging student participants in academic tasks and assignments during occurrences of off-task behaviors.

Social validity. Social validity was reported in eight of the 11 studies identified. Measures of social validity were listed as follow-up surveys and a participant interview (Brock & Carter, 2016; Carter et al., 2017; Dugan et al., 1995; Kamps et al., 1994; Kamps et al., 1999; Kamps et al., 1995; Murphy, 2004), and as an intervention rating profile (McCurdy & Cole, 2014). It is important to note that only one study reported one participant who negatively

responded on one survey question within the high school peer support intervention (Carter et al., 2017). In this study, Carter et al. (2017) reported that one of the four primary participants reported "not wanting to continue hanging out with his peer partners moving forward." Other social validity questions within this study's survey included: "I felt like I was effective in this role." "I would be a peer support again in the future." "Others in this class should also do this." "I benefitted socially from having a peer support." And, "I benefitted academically from having a peer support" (p. 218).

Future Research in PMI Supporting Academic Achievement of Students with ASD

Although limited in study, the literature suggests that PMI structures are effective in supporting the academic engagement of students with ASD across various academic content areas (e.g., math, language arts). Both peer tutoring and cooperative learning models have been found to effectively promote academic achievement and social interactions for students with ASD. However, the literature also highlights areas for future research. Research in peer-mediated interventions supporting students with ASD is greatly needed in secondary settings. To date, only three studies in PMI (Brock & Carter, 2016; Carter et al., 2005, Carter et al., 2017), have been conducted in supporting the academic achievement of secondary students with ASD in general education settings. Two of these studies (Brock & Carter, 2016; Carter et al., 2005) were conducted in middle school settings and only one study (Carter et al., 2017) was conducted in high school classrooms. In addition, the incorporation of additional strategies (e.g., flashcards, math manipulatives) may further support specific academic outcomes within PMI structures (Dugan et al., 1995; Hunt et al., 1994; Kamps et al., 1989; Kamps, et al., 1995). By combining additional strategies that are unique to academic achievement, within PMI structures, teachers

may further assist peers in the delivery of specific academic concepts as well as communicate the steps necessary to complete assignments in class.

Overall, PMIs have been identified as an evidenced-based practice by both the National Professional Development Center on Autism Spectrum Disorders (Wong et al., 2015) and the National Standards Project (2015). In the context of inclusive classroom settings, PMIs are particularly effective in providing additional academic supports to students with ASD and specific learning needs while not further impacting the instructional demands of the teacher. While PMIs have been effective at increasing academic engagement and task completion, the practice of using PMIs to support the academic achievement of students with ASD is limited, and as a result, it is difficult to make generalizations regarding the implications of PMIs in secondary classroom settings.

PMIs are effective because they: 1) increase the proportion of instructional time, 2) support individual students with additional practice, and 3) provide immediate feedback with error correction (Bene et al., 2014; Fuchs et al, 1997). What is yet to be known, is how the use of PMIs can be further incorporated to support the maintenance and completion of assignments throughout an entire class period, particularly without modifications to the requirements of academic tasks and assignments within the general education curriculum.

In supporting the academic achievement of students with ASD and specific learning needs, there are two major areas of research needed in this field: 1) the application of PMI models previously validated as effective for general education students (e.g., PALS, CLGs) extended to support the achievement of students with ASD, and 2) the application of additional evidence-based strategies, that are effective in supporting students with ASD, implemented through peer-mediated interventions. That is, how can PMI be used to increase the

implementation of other EBPs to support the academic achievement of students with ASD? In a study on Peer Support Arrangements to support students with significant disabilities, Brock, Biggs, Carter, Cattey, and Raley (2016), trained paraprofessionals to facilitate time delay procedures to support the engagement of students with significant disabilities during elective art and computer classes, including one student participant with ASD in a fifth grade art class. In a similar approach, training peers to model the use of additional evidence-based practices, may be beneficial in supporting and maintaining an inclusive, secondary classroom setting for students with ASD and specific learning needs. Incorporating academic practices (EBPs) that are supportive of students with ASD in general education settings (i.e., priming, visual supports) with PMI structures (i.e., modeling, prompting, opportunities to respond and receive feedback) may establish a learning environment that is supportive of students with ASD within inclusive, secondary classroom settings.

Statement of Purpose

This study adds to the literature on using PMI strategies in inclusive, secondary classroom settings to support students with ASD and specific learning needs. In addition, this study extends the literature by examining the effects of combining evidenced-based strategies for academic achievement (i.e., priming, visual supports) with the components of a PMI structure (i.e., peer modeling, prompting, and reinforcement) to increase academic outcomes for students with ASD. This study examines the effects of this multicomponent intervention on the social behaviors for students with ASD.

Theory of Change

The literature is clear. Students with ASD can benefit from highly structured, predictable, and consistent class routines (Griffin et al., 2006; Heflin & Alberto, 2001; Ivannone et al., 2003;

Kaufman, 2002). Variations in secondary classroom routines, resulting from multi-period daily schedules as well as increased, independent student performance expectations, make it difficult for students with ASD to understand exactly what is expected from one class period to the next (Newman, 2007). However, demands on teacher time in the secondary general education classroom provide even more challenges to the individualization of instruction by general education teachers.

PMI strategies have been effective in increasing social and academic achievement in the general education classroom, even for secondary students (Calhoon & Fuchs, 2003; Fuchs, Fuchs, & Kazdan, 1998). PMI strategies support academic structure and provide students with an increased opportunity to respond and receive feedback (Bene et al., 2014; Fuchs et al, 1997). PMIs, applied to secondary classrooms may be particularly effective in supporting cooperative task completion through peer modeling and observational learning (Bandura 1977; Wong, 2015). Yet, the vast literature in PMI has not been explored in secondary settings with students with ASD. As a result, additional research is needed combining the use of PMIs with additional evidence-based practices to support the academic achievement of secondary students with ASD.

Combining EBPs within PMI. Secondary teachers, who supplement instruction with the use of EBPs in their classrooms, will create a learning environment that is supportive of the academic needs of students with ASD. In addition, the academic achievement of students with ASD can be further supported by the use of EBPs within the structure of PMI. To date, there have been no investigations incorporating the use of PMI and EBPs, which are unique to the academic achievement of students with ASD, as a means of structuring the presentation of academic content to support students with ASD in inclusive secondary classrooms. This study will examine the use of PMI, antecedent-based instruction (i.e., priming) and visual supports as a

way to increase academic engagement and social interactions, while facilitating peer instructional practices in a secondary general education classroom.

Priming. Priming consists of previewing information about an assignment or activity prior to engaging in the activity and is considered an evidence-based practice in supporting children and students with ASD (NAC, 2015; Wong, et al., 2015). Priming is a form of antecedent-based instruction and helps students to prepare for an activity by describing exactly what to expect during the activity, what is necessary to earn credit, and to better understand when an activity or assignment is considered to be complete (Harrower & Dunlap, 2001). Priming strategies have been used to minimize disruptive behaviors in elementary and secondary students with ASD in language arts (Koegel et al., 2003), to assist preschool and early elementary students with ASD in initiating social interactions with peers during school activities (Gengoux, 2015; Zanolli, Daggett, & Adams, 1996), to reduce disruptive behaviors of preschool-aged children with ASD during transitions between activities (Schriebman, Whalen, & Stahmer, 2000), and to assist elementary-aged students in the engagement of novel events throughout the learner's day (e.g., requesting a meal for lunch, reading a sign during a field trip).

Visual Supports. Teaching cognitive and metacognitive strategies, such as the use of an organizer or activity checklist, supports the academic achievement of students with ASD in task and work completion (Whitby et al., 2009). One simple mechanism for teachers to promote structure in secondary classrooms is the use of a visual support (Bryan & Gast, 2000; Dettmer, Simpson, Myles & Ganz, 2000). Visual supports communicate a set of tasks for students to complete sequentially. "An activity schedule is a visual support system that combines photographs, images, or drawings in a sequential format to represent a targeted sequence of the student's day" (Banda, Grimmett & Hart, 2009, pg. 18). According to the NPDC, activity

schedules meet criteria for best practice in supporting the academic achievement of students with ASD falling under the category of visual supports (Wong, 2015). Activity schedules have been found to support children with ASD in self-managing task completion (Bryan & Gast, 2000; Pierce & Schriebman, 1994), remaining academically on-task (Dettmer et al., 2000), and transitioning to changes in scheduling (Krantz, McDuff, & McClannahan, 1993; Schmit et al., 2000).

Incorporating EBPs with PMIs in the classroom. This study hypothesized that the incorporation of EBPs delivered using PMI strategies would promote classroom structure and support positive academic and social outcomes for students with ASD. For the purposes of this study, the effects of two EBPs in particular were targeted. The use of antecedent-based instruction (i.e., priming) and visual activity schedules were selected because they help to deliver instructional content; i.e., assignments in a structured and predictable format. Students with ASD will be further assisted when typically developing peers model the use of the visual support, and subsequently, the completion of in-class assignments within a peer tutoring/cooperative learning structure.

The visual support served as a reference tool (catalyst) for which additional EBPs can be utilized. Using the visual support as a vehicle, PMI strategies incorporated EBPs such as: priming, modeling, prompting, and reinforcement. These EBPs facilitated the success of PMIs in secondary classroom settings by communicating classroom expectations; i.e., by breaking assignments into smaller sets of tasks, by prompting students to remain academically engaged, and by increasing the likelihood that students will remain on task and complete assignments cooperatively together.

Chapter Three: Method

This study examined the use of a peer-mediated instruction (PMI) in collaboration with the use of a priming (i.e., a preview of the tasks to complete projected on the board) and visual support (i.e., student self-monitored activity checklist) as a way of increasing social interactions and supporting the academic achievement of secondary students with (ASD) and specific learning needs. This study employed a multiple-baseline across participants design (Kazdin, 2011) to determine the effects of: 1) the multicomponent intervention consisting of priming, a visual activity checklist, and PMI on the academic engagement of students with ASD and specific learning needs, and 2) the multicomponent intervention on the social interactions of students with ASD during daily class sessions.

Setting and Participants

The study took place in a public high school located in the Pacific Northwest region of the United States. This district serves upper middle-class students with 15% receiving services in English learning and 18% qualifying for free and reduced lunch. The participating school serves 1,800 students, grades 9-12. The demographics of the participating school consists of 6% of students receiving services in English learning, 6% of students receiving special education services, and 13% qualifying for free and reduced lunch. The school also is the location for the Peers Plus program. This program was specially designed to address the wide range of needs of secondary students with ASD, with an emphasis on attending classes in the general education setting and using peers in a variety of ways to support the social membership and academic outcomes of these students. The school schedule consists of seven, 50-minute periods three days a week; three, 80-minute periods one day a week; and four, 80-minute periods one day a week.

The intervention took place for each student during a 10th grade co-taught (i.e., general education teacher and special education teacher) general education, language arts class. The co-taught class was offered twice each school day and participants were either enrolled in the first class period setting (Participant 1), or second class period setting (Participants 2 and 3). In addition to the participants, these classrooms included teachers and typically developing peers. Typical of secondary classroom settings, 29 and 30 students were enrolled in each class period, respectively. Student desks within the classroom were arranged in small groups of three to four desks facing inward. A total of eight small groups were arranged within both classroom settings.

Student participants included two students with ASD, and one student with a diagnosis of Other Health Impairment (OHI) and behaviors characteristic to ASD. In addition, eight typically developing peers (i.e., students without a disability) were recruited to serve as peer-mediated interventionists. A total of two teacher participants/interventionists were also recruited: one general education language arts teacher, and one special education teacher providing co-teaching services within the general education classroom. Both the general education teacher and special education teacher were the instructors of record in both periods in which the study took place.

Recruitment. Three primary student participants, two students with ASD and one student with a diagnosis of other health impairment (OHI) and specific learning needs (hereafter referred to as participants) were recruited for this study based on teacher nomination and parental consent. The inclusion criteria for participants were: a) a primary disability category of ASD or another disability category with behaviors characteristic to ASD, and b) a goal related to academic support or teacher report of low rates of engagement or work completion in class. The inclusion criteria for peers without a disability were: a) teacher nomination as being a potentially good fit, b) high attendance rates, c) knowledge of the target participant, and d) primary

participant preference. The inclusion criteria for teachers consisted of: a) teach within a general education classroom setting, b) assigned area of core content academic instruction including math, science, history/social science, or language arts, and c) have a student with ASD or another disability category with behaviors characteristic of ASD and specific learning needs, who may potentially benefit from additional academic support in the general education classroom.

