EFFECTS OF THE SELF-DETERMINED LEARNING MODEL OF INSTRUCTION DELIVERED THROUGH TECHNOLOGY ON THE PROBLEM-SOLVING SKILLS OF ELEMENTARY STUDENTS WITH AUTISM SPECTRUM DISORDER

by

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A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
Special Education

Charlotte

2019

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ABSTRACT

DANA E. RUSHER. Effects of the Self-Determined Learning Model of Instruction delivered through technology on the problem-solving skills of elementary students with autism spectrum disorder. (Under the direction of DR. DAVID W. TEST)

Self-determination has been identified as a predictor of post-school success for students with disabilities (Test et al., 2009); however, students with autism spectrum disorder (ASD) continue to experience poorer outcomes than their peers without disabilities in the areas of education, employment, and independent living upon leaving high school (Lipscomb et al., 2017). Providing instruction early in component skills of self-determination, particularly in the areas of self-regulation, problem-solving, and goal-setting and attainment, may offer one solution to this problem for students with ASD (Wehmeyer et al., 2010). The purpose of this study was to conduct a conceptual replication of studies by Cote et al. (2014) and Test and Rusher (2019) to determine the effects of the Self-Determined Learning of Model of Instruction (SDLMI) delivered through technology on the problem-solving ability of four elementary students with ASD. Visual analysis indicated a functional relation between the SDLMI delivered via technology and the knowledge of participants to identify a problem, set a goal, and take action. All participants maintained skills acquired 3 weeks after the intervention. Additionally, participants generalized their ability to set a goal to a novel problem scenario describing their own strengths, interests, and needs. Social significance and recommendations for practice and future research are also discussed.

DEDICATION

This dissertation is dedicated in loving memory to my mom, Peggy Rusher. She instilled in me a fierce passion to find a career that would bring me great joy and to never give up on my hopes and dreams. An amazing woman of faith, her walk inspires me to be a better person every day. She was my biggest cheerleader, and her kind, loving spirit has lifted me up throughout this endeavor. Next, I would like to dedicate this dissertation to my sister, Mitzi. For all the tears you dried, for always believing in me (especially when I doubted myself), for all the brainstorming and problem-solving session, for being the most amazing, dedicated interventionist, I am forever grateful. I cannot imagine how I would have survived the past four years without you. As this journey takes me on a new path, know I forever carry your heart, carry your heart in my heart. I would also like to dedicate this work to my dad, Turtle, who has reminded me it matters not how slow you are, only that you finish the race, I am thankful for your love and guidance and for teaching me the value of education (I think I am finely "finished"). Lastly and most importantly, I dedicate this dissertation to Jesus Christ, my Redeemer and Protector. Because of His grace and faithfulness, I am the person I am today and the person I hope to become.

"For I know the plans I have for you, declares the Lord, plans to prosper you and not to harm you, plans to give you hope and a future."
Jeremiah 29:11

"He will cover you with his feathers, and under his wings you will find refuge; his faithfulness will be your shield and rampart."
Psalm 91:4

"Hope deferred makes the heart sick, but a dream fulfilled is a tree of life."
Proverbs 13:12

ACKNOWLEDGMENTS

I have been blessed to encounter many people intrinsic to the personal and professional growth I have experienced on this journey. First, I would like to express my sincere gratitude to Dr. David Test, my advisor, who taught me so much about not only promoting self-determination for individuals with disabilities, but also encouraging me to be more self-determined about knowing what I know and believing in myself. Your patience and support have been instrumental in my journey. Next, I would like to thank Dr. Catherine Fowler for teaching me to be productive, not just busy, and modeling the kind of leadership and work ethic I hope to emulate. Additionally, I would like to express my gratitude to Dr. Kelly Clark for all her advice, brainstorming sessions, prayers, and friendship. I would also like to thank "she who went before me," Dr. Debbie Holzberg, for welcoming me as team member for her SACR studies, for showing me the ropes, and for reminding me that it is never too late to follow your dreams. To my fellow NTACT GRAs, Wen-husan Chang, Sonja Gadd, Stephen Kwiatek, and Ashley Voggt, you have made the challenging days ("bless") bearable and the great days even more beautiful! Go forth and do great things! I would also like to thank Dr. Val Mazzotti, and Dr. Dawn Rowe for being amazing mentors at critical times during my journey. By embracing me as a co-presenter (Dawn), teaching me everything you know about the SDLMI and how to graph (Val), or telling me "You can do this!" (both of you), you always took time to show me kindness and support. Also, I would like to express my appreciation to Dr. Jennifer Coyle. What a pleasure it was to collaborate with you on the ASD TWG. Although the meetings and work seemed endless, your friendship made it all worthwhile. Lastly, I would like to thank my dissertation committee, Dr. Dave Test, Dr. Jeanneine

Jones, Dr. Ya-yu Lo, Dr. Chris O'Brien, and Dr. Charlie Wood for their guidance and support during the past year.

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Chapter 1: INTRODUCTION

Research indicates students with autism spectrum disorder (ASD) are less likely to be successful in the post-school areas of education, employment, and independent living (Lipscomb et al., 2017). According to the National Longitudinal Transition Survey 2012, youth with ASD attend and complete postsecondary education programs at lower rates, experience lower rates of employment, earn less money, work fewer hours, are less engaged in their communities, and live independently less often than their peers without disabilities (Lipscomb et al., 2017). Only 43.9% of students with ASD ever attended any type of postsecondary education (i.e., 2-year or community colleges, vocational, business, or technical schools, 4-year colleges or universities) compared to 67.4% of students without disabilities. In addition, only 37.2% of individuals with ASD were employed compared to 66.1% of their peers without disabilities, and students with ASD had less paid work experience compared to their peers with other disabilities (23% vs. 40%). Additionally, statistics show students with ASD are less self-determined than their peers without disabilities (Newman et al., 2011; Wehmeyer & Shogren, 2008). Considering this evidence, education's approach to preparing students with ASD for life after high school may require inspection.

Characteristics of Students with ASD

ASD refers to a range of conditions characterized by challenges with: (a) social communication and interaction deficits; and (b) restrictive and repetitive behaviors, interests, and activities (American Psychiatric Association, 2013). Every individual with ASD has unique strengths and differences and may present with additional characteristics including intellectual impairment, sensory sensitivity, attention and executive functioning

problems, motor difficulties, and behavior problems (Johnson, 2007). The varying strengths and needs of students with ASD are highly distinctive, often presenting challenges to teachers and other school personnel who are responsible for meeting their individual needs (Test, Smith, & Carter, 2014). Students with ASD often have characteristics that affect their ability to problem solve and set and attain functional and academic goals (Wehmeyer, Shogren, Zager, Smith, & Simpson, 2010), ultimately impacting self-determined behaviors. Characteristics of students with ASD may influence the development of self-determination but do not preclude students with ASD from developing such skills and attitudes with appropriate instruction and intervention (Wehmeyer et al., 2010).

Self-Determination

One possible solution that may improve the post-school outcomes of students with ASD is to provide instruction in component skills of self-determination early. Research supports instruction in self-determination skills as a way to increase positive in-school (Lee, Wehmeyer, & Shogren, 2015; Palmer, Wehmeyer, Gipson, & Agran, 2004) and post-school outcomes for students with disabilities (Shogren, Wehmeyer, Palmer, Rifenbark, & Little, 2015). Together, Test et al. (2009) and Mazzotti et al. (2016) identified 20 in-school predictors of post-school success for students with disabilities, and one identified predictor was self-determination. Self-determination is defined as the ability to be in control of one's life, to be a causal agent across multiple aspects of one's life (Shogren et al., 2015). Component skills of self-determination include: (a) choice-making; (b) decision-making; (c) problem-solving; (d) goal-setting and attainment; (e) self-advocacy; (f) self-efficacy; (g) self-knowledge and understanding; (h) self-

observation, evaluation, and reinforcement; (i) independence, risk taking, and safety; (j) self-instruction; and (k) internal locus of control (Wehmeyer, 1999).

Research has shown all students can learn self-determination skills (Algozzine, Browder, Karvonen, Test, & Wood, 2001), and Palmer and Wehmeyer (2003) recommended promoting self-determination at the elementary level to ensure students with disabilities gain the vital skills needed to become self-determined adults. As self-determination follows a developmental trajectory (Hagiwara, Shogren, & Leko, 2017), it is important to explore the foundational skills elementary students with ASD need to be prepared to learn more complex component skills of self-determination later. Research has indicated areas of instruction such as problem-solving, goal-setting and attainment, and self-regulation warrant particular attention and may be beneficial for elementary students with ASD (Wehmeyer et al., 2010) especially for successful inclusion in, and access to, the general education curriculum (Agran, Cavin, Wehmeyer, & Palmer, 2006).

Problem-solving interventions. Explicit instruction in problem-solving skills should begin in elementary grades to increase the maintenance and generalizability of these skills throughout the life-span (Cote, 2011). Many students with ASD struggle with problem-solving skills, greatly influencing their interactions with others and hindering their ability to come up with solutions to their own problems (Wehmeyer et al., 2010). Unfortunately, teachers do not always see the benefits of teaching problem-solving skills to students with disabilities (Palmer & Wehmeyer, 2003), yet problem-solving instruction can increase self-determination and teach students with disabilities how to self-regulate their behavior (Palmer & Wehemeyer, 2003; Palmer et al., 2004).

Self-determined learning model of instruction. The Self-Determined Learning Model of Instruction (SDLMI) is a curriculum initially developed to teach youth to self-direct the instructional process (Mithaug, Wehmeyer, Agran, Martin & Palmer, 1998; Palmer & Wehmeyer, 2003). Furthermore, the SDLMI also addresses other component skills of self-determination such as goal-setting, problem-solving, choice-making, self-monitoring, and self-evaluation (Wehmeyer, Palmer, Argan, Mithuag, & Martin, 2000). Research indicates the SDLMI is an effective intervention for teaching students at risk for, and with, disabilities to self-set goals (e.g., Agran, Blanchard, Wehmeyer, & Hughes, 2002; Benitez, Lattimore, & Wehmeyer, 2005; Palmer & Wehmeyer, 2003). However, in all of the original studies, the SDLMI was taught using traditional teacher-directed instructional materials. Despite the evidence supporting the SDLMI framework, there is limited research describing its use with elementary students with ASD.

Technology-Aided Instruction and Intervention

Although several studies have cited the efficacy of technology to teach goal-setting skills related to increased self-determination for older students with or at risk for disabilities (Mazzotti, Test, & Wood, 2012; Mazzotti, Test, Wood, & Fowler, 2012; Mazzotti, Test, Wood, & Richter, 2010), there is limited research specifically supporting the use of technology-aided instruction and intervention (TAII) to improve the goal-setting skills of students with ASD. TAII is defined as when technology is the central feature to support the goal or outcome of a student during instruction (Odom et al., 2015; Wong et al., 2015) and may include graphics, pictures, audio, text, and/or video (Hutcherson, Langone, Ayres, & Clees, 2004). Technology central to this study includes a laptop used by the teacher (i.e., the interventionist), iPads used by the participants, and

an app (i.e., Nearpod) that allows the teacher to share information directly with the student via his or her iPad. Specifically, structured lessons, shared directly from the teacher's laptop to a student's iPad, visuals, repetition with variety, and multiple ways to respond, allow the student to interact with the content in a host of ways including drawing or writing via the iPad. Additionally, a student's unique characteristics of ASD (e.g., communication ability, restricted interests, cognitive ability) are taken into consideration during every phase of the intervention.

Purpose of the Study and Research Questions

This study's methodology is based on an existing research line (Agran, Blanchard, Wehmeyer, & Hughes, 2001; Agran et al., 2006; Cote et al., 2010; Cote et al., 2014; Palmer & Wehmeyer, 2003) and conceptually replicates a study by Cote et al. (2014) and Test and Rusher (2019) that found a problem-solving intervention and adapted version of the SDLMI was effective for teaching skills in problem-solving, goal-setting and goal-attainment, and self-monitoring to elementary students with ASD.

Due to the evidence supporting instruction in component skills of self-determination to increase the post-school success of students with disabilities as well as the success of using TAII and the SDLMI with older populations of students with disabilities, there is a need to extend the research to elementary students with ASD. Therefore, the purpose of this study was to conceptually replicate studies by Cote et al., 2014 and Test and Rusher (2019) that investigated the effects of the SDLMI on the problem-solving and goal-setting ability of elementary students with ASD. Additionally, the current study will extend the research of Test and Rusher (2019; see Table 1 for a description of the features changed for the conceptual replication) by examining the

ability of students to generalize their problem-solving and goal-setting skills.

Table 1
Features Changed for Conceptual Replication

Study Dimension	Cote et al. (2010)	Cote et al. (2014)	Test & Rusher (2019)	Current Study
Participants				
	• Four middle school students with ID • Age range: 11-12	• Three students in 4th and 6th grades with ASD • Age range: 9-11	• Three students in 2nd-4th grades with ASD • Age range: 7-10	• Four students in grades 2nd-5th with ASD • Age range: 7-11
Setting				
School type	• Urban middle school (i.e., 929 students)	• Urban elementary school (i.e., 482 students)	• Rural elementary (i.e., 525 students)	• Rural elementary (i.e., 550 students)
Intervention location(s)	• Self-contained classroom for students with ID	• Resource room	• Self-contained classroom for students with ASD	• School-wide Behavior Interventionist's classroom
Intervention (IV)				
Instructional Design & Delivery Features	• Problem-solving strategy (modified from *A Parent's Guide to the*	• Problem-solving strategy (*A Teacher's Guide to the SDLMI for Early Elementar*	• Problem-solving strategy and 2 adapted phases of the SDLMI for early	• Problem-solving strategy and 3 adapted phases of the SDLMI for early

	SDLMI for Early Students and Glago, 2005 study) • Problem-solving storybooks	*y Students* was used to help students self-select goals) • Problem-solving storybooks	elementary students • Problem-solving scenarios based on student experiences • Technology-aided instruction • Visual supports	elementary students • Problem-solving scenarios based on student experiences • Technology-aided instruction • Visual supports
Outcome Measures (DV)				
Dependent Variable (s)	• Identifying a problem and generating a solution • Mastery criteria of 80% on three consecutive attempts using the problem-situation measure	• Percentage of time engaged in target behavior (related to students' IEP goals; i.e., percent of time following directions, percent of time participating as required, percent of time maintaining focus on task)	• Identifying a problem and generating a solution • Percentage of time students engaged when expected to work independently • Mastery criteria of 75% across three consecutive sessions in Phase 1 and 87.5% across three	• Knowledge of the Problem-Solving process including identifying a problem and generating a solution, developing a goal, developing a plan to reach the goal, and self-monitoring/ self-evaluation • Mastery criteria equaled completion of all four

		• Mastery criteria of 80% of the time engaged in targeted behavior on three successive occasions measured by partial interval recording method	consecutive sessions in Phase 2	lessons in each Part with last data point at mastery (i.e., 75% in Phase 1, 80% in Phases 2 & 3)
Generalization	• Role-play of problem situation	• NA	• NA	• Pre-/Post goal-setting scenario
Social Validity	• One Teacher	• One Teacher	• Three Teachers • Three students	• Five Teachers • One Behavior Interventionist • Four students

This study will seek to answer the following questions:

1. What effect will an adapted version of the SDLMI delivered through technology have on the knowledge of elementary students with ASD to identify a problem, set a goal, and take action?
2. Will elementary students with ASD generalize their knowledge to identify a problem and set a goal?
3. Will elementary students with ASD maintain their knowledge to identify a

problem, set a goal, and take action?

4. What will be the perception of elementary students with ASD of an adapted version of the SDLMI delivered through technology to teach them to identify a problem, set a goal, and take action?
5. What will teacher perceptions be of an adapted version of the SDLMI delivered through technology to increase the problem-solving, goal-setting, and self-monitoring skills of elementary students with ASD?

Significance of the Study

Hagiwara et al. (2017) conducted a literature review to investigate research studies of the SDLMI to determine how the intervention has been implemented and what data have been collected to determine how self-determination and the SDLMI might be incorporated into teacher education and special education practices within school settings. This study will address several of the recommendations identified in the literature review. First, there is limited research on the efficacy of the SDLMI for students with ASD, and even less research focused on elementary students with ASD. Second, only eight of the 21 studies used a teacher as the interventionist. Third, it was noted that very few studies described the implementation of the SDLMI or the training provided to the interventionists. Lastly, the authors noted that supplemental materials need to be created to translate research into practice. The experimenter plans to both explicitly and sufficiently describe the implementation of the SDLMI for elementary students with ASD using a certified teacher as the interventionist. Additionally, the training provided to the interventionist will be described in detail and all supplemental materials will be included in this dissertation.

Delimitations

This study has several delimitations. First, the participants in this study attend the same elementary school which may make it difficult to generalize the effects of the adapted SDLMI intervention across school settings. Second, the number of participants in the sample will be small which may make it difficult to generalize the effects of the intervention across large groups of students. Third, students with ASD demonstrate diverse characteristics in the areas of communication, social interaction, and repetitive behavior/restricted interests which may make it difficult to generalize the effects of the intervention across large groups of students with ASD. Lastly, the participants in this study will be selected using purposeful sampling, therefore, because a control group will not be included in the design, the results may be difficult to generalize to different populations.

Definitions of Acronyms and Terms

Autism Spectrum Disorder (ASD): Autism, or ASD, refers to a range of conditions characterized by challenges with: (a) social communication and interaction deficits; and (b) restrictive and repetitive behaviors, interests, and activities (American Psychiatric Association, 2013). Every individual with ASD has unique strengths and differences and may present with additional characteristics including "intellectual impairment, sensory sensitivity, attention and executive functioning problems, motor difficulties, and behavior problems" (Johnson, 2007).

Generalization: Stokes and Baer (1977) described generalization as occurring in several ways (a) if a trained behavior occurs at other times outside of actual training

environment, (b) in other places without requiring training, or (c) if a related behavior develops that was not directly taught.

Goal Setting and Attainment: Goal setting and attainment are taught by instructing students to define and set a goal, identify current levels of performance, develop a plan, and evaluate progress toward reaching the goal (Agran, King-Sears, Wehmeyer, & Copeland, 2003; Wehemeyer & Schwartz, 1998).

Multicomponent Self-Determination Intervention (MCSD): Multicomponent self-determination interventions (MCSD) interventions are interventions that address multiple components of self-determination (e.g. problem-solving, goal-setting and attainment, self-monitoring; Cobb et al., 2009).

School-wide Behavior Interventionist (SWBI): the teacher providing the intervention in this study.

Self-Determination: Self-determination is defined as "acting as the primary causal agent in one's life and making choices and decisions regarding one's quality of life free from undue external influence or interference" (Wehmeyer, Kelchner, & Richards, 1996, p. 632).

Self-Determined Learning Model of Instruction (SDLMI): The SDLMI is a self-regulated problem-solving process in which students set goals based on their preferences and instructional needs, develop and implement action plans to assist them in achieving these goals, and evaluate their progress toward reaching their goals. The process consists of three phases including (a) set a goal, (b) take action, and (c) adjust goal or plan. These phases represent the steps in a problem-solving sequence. Students must identify the problem, identify potential solutions to the problem, identify barriers

to the solution, and identify consequences of each solution Wheeler, Palmer, Agran, Mithaug, & Martin, 2000). The SDLMI is an example of a multicomponent self-determination intervention.

Self-Evaluation: involves teaching students to track their progress in achieving their goals, by looking at the difference between where they currently are on a goal or task, and where they want to be in the future (Wehmeyer & Shogren, 2008).

Self-Management: allows students to become self-regulated learners who apply behavior change tactics to produce a desired behavior (Cooper et al., 2007). Self-management strategies include self-monitoring, self-evaluation, and self-reinforcement (Wehmeyer & Shogren, 2008).

Self-Monitoring: a procedure that engages someone in self-observing and self-reporting occurrences of a target behavior (e.g., those that are part of a goal; Agran, 1997; Wehmeyer, Agran, & Hughes, 1998).

Self-Regulation: the ability to control bodily functions, manage emotions, and maintain focus and attention (Palmer, 2010).

Strengths, Interests, and Needs Inventory (SINI): inventory used to collect information on participants' strengths, interests, and needs.

Technology-Aided Instruction and Intervention (TAII): Odom and colleagues (2015) defined technology as "an electronic item/equipment, application, or virtual network that is used to intentionally increase, maintain, and/or improve daily living, work/productivity, and recreation leisure capabilities for adolescents (p. 3806). TAII is when technology is the central feature of an intervention to support the goal or outcome of a student during instruction (Wong et al., 2015).

Visual Supports: Visual supports may include pictures, words, objects, environmental arrangements, schedules, maps, and labels that are used to support completion of daily activities, tasks related to the activities, and/or the behaviors necessary for completed tasks (Hume, 2008).

CHAPTER 2: REVIEW OF THE LITERATURE

The transition from high school to adulthood is a challenging time for all students, but for students with ASD it is reported that there are major obstacles to overcome (Kuo, Crapnell, Lau, Anderson, & Shattuck, 2018). Historically, students with ASD have experienced lower post-school outcomes when compared to their peers with other disabilities (Blackorby & Wagner, 1996; Lipscomb et al., 2017). One possible solution to the poor post-school outcomes of students with ASD is to provide instruction in component skills of self-determination. This review of the literature will discuss three themes important to understanding the need to promote self-determination early for students with ASD. The strands include: (a) characteristics, demographics, and post-school outcomes of students with ASD; (c) self-determination and students with ASD; and (c) technology-aided instruction and intervention.

