EFFECTS OF A PEER-DELIVERED SIMULTANEOUS PROMPTING STRATEGY TO TEACH CORE CONTENT COMBINED WITH PHYSICAL ACTIVITY TO STUDENTS WITH INTELLECTUAL DISABILITY

by

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ABSTRACT

GWITAEK PARK. Effects of A Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability (Under the direction of DR. YA-YU LO)

Learning prepositions is very important for students with an intellectual disability to engage in functional communication behaviors. In addition, it is important for the students with intellectual disability to engage in physical activity at school because they spend the majority of their waking hours during weekdays at school. One way to increase both academic learning and physical activity level is to combine academic core content learning with physical activity. Simultaneous prompting is one of the response prompting procedures, which are evidence-based practices, and has been used as an effective way to teach both academic core contents and functional skills to students with intellectual disability. Peer tutoring also has been an effective teaching strategy to increase social aspects as well as academic learning for students with intellectual disability. In this study, I used a single-case multiple probe across participants design to examine the effects of a peer-delivered simultaneous prompting procedure in teaching locative prepositions combined with movement skills to students with intellectual disability. Five elementary school students with a mild to moderate intellectual disability participated in this study as the target participants. One peer without a disability enrolled in the same school with the target participants was the peer tutor and a data collector. The special education teacher participated in social validity data collection. Results of the study demonstrated a functional relation between the first primary dependent variable (i.e., action of prepositions to verbal prompt) and the intervention. Three out of five target participants showed some improvement in responding to nontargeted information (i.e., tacting of prepositions). For the movement skills

measured by the Test of Gross Motor Development (TGMD; Ulrich, 2000), all target participants acquired higher scores in the posttest compared to their pretest scores. Further, four out of five target participants demonstrated some improvement in generalizing their knowledge of action of prepositions to verbal prompt to other materials and three target participants showed improvement in generalizing their knowledge of tacting of prepositions to other materials. Social validity data collected from the special education teacher, the peer tutor, and the target participants showed that they agreed the intervention was beneficial to all participants academically and socially. In addition, throughout the study, the peer tutor conducted both probe and training sessions with high procedural fidelity data. Limitations of the current study and suggestions for future research are discussed.

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DEDICATION

First, I dedicate this dissertation to my mother and father. You have always supported and respected me for whatever path I want to pursue. Even when I decided to study in United States, you trusted me and trusted my decision. I have learned a lot from you that can make my life happy and meaningful. The wisdom you have given me enables me to live as who I am. Thank you for being my parents and I love you so much. Second, I dedicate this dissertation to my sister. Thank you for being patient as my younger sister and for taking over my responsibilities that I have to do as the older brother for our parents while I am in the United States.

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CHAPTER 1: INTRODUCTION

Conclusive evidence has indicated that physical activity in school-aged children can have a positive effect not only on health-related areas (Centers for Disease Control and Prevention [CDC], 2013; Pate et al., 2006) but also on the improvement of academic performance (CDC, 2013; Castelli et al., 2007; Chomitz et al., 2009; Dwyer et al., 2001; Grissom, 2005; Martin, & Chalmers, 2007; Shephard, 1997; Tremblay et al., 2000). Additionally, research has shown positive correlation between structured school physical education and improved academic achievement (Carlson et al., 2008; Coe et al., 2006; Sallis et al., 1999; Trudeau & Shephard, 2008), however, many educators and parents believe that spending time during school hours on physical activity inhibits children's chances of success in academic pursuits. Departments of Education also contend that the time and money spent on physical activity might be better spent on academic pursuits (Siegel, 2006).

Students with mild to moderate intellectual disability commonly have language delays or impairments, including nonvocal expressions (e.g., pointing to a ball to ask for a ball) and vocal expressions (e.g., saying "ball, please;" Westling & Fox, 2000), as well as a low level of engagement in physical activity compared with their peers without disabilities (Rimmer & Rowland, 2008). Current high-stakes state accountability systems require teachers of students with mild to moderate intellectual disability to teach core content standards in language arts, mathematics, and science to high levels as measured by alternate assessment (Browder et al., 2004). Additionally, these teachers are responsible for ensuring their students learn the functional skills, including physical activity, and become as independent as possible in their future

environments. Due to limited instructional time, teachers often find it challenging to address both academic skills and functional skills in students' educational programs.

To improve both academic performance and physical activity of students with mild to moderate intellectual disability within limited instructional time without adding additional responsibility to teachers, it is promising to examine the effects of an intervention package including a simultaneous prompting procedure, activity-based instruction, and peer tutoring in teaching academic core content knowledge and physical activity skills to students with mild to moderate intellectual disability.

Simultaneous Prompting

Use of evidence-based practices for students with disabilities in school setting is a mandate based on provision of the No Child Left Behind Act of 2001 (NCLB, 2002) and the Individuals with Disabilities Education Act (IDEA, 2004; Bergstrom, 2008). Evidence-based practices are those that are empirically supported and substantiated with research findings that demonstrate beneficial and predictable outcomes (Forman et al., 2009). Despite the importance of evidence-based practices, a growing body of literature indicates that implementation of these interventions in schools is low because of several barriers, including (a) lack of money, (b) lack of time, (c) lack of school supports (e.g., administrators, principals, parents, and teachers), (d) other competing priorities, and (e) a heavier focus on the results of academic testing (Forman et al., 2009). These barriers may be resolved by using effective and efficient evidence-based practices resulting in increasing the use of such practices in schools. Because teachers often have limited resources and time to implement evidence-based practices in schools, it is necessary for them to select and use efficient interventions. According to Wolery et al. (1992), efficient

interventions can be defined as achieving positive outcomes while requiring less energy or time than other interventions.