After receiving approval to include human subjects in research from the University Institutional Review Board and obtaining approval from the partner school district, the researcher and special education teacher worked together and asked the general education teacher to nominate student participants who may potentially benefit from the PMI model based on: a) a goal (i.e., 504 plan, individual education plan) related to academic support, or b) teacher report of low rates of engagement or work completion in class. See Appendix B for consent forms. In addition, student peers without a disability (hereafter referred to as peers) who were enrolled within each classroom setting were also recruited based on teacher nomination (i.e., goodness of fit) or primary student participant preference (i.e., preferred peers in the classroom). For the purpose of this study, participants with comorbid, intellectual disability were not included in recruitment.

Participants. Edgar was a 15-year old Pakistani-American male with a diagnosis of ASD in the 10th grade. Edgar was enrolled in general education classes for 71% of his school day and attended special education classes in the areas of study skills (i.e., academic support) and social skills. Edgar had a one-on-one paraprofessional educator who provided academic support throughout the school day. According to his teachers, Edgar had average intellectual functioning, high levels of insight, and was well liked by his peers. Edgar's academic goals were in the areas of math and reading comprehension, and his behavioral goals were in communication and

emotional regulation. Edgar's intervention setting was the first class period co-taught by the general education and special education teacher. The class had 29 students in the classroom. In addition to meeting the inclusion criteria, Edgar was nominated by his teachers because of his goals in communication and a desire to spend more time with peers his age. Edgar's paraprofessional sat directly next to him in class. Edgar's classroom accommodations included taking breaks or using noise cancelling headphones.

Andrew was a 16-year old white male with a diagnosis of ASD in the 10th grade. In addition, Andrew also had a comorbid diagnosis of anxiety and was prescribed medication to increase attention. Andrew spent 86% of his school day in the general education classroom and received additional special education services during one period of study skills. In addition to meeting the inclusion criteria for the study, Andrew's teachers recommended him because his academic goals were revising and editing written work and he had behavioral goals to support his self-advocacy to initiate tasks without adult prompting. According to his teachers, Andrew had average intellectual functioning, came to school prepared, participated in class discussions, and cooperated well with teachers and adults. Andrew was nominated by his teachers to support his goals in task initiation and off-task behaviors including the use of his laptop computer or cell phone and fidgeting with his hands or objects during large group and small group instruction. Andrew's intervention setting was the second classroom period co-taught by the general education teacher and special education teacher. The class consisted of 30 students enrolled in the co-taught language arts class.

Benjamin was a 16-year old Hispanic male in the 10th grade with a diagnosis of Type I Diabetes, Attention Deficit Hyperactivity Disorder (ADHD) combined type, and described by his teachers as demonstrating behaviors characteristic of ASD. Benjamin received special education

services under the category of Other Health Impairment (OHI). Benjamin spent 86% of his school day in the general education classroom, including two advanced placement courses, with additional special education services provided during one daily class period of study skills. Benjamin's academic goals were in reading comprehension and written expression, and his behavioral goals were in the areas of organization and coping with stress and anxiety. According to his teachers, Benjamin's intellectual functioning was in the above average to high range. Benjamin's intervention setting was the second classroom period. Benjamin was nominated by his teachers to support his organizational skills, social interactions with peers, and in-class behaviors that included repetitiously clapping his hands and blurting out comments exacerbated by feelings of anxiety.

Peer group members. A total of eight typically developing peers were recruited for this study. Peers were nominated by the general education teacher and special education teacher for having high levels of academic engagement, potential of being a good fit in supporting participants, and having a good attendance record. Once peers were nominated, they were approached by the researcher and provided with student assent and parental consent forms.

Edgar's peer group included Jane, Steve, and John. All three students were 16-years old and nominated by the teachers for being exemplary students in the classroom with high rates of academic engagement. Jane and Steve had prior experience working well with Edgar in class. In addition to Jane and Steve, Edgar had expressed interest in working with John. John spoke Arabic as a second language and Edgar would at times ask John for translations of Arabic words in class. Andrew's peer group included Rebecca, James, and Fernando. All three students were 16-years old and were nominated as a result of high rates of academic engagement in class. According to her teachers, Rebecca, in particular, had strong social skills and leadership

capabilities when working in small groups. James and Fernando were nominated for their positive demeanor and having a history in class of working well with peers in class. Benjamin's peer group included Mary and Jessica. Mary was 17-years old and was enrolled in the class as a teacher's aide and academic support (elective coursework). Mary had previously taken the course two years ago and her teachers nominated her for her leadership skills and positive demeanor. Jessica was 16-years old. Jessica had prior experience working well with Benjamin in class and was a preferred peer with a history of talking and sharing jokes with Benjamin in class. See participant demographic information in Table 1.

Behavioral Measures

Independent variable. The independent variable in this study is a multicomponent intervention consisting of: 1) priming, 2) a visual activity schedule, and 3) implemented within the context of PMI.

Visual support activity checklist. A visual support (i.e., the use of an organizer or activity checklist) was created by the primary researcher drawing on the work of Bryan and Gast (2000), Dettmer et al. (2000), and Pierce and Schriebman (1994). The development of the visual support activity checklist was based on the "Agenda for the Day" a preview of the day's lesson provided by the general education teacher at the beginning of each class period. The "Agenda for the Day" lists three to seven tasks to be completed in class and is projected on the board in the front of the room using a Microsoft PowerPoint slide. The visual activity schedule is a printed sheet of paper with blank boxes for students to write the tasks listed on the "Agenda for the Day" with three additional boxes to the right of each listed task for students to write a plan for completing the task together. The use of the visual activity schedule was delivered by peers and the completion of academic tasks was encouraged and monitored by each set of participating

peer groups throughout the duration of each class session. See Appendix C for the visual activity schedule.

PMI. Peer-mediated intervention and instruction was employed by peer participants to systematically prompt the academic engagement of primary participants using modeling, prompting, and reinforcement. Participating peers modeled appropriate academic behavior and provided supportive feedback (i.e., prompting and reinforcement) to assist in the completion of classroom assignments.

Dependent variables. Two dependent variables were measured in this study: 1) academic engagement, and 2) social interactions between student participants and peers. Examples and non-examples of dependent variables can be found in Table 2.

Academic engagement. In this study, academic engagement was defined as student has eyes on materials or is using materials that are a part of the activity; has eyes on their peers or peer's materials; or has eyes on the teacher or his or her materials. Materials were defined as texts, worksheets, organizers, any technology that pertains to the academic task, visual schedules, writing utensils, or other materials necessary in completing tasks. For the purpose of clarifying on-task, nonexamples of academic engagement were defined as: the primary participant not looking at or manipulating academic material; or looking at or manipulating material other than academic tasks. Nonexamples of academic engagement include but were not limited to: looking at a peer not in the group looking outside, walking around the room, drawing not associated with the task, playing with materials or objects other than materials needed for the task, or having head down on desk.

Peer social interactions. Social interactions between participants and typically developing peers were measured. Social interactions were defined as an initiation followed by a

response to the initiation and continued until one member of the social interaction stopped responding for 5 seconds. *Initiations* were defined as either verbal questions, clarifications, requests for help, comments, etc. or physical communication (e.g., pointing to materials or gesturing to a peer) that begin a social interaction. *Responses* were defined as physical or verbal behaviors responding to a prior initiation within five seconds of the initiation. A social interaction was terminated if the participant or peer did not engage in any initiation or response within five seconds (Odom & Strain, 1986; Tapp, Wehby, & Ellis, 1992).

Data Collection and Analysis

Data were collected in one class period per day using a combination of a momentary time sampling (30 seconds) and partial interval recording (15 second observe, 15 second record) (Carter et al., 2017). A digital, audio interval timer was obtained through youtube.com and omitted a sound (i.e., a beep) into wireless earbuds. Data were collected in person by the researcher throughout the period (50 minutes). However, because the nature of a PMI structure requires peers to have the opportunity to provide feedback, for the purposes of this study, only data from large group instruction (i.e., teacher is addressing seven or more students) and small group instructional format (i.e., students are working in groups of two-to-four students) are presented. In addition, a category of small group with paraprofessional (i.e., paraprofessional educator within five feet of proximity) was included in observations of Edgar. For data collection sheet, see Appendix D.

Academic Engagement. Participants' engagement in academic material was measured each session using a 30-second momentary time interval. Percentages of academic engagement were calculated by dividing the number of intervals recorded as academically engaged by the total number of intervals recorded and multiplied by 100.

Peer Social Interactions. Peer social interaction data between the primary participant and peers were collected using a rotating 15-second partial interval throughout each observation of the class period. Intervals rotated between 15-s observe, 15-s record. An occurrence of a social interaction was marked during each 15-second interval if the primary participant either initiated an interaction and a peer responded (i.e., verbally or gesturally) within five seconds, or responded to a peer initiation verbally or gesturally within five seconds. Percentages of social interactions were calculated by dividing the number of intervals recorded as an interaction by the total number of intervals recorded and multiplied by 100.

Interobserver Agreement. Consistent with Kratochwill et al. (2013), interobserver agreement (IOA) was collected in at least 20% of the classroom observation sessions. The author and one of three recruited graduate students simultaneously coded academic engagement and social interactions. Prior to data collection, recruited graduate students were trained in the data collection procedure. During this training, the author and each recruited graduate student discussed the operational definitions of targeted behaviors and examples. The researcher and each graduate student practiced coding procedures together in the observed classroom setting, and data collection began once the researcher and graduate student established consistent, i.e., 10 consecutive agreements during practice coding sessions. IOA was calculated using a point by point agreement (i.e., both observers marked an interval the same) or disagreement (i.e., both observers marked intervals differently) system. The total number of intervals marked as an agreement were divided from the total number of intervals observed. This number was multiplied by 100 for a total percentage of IOA agreement for each session.

Treatment Fidelity. Treatment fidelity was measured to ensure that all participant groups received intervention as intended throughout the duration of the experimental study

(Kazdin, 2011). As a result, a treatment fidelity intervention checklist was collected at the end of each session by both the researcher and recruited graduate student observer. The treatment fidelity intervention checklist was comprised of seven questions: 1.) Were all group members present, on time, and seated together in class?; 2.) Did the student group have access to the activity schedule?; 3.) Did the student group identify and list 3-5 tasks to complete on the activity schedule prior to instruction?; 4.) Did the student group work together throughout the class period using the activity schedule?; 5.) Did peers provide verbal and gestural promoting and encouragement?; 6.) Did peers provide reinforcement?; and 7.) Was the number of tasks completed on the activity schedule recorded? Percentage of fidelity was calculated by the number of steps completed, divided by the total number of fidelity steps, and multiplied by 100. For the steps to fidelity checklist, see Appendix E.

Social Validity. Social validity surveys were completed by all participants prior to intervention and upon the completion of this study. Measures of social validity were collected to determine if the student participants found the intervention useful and acceptable for use in the classroom. Adapted from Carter et al. (2017) the social validity survey contained 10 questions using a five-point Likert scale. Survey questions asked students to respond based on their personal opinions regarding the importance of completing assignments in groups; the benefits of being seated in small groups in class; and if they would recommend participating in small group structures to both peers and teachers for future use. During the follow-up survey, students responded to the same 10 question survey as well as five additional open-ended questions asking students to provide feedback and thoughts for the improvement of the PMI model. See survey and open-ended questions in Appendix F.

Experimental Design

This study employed the use of a multiple baseline across participants design (Kazdin, 2011; Cooper, Heron, & Heward, 2014). A multiple baseline design is a single case research designed used to demonstrate a functional relationship through replicating changes in the dependent variable contingent on the staggered introduction of the independent variable across multiple participants (Kratochwill, 2013). Using this design, data were collected on all three participants during baseline. After data were collected over five observational baseline sessions, the independent variable was introduced for one participant while baseline conditions remained in place for the two participants holding all else constant (Cooper et al., 2007). Once a consistent rate of responding or pattern was established after the intervention with participant one, intervention was introduced to the second participant. Subsequently, this process continued until all participants had been introduced to the intervention and a consistent rate of responding was established in each experimental condition.

Data Analysis. Changes in experimental conditions were based on visual interpretation of dependent variables. Percentages of academic engagement and percentages of social interactions were graphed reflecting each session. Changes in experimental conditions (from baseline to intervention) were based on visual inspection of primary participant academic engagement. That is, within the multi-baseline design, students moved into intervention based upon a minimum of five observations of academic engagement within the baseline phase and an increase in academic engagement of the participant in the previous level of the design (Cooper et al., 2007). Analysis after the completion of the study included percentages of non-overlapping data (PND), calculation of level, trend, and variability.