Characteristics, Demographics, and Post-School Outcomes of Students with ASD

IDEA (2004) defined ASD as a "developmental disability significantly impacting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance." The federal definition also lists other characteristics of the disorder including "engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences" (34 C.F.R. 300.8(c)(1)).

According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; American Psychiatric Association, 2013), individuals with ASD exhibit: (a) deficits in social communication and social interaction across multiple contexts (e.g., deficits in social-emotional reciprocity, deficits in nonverbal communication, deficits in developing,

maintaining, and understanding relationships); (b) restricted, repetitive patterns of behavior, interests, or activities (e.g., stereotyped or repetitive movements, insistence on sameness, restricted and/or fixated interests, hyper- or hypo-sensitivity to sensory input or unusual sensory interests); and (c) symptoms exhibited in early developmental period even though they may not be recognized until the child is older. Symptoms of ASD occur along a spectrum (or continuum) of mild to severe and affect each individual differently.

Students with ASD present with a diverse range of characteristics due to the unique neurology caused by the disorder (Hazlett et al., 2017). These characteristics dictate how individuals on the spectrum learn (Stoner et al., 2014). Although most neuro-typical peers learn social, communication, and daily living skills implicitly, students with ASD often require explicit instruction and deliberate opportunities to practice in these areas (Myles, Aspy, Mataya, & Shaffer, 2018).

Approximately 1 in 59 students is identified as having ASD according to the Center for Disease Control and Prevention's Autism and Developmental Disabilities Monitoring Network (Baio et al., 2018), a prevalence rate that remains high. The number of students nationwide identified as having ASD rose 165% between the 2005-2006 and 2014-2015 school year (Samuels, 2016). Often teachers face challenges in providing instruction and support to students with ASD because of their unique characteristics that may create difficulty with learning, communication, socialization, and behavior (Marder & deBettencourt, 2012).

Fullerton and Coyne (1999) emphasized students with ASD think differently, making planning for life after high school more complicated than for students with other disabilities. When planning for instruction, it is important to consider the unique social,

visual, and communicative characteristics of learners with ASD and how these characteristics may impact development of self-determination skills. When designing interventions for students with ASD, it is very important to acknowledge the core deficits (i.e., those that are unique to autism) exhibited by this population (Fullerton & Coyne, 1999; Sigman, Dijamco, Gratier, & Rozga, 2004).

Students with ASD continue to experience poorer outcomes in education, employment, and independent living compared to other students with and without disabilities. For example, according to data from the National Longitudinal Transition Study-2 (NLTS2; Newman et al., 2011), individuals with ASD experienced lower employment rates, earned less money, worked fewer hours, experienced less community engagement, and lived independently less frequently than their peers without disabilities. Recent data from the NLTS 2012, indicated only 37.2% of individuals with ASD were employed compared to 66.1% of the general population and only 43.9% attended a postsecondary education program compared to 67% of all students with disabilities (Lipscomb, 2017). Additionally, completing college had little effect, as college graduates with ASD reported difficulties with underemployment and chronic unemployment (Barnhill, 2007; Hendricks & Wehman, 2009; Henninger & Taylor, 2013). Also important to note, only 17% of students with ASD had lived independently compared to 65% of students with learning disabilities, 51% of students with speech/language impairments, and 58% of students with other health impairments (Newman et al., 2011). Statistics confirm students with ASD are not experiencing the same level of postsecondary success as students with other disabilities.

Summary of Characteristics, Demographics, and Post-School Outcomes of Students with ASD

Students with ASD often experience poor post-school outcomes. Specifically, students with ASD are less likely to be employed, experience less community engagement, and live independently less frequently than their peers without disabilities (Lipscomb et al., 2017; Newman et al., 2011). One potential solution to address the poor post-school outcomes of this population is to provide instruction in component skills of self-determination. When considering the unique characteristics of students with ASD, as well as their diverse learning needs, planning for life after high school proves especially challenging (Fullerton & Coyne, 1999) not only for the students with ASD but also for their teachers (Marder & deBettencourt, 2012). Because self-determination follows a developmental trajectory (Palmer, 2010), it is critical to promote self-determination early for students with ASD.

Self-Determination and Students with ASD

There is a positive correlation between promoting self-determination and more positive in-school and post-school outcomes (Shogren, Palmer, Wehmeyer, Williams-Diehm, & Little, 2012). Specifically, self-determination/self-advocacy has been identified as a predictor of post-school education and employment for students with ASD (Halpern Yovanoff, Doren, & Benz, 1995). This section will review the definition and component skills of self-determination, self-determination as a predictor of in-school and post-school success, and self-determination interventions for students with ASD.

Definition and Component Skills of Self-Determination

The theory behind self-determination as important for individuals with disabilities dates back to Nirje (1972) when he emphasized individuals with disabilities should have a say in making choices that affect their own lives. Although the theoretical concepts behind self-determination emerged in the 1970s (Deci, 1971), the construct was not defined until 1985 by Deci and Ryan as the ability to recognize and make choices and make decisions about one's own actions. Field and Hoffman (1994) defined self-determination as

> A combination of skills, knowledge, and beliefs that enable a person to engage in goal-directed, self-regulated, autonomous behavior. An understanding of one's strengths and limitations together with a belief in oneself as capable and effective are essential to self-determination. When acting on the basis of these skills and attitudes, individuals have great ability to take control of their lives and assume the role of successful adults in society (p. 2).

Later, self-determination, or self-governance, was described by Wehmeyer and Schwartz (1998) as individuals controlling their own lives and destinies. Consisting of a combination of skills, self-determination was considered important for students with disabilities as they learned the skills needed for making their own informed choices. Definitions of self-determined behavior have evolved over the years and can be described as the actions identified by four essential characteristics (a) autonomy, (b) self-regulated behavior, (c) psychological empowerment, and (d) self-realization (Wehmeyer, Abery, Mithaug, & Stancliffe, 2003). Additionally, self-determined behavior has been described as "volitional action that enables one to act as the primary causal agent of one's life and

to maintain or improve one's quality of life" (Wehmeyer, 2005, p. 117). Self-determination, also referred to as self-regulation or autonomy, is an internal process and the way in which individuals adopt their own social values (Ryan & Deci, 2006). Most recently, self-determination has been defined as "a dispositional characteristic manifested as acting as the causal agent in one's life" (Shogren et al., 2015, p. 2) and as "the ability to make choices, solve problems, set goals, evaluate options, take initiative to reach one's goals, and accept consequences of one's actions" (Rowe et al., 2015, p. 121).

The following component skills are typically found in a model of self-determination: (a) choice-making; (b) decision-making; (c) problem-solving; (d) goal-setting and attainment; (e) independence, risk-taking, and safety; (f) self-regulation/self-management; (g) self-instruction; (h) self-advocacy and leadership; (i) internal locus of control; (j) positive attributions of efficacy and outcome expectancy; (k) self-awareness; and (l) self-knowledge (Wehmeyer & Schalock, 2001). Although there is acknowledgment that promoting instruction in component skills of self-determination needs to begin early in order to improve the self-determined behavior of students with disabilities, ultimately positively influencing post-school outcomes (Erwin & Brown, 2000; Wehmeyer & Palmer, 2000, Wehemeyer, Sands, Doll, & Palmer, 1997), the majority of instruction in these component skills focuses on middle and high school students (Palmer & Wehemeyer, 2003).

Self-Determination as a Predictor of In-School and Post-School Success

As a predictor of post-school success (Test et al., 2009), self-determination has been lauded as the best practice in special education (Shogren, 2013). When considering how to increase the post-school outcomes of students with ASD, it may prove beneficial

to promote explicit instruction in component skills of self-determination. Although the distinctive characteristics of students with ASD influence planning for the teaching of component skills of self-determination, there is no reason why these skills cannot be taught and learned (Wehmeyer & Smith, 2012).

Importance of Self-Determination Interventions for Students with ASD

There is increasing research to support promoting instruction in self-determination skills for students with disabilities, including those with ASD, as a way to increase positive school and post-school outcomes. For example, there is evidence that teaching self-determination skills to students with disabilities allows for more positive academic outcomes (Fowler, Konrad, Walker, Test, & Wood, 2007; Lee, Wehmeyer, Soukup, & Palmer, 2010), improves transition outcomes in the areas of postsecondary employment and independent living (Wehmeyer & Palmer, 2003), addresses recreation and leisure needs (McGuire & McDonnell, 2008), and improves overall quality of life (Shogren, Lopez, Wehmeyer, Little, & Pressgrove, 2006). However, specifically for students with ASD, the need to provide instruction in the component skills of self-determination is supported in the literature. For example, Carter, Owens, Trainor, Sun, and Sweden (2009) conducted a study to determine teacher and parent perspectives regarding self-determination prospects for students with significant intellectual disability and/or ASD. Findings reported, although teachers saw self-determination as an important attitude and skill, teachers often did not feel equipped to promote instruction in this area. Another interesting finding indicated teachers believed in students' abilities to learn component skills of self-determination more so than parents did. In another study, Chou, Wehmeyer, Palmer, and Lee (2016) compared the self-determination of 222 middle and

high school students with ASD, intellectual disability (ID), or learning disabilities (LD). The study indicated that in the autonomous functioning domain, students with ASD scored lower than all other students and scored lower than did students with LD in all domains. In addition, Carter et al. (2013) conducted a study to survey parent perspectives about the self-determination skills of their children with ASD and ID. Results indicated parents viewed instruction in component skills of self-determination as important although they did not indicate their children were proficient at any of the component skills. As a result, the specific areas of instruction, such as self-regulation, goal-setting and attainment, and problem-solving may warrant particular attention and provide benefit for students with ASD (Wehmeyer et al., 2010).

Self-regulation interventions for students with ASD. Self-regulated behavior can be defined as the personal ability to control one's actions (Palmer, 2010). Self-regulated, or student-directed learning, refers to the ability of students to be aware of, and have knowledge of, multiple ways to respond to their environments, as well as revise responses as needed (Wehmeyer & Schwartz, 1998). Instruction in self-regulation includes teaching students to solve problems and employ self-management skills (e.g., self-evaluation, self-monitoring, self-observation, self-reinforcement; Wehmeyer et al., 2010; Wehmeyer & Schwartz, 1998). There has been consistent research offering evidence for teaching students with ASD how to self-regulate and providing them with opportunities to practice using the skill to increase socially desired behaviors (Koegel, Harrower, & Koegel, 1999). In fact, teaching students with ASD self-management skills may also positively impact problem-solving ability (Koegel, Koegel, & Parks, 1995), communication (Newman, Reinecke, & Meinberg, 2000), daily living skills (Sherer et al.,

2001), and academic performance (Callahan & Rademacher, 1999). Three studies reviewed in this section provide evidence for teaching self-regulation to students with ASD. The studies investigated the interventions of self-management and self-monitoring. Of additional interest was observing whether proficiency in self-regulation skills/student-directed learning may also have a positive impact on the component skills of goal-setting and problem-solving.

Carr, Moore, and Anderson (2014) conducted a meta-analysis of self-management interventions focused on acquiring new skills and/or increasing appropriate behavior for students diagnosed with ASD. The review included 23 single-case studies conducted between 1992 and 2008 including students with ASD ages 3 to 25 years of age. The authors updated information from earlier reviews, specifically evaluating the quality of studies by applying the What Works Clearinghouse (WWC) standards (Kratochwill et al., 2010) for single-case design. The analysis expanded the search terms associated with self-management (i.e., self-recording, self-control, self-determination, and empowerment). Results indicated of the 23 studies, 12 met the WWC quality assessment standards and 11 met standards with reservation reflecting sufficient evidence for implementing self-management interventions with students with ASD. Results were analyzed by age, setting, functional level, and target behaviors and indicated that self-management interventions are effective for increasing social and academic skills for all ages and all ability levels. Additionally, results from the meta-analysis show goal setting training may be a valuable component of treatment packages aimed at increasing independence of students with ASD. The analysis resulted in sufficient evidence to support self-management as an evidence-based practice (EBP) for students with ASD.

Next, Bouck, Savage, Meyer, Taber-Doughty, and Hunley (2014) conducted a study to determine the effects of paper-pencil self-monitoring versus technology-based self-monitoring (using an iPad) on food preparation tasks. Participants included three students, ages 13 to 15, diagnosed with ASD who received special education services in a self-contained classroom. The intervention included having students complete food preparation tasks of equal number with both paper/pencil and on the iPad. Checklists were used to self-monitor completing each step of a recipe. Using an alternating treatments design, results indicated self-monitoring with both paper/pencil, as well as with an iPad increased task independence and decreased number of prompts needed by students during each session including maintaining skills for 14 weeks. However, the iPad was the most effective, efficient, and preferred system for self-monitoring.

Lastly, Rouse, Everhart-Sherwood, and Alber-Morgan (2014) evaluated the effects of a self-monitoring intervention combined with recruiting teacher attention on pre-vocational task completion for students with moderate to severe disabilities. Two students, 12 years of age, with moderate to severe disabilities (one with Down Syndrome, one with ASD) were participants in the study. Both students presented with significant academic, social, and communication deficits. The intervention included using a job board with self-monitoring picture prompts depicting (a) do your work, (b) look at the picture, (c) check your work, (d) raise your hand, (e) quietly wait for the teacher, and (f) put bin away. Modeling, prompting, and verbal guidance were employed to teach the students how to use the checklist with one task, and students were expected to generalize the skills learned to two other pre-vocational tasks. Using a multiple probe across behaviors design, results showed a functional relation between the self-monitoring and

recruiting intervention and ability of both participants to use a picture prompt checklist to self-monitor completion of the pre-vocational task and appropriately recruit teacher feedback. Both participants also demonstrated the ability to generalize using the self-monitoring checklist to two different tasks.

Goal-setting and attainment interventions for students with ASD. Wehmeyer and Schwartz (1998) defined goal-directed behavior as the actions students need to complete to reach a particular outcome. Teaching goal-setting and attainment skills includes instruction in describing and communicating a goal, explaining where one stands in relation to meeting the goal, creating an action plan, and determining progress toward achieving the goal (Wehmeyer & Schwartz, 1998). Although explicit teaching of goal-setting and attainment skills is important for students with ASD who often struggle to work on more than one goal-directed task at a time (Ruble & Scott, 2002), there is limited research on goal-setting interventions for students with ASD.

In Carr et al.'s (2014) literature review of single-case research design studies that focused on the use of goal-setting as an intervention for participants across a wide range of learning needs and challenges, a research question was to determine what the current literature suggests for applying goal-setting to participants with ASD. The review included 38 studies describing research with 186 participants conducted prior to November 2013 and including individuals between the ages of 6 and 54 years. Of the 186 participants, 82 (44%) were elementary students between the ages of 6 and 12, 73 (39%) were high school students between the ages of 13 and 17, and 31 (17%) were adults 18 years of age or older. Participants' were classified using the primary diagnosis provided in the original study. Only 5 (3%) participants were diagnosed with autism and 4 (2%)

with Asperger's syndrome. The remaining participants included 14 (8%) with ADHD, 14 (8%) with behavioral emotional disorder/difficulties, 45 (24%) with learning disability/difficulties, 21 (11%) with mental retardation, 12 (6%) with non-compliance/conduct disorder, 1 (1%) participant who was manic/depressive, 2 (1%) gifted, 15 (8%) typically developing, 49 (26%) participants were athletes, and 4 (2%) with physical disabilities. The majority of the 38 studies included goal-setting interventions implemented along with other dependent variables; none of the studies that identified the effectiveness of goal-setting alone included participants on the autism spectrum. The six studies including students with ASD population are described in the coming section on multicomponent interventions for students with ASD. Results of this review emphasized that although limited research has been conducted with individuals with ASD and with little consistency demonstrated with younger children, goal-setting interventions have been used successfully among participants with a wide range of learning difficulties or cognitive challenges.

Problem-solving interventions for students with ASD. Problem-solving, as defined by Wehmeyer and Schwartz (1998), refers to an activity or situation that does not have a known immediate solution. Teaching problem-solving skills includes instruction in identifying and defining a problem and formulating possible solutions (Wehmeyer & Schwartz, 1998). Problem-solving ability is important for students with ASD especially in the realm of social interactions. Although social problem-solving may be difficult for this population, there is evidence to support students with ASD can learn to generate positive solutions to social problems (with appropriate instruction and supports as needed), as well as initiate and engage in reciprocal conversations with peers

(Bauminger, 2007). Two experimental studies reviewed in this section provide evidence for teaching problem-solving skills to students with ASD.

First, Bauminger (2002) conducted a study to investigate the effects of an adaptation of a social-emotional intervention on the ability of students with ASD to use social and interpersonal problem-solving skills. Participants included 15 students (4 girls, 11 boys), diagnosed with high-functioning ASD, between the ages of 8 and 17. Students attended four high schools throughout Israel and had all (except one) been included in general education settings for at least one year. The intervention included three sections: (a) teaching perquisite concepts such as what is a friend, why is it important to listen to a friend, how do we listen to a friend; (b) affective instruction to teach recognition of simple emotions (e.g., happy, sad, mad, scared), descriptive rules for each emotion, and how to identify emotions in oneself and others when in social situations; and (c) instruction in social-interpersonal problem-solving designed to teach 13 main social interactions (e.g., initiating conversations, comforting a friend, and sharing experiences with a friend). Using an open-trial design, results indicated students generated more appropriate solutions to problems experienced during social situations and initiated more social interactions with peers. Even though students could not brainstorm alternative solutions to social problems after treatment, there was a qualitative change in students' ability to produce more meaningful social exchanges and to understand more complex emotions.

Additionally, Yakubova and Taber-Doughty (2015) conducted a study to investigate the effects of a multicomponent intervention (including video clips showing sample tasks and practice sessions to apply the steps in the strategy) on the problem-

solving ability of four students with ASD during vocational tasks. Students in the study ranged in age from 17 to 20 and received special education services in self-contained classrooms in two high schools. During intervention, students watched point-of-view video clips on an iPad, practiced how to solve problems using problem-solving steps on a cue sheet, and received individualized help (e.g., verbal prompts, error correction, verbal feedback) as needed. Using a multi-probe across students design, results indicated a functional relation between point-of-view video modeling and practice sessions on all students' ability to follow the steps for problem-solving during vocational tasks; skills were maintained at 6-weeks post-intervention for three of the four students.

Multicomponent self-determination interventions for students with ASD. Multicomponent self-determination (MCSD) interventions are interventions that address multiple components of self-determination (e.g. problem-solving, goal-setting and attainment, self-monitoring; Cobb et al., 2009). Although the literature supports the efficacy of MCSD interventions for students with disabilities (Hagiwara et al., 2017; Wehmeyer et al., 2000), there has been minimal research investigating the effects specifically for students with ASD.

Todd, Reid, and Butler-Kisber (2010) conducted a study to determine the effects of a self-regulation intervention treatment package that included the self-determination components of goal setting, self-monitoring, and self-reinforcement on the prolonged physical performance (bike riding) of three students with ASD. Participants were between the ages of 15 to 17, nonverbal, had significant ID, and received services in a class for students with severe disabilities. The intervention took place three times per week for 3 months on the cycling course at the students' school. Goal-setting was

systematically introduced as a process to students, first setting goals related to intensity and then goals related to distance. Students used happy face cues to indicate their progress on a self-monitoring board with all their names. Each student was asked how confident they felt about reaching their goal to assess self-efficacy. Students indicated their answers by pointing to a picture representing how they felt. Using a multiple baseline changing criterion design, results indicated the intervention package increased the distance two of the three students were able to cycle.

One multicomponent self-determination intervention that has been widely used is the SDLMI. The SDLMI (Mithaug et al., 1998; Wehmeyer et al., 2002) is a self-regulated problem-solving model of instruction that teaches students to (a) set goals, (b) develop a plan of action to reach those goals, and (c) monitor progress toward those goals (Lee et al., 2015). The SDLMI can be used along with instruction in any curricular area (e.g., academic, social, transition) by assisting students in setting goals for their learning within a particular area and engaging in activities dictated by the curriculum to attain these goals (Shogren et al., 2017). As such, the model promotes self-directed learning by teaching students to make choices and decisions and solve problems encountered as they work toward their learning goals (Hagiwara, Shogren & Leko, 2017).

Although a number of studies have investigated the effectiveness of the SDLMI (Lee et al. 2015), and the SDLMI has been identified as a research-based practice to promote self-determination (Wehmeyer et al., 2012) and goal attainment and general curriculum access (Shogren et al., 2012), there are a limited number of studies investigating the efficacy of the SDLMI for students with ASD, especially elementary students with ASD.

First, Agran et al. (2001) conducted a study to investigate the effects of SDLMI on specific classroom behaviors of four middle school students with cognitive or developmental disabilities. One participant was identified as having ASD. Participants, along with their general education and special education teachers, identified target behaviors related to Individualized Education Program (IEP) goals. The intervention involved using the SDLMI to teach students to set a goal, create an action plan, and evaluate the outcome. Using a multiple-baseline-across-participants design, results indicated a functional relation between the self-regulated problem-solving instruction and increased performance for target behavioral goals. Not only did he the participant with ASD reach his personal goal of appropriately touching others 80% of the time, but exceeded his goal by 20%.