Percentages of non-overlapping data. Percentages of non-overlapping data (PND) were calculated by counting the number of data points in the intervention phase that were above the highest data point in the baseline phase divided by the number of data points in the intervention phase and multiplied by 100 (Scruggs & Mastropieri, 1994). Higher percentages of PND are associated with higher rates of the effectiveness of an intervention.

Levels. Levels were also calculated. Changes in levels were obtained by calculating the mean of data points in the baseline phase and comparing that number to the mean of data points in the intervention phase. Means were calculated by adding all percentages of intervals recorded within each data point, dividing the total sum of all percentages of intervals by the total number of sessions, multiplied by 100.

Trend. Data trends were calculated using the split-middle technique (White, 1975). The split-middle technique compares trend directions within conditions. Trends were calculated by dividing the data into two equal parts. Next, mid-rate (up and down) and mid-date intersections (left and right) were marked on opposite sides of the vertical line. For example, if there were 7 data points within a condition, a vertical line was drawn on the fourth data point. Then, intersections were marked on the second data point up and down (mid-rate) and second data point from left to right (mid-date) on either side of the vertical line. A trend line was then physically drawn connecting the two mid-rate and mid-date intersections and adjusted so that there was an equal number of data points above and below the trend line (Cooper et al., 2007; Gast & Ledford, 2014).

Variability. In addition to trend, a stability envelope for each condition was calculated to determine variability (Gast & Ledford, 2014; Lane & Gast, 2014). A stability envelope demonstrates variability within a trend by comparing the range of data points that fall within

25% of the median (middle) data point in the baseline phase. This "envelope" is then applied to the median data point in the intervention phase. Data were considered "stable" if 80% of the data points within each condition fell of 25% of the median (Lane & Gast, 2014).

Procedures

Baseline. Baseline consisted of classroom instruction as usual. In the baseline phase, teachers continued instruction as it typically occurred without the use of the visual activity schedule or PMI model. That is, each day the teacher began the day by introducing the "Agenda for the Day" and describing three to seven activities that the students were expected to complete during that class period. After the "Agenda for the Day" had been reviewed, the teacher began instruction. All students were seated in groups of three to four. The baseline phase was used as a comparison to measure the effects of the intervention on dependent variables. Baseline conditions remained in place until a consistent rate or pattern of responding for each primary participant's academic engagement was identified. Using a multiple baseline design, this process continued with the remaining primary participants until all primary participants received intervention. The only exception to this was for Edgar. During the baseline condition, Edgar's paraprofessional educator remained seated next to him. After five baseline condition sessions, the paraprofessional educator was then asked to move to the side of the room with a proximity greater than five feet. All other conditions remained the same.

Student training. After baseline, the researcher trained peer groups (i.e., participants and peers) in the use of the multicomponent intervention (i.e., visual activity schedule and PMI model). Edgar's group (i.e., Edgar, Jane, Steve, and John) was trained during one 30-minute session after school in the special education teacher's classroom. Andrew and Benjamin's groups were trained during one 30-minute training session during lunchtime. Training materials

included a Microsoft PowerPoint presentation, copies of the visual activity schedule, and a one page social script of examples of prompts and reinforcement to use within the group. See training materials in Appendix G.

Student training in the PMI model and prompting. All peer group members were trained to implement a system of modeling, prompting, and reinforcement and to encourage the academic engagement of all group members including peers with ASD. During the training session, students were introduced to operational definitions of the following terms: academic engagement, modeling, verbal prompting and encouragement, gestural prompting, and positive feedback. The author and students then discussed examples of each term and students were asked to brainstorm additional examples of academic engagement and to practice (i.e., role play) each term within the group. Groups were considered to be trained in each term when the group was able to provide and demonstrate (i.e., role play) three additional examples of each term.

Student training in the visual activity schedule. During the training session, groups were trained in the use of the visual support by the author. Students were introduced to the visual activity schedule and instructed to copy a hypothetical "Agenda for the Day" into the activity schedule. Student groups were guided by the author in creating a plan as a group for the completion of each in-class academic task. At the end of the training session, peer participants practiced the use of the activity schedule and the completion of the hypothetical tasks by incorporating engagement, modeling, verbal prompting and encouragement, gestural prompting, and positive feedback through the use of role play. During this stage, the author was present in the room and provided feedback to groups.

Intervention. At the beginning of each session, student groups sat together and previewed the "Agenda for the Day" (i.e., in class tasks to be completed for credit) projected on

the board in the front of the room by the teacher. Together, the participant group set up the visual activity schedule and included a plan for completing each step as a group. For example, in the beginning of a class session, using the "Agenda for the Day" the general education teacher explained the lesson plan for the day: to complete a warm-up activity, to take notes in class, and to complete a follow-up worksheet. The students then entered these tasks into the visual activity schedule and included a plan of one-to-three steps that the group could do to work together in completing each task (e.g., Who will be responsible for obtaining materials? Who will be responsible for sharing out? etc.). During the class session the students worked together to complete assignment tasks. All peer group members (participants and peers) supported the academic engagement of one another by using modeling, prompting, and reinforcement as well as the visual activity schedule to complete academic tasks. Given variation within each day's lesson, the academic tasks projected on the "Agenda for the Day" also varied. However, academic tasks to be completed within each class period were introduced in the same format at the beginning of each session (i.e., What is due at the end of the period and what are the steps to be entered into the visual activity schedule for completion?). At the end of each class period, the group recorded the number of tasks completed on the visual activity schedule and submitted completed visual supports to the teacher. The intervention fidelity checklist was completed by the author with the assistance of student group members at the end of each class session. Data on engagement and social interactions between participant groups were collected and measured. Data collection occurred daily during each class period for a total of 28 observational sessions.

Chapter Four: Results

Interobserver Agreement and Fidelity of Implementation

Interobserver agreement (IOA) data were collected during a minimum of 20% of all observations across all phases. For Edgar, total IOA were collected during 38% of all observations. Edgar's mean IOA for academic engagement was 91.17% (range 81%-100%) and 99.5% (range 97%-100%) for social interactions. For Andrew, IOA were collected during 31% of all observations. Andrew's mean IOA for academic engagement was 87.67% (range 75%-100%) and 93.44% (range 83%-100%) for social interactions. Lastly, IOA were collected during 38% of all observations for Benjamin. For Benjamin, his total mean IOA for academic engagement was 91.13% (range 80%-100%) and 92.13% (range 83%-100%) for social interactions. For all student participants, IOA never fell below 75%. No additional IOA booster trainings were required.

Fidelity of implementation of the intervention was collected using a checklist and filled out by the researcher and peers in the study daily. Across all sessions and all peer groups the fidelity of implementation checklist was 100%. Observations for Edgar averaged 21 minutes (range 8 minutes to 48 minutes). For Andrew and Benjamin, observations averaged 18 minutes (range 6 minutes to 44 minutes).

Percentage of Intervals of Academic Engagement and Social Interactions

Data for academic engagement and social interactions for each participant are described below and shown in Figure 1. Mean number and ranges for academic engagement and social interactions are shown in Table 3. For each participant, trends for academic engagement are shown in Figure 2 and trends for social interactions are shown in Figure 3. In addition, stability

envelopes for academic engagement are shown in Figure 4 and for social interactions in Figure 5 and percentages of data points falling within the median are reported in Table 4.

Edgar. During baseline, Edgar's academic engagement was variable with a mean percentage of 25.6% of intervals and a range of 3%-46%. On session five, Edgar's one-on-one paraprofessional educator was moved from sitting next to Edgar to the side of the classroom (proximity greater than 5 feet). After asking Edgar's one-on-one paraprofessional to move to the side of the room, five additional baseline sessions were collected. Edgar's academic engagement at baseline without the one-on-one support of his paraprofessional educator was a mean 25.4% of intervals (range 13%-32%) indicating a minimal change in percentages of intervals of academic engagement (-0.35%). In addition, during the baseline phase Edgar's social interactions with peers was a mean of 3.11% of intervals with a range of 0%-7%. After the removal of the paraprofessional educator to the side of the classroom, Edgar's social interactions increased slightly during baseline (+0.29%) to a mean of 3.40% of intervals (range 0%-7%). Edgar's social interactions in the baseline phase showed variability and no direction in trend.

After the implementation of intervention, Edgar's percentages of intervals of academic engagement increased to a mean of 51.4% (range: 38%-69%). When examining level and trend, Edgar's percentages of intervals of academic engagement indicate an immediate change from a variable, descending trend in baseline to a variable, ascending trend during intervention. The percentage of non-overlapping data points (PND) on academic engagement from baseline to intervention was 71%. During intervention, Edgar's percentage of intervals of social interactions increased to a mean of 12.86% (range: 6%-31%) with variability and a flat (no direction) trend.

Andrew. Andrew's academic engagement during baseline was variable with a mean of 38.81% of intervals and a range of 19%-77%. Of note, Andrew demonstrated a particularly high

percentage of academic engagement on the 10th session (out of 16) of the baseline phase (77%) that was 23% above the second highest data point (54%) during baseline. Excluding this data point, Andrew's range of academic engagement was 19%-54% of intervals. Andrew's percentages of social interactions was low and also showed variability during baseline with a mean of 7.38% (range: 0%-19%).

During intervention, Andrew's percentage of academic engagement increased to an mean of 62.5% of intervals with a range of 50%-79%. Examination of trend for Andrew's academic engagement indicates an immediate change in trend from a descending direction during baseline to a variable, ascending trend during intervention. The PND for academic engagement was 0%. Throughout intervention, Andrew's percentage of intervals of social interactions increased to a mean of 27.33% (range: 0%-46%). Trend lines for Andrew's social interactions also indicate a level change and a change in trend to a variable but ascending direction. The PND for social interactions from baseline to intervention was 75%.

Benjamin. During the baseline phase, Benjamin's academic engagement was highly variable. Of particular note, Benjamin demonstrated high percentages of academic engagement during the fourth (85%), eighth (96%), and 16th (79%) sessions within the baseline phase (22 total sessions). Overall, his mean percentage of academic engagement was 52.7% with a range of 21%-96%. In addition, Benjamin's social interactions at baseline were a mean of 14.85% and a range of 0%-42%. Benjamin's baseline percentage of intervals of social interactions also showed variability.

In intervention, Benjamin's mean percentages of intervals of academic engagement increased to 77.83% (range: 58%-100%). During the intervention phase Benjamin demonstrated higher percentages of intervals of academic engagement with a variable no direction trend. The

PND of percentages of intervals from baseline to intervention was 17%. Throughout intervention, Benjamin's mean averages of percentages of intervals of social interactions with peers increased to 33.67% (range: 21%-50%). Examining trends, Benjamin demonstrated variable but higher percentages of social interactions with a descending direction in trend. The PND of percentages of intervals from baseline to intervention was 17%.

Social Validity

Measures of social validity are reported in Table 5. Social validity data were measured using pre and post 10 question, 5-point Likert scale surveys with 3 open ended questions included in follow-up measures: "What I liked about working in the group", "What I did not like about working in the group", and "Do you have any suggestions/ideas that would make this type of group setting better?" On average, all student participants, i.e., participants and peers reported that they "enjoyed participating in groups in class" (M = 3.9); "felt confident within a group" (M = 4.5); "benefited socially from working in groups" (M = 4.2); "would recommend working with a group to other students" (M = 4.5); and "would recommend working within a group to other teachers" (M = 4.4). One peer participant was absent during the follow-up survey (N = 10).

Chapter Five: Discussion

The results of this study showed that the multicomponent intervention delivered within the context of peer-mediated instruction had positive outcomes for all three secondary students' academic engagement and social interactions. In particular, this study demonstrated positive effects on both the mean percentage of academic engagement and in reducing the variability of participants' engagement in daily lessons and activities. In addition, for all three participants, the intervention produced positive effects on participants' social interactions. This study adds to the literature in supporting the academic engagement of students with ASD by incorporating the use of a PMI structure with visual activity schedules and priming. PMIs in combination with visual supports have been previously applied in supporting the social interactions of students and children with ASD (Garrison-Harrell, Kamps, & Kravits, 1997; Thiemann & Goldstein, 2004). However, to date, the effects of activity schedules within a PMI structure on social interactions and the subsequent academic engagement of students with ASD, have limited application in secondary, general education classrooms. Findings from this study address the call for multicomponent interventions supporting links between academic and social skills in adolescent students with ASD (Fluery et al., 2014). Finally, this multi-component intervention has promise for use in secondary classrooms supporting the needs of students with ASD without the use of extra adult support and while still providing support for the teacher and students. This chapter presents a summary of the interpretations of this study in the following order: 1) academic engagement, 2) social interactions, and 3) utility of the multicomponent intervention. This chapter then presents the limitations of the study and conclude with implications for teachers and future research in the field.

Academic Engagement. The primary purpose of this study was to examine the effects of this multicomponent intervention on the academic engagement of secondary students with ASD in an inclusive classroom setting. The results of this study highlight two important findings in support of participants' academic engagement in the classroom. First, all three student participants demonstrated positive increases in overall percentages of academic engagement; and second, the variability of academic engagement was reduced within small and large group instructional settings. Some variability was expected in academic engagement within secondary settings as academic engagement is influenced by the instructional format during lessons (e.g., large group instruction, small group instruction, independent work), topics of interest within the lesson (e.g., survival skills in the wilderness; Lawson & Mason, 2015), and teacher pedagogy (e.g., the use of project-based learning, opportunities to respond, and providing specific feedback; Hirn & Scott, 2014; Menzies, Lane, Oaks, & Ennis, 2017) which may impact the way secondary students, including students with ASD react and engage with in-class tasks and assignments.

Various components of the multicomponent intervention used in this study likely contributed to the positive outcomes and addressed these sources of variability. For example, the use of peers to assist with the delivery of instruction or supports provided participants with more opportunities to respond as the peers were trained to ask questions and prompt the students to engage in the activities at hand. In addition, the peers were trained to provide feedback through comments (e.g., "Now that we are done, let's move to the next problem.") or praise (e.g., "That's the right answer."). The repeated use of the visual supports (MacDuff et al., 1993) to help organize the day also likely increased the predictability of the classroom routines (Mesibov & Shea, 2010; Schwartz & Davis, 2017) and assisted in increasing the overall mean and reduced

the variability of academic engagement. Finally, the peers used the visual support along with priming (i.e., "The first thing to do today is…"; Koegel et al., 2003) which also contributed to the positive effects.

Personal feelings of belonging in the classroom have also been hypothesized to have influence over a student's academic engagement and could account for the variable nature of academic engagement, particularly for students in secondary classrooms (Newman, 1992). This belonging includes student perceptions of themselves as active members, and not passive members of the class. In order for students to become actively engaged in academic tasks, students themselves need to be personally and psychologically invested in their learning and not simply committed to completing rudimentary tasks (Dunleavy & Milton; 2008). According to Dunleavy and Milton (2008), when students are intellectually engaged, they experience a "personal cognitive and psychological investment in learning" (p. 7). For students in secondary classrooms, meaningless rituals and mechanistic reproduction of knowledge combined with outside activities and concerns (e.g., friends, school clubs) may occupy the attention and energy of secondary students in school (Newman et al., 1992). For students with ASD this may include a lack of tolerance for novel learning and may be further impacted by restricted areas of interests (Kaufman, 2002). To support investment and ownership within the classroom, students first need to feel like they belong (Marks, 2000; Osterman, 2000). This sense of belonging is further enhanced when the classroom environment is supportive of social relationships with classroom peers and adults (Dunleavy & Milton, 2000). For students with ASD, impairments in social communication and executive functioning make it difficult to engage academically and socially with peers in classroom activities during large group and small group instructional formats.

PMI structures likely increased each student's overall sense of belonging in school (Carter, 2008). By supporting the social interactions of students seated within small groups, educators may also facilitate a greater sense of investment, and in turn, support the overall; i.e., academic, psychological, and social engagement of their students in the classroom (Dunleavy & Milton, 2000). Because students with ASD may have difficulties initiating in social interactions such as asking for help or clarifications in class, these students may be prone to becoming disengaged in in-class tasks and activities. Incorporating PMI within classroom structures is one way to foster a socially supportive classroom and subsequently encourage the engagement of all students, including students with ASD and diverse learning needs. Overall, the use of this multicomponent intervention comprised of evidenced-based practices to target positive outcomes in academic engagement and social interactions or school belonging has promise for secondary students with ASD.

It is interesting to note that for one participant, the data may indicate that PMI is in fact more successful than traditional support methods. Oftentimes, students with ASD are provided access to the general education curriculum if they have support in the form of an adult or one-on-one assistant (Giangreco, Sutter, & Doyle, 2010; Robertson, Chamberlain, & Kasari, 2003). For Edgar, data suggest that the typical strategy (i.e., one-on-one adult support) for addressing academic engagement in the general education classroom had little effect on his academic engagement. That is, there was little change in his academic engagement (-0.2%) when the one-on-one paraprofessional was removed from close proximity of Edgar. This suggests his rates of academic engagement were not contingent on the presence of his adult support. Furthermore, upon implementing the intervention Edgar's mean percentages of academic engagement

increased from 25.4% in baseline to 51.4% indicating the multicomponent intervention had a larger effect on academic engagement than the previous strategy (one-on-one adult support).

Social Interactions. This study also showed positive, but variable results on the student's social interactions for all student participants and their peer group members. For all participants, social interactions were low and somewhat variable. Edgar and Andrew showed increases in mean percentages of social interactions with a consistent trend for Edgar and an ascending trend for Andrew. Although Benjamin demonstrated an increase in level (i.e., mean percentages of social interactions) in intervention, an analysis shows a descending direction in trend. It is important, however, to note that Benjamin was the 3rd participant to receive intervention and as a result, he had the least number of data points at intervention and state testing prevented continuation of the study. Given Benjamin's high rates of variability in the baseline phase, it is possible that the direction of this trend would change over time. These positive effects were not unexpected as the crux of the multicomponent intervention was social, that is, peers were trained to provide one another with prompting and encouragement in the engagement and completion of academic tasks and assignments.

The variability of social interactions is consistent with the literature for adolescents in general (Ryan, 2000) and more specifically for students with known deficits in social interactions (Brock & Carter, 2016; Carter et al., 2005; 2017). Moreover, variability in social interactions of students with ASD in peer group settings is also in line with the results of this study. One possible reason for variability is that difficulties in social interactions is a central feature of ASD and students with ASD may start conversations infrequently or introduce new or off topic comments during discussions (Bambara, Thomas, Chovanes, & Cole, 2018). Likewise, typically developing peers may not know how to initiate social conversations with peers with a

developmental disability (Carter, Moss, Hoffman, Chung, & Sisco, 2011). As a result, it may be difficult for peers to participate or engage socially with their peers with ASD at a consistent rate of response. In addition, lower rates of social interactions may also reflect the opportunities that students had to engage in social interactions embedded within large and small group instructional settings. Not all lessons require the same amount of social communication. Certain lessons may be more teacher rather than student directed. In particular, because data were collected during large group instruction (i.e., teacher is instructing seven or more students) there may have been less opportunities for social interactions among peer group members. During small group instruction, students may have been asked to engage socially with peers in different ways (e.g., respond to a teacher generated set of questions, complete a jigsaw activity). While it was the attempt of this study to control for instructional formats, there was still variation in the opportunities embedded for peer group members to interact within individual lessons.

Findings from this study suggest that the physical inclusion of students with ASD in general education classrooms alone is not enough to promote the rates of social interactions of students with ASD without some intervention. That is, even though during baseline conditions each participant was included in a general education classroom with typically developing same-age peers, their social interactions were low and variable. However, once the peers were trained explicitly to support the social interactions of classmates with ASD, increases in social interactions occurred for all target participants. Although the application of PMI to support the social interactions of students with ASD produced an immediate change, it is unclear how long that change will persist. In this study, all three student participants showed higher mean percentages of social interactions in the intervention phase, but only Andrew demonstrated increasing percentages with an increasing trend. Although peer group members were effectively

trained to prompt and reinforce one another, a positive rapport within social interactions may take time to develop more naturally.

Utility of the multicomponent intervention. Since the early demonstration of the power of a multicomponent intervention by Carr and Carlson (1993), the use and awareness in the literature has increased (Fluery et al., 2014; Moskowitz, 2017). Multicomponent interventions are valuable because they address the multiple potential variables that may contribute to a particular behavior, they are efficient, and can easily be implemented in applied settings. In this study, the use of peers provided a "normalized" context for providing the intervention and the priming and visual schedule addressed the academic engagement of the learner with ASD.

Similar to reported findings from the work of Bambara, Cole, Kunsch, Tsai, and Ayad (2016) and Brock and Carter (2016), the findings from this study demonstrate that small groups of peers can be trained to support the social interactions of their group members within a relatively limited timeframe. The training session in this study took little time and was conducted during one didactic session. In addition, the peers were able to maintain the fidelity of the intervention throughout the study as measures of treatment fidelity were 100%. This finding lends support for the continued use of PMI in secondary classrooms rather than relying on traditional approaches which are to provide services through the use of paraprofessional educator.

A unique finding from this study was the use of the activity schedule as a reference in social communication. The activity schedule was used as a tool for peers to provide opportunities to respond and provide feedback. In addition, the activity schedule was used as method for social initiations. For example, at the beginning of the period when filling out the activity schedule,

Andrew's group members determined who would be responsible for the obtaining and returning of materials needed for each task. During transitions between each task, the group then referred to the activity schedule. Group members took turns checking off boxes and giving each other high-fives as they progressed through the activity schedule and completed each task. Thus, incorporation of a visual activity schedule may assist in the implementation of PMI by serving as a vehicle in the communication of social interactions that will positively support the academic engagement of peers within small group settings. In this particular classroom setting, the teacher projected a preview of the tasks to complete at the beginning of the class period ("Agenda for the Day"). By including a preview of the tasks to be completed, coupled with an activity schedule, PMI groups will have a vehicle from which to refer and communicate the tasks necessary to complete in-class assignments.

Social validity. Measures of social validity were obtained to address the satisfaction that the consumers (i.e., participants with ASD, peers, and teachers) felt toward this intervention (Schwartz & Baer, 1991). Data on social validity were collected via follow-up surveys and open-ended questions adopted from Carter et al. (2017). The purpose of collecting information on social validity was to better understand if consumers found the PMI intervention helpful and acceptable to use in the classroom. In addition, because students in this study demonstrated high verbal ability, the researcher checked in with student groups daily and students (participants and peers) were reminded that they could terminate their participation at any time. During observations of this intervention, consumers (student participants, peers, and teachers) did not demonstrate behavioral signs of rejection or discomfort while engaging in the study.

Overall, participants, peers, and teachers reported positive measures in the use of this intervention within small group settings. In addition, students and peers also provided valuable

suggestions for improving the use of this intervention in classroom settings. During open-ended responses, participants, the primary consumers, described the what they liked about working collaboratively within their group: "They (the group) helped me with stuff" (Edgar). "I got to learn about being in a group and (improve) communication" (Andrew). "Things (were able to) get done faster when we collaborated" (Benjamin). When asked about what they did not like about working in a group, Edgar reported, "N/A." However, Andrew and Benjamin reported wanting more time to work independently: "Not enough self-work on assignments" (Andrew). "I like (prefer) to do all the work (independently)" (Benjamin). Finally, when asked to report suggestions and ideas for making the group setting better, Edgar and Andrew reported no changes: "N/A" (Edgar). "Nope" (Andrew). Benjamin reported wanting to continue with the group setting.

For Andrew and Benjamin, both students reported that working in groups helped them to complete assignments in class (M = 4.5), respectively. Andrew and Benjamin also felt that they were able to benefit academically from working in the group (M = 5). However, both students also expressed a desire for additional opportunities to complete assignments independently as well. As a result, this intervention may be of even greater acceptability to primary consumers by embedding additional opportunities and choices for students to work independently within small group settings.

Peers (without disabilities) also reported an overall general satisfaction in participating in the PMI model and recommended the use of the model to both teachers and classmates. Peers reported that they felt confident within the group (M = 4.5), that they were able to help out other group members (M = 4.0), and would recommend working in a group to other students (M = 4.5)

and teachers (M = 4.4). Peers also reported that participating in the groups benefited them academically (M = 4.0) and socially (M = 4.2).

Specifically, in response to open ended questions, when asked about what they liked about being in the group, peers responded: "I talked to people I wouldn't normally talk to and I made new friends." "It (being in the group) put me in a positive mood and made working easier." "I definitely felt like I bonded with the (other group members) and I think (we) were able to open up about sensitive topics." Peers also reported feeling confident in their role within the group and reported satisfaction in using this model to benefit both their academic achievement and the engagement of the other group members. "We helped one another and reminded each other with (assignments) and homework." "We could depend on each other for help." When asked about what they did not like about working in the group, peers responded that it could sometimes be difficult to engage with group members: "(At times) it was difficult to get peers out of their shell." "I (felt) that I was trying to be positive and helpful and I didn't want to come off as fake or to intrude (in anyone's) personal space." Given deficits in social interactions for students with ASD, these results are not particularly unexpected. It may be of additional benefit for all peer group members (participants and peers) for teachers and researchers to reiterate that peer group members may not wish to engage socially at times, which is okay, and to let peer group members know that they are available to give support when individual group members are ready.