Next, Agran et al. (2006) examined the effects of the SDLMI on the academic performance of three middle school students with moderate to severe disabilities, including one student with ASD, across various general education content classes. The participant with ASD was nonverbal and required intensive support needs. Each participant, with the assistance of a researcher and his or her special education teacher, chose a specific curriculum area of focus from three to seven different academic areas based on the district's general education curriculum standards. Using a multiple baseline across participants design, results indicated a functional relation between instruction using the SDLMI (i.e., goal-setting, self-monitoring, and self-instruction) and acquisition of target academic skills in the general education classroom.

Then, Lee, Wehmeyer, Palmer, Soukup, and Little (2008) conducted a study to determine the effects of the SDLMI and academic goals. Participants included 45 high

school students with disabilities, one of whom was identified as having ASD, who received core content instruction in the general education classroom. Special education teachers of participants in the experimental group received training in promoting self-determination using the SDLMI. Additional training in data collection methods was provided to these teachers. Once trained, special education teachers implemented Phase 1 (to set a goal) and Phase 2 (to develop an action plan that included self-monitoring to achieve the goal) of the SDLMI with participants. After receiving instruction and support in Phases 1 and 2, participants implemented their action plan and self-monitored their progress toward their goal in a general education content class. Using a pretest-posttest randomized control group design, results established a relationship between the SDLMI and academic goals but results were inconclusive regarding the impact of the SDLMI on access to the general education curriculum.

Kleinert, Harrison, Mills, Dueppen, and Trailor (2014) conducted a post-hoc analysis using a large database of self-selected/self-determined goals developed by 205 students with disabilities ages 7-21, including 10 (6.1%) students with ASD, during the Kentucky Youth Advocacy Project. Of the 195 participants for whom grade level data were available, 101 (50.7%) were high school students, 63 (30.7%) were middle school students, and 30 (14.6%) were elementary students. The analysis determined the types of goals selected per grade level and disability category and success rate across grade level and disability type. Results of interest include a high overall achievement rate for the goals students selected with 71% of the goals achieved and a high correlation between the category of autism and self-selection of a social goal. This study provides strong evidence

for the effectiveness of the SDLMI across level of severity of disability and across grade levels.

Most recently, Cote et al. (2014) investigated the impact of a problem-solving intervention and phases from the Self-Determined Learning Model of Instruction (SDLMI) to teach three students with autism (ages nine to 11) to set and meet goals, identify problems, and self-evaluate their problem-solving skills. The intervention occurred in an elementary resource classroom in a western state and included teacher, researcher, and student selected behaviors related to IEP goals. The problem-solving strategy included a script followed by the teacher each day to instruct students in three steps to setting a goal. These steps were taken from *A Teacher's Guide to Implementing the Self-Determined Learning Model of Instruction* (Mithaug et al., 1998; Wehmeyer et al., 2002). Using a multiple-probe design, results indicated a functional relation between the intervention and students achieving the problem-solving skills that helped them to reach and maintain goals. The study demonstrated the effectiveness of the problem-solving intervention on several component skills (i.e., goal setting, problem-solving, and self-regulation) of self-determination.

Summary of Self-Determination and Students with ASD

Promoting instruction in component skills of self-determination such as self-regulation/student-direct learning, goal setting, and problem-solving may provide opportunities to learn necessary skills that will lead to improved post-school outcomes for students with ASD. The findings from the review of the literature indicate teaching self-regulation/student-directed learning skills can increase independent task completion and decrease the number of prompts students require to be actively engaged in learning

(Bouck et al., 2014; Rouse et al., 2014). In addition, goal setting interventions can positively impact success in the areas of physical performance (Todd et al., 2010), and academic skills (Agran et al., 2006; Lee et al., 2008). Lastly, instruction in problem-solving skills for students with ASD may increase social interactions, goal attainment, and completion of vocational tasks (Bauminger, 2002; Cote et al., 2014; Yakubova & Taber-Doughty, 2015). Although the efficacy of the elementary version of the SDLM (Palmer & Wehmeyer, 2002) was determined to be effective on participants' knowledge of problem-solving steps and ability to apply the steps to relevant scenarios for students with disabilities (Palmer & Wehmeyer, 2003), no students with ASD were included. While there is emerging research supporting the effectiveness of the SDLMI to teach elementary students with ASD to use a problem-solving strategy to set goals and monitor progress toward reaching those goals (Cote et al., 2014), it is imperative for research to continue to investigate the efficacy of the SDLMI to promote self-determination for elementary students with ASD. Future research is needed using self-determination interventions with elementary students with ASD.

Technology-Aided Instruction and Intervention

Adolescents in the 21st century are the first to access computer and online technology since early childhood, and its use is pervasive (Odom et al., 2015). In a recent national survey, investigators with the Pew Foundation reported that 78% of respondents between 12 and 17 years had a smartphone and 95% had access to get online via some form of technology (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). There is a similar increase in the number of studies exploring the efficacy of a diverse range of technology used in interventions with students with disabilities (Boser, Goodwin, &

Wayland, 2014; Grynspzpan, Weiss, Perez-Ouriel, & Gal, 2014). Additionally, enthusiasm over the potential uses of technology for students with ASD continues (Kuo, Orsmond, Coster, & Cohn, 2014; Mazurek, Shattuck, Wagner, & Cooper, 2012). The purpose of this strand is to: (a) define and identify the benefits of TAII; (b) review how TAII has been used with students with ASD; (c) examine how TAII has been used to teach transition-related skills, including component skills of self-determination, to students with ASD; and (d) identify how TAII has been used to teach goal-setting skills to students with ASD.

Definition and Benefits of Technology-Aided Instruction and Intervention

Developing and using technology to teach students with ASD requires an interdisciplinary approach. This is evident when considering the spectrum of fields (e.g., human computer interaction, computer science design, assistive technology, occupational sciences/therapy, rehabilitation engineering, speech-language pathology, learning sciences/technology, and special education) represented by professionals who have contributed to this phenomenon (Porayska-Pomsta et al., 2012). Because of the diverse representation, multiple terms have been used when discussing using technology to teach students with ASD.

In a review of evidence-based practices for students with ASD, the National Professional Development Center (NPDC) on ASD used the term, Technology-Aided Instruction and Intervention (TAII), and defined it as when technology was the central feature to support the goal or outcome of a student during instruction (Wong et al., 2015). Odom et al. (2015) defined technology as "an electronic item/equipment, application, or virtual network that is used to intentionally increase, maintain, and/or improve daily

living, work/productivity, and recreation leisure capabilities for adolescents with ASD" (p. 3806) for the purposes of their review. Some examples of TAII are programs or apps installed on a desktop computer, laptop or notebook computer, tablet (e.g., iPad), or handheld mobile device (e.g., Android phone, iPod, iPhone; Wong et al., 2015).

Another commonly used term is computer-assisted instruction (CAI). CAI is defined as interventions that use computers as the main feature to support student learning, display instructional materials, or assess student's knowledge (Anohina, 2005). The main difference between TAII and CAI is the type of technology that is the focus of the intervention. This dissertation study will investigate the effects of TAII on specific component skills of self-determination (i.e., problem-solving, goal-setting, self-monitoring) for students with disabilities. Specifically, the technology employed in this study will include: (a) a laptop computer used by the teacher to visually deliver the goal-setting intervention; (b) an app, Nearpod, that allows students to virtually interact with problem-solving activities; and (c) iPads that students will use during intervention to complete problem-solving activities and during independent work time to monitor their progress towards their goal.

There are many identified benefits of TAII reputed in the literature. For example, TAII provides opportunities for teachers to deliver instruction in a potentially more engaging mode (Elder-Hinshaw, Manset-Willimason, Nelson, & Dunn, 2006). TAII also has been shown to promote active student engagement (Boon, Fore, Blankenship, & Chalk, 2007; Hutcherson et al., 2004) and increase students' motivation, self-efficacy, and on-task behaviors (Boon et al., 2007; Cumming et al., 2008). Also of importance, research indicates individuals with ASD often prefer information to be presented visually

(Shane & Albert, 2008) and prefer to use technology as opposed to engaging in other social and leisure activities (Mechling, Gast, & Cronin, 2006).

Current research conducted by Hedges, Odom, Hume, and Sam (2018) explored how secondary students with ASD used technology as a support tool to accommodate social and behavioral challenges affecting academic and functional performance important for successful post-school transitions. This study used questionnaires to ask 472 adolescents with ASD enrolled in high school to describe the kinds of technology they used at school and for what purposes. Student responses included using technology at school to increase independence, reduce anxiety, and increase social opportunities. Although the use of technology may positively influence the post-school academic and career outcomes for students with ASD (Odom et al., 2015), the authors of the study emphasized the need for teachers to ensure students have access to technology and learn to use it responsibly while learning and practicing transition-related skills. As students with ASD will most likely have access to technology in post-secondary and employment settings, there is a need for researchers to conduct efficacy studies on the benefits of technology and how it can be used as a support tool for high school students as they learn necessary transition skills for post-school success.

Technology-Aided Instruction and Intervention for Students with ASD

Recent research investigating the effectiveness of TAII for students with ASD provides invaluable insight for the field of special education. Three meta-analyses or systematic reviews of the literature are summarized here. First, Grynszpan et al. (2014) conducted a meta-analysis of innovative technology interventions used for the training of skills for individuals with ASD. This analysis included a review of research that

employed a pre-post design to assess the effectiveness of interventions that involved active interaction with a computerized system. Interventions based on noncomputerized and noninteractive technology (e.g., video-modeling) were not included. Instead, the analysis focused on evaluating training with robots, virtual reality, computer games, mobile computers, and other types of computer devices. Twenty-one studies between 1990 and 2011, across 419 participants with ASD, met inclusion criteria. The average of the mean age of participants across studies was 12.68 years and the average of mean IQs of participants with ASD was 94.42. The specific skills being targeted across the 21 studies were: (a) training in social problem-solving; (b) facial and emotional processing; (c) spatial planning; (d) literacy skills; and (e) multiple skills (e.g., academics and cognitive skills, receptive language, social skills, skills for independent living). Desktop computer-assisted instruction was the most represented type of technology in studies for this review. Significant overall effect sizes were demonstrated for both controlled and randomized control studies, yielding support of the efficacy of innovative technological interventions.

Next, Odom et al. (2015) reviewed technology studies conducted with students with ASD published between 2011 and 2013. Thirty articles met the inclusion criteria as technology interventions and included 238 adolescents and young adults with ASD. Researchers used a variety of technology ranging from traditional (e.g., desktop computers, specialized software, multimedia displays) to recent innovations (e.g., smartphones, personal digital assistants, tablets, virtual reality). The review contributed to the literature in several ways including: (a) focusing on an underrepresented group, adolescents with ASD; (b) providing information across outcomes, types of interventions,

and types of technology platforms; (c) including both single case and group design studies; (d) using a systematic evaluation process to include only studies of high methodological quality; and (e) developing a conceptual framework that organizes information from the research literature consistent with current thinking in the fields of assistive technology and human computer interaction. The analysis provided evidence that TAII can be an effective way to teach students with ASD academic and functional skills, but an important next step underscored by the authors was to translate research into practitioner-friendly practice for adolescents with ASD.

Most recently, Barton, Pustejovsky, Maggin, and Reichow (2017) conducted a systematic review and meta-analysis using a combination of novel methods to synthesize research conducted between 2012 and 2015 using TAII with students with ASD. The purpose of this review was to extend the findings of Wong et al. (2015) using a framework that could be applied to both single case and group design studies. Specifically, the authors explored the effectiveness of TAII compared to business as usual or with other interventions designed to improve targeted communication, academic engagement, social, emotion recognition, and adaptive outcomes for students with ASD. Additionally, the authors sought to determine if single case and group design studies provided enough empirical evidence for specific independent-dependent variable combinations, specifically augmentative and alternative communication (AAC), CAI, and virtual reality (VR), to be identified as evidence-based practices for students with ASD. Ultimately, 10 group design studies and 10 single case design studies met the criteria for inclusion in the meta-analysis. Using single case studies, CAI was determined to be an evidence-based practice although the outcome categories varied across studies, limiting

valid interpretations to include in an overall summary. The categories of TAII, specifically AAC and VR, did not qualify as an evidence-based practice because of an insufficient research base. Additional support was provided for CAI by group design studies; however, there was again insufficient evidence for AAC and VR interventions. The most common form of TAII intervention was CAI, used to teach skills via a mobile device or personal computer. Functionally relevant skills (i.e., communication, academic, social) were most often identified as the target behavior in studies included in this analysis. Overall, the results of this review endorsed using TAII for students with ASD. Collectively, these reviews support TAII as a potential class of interventions. However, additional research is needed to identify technologies that have the greatest potential for specific outcomes. Based on information provided in these reviews, there is sufficient evidence supporting using TAII to teach students with ASD academic and functional skills.

Technology-aided instruction and intervention to teach transition-related skills to students with ASD. Considering the poor post-school outcomes of students with disabilities, it is imperative to consider the evidence for using TAII to increase the skills needed to be successful after leaving high school in the areas of education, employment, and independent living. As mentioned previously, self-determination skills are a predictor of post-school success for students with disabilities (Mazzotti et al., 2016; Test et al., 2009; Wehmeyer & Palmer, 2003). Therefore, it is worth considering using emerging instructional methods, such as TAII, to teach transition-related skills, including component skills of self-determination, to students with ASD. The following studies

provide support for the efficacy of TAII to teach skills related to transition, as well as the need for continued research in this area.

First, Kellems and Morningstar (2012) evaluated the effectiveness of video modeling using an iPod on the job performance of four young adults with ASD. All jobs were related to maintenance tasks at various job sites (i.e., airport, bowling alley, community center, museum). Videos, unique to each participant, were created to correctly model each targeted task. Models in the videos were chosen according to attributes or qualities that were familiar to each participant. The videos were uploaded to a fifth-generation iPod using iTunes. Participants could choose what kind of headphones or earbuds they would like to use during the intervention sessions. Using a multiple probe across participants design, results indicated a functional relation between video modeling with an iPod and percentage of steps completed correctly for job-related skills; all participants made substantial progress in their job performance, were able to independently use the iPod, and maintained their skills. In addition, video modeling was described as helpful and socially acceptable for community employment settings by both employers and job coaches.

As described earlier under self-regulation interventions, Bouck et al. (2014) conducted a study to investigate paper-pencil self-monitoring versus technology-based self-monitoring (using an iPad) on food preparation tasks. Participants completed paper/pencil-based recipes with a self-monitoring checklist and technology-based recipes with a self-monitoring checklist. During intervention, participants completed the checklist by either checking boxes with a pencil or using their finger to check boxes on the iPad. Results indicated that although both interventions increased students' level of

independence, students demonstrated higher levels when using the iPad to self-monitor. In addition, students maintained their level of independence with food preparation tasks after returning from summer vacation. Social validity surveys indicated students preferred using the iPad compared to paper and pencil.

Additionally, Smith et al. (2016) investigated the effects of progressive time delay to teach four high school students with ASD and ID how to begin self-instruction (i.e., find and play correct video) using an iPhone when presented with a direction for an untrained vocational and living skills task. Using a multiple probe across settings replicated across participants design, results indicated a functional relation between progressive time delay and initiation of self-instruction. All participants maintained self-instruction skills for one week in each setting. The authors suggest using TAII, specifically video self-instruction or other mobile devices, to increase independence in individuals with ASD and ID.

Technology-aided instruction and intervention to teach goal-setting skills to students with ASD. As discussed previously, goal-setting is one component skill of self-determination. While no research was found using TAII to teach goal-setting skills to students with ASD, three studies provide evidence for using technology to teach goal-setting skills related to increased self-determination for students with or at-risk for disabilities. First, Mazzotti et al. (2010) conducted a study to determine the effects of CAI on participants' knowledge of post-school options, in the areas of education, employment, and independent living, with four high school students, ages 16 to 19 years, with mild to moderate ID; one participant was diagnosed as having autism and moderate ID. The technology used in this intervention included a laptop computer and Microsoft

PowerPoint that were used to provide visual and audio elements of the intervention. Additionally, SNAGIT software was used to capture photographs from online and a digital voice recorder was used to recorded necessary intervention-related information. Using a multiple baseline across behaviors design replicated across participants, results indicated a functional relation between the CAI instruction and knowledge of post-school options for all four students.

Next, Mazzotti et al. (2012a) conducted a systematic replication of earlier research (Mazzotti et al., 2012b), but with a different study population, to investigate the effects of a multimedia goal-setting intervention (MGSI) on participants' knowledge of the self-determined learning model of instruction and disruptive behavior. Participants included four middles school students, ages 9 and 10, at risk of emotional disturbance. The technology central to this intervention included a laptop computer with Microsoft PowerPoint used to display the auditory and visual elements, an external mouse used by participants to navigate through the lessons, ToonDoo to create cartoons, SNAGIT to download and capture images, and Google images to find needed photographs, Camtasia studio to audio- and video-record student responses during the lessons, and a digital voice recorder to collect probe data. Using a multiple probe across participants design, results indicated a functional relation between the MGSI and increased knowledge of the SDLMI and decreased disruptive behavior for all four participants.

Third, Mazzotti et al. (2012b) studied the effects of CAI on participants' knowledge of the SDLMI and level of disruptive behavior with three elementary students, all 10 years old, with disabilities (i.e., LD, attention deficit disorder, ADHD, mild ID, and/or speech-language impairments) and also exhibited chronic behavioral

challenges. Technology central to the intervention included (a) a laptop computer with Microsoft PowerPoint to create and display audio and visual elements, (b) Microsoft Word 2007 to document students' typed responses, (c) Comic Creator to create comics, (d) SNAGIT to download pictures illustrating disruptive behavior, and (e) a digital voice recorder to record the intervention. Using a multiple probe across participants design, results indicated a functional relation between the CAI and increased knowledge of the SDLMI and decreased disruptive behavior for all three participants.

Although the studies reviewed above cited the efficacy of technology to teach goal-setting skills related to increased self-determination for students with or at-risk for disabilities, there is limited research specifically supporting the use of TAII to improve the goal-setting skills of students with ASD. In a systematic review of single case research investigating goal-setting interventions for participants with ASD, Carr et al. (2014) noted that of the 38 studies that met inclusion criteria, only one study used computer instruction to teach goal-setting and another used video modeling. Two additional studies provided support for TAII to increase the goal-setting skills of students with ASD. First, Fitzgerald and Werner (1996) conducted a study to examine the effects of a goal-setting interactive hypermedia instructional computer program on one student, a 12-year-old male with ID and autism. Using an AB design, the researchers examined an interactive hypermedia computer program developed based on a self-management strategy (i.e., Stop-Think-Act-Results) to teach the student to self-set goals to improve his disruptive classroom behaviors (i.e., humming, talk-outs). Results indicated the CAI program promoted the student's awareness of problem behaviors and increased his ability to use self-monitoring as a strategy to improve the problem behavior. Because an AB

design was used, a functional relation could not be determined. Additionally, the study only included one participant.

Delano (2007) conducted a study to investigate the effects of video self-modeling to teach Self-Regulated Strategy Development and self-monitoring to three students, ages 13-17, with Asperger's syndrome served in the general education classroom. Prior to intervention, participants were given a bar graph, sample essay, and script about the self-monitoring strategy. After the interventionist explained how to implement the strategy, each participant made a video of him or her implementing the self-monitoring strategy. The interventionist then edited the video to remove any verbal prompts. Students watched the edited videos at the beginning of each intervention session. Using a multiple baseline design across responses, results indicated a functional relation between the intervention and both words written and functional essay elements in a persuasive essay. The author suggested using video self-modeling may have saved time and should be further explored as an effective component for teaching goal-setting.

Most recently, Test and Rusher (2019) conducted a study to determine the effects of a multicomponent intervention including technology aided instruction, problem-solving and goal-setting on the ability of elementary students with ASD to identify three problem-solving steps, apply the problem-solving strategy to solve relevant scenarios, and engage independently in work tasks. Participants included three students in second through fourth grade served in a self-contained classroom for students with social and communication skills deficits. All students participated in the general education setting for enhancements (i.e., STEM, music, art, physical education), lunch, science, and social studies. The students' special education teacher was trained to provide the intervention

and implemented it using a daily script for problem-solving instruction and adapted phases of the early elementary version of the SDLMI (Palmer & Wehmeyer, 2002). Technology used in this intervention included (a) a laptop computer used by the interventionist, (b) iPads used by participants, (c) the Nearpod app to visually present information to participants and allow them to be actively engaged in the lesson without verbally responding as needed, and (d) a digital voice recorder to collect probe data and record intervention sessions. Using a multiple probe across participants design, results indicated a functional relation between the intervention and participants knowledge of the problem-solving steps, ability to apply the problem-solving strategy to relevant problem scenarios, and increased percentage of time actively engaged in independent work tasks. The above studies showed there is emerging research to support innovative TAII to enhance the transition-related skills of students with ASD.

Summary of TAII

As the use of technology increases for the general population, there is growing enthusiasm over the potential ways technology can be used to teach students with ASD (Kuo et al., 2014; Mazzurek et al., 2012). Depending upon the type of technology and its purpose in an intervention, different terms (i.e., CAI and TAII) have been used. TAII describes the technology used in this study because more than a computer is central to implementation of the intervention. It is exciting to witness the ways technology can be used to promote instruction in skills that may meaningfully affect the post-school outcomes of students with ASD. Although there is limited research regarding teaching goal-setting to students with elementary students with ASD, there is evidence to support using TAII to increase transition-related skills such as social problem-solving and

independent living (Grynszpan et al., 2014), job performance (Kellems & Morningstar, 2012), self-monitoring (Bouck et al., 2014; Delano, 2007), initiation of self-instruction (Smith et al., 2016), and knowledge of post-school options (Mazzotti et al., 2010). However, there is still a need to investigate whether TAII can be used along with MCSD interventions to enhance the self-determination skills of elementary students with ASD.

Summary of Literature Review

Considering the unique approach to thinking, as well as the behavioral, communication, and social challenges often displayed by students with ASD, it is not surprising that promoting instruction in self-determination may prove especially challenging (Fullerton & Coyne, 1999). However, to change the poor post-school outcomes of this population, it appears more research addressing how to increase their self-determination is warranted. Equally concerning, is the notable absence of young students in self-determination studies, especially students with ASD. While research indicates teaching self-regulation/student-directed learning skills can positively impact success in the areas of physical performance (Todd et al., 2010), academic skills (Agran et al., 2006; Lee et al., 2008), social interactions, goal attainment, and completion of vocational tasks (Bauminger, 2002; Cote et al., 2014; Yakubova & Taber-Doughty, 2015), it is critical for research to continue to investigate the effectiveness of self-regulated problem-solving to promote self-determination for elementary students with ASD.

In conclusion, the current study will respond to the need to investigate the effects of an adapted version of the SDLMI with elementary students who have ASD, as well as investigate a MCSD intervention's impact on the capacity of elementary students with

ASD for self-awareness, goal-setting, problem-solving, and self-monitoring. This study will contribute to the developing evidence-base for the SDLMI by using rigorous research methods for the investigation.

CHAPTER 3: METHOD

This study used a single case multiple probe across participants design (Cooper, et al., 2007; Horner & Baer, 1978) to determine the effects of the SDLMI delivered through technology on the ability of elementary students with ASD to identify a problem, set a goal, and take action. Additionally, generalization of goal-setting skills, maintenance, and social validity data were collected. The following sections include information regarding participants, setting, dependent variables, experimental design, procedures, data analysis, and potential threats to validity.

Participants

This study included four elementary participants who were receiving special education services and had either a special education identification of Autism according to state and federal criteria or a medical diagnosis of ASD determined by the DSM-V. A school-wide behavior interventionist (SWBI) was the primary interventionist and nominated students to participate in the study using the following inclusion criteria (a) elementary student in grades 2-5, (b) special education eligibility according to state and federal criteria, (c) special education identification of Autism or diagnosis of ASD, (d) verbal language used to communicate with peers and adults but may need visual supports such as pictures or other cues to assist in responding to unfamiliar questions or directions, (e) good attendance (i.e., no more than 10 absences in the previous school year), (f) written parental consent (see Appendix B), and (g) student assent (see Appendix C).

Matthew. Matthew was an 11-year-old multi-racial male in the 5th grade receiving special education services under the category of Autism (primary area of disability; Gilliam Autism Rating Scale-3rd edition, GARS-3; Autism Index Score 89,

very likely probability of autism) and Mild Intellectual Disability (secondary area of eligibility; Differential Ability Scale-II edition, DAS-2; General Conceptual Ability score 53, very low range). His educational achievement scores in reading (52), math (41), and written language (41) were in the very low range (Kaufman Test of Educational Achievement-3rd edition, KTEA-3) as was his general adaptive behavior composite score (61; Adaptive Behavior Assessment System-3rd edition, ABAS-3). In the areas of language and communication, according to speech language pathologist observations during therapy-directed activities (Clinical Evaluation of Language Fundamentals-4th edition, CELF-4), Matthew demonstrated moderate difficulty with language skills for remembering what people say, understanding word meanings, and understanding facial expressions and body language. Additionally, he demonstrated moderate levels of difficulty with listening skills for understanding new ideas and significant levels of difficulty following spoken directions and paying attention to spoken instruction. On the Core Standard section of the Comprehensive Assessment of Spoken Language (CASL) he scored a 71, demonstrating difficulty in generating a topic sentence given specific words, listening and responding to short stories containing simple to complex sentences and then answering or pointing to pictures that answer simple questions about each story. On the Montgomery Assessment of Vocabulary Acquisition (MAVA), Matthew's Receptive Vocabulary standard score was 65 and Expressive Vocabulary standard score was 73, both indicating below average range receptive and expressive vocabulary language skills, especially noticeable with vocabulary not directly taught and more specific to grade-level academic content. According to reports from formal testing by the school occupational therapist, he could walk, self-feed, and take care of basic hygiene

needs but often exhibited extreme frustration with fine motor tasks such as buttoning his coat. Matthew also demonstrated visual perceptual deficits such as holding scissors incorrectly and placing lids/puzzle pieces upside down with limited coordination and strength. He had moderate sensory processing issues impacting his social interactions and focus because of demonstrated behaviors such as jumping, spinning, rubbing textures on his face (e.g., clothing tags, soft material), and talking to himself or others about unrelated topics. Matthew engaged in restrictive, repetitive behaviors such as perseverating on phrases or sentences numerous times on a daily basis to gain adult attention and assurance at school. Eligibility determination documentation also indicated Matthew often became fixated on days of the weeks, times, holidays, and characters. He had additional diagnoses of obsessive compulsive disorder, oppositional defiant disorder, attention deficit hyperactivity disorder (ADHD), and psychiatric disorder which required Matthew to take several prescribed medications. His school records indicated periods of physically aggressive behavior (e.g., jumping off furniture, attacking other students, verbal outbursts reenacting violent video game scenes addressed at students and staff) without medication. Matthew demonstrated the need for maximum prompting, including hand over hand assistance, to complete assignments in all academic areas. He has had the most success at school when he followed a daily schedule with written or picture cues.

Jon. Jon was an 11-year-old White male in the 5th grade receiving special education services under the category of Autism (Gilliam Autism Rating Scale-2nd edition, GARS-2; Autism Index Score 106). Both his Nonverbal Intelligence index (99) and Verbal Intelligence index (106) were in the average range on the Reynolds Intellectual Assessment (RIAS). His educational achievement included reading

composite scores in the average range (104) and math (76) and written language (76) composite scores in the low range (KTEA-3). Jon's general adaptive composite scores (77 on parent form, 88 on teacher form; Adaptive Behavior Assessment System-2nd edition, ABAS-2) indicated performance in the below average range and borderline range, respectively. In the areas of speech, language and communication, Jon had a mild articulation disorder (12th percentile, Goldman-Fristoe Test of Articulation-2. GFTA-2), average language processing ability (Language Processing Test-Revised, LPT-R), and lower average oral and written language scores (Oral and Written Language Scale, OWLS). His errors focused mostly on grammar, sentence combining, and maintaining content when stating information in his own words. Regarding behavior, Jon had a tendency to display hyperactivity, aggression, and conduct problems (at-risk to clinically significant levels of behavior in externalizing, internalizing, and adaptive skills, behavioral symptoms index scores suggested clinically significant levels of overall behavior both at home and at school; Behavior Assessment System for Children-II, BASC-II). Teacher and SWBI formal reports indicated, because of Jon's cognitive style and difficulty with emotional regulation, he often misunderstood when someone is teasing him, failed to predict probable consequences in social events, engaged in tantrums when frustrated or when routines change, used negative language about himself (e.g., I am a moron, I hate myself, I'm am stupid), displayed superior knowledge in specific subject areas, talked about a single subject excessively, and showed intense interest in specific subjects. Reports from the Autism Diagnostic Observation Schedule-2 (ADOS-2) indicated impairments in social communication. For example, Jon had difficulty initiating appropriate social contact, preferring to play alone or in parallel play. Reports from the

ADOS-2 also indicated he used some descriptive gestures and directed some facial expression toward the examiner but displayed a limed range of facial expressions. Jon engaged in restrictive, repetitive behaviors such as talking at length about cartoon/comic book characters, monsters, and dinosaurs. Eligibility determination documentation also indicated Jon became easily frustrated when academics challenged him. He often had meltdowns, tantrums, or runs from the classroom and required an extensive amount of time to get back on task. During the 2018-2019 school year, Jon received nine discipline referrals resulting in 5 days out of school suspension for incidents such as aggressive behaviors (i.e., hitting, punching, spitting, biting, throwing chairs) towards students and disruptive behavior (i.e., running from room, yelling profanity, kicking items). He has had the most success navigating his school day when he followed his daily point sheet with detailed times/activities for each teacher and was given adequate time to process a change in his daily routine.

David. David was a 12-year-old White male in the 5th grade receiving special education services under the category of Autism (GARS-3; Autism Index Score 74, very likely probability of autism). His most recent psychological evaluation reported a full-scale IQ of 56, general ability index score of 66 and nonverbal index score of 65 (Wechsler Intelligence Scale for Children-5th edition, WISC-V). David's educational achievement scores in reading (63), math (52), and written language (50) were in the very low range (KTEA-3). His general adaptive composite scores (79 on parent form, 84 on teacher form; ABAS-3) indicated performance in the average range and low average range respectively. In the areas of speech, language and communication, David had difficulty when asked to listen to and consider a larger amount of information prior to

creating a less structured response (Test of Problem-Sovling-3, TOPS-3). On the CASL he scored a 69 on the core language composite, with better performance on tasks that required short, structured responses. On the MAVA, Matthew's Receptive Vocabulary standard score was 80 and Expressive Vocabulary standard score was 79, both indicating below average range receptive and expressive vocabulary language skills, with a more difficult time with vocabulary not directly taught and more specific to academic content. In addition, David had a moderate deficit in speech sound production skills at the word level as indicated by a standard articulation score of 76 on the GFTA-3). According to reports from formal testing by the school occupational therapist, David's visual motor and fine motor skills were adequate to function at school. Regarding sensory responses and experiences, he had definite differences in sensory response from his peers in the area of tactile sensitivity, under responsive/seeks sensation, auditory filtering, low energy/weak, and visual/auditory sensitivity (Short Sensory Profile). In the area of social communication, David struggled to coordinate his eye gaze when speaking and when being spoken to, had very limited spontaneous use of gestures, did not direct facial expressions to others, and struggled with reciprocal conversation (Autism Rating Scales). David engaged in restrictive, repetitive behaviors such as extreme interest in godzilla, emojis, television, and movies, often turning conversation toward these topics. His teachers reported an unusual need to follow set routines during the school day (e.g., using same color pen for writing, sitting in same seat). Matthew also had a diagnosis of post-traumatic stress disorder and took several prescribed medications for treatment at the time of the study.

Marc. Marc was a 10-year-old White male in the 5th grade receiving special education services under the category of Other Health Impaired (for diagnoses of ADHD, other specified disruptive, impulse-control, and conduct disorder, other specified trauma- and stressor-related disorder, other specified depressive disorder, and other specified anxiety disorder). Marc was also diagnosed with ASD although no information regarding severity was indicated in his school records. According to scores on the WISC-V, his full-scale IQ (99) and verbal comprehension index (86) fell within the average and low average range respectively. His educational achievement included broad reading (92) and broad math (93) scores in the average range and broad written language (88) score in the low average range (Woodcock-Johnson-4th edition). Marc's overall adaptive functioning was in the low or impaired range (59; Vineland Adaptive Behavior Scale) indicated performance in the below average range and borderline range respectively. School records reported voice, fluency and articulation to be within normal limits. Regarding behavior, Marc had a tendency to display hyperactivity, aggression, and conduct problems (clinically significant levels of behavior in externalizing, behavioral symptoms index scores suggested clinically significant levels of overall behavior both at home and at school; BASC-III). Marc engaged in restrictive, repetitive behaviors such as perseverating on topics such as video clips from YouTube and video games that include zombies and aliens that and display violent content. Eligibility determination documentation also indicated Marc presented with anxiety, tantrums, and aggression towards self and others. In the area of social communication, he has had the most difficulty engaging in conversation with peers and expressing his feelings. Marc wanted to make good grades and be liked by his peers.

Setting

The setting was a small public elementary school in a rural school district in the southeast region of the United States. The school has a student population of 445 (40% Black, 32% White, 17% Hispanic, 9% Multi-racial, 1% Asian, .9% American Indian/Alaskan Native, .2% Native Hawaiian/Pacific Islander) and was designated as Title 1 with 100% of students receiving free breakfast and lunch. All phases of the study took place in the SWBI's classroom. The classroom was a large room divided into two areas by a wall with a door leading into the other room. One room included sensory activities (e.g., ball pit, fidgets, sensory-sensitive lighting, bulletin board with emotional regulation cues) as well as a horseshoe table, one individual student desk, and a teacher desk. The other room contained motor activities (e.g., balance beam, yoga mats, exercise balls, spinner boards, weighted balls) and a flatscreen TV on the wall where students could view relaxation videos or take brain breaks. All intervention sessions took place at the horseshoe table in the center of the sensory part of the classroom with the SWBI sitting beside the participant currently in intervention. During some sessions one to two non-participant students were also in the sensory room completing assigned tasks at the individual student desks or in the motor room engaging in assigned activities.

Experimenter, Interventionist, and Data Collectors

The experimenter was a doctoral candidate in special education who has worked with individuals with ASD, as both a teacher and statewide consultant, for 20 years. She: (a) designed the study; (b) developed the individualized interventions; (c) trained and supervised the primary interventionist; (d) collected baseline, maintenance, and

generalization full probes; and (e) collected social validity data from student and teacher participants.

The primary interventionist was the SWBI. She implemented the intervention and collected Phase probes (See Appendix D) at the end of each intervention session. The SWBI has been a special education teacher for students with ASD for 19 years. At the time of the study, she was in a new role and responsible for assisting teachers in developing behavioral interventions for any student in the school, as well as providing targeted and tertiary behavioral and social interventions for a select group of students. The SWBI has had experience implementing the first two phases of the adapted SDLMI as the interventionist for a previous study (Test & Rusher, 2019). Because of her experience, the experimenter provided a training lasting 2 hours that included a review of the SDLMI, a review of the first two phases of the SDLMI, and training to address implementation of the third phase of this study. Another doctoral student in special education collected interobserver agreement and treatment fidelity data. She was a second year doctoral student in special education with bachelor's degree in psychology and master's degree in special education. She was a special education teacher for 4 years.

Dependent Variable and Measurement

Data were collected on one dependent variable measured in this study. The dependent variable was knowledge of the adapted SDLMI process measured by a Problem-Solving Questionnaire (PSQ; see Appendix D).

Adapted SDLMI process. The dependent variable was the number of correct responses on an 18-question Full PSQ probe (see Appendix D) and was recorded item-by-item. The Full PSQ probe had three parts aligned to each of the three phases of the

SDLMI (Palmer & Wehmeyer, 2002) and adapted to address the core deficits typically exhibited by students with ASD. Participants were given the opportunity to choose how they responded from three different options (a) orally (answers were recorded using a digital voice recorder), (b) using their iPads, or (c) in writing. In Part 1, Identify the Problem, participants were asked to identify the three problem-solving steps and answer five questions about a problem scenario (related to individual participant experiences), resulting in a total of eight possible items correct. In Part 2, Set a Goal, participants were asked to develop a goal based on a problem scenario (related to individual participant strengths, interests, and needs identified during the pre-intervention phase) and identify when he or she would begin working on the goal. The goal quality was scored based on meeting three criteria (i.e., measurable, observable, specific) resulting in five possible items correct (see Appendix L). In Part 3, Take Action, participants were asked five questions about the self-monitoring process, resulting in a total of five possible items correct. The Full PSQ probe was read (if requested) to each individual participant by the experimenter during baseline, maintenance, and generalization phases and by the SWBI during intervention. During Part 1, after the participant, experimenter, or SWBI read each of the first three questions (i.e., What is the first problem-solving step, What is the second problem-solving step, What is the third problem-solving step), the experimenter or SWBI paused for 3 s and then asked the participant if he/she would like choices to choose from (i.e., three picture choices presented on their iPad) for each question (See Appendix E for examples of how the pictures choices were provided). Distractors were taken from the Strengths, Interests, and Needs Inventory (SINI; see Appendix F) completed during pre-intervention and randomly generated to determine placement for all probes.

In addition to Full PSQ probes, Phase probes were used during each of the three phases of the SDLMI; problem-solving, goal-setting and attainment, and self-monitoring. Phase probes were identical to the Part 1, 2, and 3 probes described above in the Full PSQ probe.

Problem scenarios (see Appendix G) were included as a part of every Full PSQ probe during baseline, intervention, and maintenance, and as part of the daily Phase probe in Part 2. The intent of these scenarios was to assess participants' skill performances of problem-solving when presented with a problem situation. The content and length of each problem scenario was modeled after the Problem Situation Measures used by Cote (2009) and Cote et al. (2014). The problems described in each scenario were relevant to situations that may prove problematic for students with ASD at home, at school, and in the community. For example, scenarios included situations such as what to do when (a) your stomach is growling, (b) you get lost in a store, and (c) what to do when people are talking about you (see Appendix G for complete list). A different problem scenario was used for each Full or Phase probe. The scenarios were the same for each participant, with the exception of changing the names used in the scenario and other relevant details (e.g., friend's name, teacher's name, gender of parent/guardians). The experimenter or SWBI read (as requested) the problem scenarios to students.

Interobserver Agreement

To determine interobserver agreement (IOA) for the dependent variable, a second observer, a doctoral student in special education, independently scored 33.6% of all phases of the study (i.e., baseline, intervention, maintenance, generalization), including Full and Phase probes. The primary investigator provided training for collecting IOA.

The first training session lasted for one hour and included an overview of the phases of the intervention and a discussion about the PSQ and its scoring rubric. The second training session also lasted one hour and provided the second observer opportunities to practice rating individual participant responses on the PSQ. A level of 90% agreement had to occur during the training session. The second observer conducted IOA by reviewing products and audio recordings of the dependent variable. An item-by-item analysis was used to determine agreement. The experimenter and interventionist assigned points for the items, and the number of agreements were divided by the total number of items and multiplied by 100 to yield a percent.

Social Validity

At the conclusion of the study, the SWBI, at least one special education teacher, and at least one general education teacher of each participant were asked to complete an online survey (see Appendix H) using survey monkey to assess perceptions of effectiveness of the adapted SDLMI, ability of participants to set personal goals, and feasibility of using adapted SDLMI intervention as an instructional method (Cote, 2009). The survey included five questions that required a "yes" or "no" response. Additionally, respondents were asked to explain their answers to each question.

Student participants were also asked to complete a six-item survey (see Appendix I), requiring "yes" or "no" responses. Participants were asked if the problem-solving lessons taught them to solve problems and set goals, if they were better at monitoring their behavior, and if they liked using the iPad during intervention. Participants completed the survey in the Nearpod app. The experimenter administered the survey by providing each participant with directions to complete the survey on their iPad. Students

could request to have the questions read to them. At the end of the survey, the experimenter asked students if they had anything else they would like to share about the intervention. If a participant chose to share additional information, they could do so by typing or writing in the provided text box, or asking the experimenter to type their response for them.

Experimental Design

A multiple probe across participants design (Cooper et al., 2007; Horner & Baer, 1978) was the experimental design used for this study to determine the effectiveness of the adapted SDLMI. There were baseline, intervention, maintenance, and generalization phases. This design allowed for both Full and Phase probes using the PSQ across all intervention phases. Full probes consisted of all 18 questions within the PSQ and were given during baseline to verify the prediction of the baseline pattern for the dependent variable of learning the adapted SDLMI process and after completing each Phase to determine maintenance of skills. Phase probes aligned with each instructional phase (i.e., problem-solving, goal-setting and attainment, self-monitoring) measured the effect of the intervention during each intervention phase (see Figure 1).

Once a stable baseline trend was established (after three baseline sessions) for the dependent variable, the participant with the most need and most stable data points on the PSQ (Matthew) entered intervention first. The problem-solving process was systematically introduced to each participant one phase at a time. The participant did not move to the next phase until criterion (75% for Phase 1; 80% for Phases 2 and 3) was met for the previous phase. If a participant reached criterion before completing all lessons within a phase, he or she continued in that phase until all lessons in the phase had been

completed. Once instruction for a phase was complete, a full probe was administered on the following day and instruction in the next phase began.

Remaining participants were probed on the dependent variable at least one time (i.e., once per week) while the first participant was in Phase 1. Weekly probes for participants not currently receiving intervention also occurred during Phases 2 and 3. The participant with the most need and most stable data points on the PSQ (Jon) entered intervention next. This continued with David and Marc until all participants had entered intervention. Once participants completed all lessons in each phase of the adapted SDLMI and reached mastery criteria for all Phase probes, participants entered the maintenance phase.