When informal, unstructured interviews were conducted with the general education teacher and the special education teacher, they both agreed that the model was acceptable to use in their classroom and was supportive of their students' academic and social needs. Both teachers reported that they plan to continue using this intervention within small group structures and that

they felt the intervention would be beneficial to other students in class with various learning and behavioral needs.

Limitations

The term applied research suggests the study of a set of variables in a setting in which all aspects are not controlled. One might conclude that studies in secondary settings are particularly difficult given the paucity of research in secondary settings. That being said, this study had limitations. First, this study included three participants and was conducted in two classroom settings. Edgar was in one classroom, while Andrew and Benjamin were in a second classroom. While a stronger design might have included three participants in three settings to ensure there was no intervention spillover, Andrew and Benjamin were in a classroom of 30 students and sat on the opposite sides of the classroom. Students were seated within small groups and the groups were trained independently in an outside location during lunchtime. Since the classes consisted of a fairly structured setting, there was little time for the students to interact in the classroom beyond their small groups.

Second, this study measured academic achievement through the observation of academic engagement. Other measures of academic achievement (e.g., academic responses on worksheets, grade point average, curriculum-based measures, etc.) would provide additional information on the effects of this intervention. Previous studies on PMI included weekly pre- and post-tests generated by researchers and delivered at the beginning and end of each school week (Dugan et al., 1995; Kamps et al., 1995; 1999). It is possible to assume that increases in academic engagement would result in the completion of higher rates of work completion which may also have positive effects on students' grade point averages in class. It was the intent of this study to be as unobtrusive to classroom teachers as possible. And, as a result, additional measures of

academic engagement (i.e., pre and post testing) were not collected. Less obtrusive measures of academic engagement may include student percentages work completion (permanent product) and researcher access to online grade books which may provide additional information in future research. It would be of interest in future research to explore additional less obtrusive measures of academic achievement within general education classroom settings.

Third, measures of social validity could be improved. Although post surveys were adopted from the work of Carter et al. (2017), in-person, follow-up interviews were not conducted. This study would have stronger measures of social validity, and greater improvements to the future design of this intervention, if researcher led, follow-up interviews were conducted based on participant's responses to post intervention surveys and open-ended questions.

Implications for Teachers

Given the prevalence of students with ASD, without comorbid intellectual disability, it is highly likely that secondary teachers will have students with ASD enrolled in their classrooms every day. Peer-mediated interventions continue to be a promising strategy for the inclusion of all learners, including students with ASD in large secondary classroom settings. Moreover, PMI has promise for replacing more traditional use of adults as supports or the need for extensive modifications by the teacher. In particular, this study demonstrates that peer group members who have been systematically trained in modeling, prompting, and reinforcement can effectively provide the necessary support to promote the academic engagement and social interactions of all group members including students with ASD. It is important to note that students within this study were previously seated in small group settings prior to the training in PMI. As a result,

students were already familiar with the dynamics of working together in small group settings and students were less likely to feel stigmatized to be part of a PMI group.

Students with ASD will benefit from highly structured, predictable class routines (Griffin et al., 2006; Heflin & Alberto, 2001; Ivannone et al., 2003; Kaufman, 2002). Two instructional strategies supporting predictability and structure in the classroom are priming and activity schedules. However, the implementation of these strategies in large secondary classrooms can be difficult given large student to teacher ratios. Through the use of this multicomponent intervention, by incorporating peers to support predictability and structure, teachers can implement these additional strategies thereby assisting students to complete in-class tasks and assignments while further supporting the social interactions of their students.

Implications for Future Research

This study has several implications for future research in the field. First, continued research is needed in secondary school settings. Of all studies incorporating PMI to support the academic achievement of students with ASD, only three studies were conducted in middle school or high school settings (Brock & Carter, 2016; Carter et al., 2005, Carter et al., 2017). Because students with ASD have additional academic needs in the areas of executive functioning, working memory, and theory of mind, and because secondary school settings require students to shift throughout multiple class periods, additional research in the use of PMI supporting students with ASD in large general education classroom settings is greatly needed. In addition, research should focus on the effects of the use of peers in the classroom on the social interactions and membership of students with ASD outside of the classroom (outside of the intervention setting). That is, what are the carry over effects of PMI to support social interactions in classroom settings, within additional school settings (e.g., lunch time, other classes, after school clubs).

Second, the literature is replete with promising models of PMI that have yet to be applied to support secondary students with ASD. Other models of peer-mediated interventions, that have been found to support academic achievement, have yet to be applied specifically to students with ASD such as Peer-Assisted Learning Strategies (PALS), Peer Reciprocal Tutoring, and Class-wide Student Tutoring Teams. These strategies use a games-based approach and students take turns serving as both the tutor and tutee (same-age peer tutoring). Components of these strategies, such as fluency practice (e.g., studying for a test, memorizing key terms), could also be incorporated within small group seating arrangements.

Third, the literature is clear that an overreliance on paraprofessionals impacts the social development of students with ASD and opportunities for students to interact and learn constructively together with peers in general education settings (Carter, 2005; Giangreco, Edelman, Luiselli, & McFarland, 1997; Giangreco, Halvorsen, Doyle, & Broer, 2004). Taken together with the growing literature, the use of PMI is an effective and efficient way to provide supports for secondary students with ASD. Future research in this use of paraprofessionals to facilitate peer interactions within general education settings will continue to provide students with individualized support needs while maintaining the social development of same-age peers.

Additional evidence-based strategies, effective in supporting academic achievement (e.g., Self-Regulated Strategy Development; Self-Monitoring) have not been implemented through peer supports to promote the academic achievement of students with ASD in large classroom settings. As a result, future research in the combination of additional evidence-based practices in support of students with ASD is necessary given large student to teacher ratios within secondary classrooms. In addition, PMI structures promote the investment of individual students as active

members of the class thus supporting the overall academic engagement of all students, including students with ASD.

Conclusion

The purpose of this study was to address classroom strategies based around PMIs which can assist students with ASD and which do not interrupt the daily, general education class organization and curriculum. These strategies were tested in attempt to not only assist the student with ASD, but also the classroom teacher who must accommodate growing numbers of students of varying academic abilities. The model for this study was easily designed and can be easily replicated and implemented by teachers. And, given the limitation of this study the strategies utilized were shown to be effective. Because students with ASD have been shown to experience deficits in the areas of working memory, executive functioning, and theory of mind, a PMI structure, in combination with antecedent-based instruction (priming) and visual activity schedules will help to provide classroom structure and to better support the academic needs of students with ASD in the classroom.

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Table 1

Participant Demographics

Student participants	Peers	Setting	
Name, age, gender, race, diagnosis	Gender; race	Reason for teacher nomination	Classroom setting and number of students
Edgar, 15, M, PA, Autism	1 F, 2 M; 1 W, 1 EA, 1W	Goals in communication and expressed desire to spend more time with same age peers	Co-taught language arts, first period setting, 29 students
Andrew, 16, M, W, Autism, Anxiety	1 F; 2M; 1 PI, 2 A	Goals in task initiation and off-task behaviors	Co-taught language arts, second period setting, 30 students
Benjamin, 16, M, H, Attention, deficit disorder, Other health impairment	2F; 2A	Support in organization, social interactions with peers, and in-class behaviors	Co-taught language arts, second period setting, 30 students

Note. PA = Pakistani-American; W = White; EA = Egyptian-American; PI = Pacific Islander; H = Hispanic; A = Asian

Table 2

Operational Definitions of Engagement and Social Interactions

Term	Operational Definition	Example	Non-Examples
Academic engagement	Student is attentive and engaged with eyes on materials, peers, or the instructor	Student is working on assignments, reading materials, comparing notes with peers	Student is walking around the room, drawing, playing with materials or objects, or having head down on desk
Social interaction - initiation	Verbal comments (e.g., questions, clarifications, requests for help, comments, etc.) or physical communication (e.g., pointing or gesturing)	Student requests help, points to materials, taps peer on the shoulder replies to a peer question, nods head	Student accidently bumps into peer. Student engages in self-talk
Social interaction - response	Physical or verbal response to a prior initiation within five seconds	Student replies to a peer question, nods head	Student ignores peer initiation. Student does not respond to a question within five seconds

Table 3

Mean Percentages of Intervals for Academic Engagement and Social Interactions

	Edgar		Andrew		Benjamin	
Measure	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Academic Engagement (%)	25.56 (3-46)	51.4 (38-69)	38.81 (19-77)	62.5 (50-79)	52.7 (21-96)	77.83 (58-100)
Social Interactions (%)	3.11 (0-7)	12.86 (3-35)	7.38 (0-19)	27.33 (0-46)	14.85 (0-42)	33.67 (21-50)

Table 4

Percentage of Data Points Falling within the Median Stability Envelope

	Edgar		Andrew		Benjamin	
Measure	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Academic Engagement %	67%	42%	50%	58%	30%	50%
Social Interactions %	44%	14%	13%	17%	30%	50%

Note. The figures represent percentages of data points falling within 25% of the median data point (stability envelopes).

Table 5

Social Validity Pre and Post Test Survey Questions

Social Validity Questions	Edgar		Andrew		Benjamin		Peers*	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
I enjoy(ed) participating in groups in class	-	3	4	4	3	3	3.4	3.9
I feel/felt confident within a group	-	2	4	5	4	5	3.8	4.5
I feel/felt like participating in a group is/was too much additional work in class	-	1	2	1	4	2	2.0	1.3
Working in groups helps/helped me to complete assignments in class	-	4	5	4	5	5	4.1	4.0
I am/was able to help out my group in class	-	3	4	3	4	4	4.1	4.0
I benefit(ed) academically from working in groups	-	3	5	5	4	5	4.0	4.0
I benefit(ed) socially from working in groups	-	3	5	4	4	5	3.9	4.2
I hang out with group members outside of school	-	1	2	1	3	1	2.4	1.4
I would recommend working with a group to other students	-	3	4	5	3	4	3.6	4.5
I would recommend working with a group to other teachers	-	3	5	5	5	4	3.9	4.4

Note. Adopted from: Carter, E. W., Gustafson, J. R., Sreckovic, M. A., Dykstra Steinbrenner, J. R., Pierce, N. P., Bord, A., . . . Mullins, Teagan. (2017). Efficacy of Peer Support Interventions in General Education Classrooms for High School Students with Autism Spectrum Disorder. *Remedial and Special Education*, *38*(4), 207-221.
1=low, 2-med low, 3=medium, 4=medium high, 5=high.
The figures for Peers* represent mean scores (*M*).