Materials

Materials used in the study included: (a) lesson plan guide for adapted SDLMI*;* (b) problem-solving scenarios individualized to each participants' experiences/needs; (c) adapted Teacher's Guide to Implementing the SDLMI for Elementary Students ; (d) Parent's Guide to the SDLMI for Elementary Students; (e) visual supports individualized to each student's needs, (f) iPad with Nearpod app; (g) hands-on tasks for practicing problem-solving steps; (h) data collection forms (i.e., PSQ, Procedural Fidelity); (i) Goal Action Plan (GAP), (j) digital voice recorder; and (k) laptop computer used by SWBI to direct lessons to participant's iPad. The lesson plan guide included steps the interventionist should take to prepare to deliver the lesson, materials required, objectives of the lesson, general feedback procedures, and lesson procedures for each phase of the intervention. The adapted Teacher's Guide to Implementing the SDLMI for Elementary Students and Parent's Guide to the SDLMI for Elementary Students outlined the changes

made to the original SDLMI phases and were used in training the interventionist to provide the intervention and doctoral student to conduct interobserver agreement and procedural fidelity. Additionally, visual supports included picture cues for each step of the problem-intervention. For example, a stick figure with question marks above its head to depict What is the problem?, a band aid to depict How can you fix it?, and a thumbs-up to depict Why would it work?. The hands-on tasks included matching and fill-in the blank activities that were laminated to allow students to velcro picture or word cues of the problem-solving steps to the appropriate phrase. Additional hands-on tasks included a graphic organizer with all steps of the problem-solving strategy listed and templates with varying visual cues to assist students in writing a goal with all parts (i.e., who, what, how much, where, and by when; see Appendix L). The GAP was a daily rating scale, introduced in Phase 3, that participants used to remember the steps they needed to take monitor progress toward achieving their goal (see Appendix K).

Procedures

Individualized Education Program (IEP) review. Following participant selection and receipt of parent consent and student assent, the experimenter and SWBI reviewed each participant's present level of performance and IEP goals to develop a list of strengths, interests, and needs. Using each participant's list, as well as additional strengths, interests, and needs examples taken from a review of other inventories used during self-determination interventions with elementary students (i.e., Field, Hoffman, & Cornell, 2016; Kleinert et al., 2006; Palmer & Wehemeyer, 2002; Palmer & Wehmeyer, 2003), the SINI (see Appendix F) was developed collaboratively by the experimenter and the SWBI.

Pre-intervention. Prior to beginning baseline, the participants took part in a group session led by the SWBI. The session lasted approximately 30 min. The goal of this session was to assist students in identifying their strengths, interests, and needs. During the pre-intervention session, the SWBI discussed with participants important concepts. First, the word "strengths" (i.e., what you do well compared to other things you do) was defined and distinguished between "interests" (i.e., not just things you like to do, watch, or learn but that you do well). Next, the word "needs" was defined (i.e., something that you feel you should be able to do better). The SWBI provided examples and helped participants brainstorm personal examples of strengths, interests, and needs. Examples included, "I love to buy new superhero action figures but do not know how to count money," "I'm good at science facts but need help identifying the main idea of a story," and "I like to watch videos about monsters online and am good at using the computer to find the videos, but I need to get better at paying attention to movies my teacher makes me watch in social studies." Last, participants completed the SINI (see Appendix F) developed after the IEP review.

Participant responses on the SINI (see Appendix F) were used during Phase 2 of the intervention when learning to set a goal. After reviewing participant responses to the SINI, the experimenter and SWBI chose two goal categories (e.g., academic, behavior, social) to present during instruction in Phase 2 to facilitate selection of a target goal.

Baseline. Participants initially received a generalization probe to establish goal-setting abilities (see Appendix L). Then, all participants received three baseline probes until a stable baseline trend was established for the dependent variable. Baseline probes occurred in the classroom used by the SWBI and were scored using the Full PSQ probe.

Because the participants in this study had the potential to experience frustration when asked to complete a task that was too difficult for them or they did not understand, prior to asking them to complete the baseline probe, a social narrative was shared instructing them to do their best, and reminding them that it was okay if they did not know the answers to the questions. No instruction was provided during this phase and the only prompts used included encouraging the student to answer all questions in the probe (e.g., Keep going, you are almost finished) and asking the participant if he/she would like the question read out loud.

Phase 1: Problem-solving instruction. Objectives for Phase 1 included identification of the three problem-solving steps and application of the steps to a problem scenario to identify a problem and choose the best solution. Participants took part in the intervention for four 15-30 min sessions per week. Instruction during Lessons 1-4 (See Appendix I) were presented by the interventionist using guided lesson plans, technology (i.e., laptop, iPad, Nearpod app) visually displaying intervention content, and explicit instruction as required. Pictures were used to visually represent content and questions. Daily Part 1 probes (questions 1-8) were used to collect data at the end of each lesson for the participant in intervention. Mastery was set at 75% (6 out of 8 possible points) for two consecutive sessions for this phase of the intervention. If a student reached mastery before completing all lessons for each part of the intervention, instruction and probes continued until all lessons were taught. After a participant reached mastery during Phase 1, a Full PSQ probe was administered on the following day and instruction in Phase 2 began.

Phase 2: Goal-setting instruction. Objectives for Phase 2 included applying the problem-solving steps to a personal problem scenario to identify something the participant wanted to get better at doing and learning to develop a goal using a goal template. Instruction during Phase 2 included Lessons 5-8 (See Appendix J) and took place for four 15-30 min sessions per week. Lessons were presented in the same manner described in Phase 1. During this phase participants self-selected a goal category from two choices determined by the SWBI and experimenter during the IEP review. Participants learned about the GAP (see Appendix K) as a tool to document the goal they chose to work on during this study. Daily Part 2 probes (questions 9-13) were used to collect data at the end of each lesson for the participant in intervention. Mastery was set at 75% (4 out of 5 possible points) for two consecutive sessions in Phase 2. If a student reached mastery before completing all lessons in Phase 2, instruction and probes continued until all lessons were taught. After a participant reached mastery during Phase 2, a Full PSQ probe was administered on the following day and instruction in Phase 3 began.

Phase 3: Self-monitoring instruction. Objectives for Phase 3 included participants stating their goal, identifying the tool they used to monitor progress toward their goal, and learning to use their GAP to tell if their goal had been reached. Instruction during Phase 3 included Lessons 9-12 (See Appendix J) and also lasted for four 15-30 min sessions per week. Lessons were presented in the same manner described in Phase 1. During this phase, participants learned to use their GAP (see Appendix K) to rate their performance on the self-selected goal. Daily Part 3 probes (questions 14-18) were used to collect data at the end of each lesson for the participant in intervention. Mastery was set

at 80% (4 out of 5 possible points) for two consecutive sessions in Phase 3. If a student reached mastery before completing all lessons in Phase 3, instruction and probes continued until all lessons were taught. After a participant reached mastery during Phase 3, a Full PSQ probe was administered on the following day. Once mastery criteria for all Phase probes was reached and all lessons in the intervention had been completed, maintenance began.

Generalization. Generalization was a measure of participant's ability to develop a goal for a randomly generated area (e.g., academic, behavior, social). Participants were given a problem scenario describing their own strengths, interests, and needs. Using the Generalization Measure (see Appendix L), participants were asked to set a goal based on the information in the problem scenario. If after reading, or having the problem situation read to them, the participant indicated he/she was unable to set a goal, the experimenter asked if the student would like a template to assist in developing his/her goal (See Appendix J for prompting hierarchy). Generalization data were collected at the following times during the study (a) prior to intervention at the beginning of baseline, (b) during intervention when collecting Full PSQ probes, and (c) after intervention during the maintenance phase. The GAP was used to determine if an increase in participants' goal-setting ability was a result of participation in the adapted SDLMI intervention.

Maintenance. Participants entered maintenance after completing all lessons in Parts 1-3 and reaching mastery on the three Phase probes. Maintenance data were gathered 2 and 3 weeks post-intervention. Students were given the Full PSQ probe and the generalization probe with options for answering (i.e., orally, using their iPads, in writing).

Procedural Reliability

To assess accuracy of intervention implementation, procedural reliability was by a second observer, a doctoral student in special education, by observing the interventionist via audio-recording deliver the intervention. Procedural fidelity was gathered on 31.3% of random sessions across all phases of the intervention. The observer had a copy of the lesson plan guide (Appendix J) for each session observed. The lesson plan guide was used to document that the interventionist followed all procedures of the intervention. Number of steps completed correctly were divided by total number of steps and multiplied by 100 to obtain a procedural fidelity mean score.

CHAPTER 4: RESULTS

Findings are presented below. First, results for IOA and procedural fidelity are given, followed by the results for each research question.

Interobserver Agreement

IOA was determined by having a second observer independently scored 33.6% of sessions across all phases. An item-by-time analysis was used to determine agreement for the dependent variable during intervention. Using the PSQ, the experimenter and interventionist assigned points for each item, and the number of agreements were divided by the total number of items and multiplied by 100 to yield a percent. During baseline, interobserver agreement ranges from 94.4% to 100% with a mean of 97%. During Phase 1, interobserver agreement ranged from 87.5% to 100% with a mean of 96.9%. During Phase 2, interobserver agreement ranged from 80% to 100% with a mean of 95%. During Phase 3, interobserver agreement was 100%. At the end of each Phase and for four sessions post-intervention, interobserver agreement on the Full PSQ ranged from 94.4% to 100% with a mean of 97.6%. During generalization, interobserver agreement ranged from 80% to 100% with a mean of 95%.

Procedural Fidelity

Procedural fidelity data were collected for 31.3% of all intervention sessions. Observations were distributed across all intervention phases. Fidelity scores were 100% for all sessions.

Research Questions

Research Question 1: What effect will an adapted version of the SDLMI delivered through technology have on the knowledge of elementary students with ASD to identify a problem, set a goal, and take action?

Research Question 3: Will elementary students with ASD maintain their knowledge to identify a problem, set a goal, and take action?

The effects of an adapted version of the SDLMI delivered through technology on the ability of each participant to identify a problem, set a goal, and take action are presented in Figure 1. Results are shown for each participant across baseline, intervention, and maintenance phases. Data for participants' knowledge of the adapted SDLMI process are reported as percentages.

Although a mastery criteria of 75% for Part 1, 80% for Part 2, and 80% for Part 3 on the Phase probes for two consecutive phases was originally proposed, based on the data from participant 1 (Matthew), it was decided to change mastery to completion of all four lessons in each Part with the last data point at mastery (i.e., Part 1-75%, Part 2-75%, Part 3-80%). Using visual analysis to evaluate the graphed data collected, results indicated a functional relation between an adapted version of the SDLMI delivered via technology and participants' ability to identify a problem, set a goal, and take action.

Matthew. Figure 1 presents the scores of Matthew's responses to Full and Phase probes for all three parts of the adapted SDLMI intervention. During baseline, Matthew's scores on the Full PSQ ranged from 0% to 5.6% with a mean of 3.7%. During intervention on Part 1, his scores on the Phase probe ranged from 50% to 100% with a mean of 75%, meeting mastery criteria of 75% after the third session and surpassing

mastery by the fourth and final session. At the end of Part 1, he scored 38.9% on the Full PSQ. On Part 2, Matthew's scores on the Phase probe ranged from 20% to 80% with a mean of 55%, meeting mastery criteria of 80% after the fourth session. By the end of Phase 2, Matthew had set his goal as "Matthew will check his schedule by himself at least 7 times by himself in school every day." At the end of Part 2, he scored 66.6% on the Full PSQ. On Part 3, Matthew's scores ranged from 20% to 100% with a mean of 60%, meeting and surpassing mastery criteria of 80% after the fourth session. At the end of Part 3, he scored 55.6% on the Full PSQ. Table 2 presents the expected versus actual scores of Matthew's responses to the Full probe given at the end of Parts 1, 2, and 3.

Jon. Figure 1 presents the scores of Jon's responses to Full and Phase probes for all three parts of the adapted SDLMI intervention. During baseline, Jon's scores on the Full PSQ ranged from 11% to 25% with a mean of 20.3%. During intervention on Part 1, his scores on the Phase probe ranged from 87.5% to 100% with a mean of 96.9%, meeting and surpassing mastery criteria of 75% after the first session. At the end of Part 1, he scored 61.1% on the Full PSQ. In Part 2, Jon's scores on the Phase probe ranged from 40% to 100% with a mean of 85%, meeting and surpassing mastery criteria of 80% after the second session. By the end of Phase 2, Jon had set his goal as "Jon will go to an X-spot when frustrated at least 4 out of 5 days in core classes by March 5." At the end of Part 2, he scored 83.3% on the Full PSQ. In Part 3, Matthew's scores ranged from 60% to 100% with a mean of 90%, meeting and surpassing mastery criteria of 80% after the second session. At the end of Part 3, he scored 55.6% on the Full PSQ. Table 2 presents the expected versus actual scores of Jon's responses to the Full probe given at the end of Parts 1, 2, and 3.

David. Figure 1 presents the scores of David's responses to Full and Phase probes for all three parts of the adapted SDLMI intervention. During baseline, David's scores on the Full PSQ ranged from 22.2% to 38.9% with a mean of 27.8%. During intervention on Part 1, his scores on the Phase probe ranged from 75% to 100% with a mean of 90.6%, meeting and mastery criteria of 75% after the first session. At the end of Part 1, he scored 33.3% on the FULL PSQ. On Part 2, David's scores on the Phase probe ranged from 40% to 100% with a mean of 80%, meeting mastery criteria of 80% after the second session. By the end of Phase 2, David had set his goal as "David will start his work right away at least 3 times in the classroom by March 5." At the end of Part 2, he scored 66.7% on the Full PSQ. On Part 3, David's scores ranged from 60% to 100% with a mean of 90%, meeting and surpassing mastery criteria of 80% after the second session. At the end of Part 3, he scored 100% on the Full PSQ. Table 2 presents the expected versus actual scores of David's responses to the Full probe given at the end of Parts 1, 2, and 3.

Marc. Figure 1 presents the scores of Marc's responses to Full and Phase probes for all three parts of the adapted SDLMI intervention. During baseline, Marc's scores on the Full PSQ ranged from 27.8% to 33.3% with a mean of 29.6%. During intervention on Part 1, he scored 87.5% (mastery criteria of 80%; mean of 87.5%) on each of the Phase probes. At the end of Part 1, he scored 55.6% on the FULL PSQ. In Part 2, David's scores on the Phase probe ranged from 60% to 100% with a mean of 90%, meeting and surpassing mastery criteria of 80% after the second session. By the end of Phase 2, Marc had set his goal as "Marc will use his power chart to complete his work at least 3 times every day in the classroom by March 15." At the end of Part 2, he scored 77.8% on the Full PSQ. On Part 3, Marc's scores ranged from 40% to 100% with a mean of 85%,

meeting mastery criteria of 80% after the second session. At the end of Part 3, he scored 100% on the Full PSQ. Table 2 presents the expected versus actual scores of Marc's responses to the Full probe given at the end of Parts 1, 2, and 3.

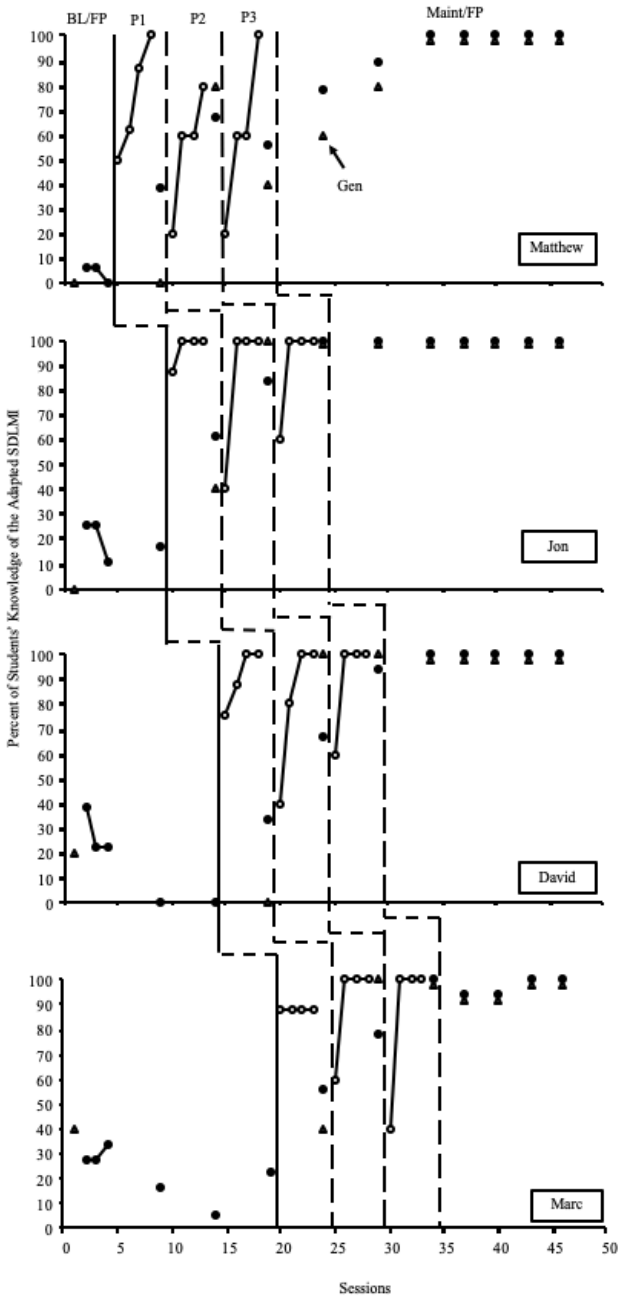

Figure 1. Percent of Students' Knowledge of the Adapted SDLMI
Note. P1, P2, P3 = Three part intervention using technology and an adapted multicomponent self-determination intervention.

Table 2: *Expected versus Actual Full Probe Scores by Participant*

Full Probe Part	Student			
	Matthew	Jon	David	Marc
#1 Expected	44%	44%	44%	44%
#1 Actual	66.6%	61.1%	33.3%	55.6%
#2 Expected	72%	72%	72%	72%
#2 Actual	55.6%	83.3%	66.7%	77.8%
#3 Expected	100%	100%	100%	100%
#3 Actual	77.8%	100%	94.4%	100%

Research Question 2: Will elementary students with ASD generalize their knowledge to identify a problem, and set a goal?

Matthew. Figure 1 and Table 3 show the scores of Matthew's responses to a generalization probe to determine his ability to identify a problem and set a goal when given a novel problem scenario about his strengths, interests, and needs. Prior to intervention, Matthew scored 0% on the generalization probe. After Part 1, he again scored 0%. After Part 2, he scored 80% (4 out of 5 possible points) demonstrating the effectiveness of the lessons included in Phase 2 to increase Matthew's goal-setting ability. After Part 3, Matthew scored between 40% and 80% with a mean of 60% on three weekly generalization probes.

Jon. Figure 1 and Table 3 show the scores of Jon's responses to a generalization probe to determine his ability to identify a problem and set a goal when given a novel

problem scenario about his strengths, interests, and needs. Prior to intervention, Jon scored 0% on the generalization probe. After Part 1, he scored 40%. After Part 2, he scored 80% (4 out of 5 possible points) demonstrating the effectiveness of the lessons included in Phase 2 to increase Jon's goal-setting ability. After Part 3, Jon scored a mean of 100% on three weekly generalization probes.

David. Figure 1 and Table 3 show the scores of David's responses to a generalization probe to determine his ability to identify a problem and set a goal when given a novel problem scenario about his strengths, interests, and needs. Prior to intervention, David scored 20% on the generalization probe. After Part 1, he scored 0%. After Part 2, he scored 100% demonstrating the effectiveness of the lessons included in Phase 2 to increase David's goal-setting ability. After Part 3, David scored 100% on the generalization probes.

Marc. Figure 1 and Table 3 show the scores of Marc's responses to a generalization probe to determine his ability to identify a problem and set a goal when given a novel problem scenario about his strengths, interests, and needs. Prior to intervention, Marc scored 40% on the generalization probe. After Part 1, he again scored 40%. After Part 2, he scored 100% demonstrating the effectiveness of the lessons included in Phase 2 to increase Marc's goal-setting ability. After Part 3, Marc scored x% on the generalization probes.

Table 3: *Percentage Correct on Generalization Probe for Goal-Setting Skills*

Student	BL	P1	P2	P3	1 wk post	2 wks post	3 wks post	4 wks post	5 wks post
Matthew	0	0	80	40	60	80	100	100	100
Jon	0	40	100	100	100	100	100	100	100
David	20	0	100	100	100	100	100	NA	NA
Marc	40	40	100	100	100	100	100	NA	NA

Research Question 4: What will be the perception of elementary students with ASD of an adapted version of the SDLMI delivered through technology to teach them to identify a problem, set a goal, and take action?

To analyze student perception of the intervention, participants were asked to complete a six-item survey requiring "yes'' or "no" responses via the Nearpod app using their iPads. Results are presented in Table 4. For items, 1, 3, and 5, all participants responded "yes.: For item 2, one participant indicated he did not like using his iPad "because he was afraid it would die, and then he would not be able to use it in class during breaks." Another participant answered "yes" but stated he liked using his iPad to "watch something." Although another participant answered "yes," he shared he had lost his iPad for "bad behavior" for the rest of the year. For item 4, one student answered "I do not know. I'm in the middle" (i.e., in between "yes" and "no"). For item 6, one participant answered "a little bit," and another participant stated "no, because I still get in trouble and make my teachers mad a lot."

Table 4: *Student Perceptions of the Intervention*

Question	Number of "yes" responses by participants
The lessons taught me how to solve problems I may have at school.	4
I liked using the iPad during my problem-solving lessons.	3
I liked learning how to solve problems I have at school.	4
Since the problem-solving lessons, I am better at problem-solving.	3
Since the problem-solving lessons, I am better at setting goals.	4
Since the problem-solving lessons, I am better at monitoring my daily behavior.	2

Research Question 5: What will teacher perceptions be of an adapted version of the SDLMI delivered through technology to increase the problem-solving, goal-setting, and self-monitoring skills of elementary students with ASD?

To analyze teacher perceptions of the intervention, six teachers (general education teachers=2, special education teachers=3. SWBI=1) were asked to complete an online six-question survey requiring "yes" or "no" responses. Results are presented in Table 5. All six participants responded "yes" to all questions. Teachers were also given the opportunity to expand on their responses. For item 2, one special education teacher stated "the intervention made each student more aware of their responsibilities" and another special education teacher shared the intervention "helped him become more independent when checking his schedule." For item 4, one general education teacher stated she would be willing to implement the intervention in her classroom because it would "benefit more

students with acquiring problem-solving skills" and the SWBI shared she wanted to implement the intervention for all students within the school because "this has improved participants' overall engagement in the school environment and self-awareness of why they come to school. It has helped tremendously with independence and provided a strategy that can be applied to any struggle they encounter, academic, behavioral, or social."

Table 5: *Teacher Perceptions of the Intervention*

Question	Number of "yes" responses by teachers
Did you feel the intervention helped students acquire self-determination (e.g., problem-solving, goal-setting and attainment, self-regulation) skills?	6
Do you think the intervention helped students to self-set goals related to working independently?	6
Do you feel the intervention had a positive effect on students' ability to monitor their own behavior in the classroom?	6
Would you like to implement this intervention in your classroom?	6
Do you feel this strategy is practical in terms of time for supplementing classroom instruction?	6

CHAPTER 5: DISCUSSION

Effects of Intervention on Dependent Variable

The purpose of this study was to conduct a conceptual replication of a study by Test and Rusher (n.d.) to determine the effects of the SDLMI delivered through technology on the ability of elementary students with ASD to identify a problem, set a goal, and take action. Additionally, generalization of problem-solving and goal-setting skills, maintenance, and social validity data were collected. The findings of the study organized by research questions are discussed below. Additionally, study limitations, suggestions for future research, and implications for practice are presented.

Research Question 1: What effect will an adapted version of the SDLMI delivered through technology have on the knowledge of elementary students with ASD to identify a problem, set a goal, and take action?

Research Question 2: Will elementary students with ASD generalize their knowledge to identify a problem and set a goal?

Research Question 3: Will elementary students with ASD maintain their knowledge to identify a problem, set a goal, and take action?

A multiple probe across participants design was used to determine the impact of the independent variable (i.e., an adapted version of the SDLMI delivered via technology) on the dependent variable (i.e., ability to identify a problem, set a goal, and take action). The intervention was implemented with four 5th grade students with ASD. Findings from this study indicated a functional relation between an adapted version of the SDLMI delivered via technology and participants' ability to identify a problem, set a goal, and take action. All participants demonstrated an immediate increasing trend in

their ability to identify a problem on the Part 1 Phase probe, set a goal on the Part 2 Phase Probe, and take action on the Part 3 Phase probe. Jon maintained his ability to identify a problem, set a goal, and take action as measured by the Full PSQ for 4 consecutive weeks. David maintained his ability to identify a problem, set a goal, and take action as measured by the Full PSQ for 3 consecutive weeks. Marc maintained his ability to identify a problem, set a goal, and take action as measured by the Full PSQ for 2 consecutive weeks. Matthew, however, experienced an increase in his score on the Full PSQ from the end of Part 3 (55.6%) to one (77.8%), two (88.9%), and three (100%) weeks following intervention. He maintained his score of 100% on the Full PSQ for 3 weeks. His special education teacher reported he was without medication during his participation in Phases 2 and 3. When he was probed one week after intervention, he had been taking his medication again for approximately one week. During the Full PSQ probe, he exhibited a longer attention span, less agitation, and more on-topic conversation (i.e., related to the content of the probe).

All participants were able to generalize their ability to identify a problem and self-set a goal when given a novel problem scenario about his personal strengths, interests, and needs. Generalization scores for Jon, David, and Marc show they were able to set goals that contained all parts of a goal (who, what, how much, when, and where) at 100% after instruction in Phase 2. Matthew's generalization scores, however, were 80% after Phase 2, 40% after Phase 3, 60% one week post-intervention, 80% two weeks post-intervention, and 100% three weeks post-intervention. This further supports that some of Matthew's difficulties (difficulty focusing, increased agitation and off-topic conversation) during Phases 2 and 3 may have been because he was not taking his

prescribed medications. Additionally, Matthew's characteristics of ASD (i.e., cognitive style, restricted patterns of interest and behavior, communication differences, emotional vulnerability) also appeared to influence the speech at which he acquired the intervention content.

In general, this study supports the limited research related to teaching elementary students with ASD component skills of self-determination, including problem-solving, goal-setting and attainment, and self-monitoring. For example, Kleinert et al. (2014) conducted a post-hoc analysis of the self-selected goals of 205 students with disabilities. Of the 205 participants, 6.1% were identified as having ASD. The study indicated that 14.6% of the participants were elementary age, however, the exact number of elementary students with ASD was not reported. Of interest, there was a high overall achievement rate (71%) for self-selected goals. Similarly, in the current study, participants self-selected their goals and developed plans of action to reach those goals. This provides additional support for the importance of goal-setting instruction that allows students with ASD to have a voice in determining the goals most important for them. However, the Kleinert et al. (2014) study showed a high correlation between the category of autism and the self-selection of social goals. This is different than the current study in that none of the participants self-selected a social goal. Matthew was most concerned with getting in trouble for falling asleep in class and set a goal to follow his schedule so he would know what he should be doing (instead of sleeping) at all times. Jon was extremely critical of himself, sharing he felt stupid because he had difficulty remaining in the classroom when he became frustrated with a task he was unable or did not want to complete. He self-selected a goal to give his teacher an X card to communicate he needed to go to his X

spot instead of running out of the room. David rarely completed work because he engaged in avoidance behaviors such as crying, asking to call his mom, and saying he did not want to do his work. He self-selected a goal to begin his work "right away" instead of making excuses that interfered with task completion. Marc was very concerned with making good grades but did not realize the connection between his own behavior and its effect on grades he received. He self-selected a goal to use a power chart that provided a visual checklist (Listen, Do, Complete, Turn in) to remind him to not only "do" his work but listen carefully to the directions, do the work, check to make sure he had completed all parts of his work, and turn it in. Because Kleinert et al. (2014) did not disaggregate results of their study by students with autism in elementary versus middle versus high school, it is possible the developmental age of the students in the current study influenced the type of goal selected.

Furthermore, the literature includes only a few examples of studies that used TAII to teach goal-setting skills (Delano, 2007; Mazzotti et al., 2012a; Mazzotti et al., 2012b; Test and Rusher, n.d.) to students with ASD. In previous studies, video self-modeling (Delano, 2007) or a laptop computer (Mazzotti et al., 2012a; Mazzotti et al., 2012b; Test & Rusher, n.d.) were the primary technology used. This study extends the literature on TAII because it used the interventionist's laptop to deliver instruction via an app from the interventionist's laptop to student iPads to teach students with ASD component skills of self-determination (i.e., problem-solving, goal-setting and attainment, self-monitoring).

This study was a conceptual replication of Test and Rusher (n.d.) that taught three elementary (grades 2nd-4th) with ASD a problem-solving strategy (What is the problem?, How can you fix it?, Why would it work?; Cote et al., 2014) to self-set goals. Two phases

of the SDLMI were adapted to address the characteristics of ASD exhibited by participants in the study. Findings from Test and Rusher (n.d.) indicated participants learned the steps of the problem-solving strategy and could apply the strategy to answer the student question from the SDLMI, "What is my goal?" The current study extended Test and Rusher (n.d.) by adding an additional adapted phase of the SDLMI to teach participants to Take Action and answer the student question "What is my plan?" (see Table 6). After learning the steps of the problem-solving strategy, participants used the strategy to identify the problem in a personal problem scenario describing their strengths, interests, and needs. Next, participants set a goal based on the problem they identified. Finally, all participants were able to develop a plan (Take Action) to implement as they worked to reaching their goal.

Table 6: *Comparison of Phases included in SDLMI Studies*

SDLMI; Palmer & Wehmeyer, 2003	Test & Rusher, 2019	Current study
Phase 1 - Set a Goal	Phase 1 - Identify the Problem	Phase 1 - Identify the Problem
Phase 2 - Take Action	Phase 2 - Set a Goal	Phase 2 - Set a Goal
Phase 3 - Adjust Goal or Plan		Phase 3 - Take Action

Most importantly, this study contributes to the literature because it: (a) taught elementary students with ASD to identify a problem, set a goal, and take action; (b) used technology to deliver instruction on the SDLMI; (c) documented the influence of educational supports and EBPs when implemented to address each participants' unique characteristics of ASD; and (d) incorporated a measure of generalization to measure participants' ability to identify a problem and set a goal when given a novel problem

scenario about his strengths, interests, and needs.

First, participants in this study were elementary students (i.e., 5th grade) with ASD. Research supports promoting instruction in self-determination skills for students with disabilities, including those with ASD, as a way to: (a) increase positive academic outcomes (Fowler et al., 2007; Lee et al., 2010); (b) increase positive transition outcomes in the areas of postsecondary employment and independent living (Wehmeyer & Palmer, 2003), (c) address recreation and leisure needs (McGuire & McDonnell, 2008); and (d) improve overall quality of life (Shogren et al., 2006). Of importance, the need to provide instruction in the component skills of self-determination specifically for students with ASD is supported by the literature as well (Carter et al., 2009; Carter et al., 2013; Chou et al., 2016). Specifically, it has been suggested that areas of instruction such as self-regulation, goal-setting and attainment, and problem-solving may promote increased self-determination (Wehmeyer et al., 2010). This study provides emerging support for this suggestion as all participants acquired and maintained problem-solving and goal-setting skills. Teachers of participants included in this study provided additional evidence that the multicomponent intervention improved their self-determination skills. For example, Matthew's special education teacher noted his awareness of his goal increased his independence in checking his schedule and decreased the amount of time he was off-task (sleeping) and not engaged in activities in the classroom. Jon's special education teacher noted increased self-regulation, specifically in his independent use of applying the problem-solving strategy across situations in her classroom. One of Jon's general education teachers shared she saw "improvements in problem-solving, goal-setting and attainment and self-regulation skills." She noted Jon now demonstrates an increased

awareness of his own behavior and how he can work to control running out of the classroom when frustrated. Jon continues to set daily goals for regulating his behavior in her classroom. David's special education teacher noted how much more aware he was of his responsibility for learning. Monitoring his goal using his GAP became a part of his daily routine in her classroom and provided opportunities to talk about what worked well and what he wanted to do better. Finally, the SWBI pointed out how all participants learned to identify their own strengths and needs when setting goals. She stressed how all participants now demonstrate increased self-awareness of their purpose for being at school and responsibilities as a learner in the total school environment. She shared her observations that participants' self-awareness and independence improved regardless of cognitive ability or severity of ASD characteristics. Although this study did not provide explicit instruction to participants in learning to determine if they needed to adjust or change their goal or plan (SDLMI Phase 3), findings indicated elementary students with ASD can became more aware of their strengths and needs, and use this awareness to set goals and monitor their progress toward attaining those goals. Because self-determination is developmental in nature, this study adds to the dearth of literature that supports creating a foundation for more complex self-determination skills later (Hagiwara, 2017).

Second, TAII has been used to effectively teach students with ASD academic and functional skills (Barton et al., 2017; Odom et al., 2015). Like the findings of the meta-analysis by Grynspan et al. (2014), this study used technology to teach students with ASD problem-solving, spatial planning, and other skills, such as goal-setting and attainment and self-monitoring, important for academics, communication, social engagement, and independent living. Similar to a previous review of technology studies

conducted by Odom et al., 2015, this study provides evidence that TAII can be an effective way to teach students with ASD academic and functional skills but, as the authors point out, an important next step in the research is to translate research into practitioner-friendly practice for students with ASD. In addition, this study used a laptop and student iPads for delivery of self-regulated problem-solving instruction. This is similar to findings presented in a meta-analysis by Barton et al., 2017 that identified CAI (i.e., mobile device or personal computer) as the most common form of TAII and functionally relevant skills (i.e., communication, academic, social) as the most identified target behavior in studies. This study further supports using TAII (i.e., laptop, student iPad) as a supplemental instructional tool to facilitate teaching elementary students with ASD self-determination skills.

Third, each participant in this study exhibited unique and diverse characteristics of ASD that required implementation of individualized educational supports and EBPs. This supports what the literature suggests about the wide range and distinctive characteristics caused by the neurology of ASD (Hazlett et al., 2017) that dictate how students with ASD learn (Stoner et al., 2014). During planning and implementation of this study, each participant's unique social, visual, and communicative learning characteristics were considered because, as literature shows, students with ASD think differently and require additional or more intensive implementation of strategies and interventions (Fullerton & Coyne, 1999). Participants in this study exhibited certain consistencies across the intervention that required individualized supports. For example, Matthew demonstrated cognitive differences (i.e., extremely slow processing speed, easily distracted by irrelevant details, weakness in reading comprehension, difficulty

generalizing learned skills, attention problems, literal understanding of concepts, inconsistent recall of previously learned information), restricted patterns of behavior, interests, and activities (i.e., strong need for routine and repetition, intense preoccupation with characters in video games, difficulty transitioning from preferred activity, stemming in the form of back-and-forth hand rubbing), communication differences (i.e., immediate echolalia, mechanical speech, difficulty using facial expressions, expressing thoughts, understanding language with multiple meanings, and following verbal directions), emotional vulnerability (i.e., exhibits meltdowns, low frustration tolerance, difficulty expressing/controlling emotions), and social differences (e.g., difficulty recognizing feelings/thoughts of others and initiating an interaction to share an experience, limited interaction with others). During Part 1 of the intervention, Matthew demonstrated the need for additional instruction on Lessons 1 and 2 to teach him how to brainstorm solutions to a problem scenario. It is not clear whether he was having difficulty imagining possible solutions to a hypothetical situation or if he had limited experience with the problem represented in the story. Throughout the intervention, Matthew's cognitive difficulties (e.g., up to 15 s pause when prompted to answer a question during intervention, often repeated the words over and over on the screen of the iPad the interventionist had just read) influenced the need for intentional differentiation of instruction (e.g., allowing adequate processing time, covering what was on the iPad after Matthew read at least one time, use of visual, hands-on manipulatives representing important intervention concepts). Educational supports (from those identified by the SDLMI, Palmer & Wehmeyer, 2003) implemented to accommodate Matthew's learning and behavioral needs included antecedent cue regulation, self-assessment of interests,

abilities, and instructional needs, and awareness, choice-making, decision making, goal-attainment, goal-setting, problem-solving and self-advocacy instruction. Additional EBPs (i.e., modeling, prompting, reinforcement, response interruption/redirection, social narratives, time delay, visual supports; Wong et al., 2015) were used to support Matthew's characteristics of ASD.

Jon's ASD was characterized by cognitive differences (i.e., extensive knowledge in narrow areas of interest, poor organizational skills, difficulty with abstract reasoning, attention problems, difficulty understanding cause-effect relationship between behaviors and consequences, knowledge of many facts but difficulty with abstract reasoning), restricted patterns of behavior, interests, and activities (i.e., need for repetition, intense preoccupation with comic book characters, riddles, and science facts, stemming in the form of rocking), communication difficulties (i.e., difficulty with the rules of conversation such as interrupting others and understanding figurative language, talks incessantly with familiar adults, speaks in an immature tone of voice, uses advanced vocabulary, difficulty asking for help, understanding sarcasm/humor, expressing thoughts and feelings, understanding verbal directions, and talking about other's interests), emotional vulnerability (i.e., easily stressed, engages in meltdowns and self-injurious behavior, displays inconsistent behaviors, low frustration tolerance, low self-esteem, difficulty tolerating mistakes, and identifying/expressing emotions), and social difficulties (i.e., appears rude, difficulty recognizing feelings/thoughts of others, making friends, joining an activity, and understanding jokes). During Part 1 of the intervention, Jon had an extreme preoccupation with talking about videos he had recently watched, demonstrating the need for instruction that incorporated his interests. Video clips were

included in Lessons 1 and 2 to pique his interest and motivate him to learn the problem-solving strategy. Throughout the intervention, Jon's emotional vulnerability (e.g., negative comments about himself, fear of failure) influenced the need for intentional differentiation of instruction (e.g., providing explicit verbal praise for appropriations of expected behavior, brainstorming positive phrases to replace negative comments made about himself). Educational supports (from those identified by the SDLMI, Palmer & Wehmeyer, 2003) implemented to accommodate Jon's learning and behavioral needs included antecedent cue regulation, self-assessment of interests, abilities, and instructional needs, and awareness, goal-attainment, goal-setting, problem-solving, and self-advocacy instruction. Additional EBPs (i.e., modeling, reinforcement, response interruption/redirection, visual supports; Wong et al., 2015) were used to support Jon's characteristics of ASD.

David's ASD was characterized by cognitive differences (i.e., displays extensive knowledge in narrow areas of interests, poor organizational skills and reading comprehension, literal understanding of concepts, fantasizes/withdraws into inner world, easily distracted by irrelevant details, difficulty with abstract reasoning, generalization of skills, attention, and understanding the connection between behavior and resulting consequences), restricted patterns of behavior, interests, and activities (i.e., need for repetition and sameness, intense preoccupation with "mommy", godzilla, and finishing an assignment, asks repetitive questions, and difficulty with transitions/change), communication differences (i.e., interprets words/conversations literally, makes irrelevant comments, appears to understand more than what he does, speaks using an immature tone, and difficulty with rules of conversation, initiating social greetings, using facial

expressions, following instructions, asking for help, and understanding language with multiple meanings, and talking about other's interest), emotional vulnerability (i.e., easily stressed, overly fearful, appears anxious, engages in meltdowns and inconsistent behaviors, and difficulty tolerating mistakes), and social difficulties (i.e., easily bullied and difficulty recognizing thoughts/feelings of others, maintaining personal space, making/keeping fiends, joining an activity, and understanding nonverbal communication). During Part 1 of the intervention, David also had a preoccupation with talking about whatever was of interest to him on a given day (e.g., godzilla, amendments to the United States Constitution) demonstrating the need for instruction that incorporated his interests. Video clips were included in Lessons 1 and 2 to pique his interest and motivate him to learn the problem-solving strategy. Throughout the intervention, David's restricted interests influenced the need for intentional differentiation of instruction (e.g., prompting to redirect his attention to content in the intervention session, visual cues) in order to assist with his difficulty transitioning from his classroom or preferred activity to the intervention setting. Educational supports (from those identified by the SDLMI, Palmer & Wehmeyer, 2003) implemented to accommodate David's learning and behavioral needs included antecedent cue regulation, self-assessment of interests, abilities, and instructional needs, and awareness, goal-attainment, goal-setting and problem-solving. Additional EBPs (i.e., modeling, prompting, reinforcement, response interruption/redirection, social narratives, time delay, visual supports; Wong et al., 2015) were used to support David's characteristics of ASD.

Marc's ASD was characterized by cognitive differences (i.e., displays extensive knowledge in narrow areas of interests, poor organizational skills and reading

comprehension, literal understanding of concepts, fantasizes/withdraws into inner world, easily distracted by irrelevant details, difficulty with abstract reasoning, generalization of skills, attention, and understanding the connection between behavior and resulting consequences), restricted patterns of behavior, interests, and activities (i.e., need for repetition and sameness, intense preoccupation with traumatic experiences experienced in his past, zombies, and online video clips depicting violence and other graphic material, asks repetitive questions, and unmotivated my customary rewards), communication differences (i.e., talks incessantly about restricted areas of interest and difficulty with rules of conversation, asking for help, following instructions, and understanding language with multiple meanings), emotional vulnerability (i.e., easily stressed, unusually fearless, appears sad/depressed, engages in meltdowns and inconsistent behaviors, makes suicidal comments, and difficulty tolerating mistakes), and social difficulties (i.e., easily bullied and difficulty maintaining personal space, making/keeping fiends, and joining an activity,). Video clips were also included during Marc's intervention session in Lessons 1 and 2 to motivate him to learn the problem-solving strategy. When learning to apply the steps of the problem-solving strategy, Marc struggled to answer the question "Why would it work?". His answers almost always included a reference to an emotion or feeling instead of making a connection between the solution identified and how it would remedy the problem. For example, when he identified that he could call his sister if he got lost at the store and could not find his mom, he stated this would fix the problem of being lost because it would make his mom happy. Similarly, when he identified he could ask his teacher for a charger if his iPad was dead, he stated this would fix the problem because it would not be annoying. Throughout the intervention, Marc's emotional

vulnerability, particularly his preoccupation with pleasing his teachers and the interventionist, influenced the need for intentional differentiation of instruction (e.g., specific verbal praise, graphic organizers to show there should be a direct link between a solution and solving a problem) in order to address his difficulties. During the study, Marc made increasingly obvious suicidal comments and perseverated about events that were occurring at home. The SWBI and experimenter notified the principal each time. On two occasions, it was decided to request immediate mobile crisis intervention, and Marc is now receiving outside counseling. Educational supports (from those identified by the SDLMI, Palmer & Wehmeyer, 2003) implemented to accommodate David's learning and behavioral needs included antecedent cue regulation, self-assessment of interests, abilities, and instructional needs, and awareness, goal-attainment, goal-setting, problem-solving, and self-advocacy instruction. Additional EBPs (i.e., modeling, prompting, reinforcement, response interruption/redirection, social narratives, visual supports; Wong et al., 2015) were used to support Marc's characteristics of ASD. As shown in the above descriptions, this study extends what we know about the need to differentiate instruction and individualize supports to address the characteristics of ASD exhibited by students on the autism spectrum.