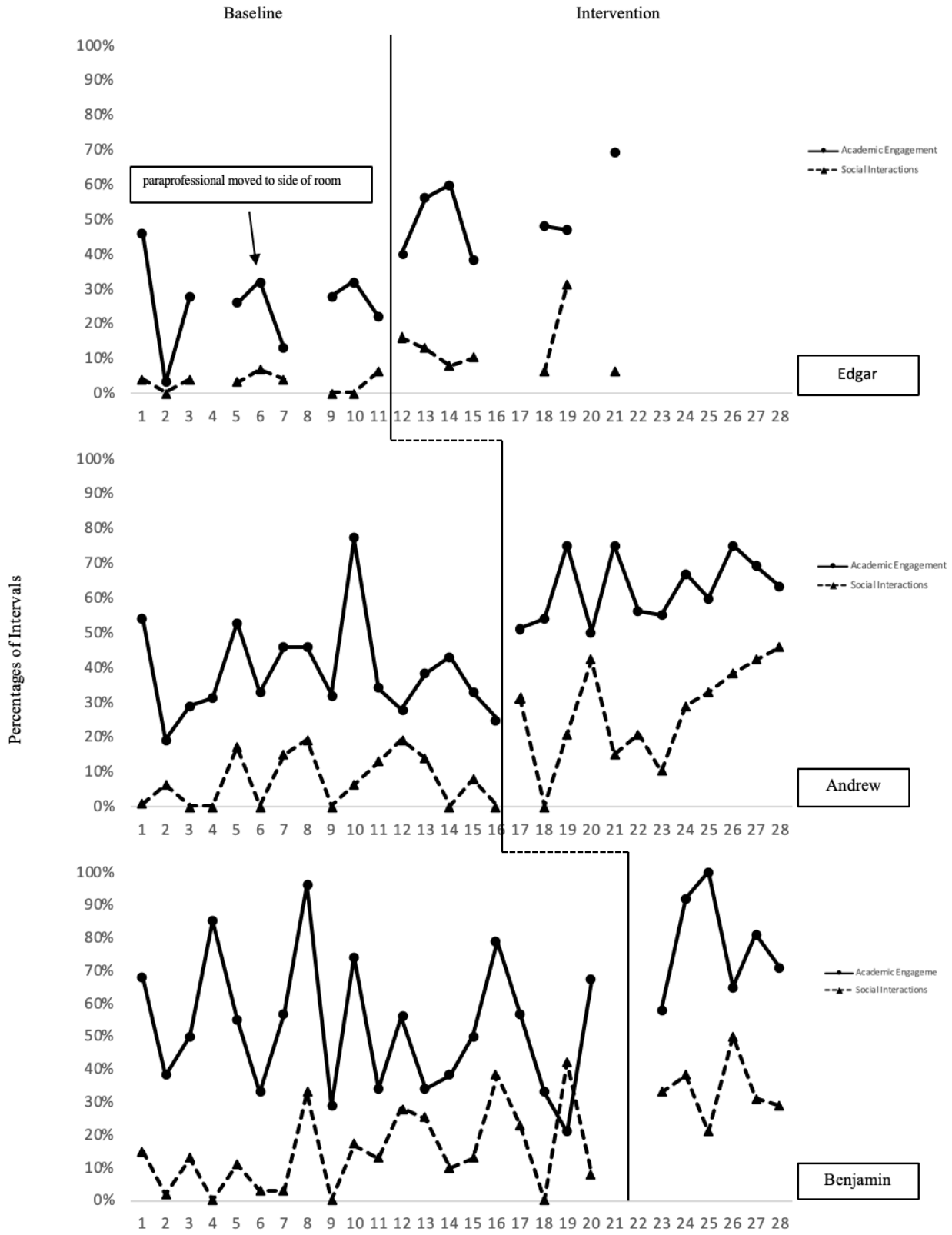

Figure 1. Percentages of intervals of academic engagement (closed circles) and social interactions (closed triangles) of student participants with ASD during baseline and intervention settings.

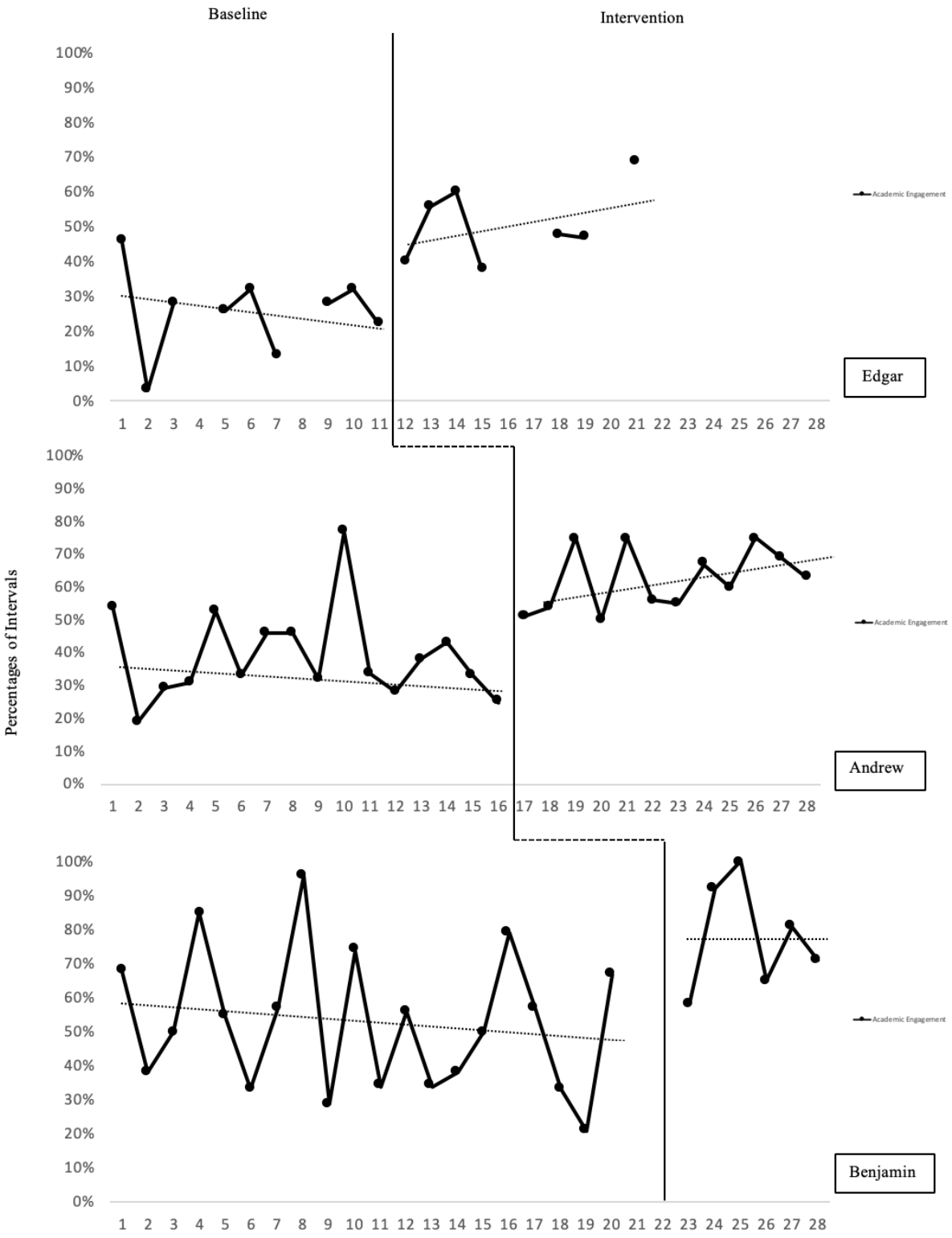

Figure 2. Split-Middle Trend lines for percentages of intervals of academic engagement (closed circles) across participants.

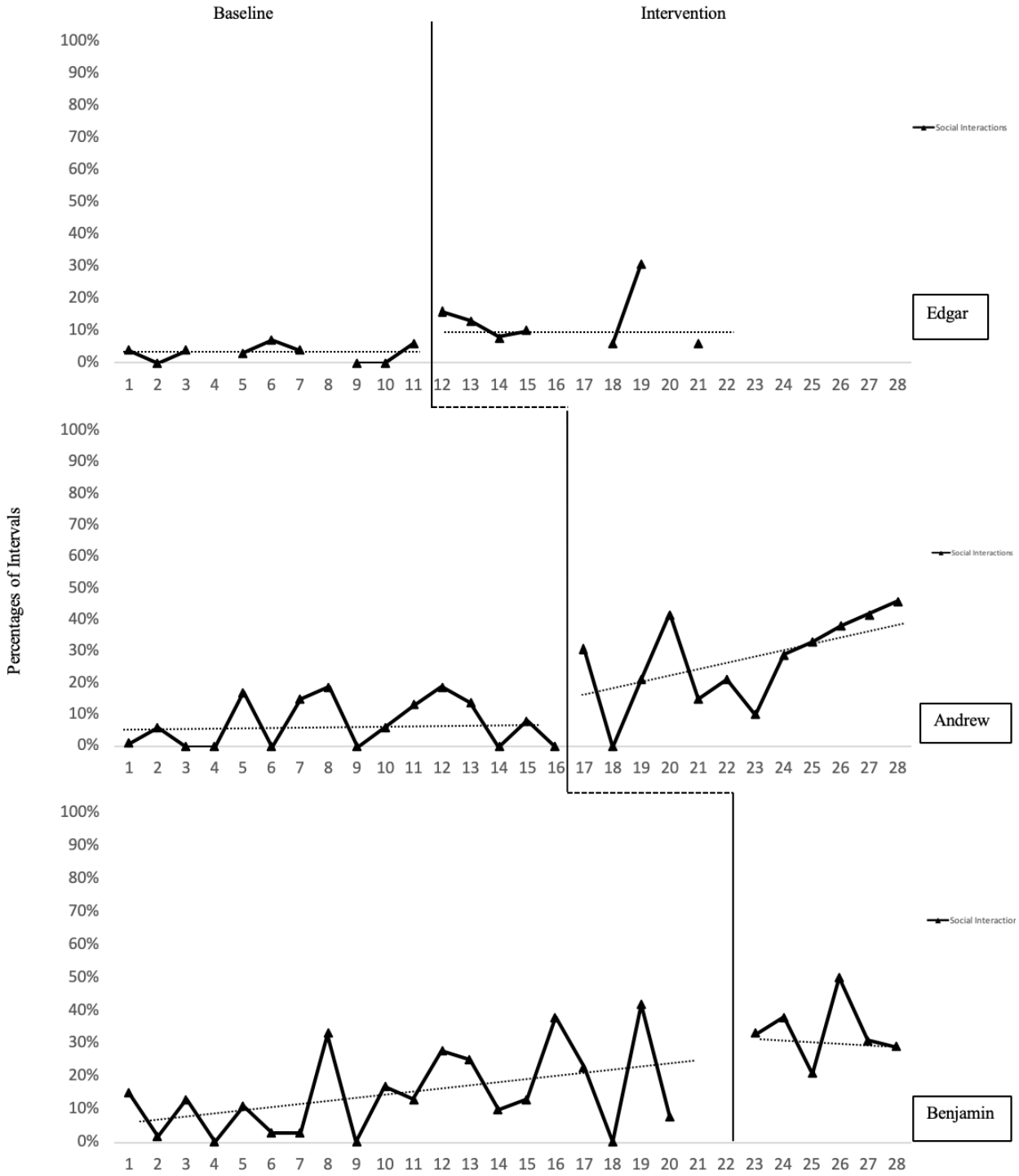

Figure 3. Split-Middle Trend lines for percentages of intervals of social interactions (closed triangles) across participants.

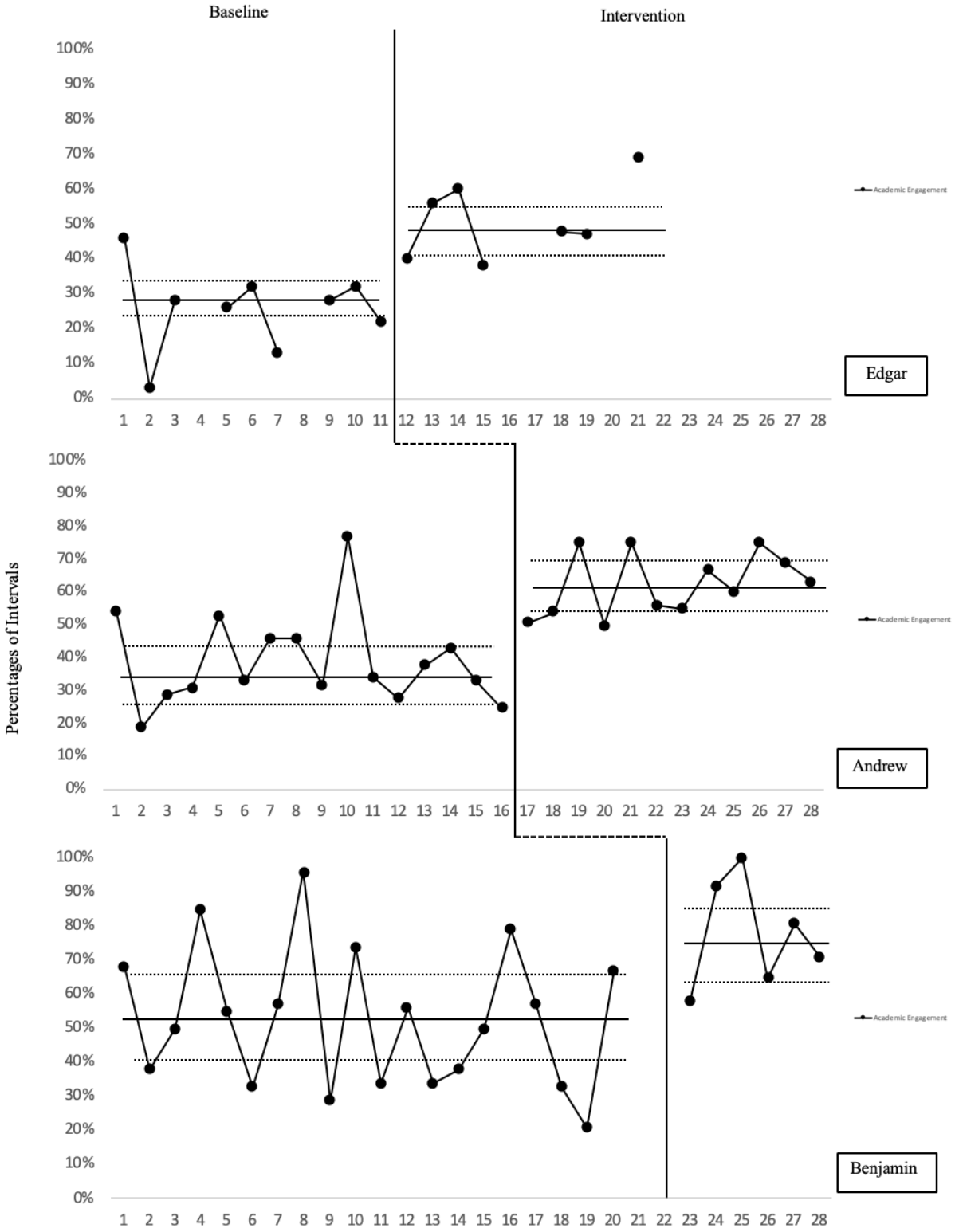

Figure 4. Stability envelope for percentages of intervals of academic engagement (closed circles) across participants.

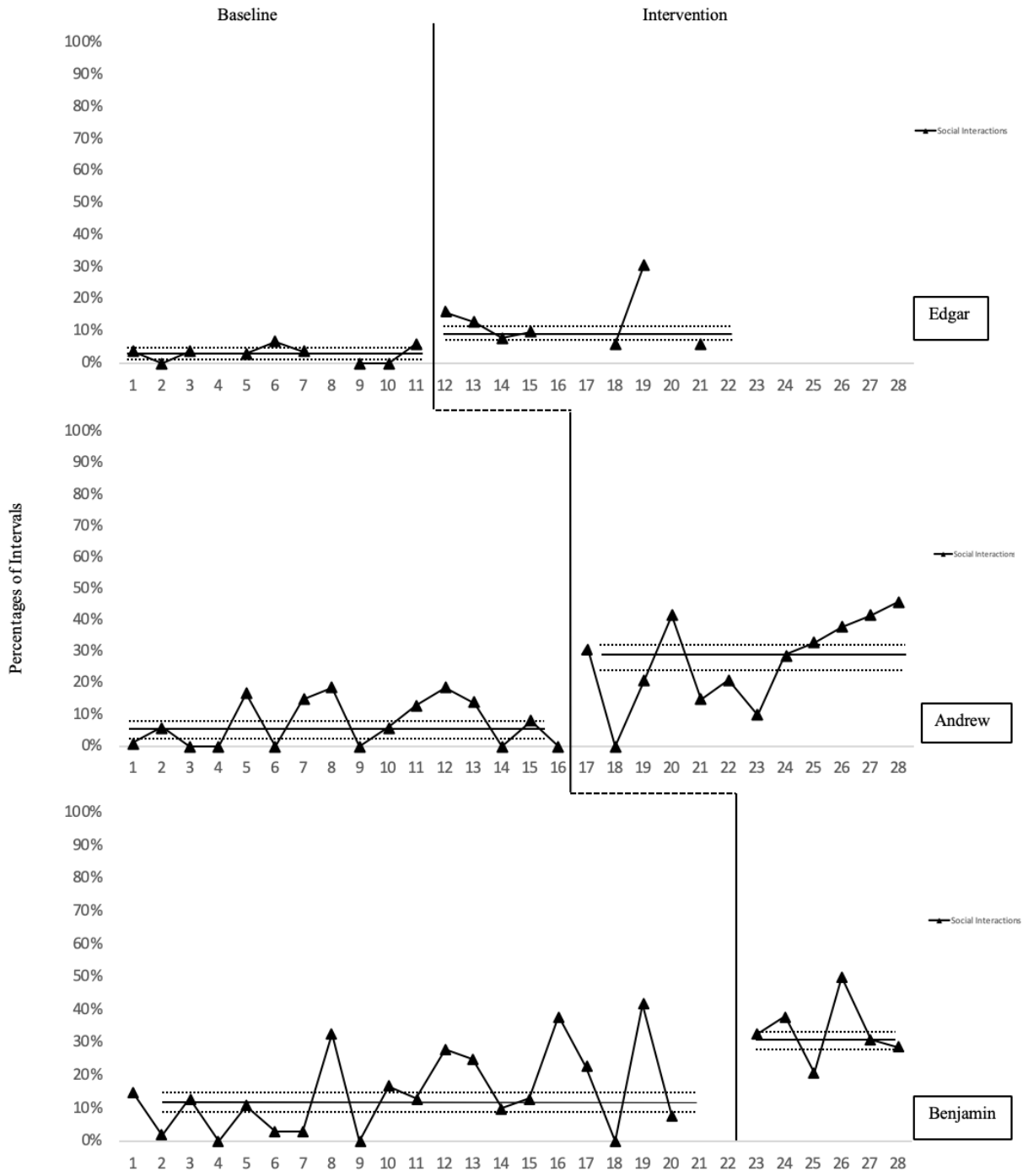

Figure 5. Stability envelope for percentages of intervals of social interactions (closed triangles) across participants.

Appendix A
Systematic Review of the Literature:
PMI Support the Academic Achievement for Students with ASD

Author	Participants	Academic Setting	Intervention	Method of Peer Training	Method	Academic Content (Dependent Variable)	Findings	Social Validity	Evidence –Based Practices
Kamps et al. (1989)	2 males; autism and intellectual disability; 9 and 11 years old	Isolated self-contained special education classroom (reverse mainstream). No other students present in the classroom	Same-age peer tutors	Direction, modeling, prompting	SCD: multiple baseline across participants	Percentages of correct responses: math (counting coins), verbal expression, and oral reading	Increased performance levels for both students across all three tasks (math, verbal expression, oral reading)	Not reported	Visual Supports (math manipulatives, worksheets, flashcards) Reinforcement (praise) Prompting
Hunt et al. (1994)	Male, autism and severe intellectual disabilities; 7 years old	2nd grade general education classroom	Cooperative Learning Groups	Cues, prompting	SCD: ABAB withdrawal	Pretest and post test scores (numbers of correct responses): geometric shapes (tangrams): parameters, areas, measurement	Increase in group scores at posttest. Increase in correct prompted and independent communication and motor responses	Not reported	Visual Supports (math manipulatives)
Kamps, Barbetta, Leonard & Delquadri (1994)	3 males; high functioning autism; 8, 8, and 9 years old	3 general education classrooms; 1st second grade split, 2nd grade, 3rd grade	Classwide Peer Tutoring	Classwide training (45 minute sessions provided 3 times)	SCD: multiple baseline across participants	Rate of words read correctly per minute, percentages of correct responses to comprehension questions	Increase in mean number of words read correctly and correct responses to reading comprehension questions for all 3 student participants	Follow up survey interviews of all student participants, peers, and teachers	Prompting
Kamps, Leonard, Potucek and Garisson-Harrell (1995)	Experiment 1: 1 male; high functioning autism; 8 years old Experiment 2: 2 females; moderate and lower functioning intellectual disability; 13 and 12 years old	Experiment 1: 3rd grade general education classroom Experiment 2: 5th grade general education classroom	Cooperative Learning Groups	Group training (10 minutes before each session)	SCD: ABAB withdrawal	Weekly pretest and posttest quizzes on reading passages and academic engagement	Experiment 1: Increase in reading gains (vocabulary and comprehension) at grade level and increase in academic engagement Experiment 2: Mixed results. Increase in academic engagement. Variability in weekly quizzes	Consumer satisfaction questionnaires. Follow up surveys administered the last month of school to all participant teachers and student	Visual Supports (organizers, flashcards, game cards) Reinforcement

Dugan et al. (1995)	1 female, 1 male; moderate and high functioning autism; 10 and 9 years old	4th grade general education classroom (social studies)	Cooperative Learning Groups	Group training (40 minute sessions provided 4 days)	SCD: ABAB withdrawal	Weekly pretest and posttest quizzes on social studies curriculum (sight word vocabulary and comprehension)	Increases in pretest and posttest scores (higher in vocabulary recognition) and increases in academic engagement	Participating teachers completed consumer satisfaction surveys at the end of the study	Visual Supports (activity sheets, flashcards) Reinforcement (sticker chart)
Kamps, Dugan, Potucek and Collins, (1999)	1 male; autism; 10 years old	Hallway; elementary school setting	Same Age Peer Tutoring	Role play, modeling, feedback	SCD: ABABA withdrawal	Weekly pretest and posttest quizzes on sight-word reading responses	Increases in sight word recognition	Anecdotal reporting and follow up interviews with teachers	Reinforcement (praise)
Murphy, Grey & Honan (2004)	1 male; autism; 8 years old	Self-contained special education classroom (reverse mainstream). No other students present in classroom	Cooperative Learning Groups	Group training (10 minutes before presentation of task)	SCD: AB baseline and intervention	On-task engagement. General education science curriculum	Slight decrease in academic engagement	Teachers and parents of student participants were interviewed for intervention validity	Reinforcement (activity for completed tasks, praise)
Carter, Cushing, Clark & Kennedy (2005)	1 male Caucasian, 1 female Caucasian; autism and moderate intellectual disabilities, 12 and 13 years old	6th and 8th grade general education science classes	Peer Support	2 to 4 days of initial training, ongoing feedback	SCD: ABAB, BABA reversal	Academic engagement with the general education curriculum	Higher rates of contact with the curriculum when working with 2 peers versus 1 peer alone for one student participant (male). No differences in contact with the curriculum for the second student participant (female)	Not Reported	Prompting
McCurdy & Cole (2014)	3 males; high functioning autism; 8, 7, and 11 years old	3rd, 2nd, and 5th grade general education classes	Peer Support	Role play, modeling	SCD: multiple baseline across participants	Academic engagement (reduction in off-task behaviors) within general education curriculum	Decrease in off-task behaviors for all 3 participants	Intervention acceptability: Teachers completed Intervention Rating Profile-15 (IRP-15). Student participants completed Children's Rating Intervention Profile (CIRP).	Reinforcement (praise)
Brock & Carter 2016	1 female African American; autism; 10 years old	5th grade, general education science and math block	Peer Support	Initial training, ongoing feedback	SCD: multiple baseline across participants	Academic engagement with the general education curriculum	Consistent academic engagement	Social validity: Questionnaire/ survey provided to teachers and paraprofessionals	Reinforcement, prompting

Carter et al. (2017)	1 male African American 18 years old, 2 males Caucasian, 17, 16 years old	12th grade business, 11th grade math, 10th grade science, 12th grade	Peer Support	Initial training, ongoing feedback	SCD: multiple baseline across participants (non-concurrent)	Academic engagement with the general education curriculum	Increase in academic engagement for 2 participants, maintenance of academic engagement in 1 participant, decrease in academic engagement in 1 participant	Social validity: survey provided to primary and peer participants	Prompting

Appendix B
Consent Forms

UNIVERSITY OF WASHINGTON
PARENT CONSENT FORM

Peer-Mediated Instruction and Interventions Supporting the Academic Achievement of Secondary Students

Researchers: Michael Mahoney
College of Education
Department of Special Education
mwmm@uw.edu
(760) 413-1743

Faculty Advisor: Dr. Carol Ann Davis
cadavis1@uw.edu
(206) 221-5043

Researcher's Statement

We are asking for your permission for your child to participate in a research study looking at the effects of a peer-mediated instruction and intervention (PMI) on the academic achievement of secondary students. The purpose of this consent form is to make sure that you are provided with enough information to decide if you would like your child to participate in this study or not. You may ask any questions you have including but not limited to the purposes of this study, the procedures, and any potential risks or benefits that may be associated with participation. Upon answering any questions that you may have regarding this study, you can decide if you would like your child to participate in this study or not.

This process is called "informed consent". After you have made the decision to participate in this study or not, we will provide you with a copy of this form for your records.

This form will also be used for students who are 18 years old or older. When this form is used for such students then "your child" and "child" should be read as "you" or "your".

PURPOSE OF THE STUDY

The purpose of this study is to measure the effects of a 4-5 weeklong peer-mediated instruction and intervention model to increase the academic achievement and academic engagement of secondary students in general education classroom settings. Peer-mediated instruction and interventions are strategy of best practice where students model task completion and construct knowledge together. Working together, small groups of peers will complete daily assignments throughout one designated classroom period (e.g., biology class).