Finally, setting/situation generalization is the "extent to which a learner emits the target behavior in a setting or stimulus situation that is different from the instruction example" (Cooper et al., 2007, p. 617). None of the five multicomponent self-determination intervention studies for students with ASD reviewed in Chapter 2 included generalization measures. This study adds to the literature base by including a measure of participants' ability to generalize goal-setting skills to a novel problem scenario about

personal strengths, interests, and needs. Although setting generalization was not measured, statements made by teachers and the SWBI on social validity surveys and to the experimenter when picking up and returning participants to their classroom, indicated there was some generalization to school settings such as the cafeteria, classroom, and playground. For example, a special education teacher shared how much Marc enjoyed using his power chart in the resource setting, and she was excited about his increased independence when completing work. The SWBI stated she had been able to prompt Jon to use the problem-solving strategy, on several occasions, when he became frustrated. Instead of running from the classroom, he was able to think of a better solution and chose to go to his X spot instead. Additionally, Jon's general education teacher said he "sets goals daily" and "is aware of his behavior and tries to control it daily." On the social validity questionnaire, a general education teacher who worked with both Jon and David stated, "the intervention made each student more aware of their responsibilities." Matthew's special education teacher indicated the intervention had "helped him manage his schedule and decrease the amount of time he slept in class."

Research Question 4: What will be the perception of elementary students with ASD of an adapted version of the SDLMI delivered through technology to teach them to identify a problem, set a goal, and take action?

All participants indicated they liked learning how to solve problems experienced at school, and the lessons taught them to solve problems and become better at setting goals. The majority of previous research (Cote et al., 2014; Kleinert et al., 2014; Palmer & Wehmyer, 2003) investigating the effectiveness of the SDLMI with elementary students with disabilities has not included the perception of students as a measure of

social validity. However, Mazzotti et al. (2012b) found most participants liked using a computer program and agreed or strongly agreed the program helped them learn to set goals and use their goals to focus on improving their behavior.

Research Question 5: What will teacher perceptions be of an adapted version of the SDLMI delivered through technology to increase the problem-solving, goal-setting, and self-monitoring skills of elementary students with ASD?

Teacher perceptions of the intervention indicated everyone (i.e., two general education teachers, three special education teachers, one SWBI) believed the intervention helped students acquire self-determination, helped students problem-solve, set goals, and self-regulate their own behavior to attain goals. In addition, all teachers believed the intervention would be practical to implement as a supplement to classroom instruction. This is similar to previous research studying the effects of the SDLMI for elementary students with disabilities that found the teachers felt the intervention was fairly easy to implement and helpful for teaching problem-solving skills (Cote et al. 2014) and effective for helping students acquire self-determination, particularly goal-setting, and a valuable way to supplement academic instruction to help students attain self-determination skills" (Mazzotti, et al., 2012b).

Limitations and Implications for Future Research

There were several limitations of this study. First, this study included a small number of participants (n=4) at one elementary school. Although every student with ASD exhibits unique characteristics, all participants in this study had average oral communication skills which makes generalizing study effects to students with ASD with limited or no oral communication problematic. As this limits the generalizability of findings, there is need for future studies to investigate the effectiveness of this

intervention with other elementary students with ASD across diverse geographic locations. Conceptual replications of this study to investigate the effectiveness of the SDLMI to increase self-determination skills (i.e., problem-solving, goal-setting, self-monitoring) of elementary students with ASD would provide additional evidence that elementary students with ASD can increase their ability to engage in self-regulated learning.

Second, this study did not measure generalization of skills to other settings. Although generalization of problem-identification and goal-setting to a novel personal problem scenario was measured, there is no way to determine if participants would identify a problem and set a goal under different circumstances (e.g., if the problem was not related to a personal experience) or in a different setting (e.g., in the general education classroom, at home, in the community). Future studies should include measures of participants' ability to use problem-solving, goal-setting and attainment, and self-monitoring skills in other settings.

Next, this study did not include a measure of self-determination to identify the influence of the intervention on the self-determination skills of elementary students with ASD, because there was no assessment available to explicitly measure the influence of the intervention on participants' level of self-determination. Current self-determination assessments are not sensitive to short time frames. As previous research suggests, a student's level of self-determination is correlated to positive post-school outcomes (Test et al., 2009), therefore it is important for the field to develop new assessments that can reflect the ongoing progress a student is making in learning component skills of self-determination.

Fourth, instruction was provided in a one-to-one format which may not be practical for teachers or other school personnel who wish to implement the intervention within the context of a typical school day. Also of interest is whether the intervention would be more meaningful for students with ASD when provided in small group setting. Future research should seek to investigate the effectiveness of the intervention taught in a small group format.

Fifth, this study, as well as the previous study by Test and Rusher (2019), included only male participants. Future research should consider the effect of the SDLMI on the problem-solving, goal-setting, and self-monitoring skills of female elementary students with ASD.

In addition, this study did not measure long-term maintenance of skills taught by the intervention. Although all participants maintained their ability to identify a problem, set a goal, and take action for a minimum of 3 consecutive weeks after receiving the intervention, there is no way to know if participants would have maintained these skills for a longer period of time. Future studies should include collection of maintenance data after an extended period of time (e.g., 3 months, 6 months).

Lastly, this study was a conceptual replication of Test and Rusher (n.d.), adding explicit instruction in goal-setting and attainment and self-monitoring skills. Although this study provides emerging evidence for using the SDLMI to increase the self-determination skills of elementary students with ASD, future studies should explicitly teach students to answer the final question in the SDLMI, “What have I learned?” to determine if they achieved their goal and need to set a new goal or if they need to revise their goal or develop a new action plan.

Implications for Practice

There are several implications for practice based on findings from this study. First, teaching students with ASD to problem-solve at a young age (Agran et al., 2002; Palmer & Wehmeyer, 2003) may promote self-determined behavior, ultimately increasing the post-school outcomes of this population. While there is existing evidence for using the SDLMI to teach students with ASD to identify and generate positive solutions for typical daily interpersonal and social problems (Bauminger, 2007), results from this study demonstrated elementary participants with ASD can also earn to identify problems, brainstorm and choose the best solution, justify why the solution would work, and self-set and monitor progress toward goals because of an adapted version of the SDLMI delivered through technology. Together these results provide emerging evidence for using the SDLMI to provide instruction in foundational component skills of self-determination, specifically self-regulation to address many aspects of navigating the school environment, with elementary students with ASD.

Second, this study used technology (i.e., laptop, student iPad) as an alternative delivery method of the SDLMI to teach component skills of self-determination. Practitioners may want to consider several things when deciding how to use technology to deliver instruction of the SDLMI. First, consider the availability of the technology. In this study, during several lessons, participants had left their iPads at home, had forgotten to charge their iPads, or did not have access to their iPads because they had been taken away as punishment for not using them acceptably. Because the interventionist could also access lessons via her laptop, students were still able to receive the intervention via technology. Second, consider if the technology is too distracting. In this study,

participants who were not familiar with using their iPad as a teaching tool had more difficulty disengaging from games and videos they usually watched on their iPads during breaks or leisure time. It is important to consider how technology, specifically the iPad or other tablets, is perceived by students - as a tool for learning or as access to entertainment. Students may need additional instruction, modeling, and practice to understand how to effectively use iPads/tablets as learning tools. Third, consider if other strategies should be used along with technology. For example, in this study, instruction using the iPad did not replace hands-on practice with visual tasks and role play practice. Practitioners need to use whatever tools and strategies will best support students in meeting their learning goals.

Last, this study used educational supports, identified in the SDLMI Teacher's Guide (Shogren, Raley, Burke, & Wehmeyer, 2019) to support and accommodate the unique learning characteristics of students with ASD in learning the SDLMI. Practitioners should familiarize themselves with the educational supports recommended for implementation of each phase of the SDLMI described in the SDLMI's Teacher's Guide. Additionally, EBPs were implemented to address the characteristics of ASD (see Table 7 for definitions of EBPs implemented) exhibited by each student. For example, Matthew had a tendency to perseverate on reading the words on the screen of the iPad over and over. The interventionist responded by covering up or blacking out the screen to encourage him to think about his reply to a prompt rather than re-reading what had just been read to him. Another example demonstrates Matthew's and David's need for visual representation of all important concepts (e.g., visuals of problem-solving steps, components of goal, GAP). Both students required concrete representations to address

their cognitive difficulties and increase comprehension of concepts when accompanied by a visual. Practitioners should consider the characteristics of ASD exhibited by each student with ASD and plan accordingly to use any educational supports or EBPs that will have the greatest potential in supporting elementary students with ASD in learning self-determination skills.

Table 7. *Evidence-based practices implemented*

Evidence-based Practices (by outcome and age)	Practice Description
Modeling	"Demonstrations of a desired target behavior that results in imitation of the behavior by the learner and that leads to the acquisition of the imitated behavior. This EBP is often combined with other strategies such as prompting and reinforcement" (Wong et al., 2013, p. 20).
Prompting	"Verbal, gestural, physical assistance give to learners to assist them in a acquiring or engaging in a target behavior or skill. Prompts are generally given by an adult or peer before a learner attempts to use a skill" (Wong et al., 2013, p. 21).
Reinforcement	"An event, activity, or other circumstance occurring after a learner engages in a desired behavior that leads to the increased occurrence of the behavior in the future" (Wong et al., 2013, p. 21).

Response interruption/redirection	"Introduction of a prompt, comment, or other distracters when an interfering behavior is occurring that is designed to divert the learner's attention away from the interfering behavior and results in its reduction" (Wong et al., 2013, p. 21).
Social narratives	"Narratives that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding. Social narratives are individualized according to learner needs and typically are quite short, perhaps including pictures or other visual aids" (Wong et al., 2013, p. 21).
Task analysis	"A process in which an activity or behavior is divided into small, manageable steps in order to assess and teach the skill. Other practices, such as reinforcement, video modeling, or time delay, are often used to facilitate acquisition of the smaller steps" (Wong et al., 2013, p. 21).
Time delay	"In a setting or activity in which a learner should engage in a behavior or skill, a brief delay occurs between the opportunity to use the skill and any additional instructions or prompts.The purpose of the time delay is to allow the learner to respond without having to receive a prompt and thus focuses on fading the use of prompts during instructional activities" (Wong et al., 2013, p. 22).
Visual Supports	"Any visual display that supports the learner engaging in a desired behavior or skills independent of prompts. Examples of visual supports include pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, and timelines" (Wong et al., 2013, p. 22).

Summary

Students with ASD continue to experience poorer post-school outcomes than their peers with other disabilities (Lipscomb et al., 2017). One possible solution to address these dismal outcomes is to promote instruction in component skills of self-determination early. A number of studies have investigated the effectiveness of the SDMI (Lee et al., 2015), and this model has been identified as a research-based practice to foster self-determination (Wehmeyer et al., 2012). However, very few studies have investigated the efficacy of the SDLMI for students with ASD, particularly elementary students on the autism spectrum. Because students with ASD exhibit diverse behavioral, cognitive, communication, and social characteristics, identifying and planning for the implementation of EBPs when providing instruction in any content area is critical to the success this population experiences as learners (Fullerton & Coyne, 1999). Findings from this study add to the emerging evidence base for using the SDLMI to teach component skills of self-determination to elementary students with ASD.

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APPENDIX A: TEACHER CONSENT FORM

9201 University City Boulevard
Charlotte, NC 28223-0001

Teacher Consent for
Effects of the Self-Determined Learning Model of Instruction Delivered through Technology on the Problem-Solving Skills of Elementary Students with ASD

Investigators:
Dana Rusher, M.A., Doctoral Student, Special Education, UNC Charlotte, derusher@uncc.edu, 704-433-6374
David W. Test, Ph.D., Professor, UNC Charlotte, dwtest@uncc.edu, 704-687-8853

Purpose:
This letter is to ask your permission to participate in the above-named project, a research study to look at an intervention designed to help elementary students on the autism spectrum. In this study, we will use adapted phases of the *Self-Determined Learning Model of Instruction* (*SDLMI*) to teach students how to identify a problem, set goals, and take action to reach goals.

Description of Participation:
As the teacher participant you will be asked to:

- Complete an online survey at the end of the study to indicate your opinions of the intervention and the impact on the students. The survey should take no longer than 10 minutes.

Description of Participation:
The project will begin in September 2018 and end in April 2019.

Risks and Benefits of Participation
There is no known risk associated with this study. There may be risks, which are currently unforeseeable. The benefits of participation in this study include increased knowledge for the field about the ability of elementary students to solve problems and set goals.

Volunteer Statement:
You are a volunteer. The decision to participate in this study is completely up to you. If you decide to be in the study, you may stop at any time. You will not be

treated any differently if you decide not to participate or you stop once you have started.

Confidentiality:

Any information about your participation, including your identity, will be kept confidential. The following steps will be taken to ensure confidentiality. The following steps will be taken to ensure confidentiality:

- Pseudonyms will be used in all reports.
- All educational record information and data sheets collected will be stored in a locked file cabinet. All educational record information for potential participants who were not selected will be destroyed immediately after the selection process.
- All data maintained by the researchers will be destroyed 5 years after the study has ended.

UNC Charlotte wants to ensure you are treated in a fair and respectful manner. Contact the University's Office of Research Compliance (704-687-1871) if you have any questions about how you were treated as a study participant. If you have any questions about the project, please contact **Ms. Dana Rusher** at **(704) 433-6374**.

Participant Consent

I have read the information provided above. I have asked all the questions I have at this time, and those questions have been answered to my satisfaction. I am at least 18 years of age, and I agree to participate in this research project. I understand I will receive a copy of this form after it has been signed by me and the Principal Investigator.

Participant Name (Print)	Date
Participant Signature	Date
Investigator Signature	Date

APPENDIX B: PARENTAL CONSENT FORM

9201 University City Boulevard
Charlotte, NC 28223-0001

Parental Informed Consent for
Effects of the Self-Determined Learning Model of Instruction Delivered through Technology on the Problem-Solving Skills of Elementary Students with ASD

Project Purpose:
Your child is being invited to participate in a research study. The purpose of this study is to look at an intervention designed to help elementary students on the autism spectrum. In this study, we will use adapted phases of the *Self-Determined Learning Model of Instruction* (*SDLMI*) to teach students to identify problems they may face at school as well as how to set a goal, make a plan to reach their goal, and monitor their own progress towards reaching their goal.

We will look at this intervention to see if it is practical, acceptable, and effective with elementary students with autism. Your child is being asked to be in the study because your child has been identified with and is receiving special education services under the category of autism.

This study is being conducted by Ms. Dana Rusher (Special Education and Child Development, UNC Charlotte) as part of requirements for her doctoral program.

The responsible faculty member is Dr. David W. Test (Professor in Special Education and Child Development, UNC Charlotte).

What are some general things you and your child should know about research studies? Joining the study is voluntary. You may refuse to give permission, or you may withdraw your permission for your child to be in the study, for any reason, without penalty. Even if you give your permission, your child can decide not to be in the study or to leave the study early.

Research studies are designed to obtain new knowledge. This new information may help people in the future. Your child may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you and your child understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. You and your child should ask the researchers named above or their special education teacher, any questions you have about this study at any time.

Description of Participation:
Your child will work with the school-wide behavior interventionist during his/her regularly scheduled time. The teacher will use direct instruction and short scenarios related to problems your child may encounter at school and outside of school to teach your child the steps for solving a problem, setting and attaining goals, and monitoring his/her progress toward reaching goals. Your child will not miss any academic instructional time.

Length and Duration of Participation:
Your child's participation in this project will begin sometime in September 2018. This study will end in April 2019. The school-wide behavior interventionist will provide the instruction in the SDLMI intervention and each session will last between 15 and 30 minutes, 4-5 times a week. In addition, your child will also be asked to complete a survey at the end of the study, which will take about 5-10 minutes. The survey will be completed during his or regularly scheduled time with the school-wide behavior interventionist. Your child will be given assistance to complete the questionnaire, if needed. If you decide to grant consent for your child to participate, he/she will be one of 3 to 5 total participants in this study. The total amount of time your child will be in this study will amount to about 11.5 hours.

Are there any reasons you or your child should not be in this study?
Your child should not be in this study if your child 1) does not have an educational label or medical diagnosis of autism, 2) is proficient in problem-solving skills, or 3) has already learned the *SDLMI*.

Your child should not be in this study if you do not give permission for your child to be in the study.

You will be asked to allow your child's participation during the intervention to be audio-recorded for research purposes. A digital voice recorder will be used to record the instructional sessions and student responses.

What will happen if your child takes part in the study?
If you consent for your child to be a part of this study, this is what will happen.

- *Data Collection:* Your child will be asked questions about their problem-solving, goal-setting, and self-monitoring skills. Data will be collected on his/her baseline

(current) skills, skills during each intervention session, and skills after completing the intervention.

- *Intervention:* Your child will work one-on-one the interventionist to learn three steps to solve a problem (i.e., *What is the problem?*, *How can you fix* it?, *How do you know it will work?*, as well as how to set and work toward a goal, and self-monitor his/her progress toward meeting a goal using adapted phases of the *SDLMI*). The sessions will include: interacting with an app, Nearpod, on an iPad, interacting with hands-on tasks for the 3 steps of the problem-solving intervention, identifying and coming up with solutions to problems in personal scenarios, setting a goal to work on a personal need, and self-monitoring progress toward the goal. Each intervention session will be audio-recorded using a digital voice recorder.

What are the possible benefits from being in this study?
Research is designed to benefit society by gaining new knowledge. The benefits to your child from being in this study may be an increased ability to identify and solve problems and set and work toward a goal. Your child's reading comprehension may also increase.

What are the possible risks or discomforts involved from being in this study?
We foresee no more than minimal risks for you or your child.

Administration of intervention may take up to 30 minutes, 4 times a week for a period of 3-4 weeks during the school year. To minimize the risks associated with missing instructional time, research staff have worked with participating teachers to select times when intervention would be least detrimental, and intervention periods will be kept as brief as possible so students can return to scheduled activities as quickly as possible.

There may be uncommon or previously unknown risks. You should report any problems to the researcher.

What if we learn about new findings or information during the study?
You and your child will be given any new information gained during the course of the study that might affect your willingness to continue your child's participation in the study.

How will information about your child be protected?
All paper records for this study will be kept in locked file cabinets. All electronic or computer records will be password-protected. Only the members of the research team will have access to records that identify your child. Participants will not be identified in any report or publication about this study; pseudonyms (false names) will be used throughout. Although every effort will be made to keep research records private, there may be times when federal or state law requires the disclosure of such records, including personal information. This is very unlikely, but if disclosure is ever required, UNC Charlotte will take steps allowable by law to protect the privacy of personal information. In some cases, your child's information in this research study could be reviewed by

representatives of the University, research sponsors, or government agencies (for example, the FDA) for purposes such as quality control or safety.

Some of the intervention will involve audio-recording your child as they interact with the Nearpod app on an iPad. These recordings are needed so that the researchers can look carefully at implementation of the intervention. Thus, as part of your child's participation in this study, your child will be audio-recorded while they navigate through the intervention lessons. The investigators will take precautions to safeguard the audio-recordings of your child by placing the audio-recording on a secure network drive. These recordings will be coded by an identification number rather than your child's name or any personal information. Upon completion of the study, individual recordings will be archived on secure networks at UNC Charlotte. Access to the video-recordings will be restricted to research personnel on the study and destroyed after five years.

For recruitment purposes, some information from educational records will be requested from North Rowan Elementary. Participant pseudonyms will be used on all forms. There will be no data analysis of information from educational records. The information will only be used to determine if your child meets all the qualifications for this study. If for some reason your child does not qualify, information from educational records will be destroyed (i.e., shredded).

All data collected by the researchers will be kept confidential. To summarize, the following steps will be taken to ensure confidentiality:

- No real names will be reported in the results of this project
- Your and your child's identifiers will be separated from data reporting.
- All educational record information and data sheets collected will be stored in a locked filing cabinet.
- All educational record information for potential participants who were not selected will be destroyed immediately after the selection process.
- All data maintained by the researchers will be destroyed 5 years after the study has ended.

What if your child wants to stop before your child's part in the study is complete?
You can withdraw your child from this study at any time, without penalty. The investigators also have the right to stop your child's participation at any time. This could be because your child has had an unexpected reaction (such as frustration), or has failed to follow instructions, or because the entire study has been stopped.

Will your child receive anything for being in this study?
No.

Will it cost you anything for your child to be in this study?
It will not cost anything to be in this study.

Who is sponsoring this study?
This research is not funded by any internal or external source and does not have any financial interest regarding the final results of the study.

What if you or your child has questions about this study?
You and your child have the right to ask, and have answered, any questions you may have about this research. If there are questions about the study, complaints, concerns, or if a research-related injury occurs, contact the researchers listed on the first page of this form**.**

What if there are questions about your child's rights as a research participant?
All research on human volunteers is reviewed by a committee that works to protect your child's rights and welfare. If there are questions or concerns about your child's rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 704-687-1888 or uncc-irb@uncc.edu.

Parent/Caregiver's Agreement:
I have read the information provided above. I have asked all the questions I have at this time. I voluntarily give permission to allow my child to participate in this research study.