STUDY PROCEDURES

If you provide permission for your child to participate in this study, your child will receive this PMI intervention for 4-5 weeks, well as complete two surveys at the beginning and end of intervention.

Surveys.

At the beginning and end of intervention, I will ask your child to complete a short survey independently. This survey, also called social validity, tells us if your child found the intervention to be useful and acceptable for use in the classroom. This survey should take no more than 10-15 minutes to complete. These surveys will be completed using paper and pencil.

Intervention

By participating in this intervention, your child will be placed (seated together) within a small group of three students. Prior to intervention, your child will be trained in the use of the peer-mediated instruction and intervention model. This training will take approximately 1-hour in a location outside of the classroom setting during lunch or after school. At the beginning of the class period, student groups will be asked to create a visual organizer listing the tasks that are required to be completed throughout the class period. Visual organizers will be created by student groups and will list a set of 3 - 5 tasks to be completed by the end of the period based on their regular classroom assignments. For example, a list of tasks in a history class may be to 1) obtain materials, 2) complete a warm-up activity, 3) locate 10 facts using the textbook or a search of the internet, and 4) list the 10 facts chronologically on a timeline. Lists of tasks entered into the visual organizers will change given the regular classroom assignments, but the process of student groups discussing the tasks to be completed in class and entering the tasks into the visual organizer will be the same throughout this study. During the class period, students will work together to complete academic tasks though modeling and encouragement. Groups will work together throughout the duration of one designated class period for a total of 4-5 weeks (20-25 class sessions).

All child data will be stored on a password-protected computer and kept confidential.

RISKS, STRESS, or DISCOMFORT

Individuals that participate in research studies may feel nervous or self-conscious during observations or video recording. Furthermore, parents of participants may feel that sharing this type of information about your child is an invasion of privacy.

BENEFITS OF THE STUDY

There may be no direct benefit for your child by participating in this study. However, PMI interventions have been found to increase the academic achievement and academic engagement of participants with and without specific learning disabilities or needs. Specifically, PMI

interventions increase learning by providing students with additional opportunities to respond to instructional material and receive feedback from peers.

MANDATED REPORTING

If any member of the research team learns of any abuse including, but not limited to, child abuse, neglect, sexual assault, or physical assault, occurring at any time during this study we are obligated to report this information to the Washington state authorities.

OTHER INFORMATION

You may decide to not consent to your child's participation in this study and you also have the option to withdraw your child from this study at any time without penalty.

If results from this study are presented or published, I will remove all identifying information.

If you have any questions about this research study or feel you have been harmed by participating, please contact Michael Mahoney at either the telephone number or email address listed at the top of this form.

_____

Michael W. M. Mahoney

Parent Participant Consent

This study has been explained to me. I volunteer to take part in this research. If I have questions later on about this study, I can ask the researcher listed above at any time. If I have questions about my rights as a research subject, I can call the Human Subjects Division at (206) 543-0098 or call collect at (206) 221-5940.

____ I give my permission for my child to participate in this study.

_____

_____

Printed name of child subject Date

Printed name of parent Signature of parent Date

If student is 18 years old or older:

Printed name of student Signature of student Date

Copies to: Michael W. M. Mahoney

Appendix B
Consent Forms

(PARTICIPANT) ASSENT FORM

UNIVERSITY OF WASHINGTON
ASSENT TO RESEARCH

Peer-Mediated Instruction and Intervention to Support the Academic Achievement of Secondary Students with Autism Spectrum Disorder

Researchers: Michael Mahoney
College of Education
Department of Special Education
mwmm@uw.edu
(760) 413-1743

Faculty Advisor: Dr. Carol Ann Davis
cadavis1@uw.edu
(206) 221-5043

Researcher's statement:

My name is Michael Mahoney and I am studying to work with new teachers in special education.

We are asking you to be in a research study because we are trying to learn more about the effects of cooperative learning or small groups of students working together on academic achievement.

At the beginning and end of this study, we are going to ask you to complete a short survey (approximately 15 questions) about your initial thoughts about the activity and how the activity went at the end.

We will ask you to attend a training on how to help each other complete your assignments in class. This training will take approximately 1-hour in a location outside of the classroom during lunch or after school.

If you agree to be in this study, we are going to partner you with two peers from your class to work together as a group throughout the class period.

We are going to video tape your group for 15 minutes each day. This may be embarrassing at times.

This study may benefit the academic achievement of students with autism in large secondary classroom settings.

Please talk this over with your parents before you decide whether or not to do this. We will also ask your parents if it is okay for you to be in this study. But even if your parents say "yes" you can still decide not to do this.

If you don't want to be in the study, you don't have to participate. Remember, being in this study is up to you and no one will be upset if you don't want to participate or even if you change your mind later and want to stop.

You can ask any questions about the study. If you have a question later you can call me (760) 413-1743 or ask me next time.

Researcher's signature	**Date**

Copies to: Michael W. M. Mahoney

Appendix B
Consent Forms

(PEER) ASSENT FORM

UNIVERSITY OF WASHINGTON
ASSENT TO RESEARCH

Peer-Mediated Instruction and Intervention to Support the Academic Achievement of Secondary Students

Researchers: Michael Mahoney
College of Education
Department of Special Education
mwmm@uw.edu
(760) 413-1743

Faculty Advisor: Dr. Carol Ann Davis
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Please talk this over with your parents before you decide whether or not to do this. We will also ask your parents if it is okay for you to be in this study. But even if your parents say "yes" you can still decide not to do this.

If you don't want to be in the study, you don't have to participate. Remember, being in this study is up to you and no one will be upset if you don't want to participate or even if you change your mind later and want to stop.

You can ask any questions about the study. If you have a question later you can call me (760) 413-1743 or ask me next time.

Researcher's signature	**Date**

Copies to: Michael W. M. Mahoney

Appendix C
Visual Support Activity Schedule

Agenda for the Day			
Today's Date: Group Members Present: _____ _____ _____ _____	**Plan to Complete the Task** **Examples:** Person in charge of materials Person in charge of recording		
1. □	a. □	b. □	c. □
2. □	a. □	b. □	c. □
3. □	a. □	b. □	c. □
4. □	a. □	b. □	c. □
5. □	a. □	b. □	c. □

Appendix D
Data Collection Forms: Academic Engagement and Social Interactions

Date	Intervals # 1-16 (A) Instructional Format:																Total # of Occurrences
Start Time	1 0-15 sec	2 16-30 sec	3 31-45 sec	4 46-1m	5 0-15 sec	6 16-30 sec	7 31-45 sec	8 46-2 m	9 0-15 sec	10 16-30 sec	11 31-45 sec	12 46-3m	13 0-15 sec	14 16-30 sec	15 31-45 sec	16 46-4 min	
Academic Engagement X/O																	/ 8
Social Interaction		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R	
Date	Intervals # 17-32 (B) Instructional Format:																Total # of Occurrences
Start Time	17 0-15 sec	18 16-30 sec	19 31-45 sec	20 46-5 m	21 0-15 sec	22 16-30 sec	23 31-45 sec	24 46-6 m	25 0-15 sec	26 16-30 sec	27 31-45 sec	28 46-7m	29 0-15 sec	30 16-30 sec	31 31-45 sec	32 46-8 m	
Academic Engagement X/O																	/ 16
Social Interaction		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R	
Date	Intervals # 33-48(C) Instructional Format:																Total # of Occurrences
Start Time	33 0-15 sec	34 16-30 sec	35 31-45 sec	36 46-9 m	37 0-15 sec	38 16-30 sec	39 31-45 sec	40 46-10 m	41 0-15 sec	42 16-30 sec	43 31-45 sec	44 46-11 m	45 0-15 sec	46 16-30 sec	47 31-45 sec	48 46-412 m	
Academic Engagement X/O																	/ 24
Social Interaction		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R		S I S R S I S R	

Appendix E
Steps to Fidelity Checklist

Date _____
Group # _____

Steps to Implementation	**Yes / No**	Group Members	Notes
Step 1: Were all group members present, on time, and seated together in class?	*Yes / No*	Level of Preparation Low Medium High	
Step 2: Did the student group have access to the activity schedule?	*Yes / No*	Use of Activity Schedule Low Medium High	
Step 3: Did the student group identify and list 3-5 tasks to complete on the activity schedule prior to instruction?	*Yes / No*	Number of Tasks Entered 1 2 3 4 5	
Step 4: Did the student group work together throughout the class period using the activity schedule?	*Yes / No*	Group Engagement Level **Beginning of the period**: engaged / not engaged **Middle of period**: engaged / not engaged **End of period:** engaged / not engaged	
Step 5: Did peers provide verbal and gestural prompting and encouragement?	*Yes / No*	Level of Prompting Low Medium High	
Step 6: Did peers provide positive reinforcement?	*Yes / No*	Level of Reinforcement Low Medium High	
Step 7: Was the number of tasks completed on the activity schedule recorded?	*Yes / No*	Number of Tasks Completed 1 2 3 4 5	

Appendix F
Social Validity Survey

Post-Survey Questions

Circle the number that best fits your response to each question: *1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree*

1. I enjoyed participating in groups in class (1 2 3 4 5)
2. I felt confident within a group (1 2 3 4 5)
3. I felt like participating in a group was too much additional work in class (1 2 3 4 5)
4. Working in groups helped me to complete assignments in class (1 2 3 4 5)
5. I was able to help out my group in class (1 2 3 4 5)
6. I benefited academically by working in groups (1 2 3 4 5)
7. I benefited socially from working in groups (1 2 3 4 5)
8. I hung out with group members outside of school (1 2 3 4 5)
9. I would recommend working with a group to other students (1 2 3 4 5)
10. I would recommend working with a group to other teachers (1 2 3 4 5)
11. What I liked about working in the group
    _____
    _____
    _____
12. What I <u>did not like</u> about working in the group
    _____
    _____
    _____
13. Do you have any suggestions/ideas that would make this type of group setting better?
    _____
    _____
    _____

Appendix G
Training Materials: Social Script

	Things to Say to Peers	How to Use the Activity Schedule
Setting up the activity schedule	• How is it going today? • What steps should we enter into the activity schedule? • Do we have everything we need? • Are we ready to start? • What should we each work on? • I'm happy to work on ___ if you want to work on ___.	• Shake hands with peer group members • Write your name/topic/date on the schedule • List tasks
During the lesson	• Have you completed Step 1? (If yes, then): What's the next step? • Can I help you with anything? • Did you find the answer? • Does anyone need help?	• Check completed tasks/boxes • Offer help if needed
At the end of the lesson	• Did we complete all of our tasks? • Did we submit everything? • Nice work everyone	• Make sure all boxes on schedule are checked • Write the # of total tasks completed. • Give everyone a high five/fist bump/hand shake.

Appendix G
Training Materials: Training Agenda

Topic: Visual Support Peer-mediated Instruction and Intervention (VPMI)
Time: 30 minutes - 1 hour
Format: PowerPoint presentation

Time	Topic	Learning Outcomes
1 minutes	**Introduction, purpose, and overview of study**	Understand the rationale for peer-mediated instruction (PMI) in secondary classrooms
3 minutes	**Brief description of PMIs:** What is PMI and how does it work? *Discuss examples of peer-tutoring and cooperative learning models*	Understanding how PMIs support students in large secondary classrooms
3 minutes	**Review of operational definitions of key terms and targeted behaviors** - Handout of operational definitions	Learn and understand the targeted measures of the intervention
10 minutes	**Scenario of off-task student behaviors and methods of peer prompting** **Question:** What are some ways to help your peer reengage in class materials?	Learn ways to identify occurrences of off-task behaviors and practice systematically prompting peers to reengage in academic tasks
5-10 minutes	**Introduction of visual support:** including the rationale for using visual supports and examples of various visual supports that can be used (e.g., paper, smartphone application, etc.) - Handout of examples of visual supports	Understand how visual supports promote structure and how to incorporate a visual support in the classroom
10 minutes	**Scenario:** teacher presents session assignment and filling out the visual support **Question:** How can students break these assignments into smaller sets of tasks? *Practice filling out visual supports using the scenario*	Learn how to break session assignments into smaller sets of tasks and how to set up the visual support
10 minutes	**Role play scenario:** practice examples of working cooperatively to complete assignments and prompting peers to reengage in times of off-task behaviors *Researcher walks around the classroom to provide assistance and support*	Practice and understand the use of the VPMI intervention
3-5 minutes	**Questions and clarifications**	Clarify the use of the intervention