_____ _____
Printed Name of Research Participant (Child) Date

_____ _____
Signature of Parent/Caregiver Date

_____ _____
Printed Name of Parent/Caregiver Date

_____ _____
Signature of Research Team Member Obtaining Permission Date

_____ _____
Printed Name of Research Team Member Obtaining Permission Date

Contact Information (for setting up assessments and mailing study materials as needed):

_____
Street Address City, State Zip

_____ _____
Email Address Phone Number

APPENDIX C: STUDENT ASSENT FORM

9201 University City Boulevard
Charlotte, NC 28223-0001
Department of Special Education and Child Development

Student Participation Assent for
Effects of the Self-Determined Learning Model of Instruction Delivered through Technology on the Problem-Solving Skills of Elementary Students with ASD

Investigators:
Dana Rusher, M.A., Doctoral Student, Special Education, UNC Charlotte, derusher@uncc.edu, 704-433-6374
David W. Test, Ph.D., Professor, UNC Charlotte, dwtest@uncc.edu, 704-687-8853

Participants:
The people named above are doing a research study.

These are some things we want you to know about research studies:
Your parent has said it is ok for you to be in this study, but you do not have to be in this study if you don't want to be.

You may stop being in the study at any time. If you decide to stop, no one will be angry or upset with you.

Why are we doing this research study?
The reason for doing this research is to help elementary students learn to solve problems they may face at school. You will also learn to set a goal and work towards meeting that goal.

Why are you being asked to be in this research study?
We are asking you to be in this study so you can learn steps to become a better problem-solver.

How many people will take part in this study?
There will be 3-5 students in this research study.

What will happen during this study?
This study will take place at **your school** and will last for about three months. Your teacher will be teaching you the steps to be a better problem-solver.

During this study you will:

- Work with the school-wide behavior interventionist to learn the steps to become better at solving problems and setting and reaching goals.
- Answer questions at the end of each lesson. The questions are not part of a test, and you will not be given a grade for your answers.
- When you work with the interventionist, the lesson will be recorded using a recording device.

When will this study take place?

- During your scheduled time with the school-wide behavior interventionist.
- You will not miss any work or instruction during this time.

Who will be told the things we learn about you in this study?

Only people working on this project will be told what we learn about you in this study. I will write a report about this study, but I will not use your real name.

What are good things that might happen in this study?

Research is designed to help people learn new things. You may learn to be a better problem-solver, and you may learn more about yourself in this study.

What are the bad things that might happen?

Sometimes things happen to people in research studies that may make them feel bad. These are called "risks." These are the risks of this study:

- You might feel nervous about learning something new.
- You might feel frustrated when you are learning something new.

These things may or may NOT happen to you. You should tell me or your teacher about any problems you have.

Will you get any money or gifts for being in this research study?

No

If you want to be in this study, sign your name below:

Participant Name/Signature	Date
Signature of Research Team Member Obtaining Consent	Date

APPENDIX D: PROBLEM-SOLVING QUESTIONNAIRE

Problem-Solving Questionnaire

Participant: _____ Date: _____

Session: _____

Phase 1 Identify the Problem		
Identification of Problem-Solving Steps	1 point	0 points
1.What is the problem?		
2. How can you fix it?		
3. Why would it work?		
Problem Scenario		
4. Participant states the problem. (+1 if participant identifies entire problem)		
5. Participant identifies a solution. (+1 if participant identifies an appropriate solution)		
6. Student identifies a second solution. (+1 if participant identifies a different appropriate solution)		
7. Student identifies the best solution. (+1 if participant one of the previously identified solutions)		
8. Student identifies why it would work. (+1 if participant made an appropriate judgement why this solution would work)		
Total points:	/8 = %	
Part 1 Probe Mastery Criteria = 6/8 (75%)		

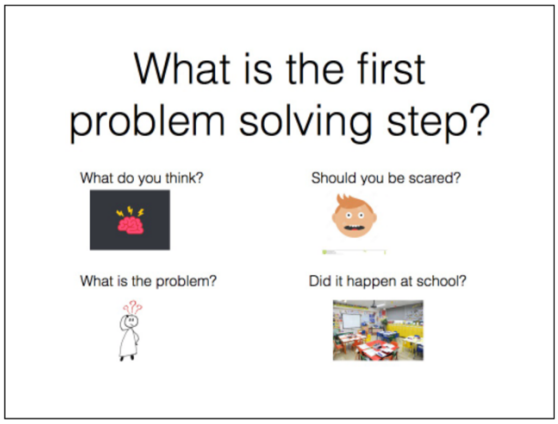
Phase 2 Set a Goal		
	1 point	0 points
9. Goal is relevant (Who)		
10. Goal is measurable (How much)		
11. Goal is observable (What)		
12. Goal is specific (When/Where)		
13. When will you begin to work on your goal? (*Gives specific date or day in past, present or future; gives a specific environmental context - e.g., when working in a group, during math class, when listening to my teacher give directions*)		
Total points:	/5= %	
Part 2 Probe Mastery = 4 /5 (80%)		

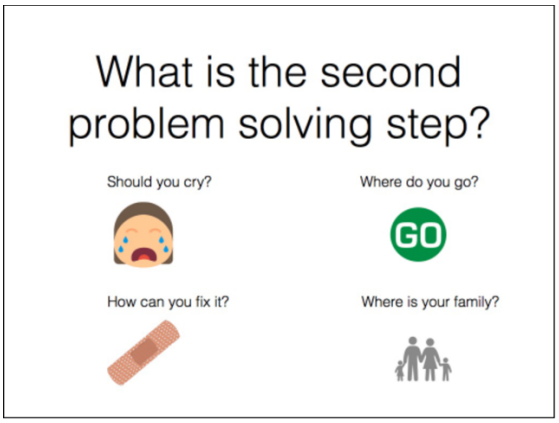
Phase 3 Take Action		
	1 point	0 points
14. What is your goal?		
15. What tool will you use to reach your goal?		
16. How will you know you have reached your goal? (e.g., I have a happy face on my GAP; I am happy; My teacher is happy; I did it)		
17. Did you reach your goal?		
18. Do you need to change anything? (Alternate Phrasing/Prompt: What else do you need to do to get a happy face?)		
Total points:	/5 = %	
Part 3 Probe Mastery = 4 /5 (80%)		

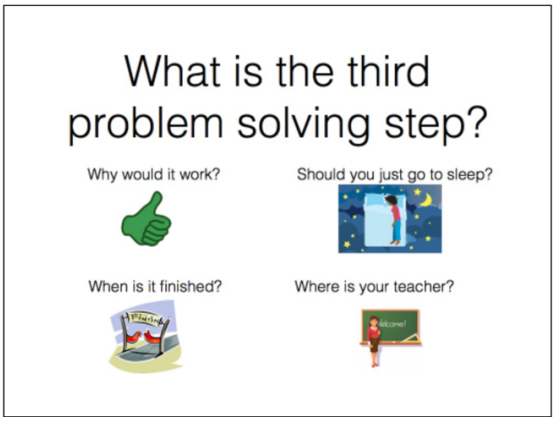
Full PSQ Probe Score = _____ out of 18 = _____%

APPENDIX E: VISUAL CHOICES

Examples of Picture/Word Choices Provided on iPad
if Participants Choose to Respond in this Manner







APPENDIX F: STRENGTHS, INTERESTS, AND NEEDS INVENTORY

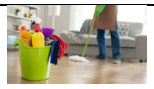
Strengths, Interests, and Needs Inventory (SINI)

NAME: _____ DATE: _____

Math Work	 Good at School	 Need help at School	Examples
Reading and answering questions	 Good at School	 Need help at School	Examples
Writing sentences	 Good at School	 Need help at School	Examples
Enhancement classes	 Good at School	 Need help at School	Examples
Staying in my seat and not leaving classroom	 Good at School	 Need help at School	Examples
Answering questions when asked	 Good at School	 Need help at School	Examples
Staying calm and using appropriate voice levels	 Good at School	 Need help at School	Examples

Have nice hands and feet	 Good at School	 Need help at School	Examples
Work with classmates in groups	 Good at School	 Need help at School	Examples
Play at recess with others	 Good at School	 Need help at School	Examples
Greet others when spoken to	 Good at School	 Need help at School	Examples
Work with your teacher	 Good at School	 Need help at School	Examples

 Sports	 Like	 Do not like	Examples
 Television	 Like	 Do not like	Examples
 Drawing	 Like	 Do not like	Examples
 Cooking	 Like	 Do not like	Examples
 Music	 Like	 Do not like	Examples
 Building	 Like	 Do not like	Examples
 Puzzles	 Like	 Do not like	Examples
 Animals	 Like	 Do not like	Examples
	 Like		Examples

Reading		Do not like	
 Helping	 Like	 Do not like	Examples
 Cleaning	 Like	 Do not like	Examples

APPENDIX G: PROBLEM SCENARIOS

Problem Scenarios for Full and Phase PSQ Probes

BASELINE (BL; Full Probe)

BL 1
Your teacher tells you it's time do work. You cannot find your pencil. The class has started the activity.

BL 2
When *participant name* gets up from *his*/her desk *he/she* trips and falls over *his/her* untied shoelace. *His/Her* friend, *friend's name*, starts laughing. *Participant name* looks around and sees other children laughing.

BL 3
You are doing your work in class. Ms. *favorite teacher's name* walks by and you want to say hey. Your teacher is reading a book to the class.

PHASE 1 (P1; Phase Probe)

P1, Day 1
You sit down to eat your lunch. You realize you forgot your fork. The cafeteria ladies do not like it when you come back through the line for forgetting your fork.

P1, Day 2
Someone takes the last good place to sit during break. You really wanted the bean bag chair. You feel very mad.

P1, Day 3
You are supposed to be doing a *least favorite subject* assignment. You do not know how to do the work. You feel VERY frustrated.

P1, Day 4
It's time to get on the iPad. The iPad is dead. *Participant name* wants to play *favorite video game*.

PHASE 1 (Full Probe)
Participant name wants *favorite food* for lunch in the school cafeteria. They only have *food* or *food*. *Participant name* is very hungry.

PHASE 2 (Full Probe)
You think people are talking about you. You spit in a boy's face. The boy gets really mad.

PHASE 3 (Full Probe)
It is time to take the final test in reading. *Participant name* starts to feel sick to *his/her* stomach because *he/she* is nervous. The test has been given to all students.

Generalization Probes
Problem Scenario were developed based on participant responses to strengths, interests, and needs inventory.

Maintenance 1 (Full Probe)
You are working with Miss Mitzi. When you go to your classroom, your class is not there. You do not know where they went.

Maintenance 2 (Full Probe)
Participant name watches all the students play *his* favorite game at recess. *He* really wants to play. *Participant name* stands and watches until time to go back in the school.

Maintenance 3 (Full Probe)
Participant name is shopping with *his parent/guardian*. He walks away to look at the *favorite toy/game*. When *he* turns around *he* cannot find *his parent/guardian*. *Participant name* is scared.

Maintenance 4 (Full Probe)
Participant name watched videos all night long. He wakes up late. He missed the bus!

Maintenance 5 (Full Probe)
Your *parent/guardian* wants you to finish all your homework before riding your bike. You have five more sentences to write. You really wants to ride your bike.

APPENDIX H: TEACHER SOCIAL VALIDITY

Teacher Social Validity Questionnaire (*to be provided via Survey Monkey online*)

Date: _____ Teacher's position (check one):

- ❑ Special Education
- ❑ General Education Teacher

1. Did you feel the intervention helped students acquire self-determination (e.g., problem-solving, goal-setting and attainment, self-regulation) skills?
   - ❑ Yes
   - ❑ No

   Why?

2. Do you think the intervention helped students to self-set goals related to working independently?
   - ❑ Yes
   - ❑ No

   Why?

3. Do you feel the intervention had a positive effect on students' ability to monitor their own behavior in the classroom?
   - ❑ Yes
   - ❑ No

   Why?

4. Would you like to implement this intervention in your classroom?
   - ❑ Yes
   - ❑ No

   Why?

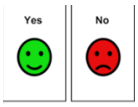
5. Do you feel this strategy is practical in terms of time for supplementing classroom instruction?
   - ❑ Yes
   - ❑ No

   Why?

APPENDIX I: STUDENT SOCIAL VALIDITY

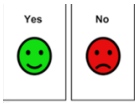
Student Social Validity Questionnaire (*will be completed on participants' iPad by circling their answer)*

1. The lessons taught me how to solve problems I may have at school.



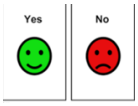
2. I liked using the iPad during my problem-solving lessons.

3. I liked learning how to solve problems I may have at school.



4. Since the problem-solving lessons, I am better at solving problems.

5. Since the problem-solving lessons, I am better at setting goals.



6. Since the problem-solving lessons, I am better at monitoring my behavior.

APPENDIX J: ADAPTED SDLMI LESSON PLAN GUIDE

Lesson Plan Guide

Pre-Intervention
Identifying Strengths, Interests and Needs

Teacher Preparation

- Ensure Pre-Intervention lesson in Nearpod are ready (Have code ready to provide to participant to access lesson in Nearpod on their iPad)
- Make sure you have all materials (listed below)
- Record lesson (including participant responses to probe at end of lesson)

Materials

- Interventionist Binder
- Visuals, hands-on tasks
- Skills, Interests, and Needs Inventory
- Digital Voice Recorder or Camtasia
- Laptop
- Participant iPad

Objectives

- I will understand the difference between strengths and interests
- I will identify my strengths, interests, and needs

Lesson Procedures

- All participants will participate in small group session

Intervention
Self-Regulated Problem-Solving Instruction

Phase 1
Lessons 1-4 Identify the Problem

Teacher Preparation
- Ensure lessons in Nearpod are ready (Have code ready to provide to participant to access lessons in Nearpod on their iPad)
- Make sure you have all materials (listed below)
- Record lesson (including participant responses to probe at end of lesson)

Materials
- Interventionist Binder
- Problem-Solving Steps (paper copy)
- Visual, hands-on task
- Problem-solving scenarios
- Video clips (optional)
- Digital Voice Recorder or Camtasia
- Laptop
- Participant iPad

Objectives
1.1. I will state the 3 Problem-Solving Steps
1.2. I will apply the 3 Problem-Solving Steps to a scenario to identify a problem and choose the best solution

General Feedback Procedures
- When student makes correct response, provide enthusiastic verbal praise (e.g., "Correct," "Great job," "Yes, you got it.")
- When student puts forth consistent effort to respond but the response is not quite complete or correct, provide enthusiastic praise (e.g., "Correct," "Great job," "Yes, you got it.") followed by a statement of the FULL correct answer.
- When student makes an incorrect response, or does not respond (after a three-second pause), prompt using a model-test format or by providing choices for the participant.

Lesson Procedures
- Ensure student inputs code into Nearpod app. If student does not have their iPad, show lesson on teacher laptop.
- Give an advance organizer - Tell the participant what he/she will be doing and why
  Sample dialogue: Today you are going to learn how to name a problem and find a solution. Begin the lesson in Nearpod on your iPad.
- Describe and Model (use explicit instruction - I do, We do, You do)
  Refer to Problem-Solving Steps in Nearpod and give paper copy.

Sample dialogue:
The pictures are to help you remember three questions.
A question mark over a person's head, means "What is the problem?"
A band-aid means, "How can you fix it?"
A thumbs-up means, "Why would it work?"
The pictures will help you remember the problem-solving questions.

- Review the three problem-solving steps with the student. Be sure to refer to the picture cues. Encourage the student to access the printed visual prompt in their student binder.
- Guide students in completing the hands-on activities to practice the three problem-solving steps. If student has mastered the steps, you may choose to skip the hands-on activities in Lessons 3 and 4.
- Utilize problem-solving scenario related to situations familiar to the participant.
- Depending on participants' current level of understanding and individual interest areas, the interventionist may choose to present a problem scenario the participant has recently experienced or use a video clip (from the supplemental resources section in the interventionist binder) to practice solving a problem.
- After reading the scenario, begin a discussion.
  Sample dialogue:
  You just listened as I read the problem story. Can you tell me: (a) "What was the problem?"; (b) "What is one way to fix the problem?"; (c) "What else would fix the problem?"; and (d) "Why would that work?"

Phase 2
Lessons 5-8 Set a Goal

Teacher Preparation

- Ensure lessons in Nearpod are ready (Have code ready to provide to participant to access lessons in Nearpod on their iPad)
- Make sure you have all materials (listed below)
- Record lesson (including participant responses to probe at end of lesson)

Materials

- Interventionist Binder
- Problem-Solving Steps (paper copy)
- Visual, hands-on task
- Problem-solving scenarios
- Goal Action Plan (GAP)
- Digital Voice Recorder or Camtasia
- Laptop
- Participant iPad

Objectives
2.1. I will apply the problem-solving steps to a personal problem scenario to identify something I need to get better at doing
2.2. I will learn to develop a goal using a goal template

General Feedback Procedures

- When student makes correct response, provide enthusiastic verbal praise (e.g., "Correct," "Great job," "Yes, you got it.")
- When student puts forth consistent effort to respond but the response is not quite complete or correct, provide enthusiastic praise (e.g., "Correct," "Great job," "Yes, you got it.") followed by a statement of the FULL correct answer.
- When student makes an incorrect response, or does not respond (after a three-second pause), prompt using a model-test format or by providing choices for the participant.

Lesson Procedures

- Ensure student inputs code into Nearpod app. If student does not have their iPad, show lesson on teacher laptop.
- Give an advance organizer - Tell the participant what he/she will be doing and why
  Sample dialogue: Today you are going to learn how to apply the problem-solving steps you've learned to name a problem you are having at school and find a solution. You will learn how to set a goal for something you want to learn to do better at school. Begin the Nearpod lesson."
- Review the three problem-solving steps with the student. Be sure to refer to the picture cues. Encourage the student to access the printed prompt and visual representation prompt.
- Use explicit instruction (i.e., I do, We do, You do) to teach student the parts of a goal
  - Who
  - What
  - How many/how much
  - Where
  - When

Phase 3
Lessons 9-12 Take Action

Teacher Preparation

- Ensure lessons in Nearpod are ready (Have code ready to provide to participant to access lessons in Nearpod on their iPad)
- Make sure you have all materials (listed below)
- Record lesson (including participant responses to probe at end of lesson)

Materials

- Interventionist Binder
- Problem-Solving Steps (paper copy)
- Visual, hands-on task
- Problem-solving scenarios
- Video clips (optional)
- Goal Action Plan
- Digital Voice Recorder or Camtasia
- Laptop
- Participant iPad

Objectives

3.1. I will state my goal
3.2. I will identify the tool I am using to monitor progress toward my goal
3.3. I will learn how to use my GAP to tell if have reached my goal

General Feedback Procedures

- When student makes correct response, provide enthusiastic verbal praise (e.g., "Correct," "Great job," "Yes, you got it.")
- When student puts forth consistent effort to respond but the response that is not quite complete or correct, provide enthusiastic praise (e.g., "Correct," "Great job," "Yes, you got it.") followed by a statement of the FULL correct answer.
- When student makes an incorrect response, or does not respond (after a three-second pause), prompt using a model-test format or by providing choices for the participant.

Lesson Procedures

- Ensure student inputs code into Nearpod app. If student does not have their iPad, show lesson on teacher laptop.
- Give an advance organizer - Tell the participant what he/she will be doing and why
  Sample dialogue: Today you are going to learn to use a tool to monitor progress toward meeting your goal. Begin the computer instruction."
- Review the three problem-solving steps with the student. Be sure to refer to the picture cues. Encourage the student to access the printed prompt and visual representations.
- Use explicit instruction (i.e., I do, We do, You do) to introduce/teach students how to use their GAP)
  - Describe how students will use their GAP to monitor their behavior.
  - Describe how students will know if they have reached their goal.
  - Discuss when students may decide to change their goal (e.g., met goal, not making sufficient progress, need to increase "how many/how much."
- Utilize problem-solving scenarios related to situations familiar to the participant.

Note: At the end of each lesson, Phase probes should be collected.

APPENDIX K: GOAL ACTION PLAN

My Goal Action Plan (GAP)

My Goal:
_____, will _____ at least

_____ in the _____by

_____.

I am working for _____.

Steps to achieve my goal: 1. 2. 3.	**How to Score Myself** 1 = I know my goal but I did not change my behavior today. 2= I tried but did not follow all the steps to achieve my goal. 3= I changed my behavior and reached my goal!	 3 Great	 2 Okay	 1 Not so good	
Daily Rating	Mon.	Tues.	Wed.	Th.	Fri.
Great	○	○	○	○	○
Okay	○	○	○	○	○
Not So Good	○	○	○	○	○

Did I reach my goal today? ___ yes ___ no

If I did not reach my goal today, what do I need to do better next time?

APPENDIX L: GENERALIZATION MEASURE

Generalization Measure

Instructions for giving generalization probe:

- Participant will be given the opportunity to write or dictate a goal without any visual organizer.
- If participant does not attempt to write or dictate a goal (or states he/she does not know how) within 3 minutes, the interventionist will provide student with a visual organizer.
- The type of organizer presented will be based on the participant's need for visual structure and current academic ability.
- There will be three visual organizers available with varying levels of visual structure (see below).

Generalization Measure Prompt:

Read the following problem and **write** a goal that you think will fix the problem.

My Goal:

I, _____, will _____ at least

_____ in _____ by

_____.

My Goal:

I, _____, will _____ at least

(WHO) (WHAT)

_____ in _____ by

(HOW MANY) (WHERE)

_____.

(WHEN)

My Goal:

I,  , will  at least 0 1 2 3 4 5 6 7 8 9

in 

by 

.