The simultaneous prompting procedure is one of the response prompting procedures (graduated guidance, Wolery et al., 1992; most-to-least prompting, Demchak, 1989; system of least prompts, Doyle et al., 1988; time delay, Walker, 2008), which are evidence-based practices, and has been used as an effective way to teach both academic core contents (e.g., reading, Collins et al., 2007; math, Creech-Galloway et al., 2013) and functional skills (e.g., independent living skill, Parrott et al., 2000) to students with disabilities. Simultaneous prompting also has been an effective way to teach students with intellectual and developmental disabilities (Aldosiry, 2023; Aljohani et al., 2022; Ozen et al., 2017). Simultaneous prompting involves daily probe trials and daily training trials of delivering a prompt immediately following the presentation of a task direction and is considered an errorless teaching method because students do not have the opportunity to make an error prior to the delivery of a prompt (Gibson & Schuster, 1992).

In addition to its effectiveness, simultaneous prompting is an efficient way in terms of minimizing learning errors and training sessions. For example, Tekin and Kircaali Iftar (2002) compared the efficiency of the simultaneous prompting and constant time delay procedures (i.e., uses single controlling prompt delivered after a preset interval that remains at constant interval across sessions; Walker, 2008) on teaching receptive identification of animals to children with mild and moderate intellectual disability. Results supported the simultaneous prompting procedure to be more efficient than the constant time delay procedure based on the number of training errors and training time required to reach mastery criterion. Celik and Vuran (2014) compared the efficiency, effectiveness, maintenance, and social validity of direct instruction

(e.g., “This is long. This is not long. Which one is long? Which one is not long?”) and the simultaneous prompting procedure (e.g., “Which one is long? This is long.”) with four participants with moderate intellectual disability attending a private education center. The researchers found that the simultaneous prompting procedure was more efficient in decreasing the number of trials and incorrect responses than direct instruction.

To further increase the efficiency of the instruction, teachers may incorporate both functional and core content instruction to maximize their time and resources and teach more than one content to students with disabilities during the same instructional period (Wolery et al., 1992). There are two approaches for incorporating both contents in the instruction. The first approach involves embedding core content in a functional activity (Karl et al., 2013). Karl et al. (2013) taught academic core contents (i.e., reading, mathematics, and science) embedded in a cooking activity to students with moderate intellectual disability. They found several benefits for teaching core content within a functional activity. First, the cooking activity was the natural reinforcement of core content learning. The activity provided students with moderate intellectual disability the motivation for learning academic core content. Second, students were exposed to more than one content resulting in an increased opportunity for students to learn more during the same sessions. The second approach for incorporating both functional and core contents in instruction involves delivering nontargeted information as instructive feedback at the end of each instructional session (Collins et al., 2021). Nontargeted information is content that is not targeted for direct instruction although students may acquire at least some of this content from repeated exposure (Collins, 2007).

Using simultaneous prompting either to add nontargeted information at the end of the intervention or to teach academic core content embedded in functional activity offers a feasible

way to teach academic core content combined with physical activity. Currently, there is limited research that examined the effectiveness and efficiency of the simultaneous prompting procedure when teaching academic core content combined with physical activity. Considering the positive link between physical activity and academic achievement, it is warranted to promote content learning while improving physical activity for students with intellectual disability through simultaneous prompting.

Teaching Academic Core Content Combined with Physical Activity

Physical activity is a bodily movement produced by the contraction of skeletal muscles that substantially increases energy expenditure. Physical activity can be defined in terms of its frequency, duration, and intensity. For example, children and adolescents with ages 6 through 17 years should engage in 60 min or more of moderate-to-vigorous physical activity per day for at least 3 days a week (CDC, 2013). Physical activity is important to adolescents as well as children. According to Rimmer and Rowland (2008), engaging in physical activity regularly can (a) increase strength and endurance, (b) build healthy bones and muscles, (c) regulate weight, and (d) promote mental health and wellness resulting in contributing to physical fitness and overall health. Physical activity also is necessary to prevent long-term risks of obesity and chronic illness, and to establish a strong foundation for children to remain physically active into adulthood (CDC, 2013). Despite the importance of physical activity for children's health, children with disabilities typically engage in physical activity 4.5 times less than their peers without disabilities (Rimmer & Rowland, 2008) and only approximately 24% of children with intellectual disability meet the current physical activity guidelines suggesting children and adolescents with ages 6 through 17 years should perform 60 min or more of moderate to vigorous physical activity daily (Downs et al., 2016).

A growing body of the literature has established a strong link between engagement in physical activity and cognitive functioning (Castelli et al., 2015). Specifically, regular physical activity and fitness can enhance a child's ability to achieve academically by having a positive influence on brain (Kibbe et al., 2011). Welk (2009) examined the relationship between aerobic fitness levels and scores on standardized achievement tests of 2.4 million public school students. Results showed that the higher physical activity level and lower Body Mass Index (BMI) children had, the higher test scores they earned. In addition, children who were more physically fit had better school attendance and fewer disciplinary concerns. However, as claimed by Kibbe et al. (2011) elementary students in school setting receive little physical activity time. A classroom-based physical activity is one way to increase students' physical activity level and physical fitness, resulting in improvement on cognition and academic achievement. A classroom-based physical activity involves incorporating movement into the classroom for at least 10 min (Donnelly & Lambourne, 2011). Classroom-based physical activity program has several benefits including (a) improving on-task behavior (Goh et al., 2016), (b) increasing children's daily physical activity (Bartholomew & Jowers, 2011; Mahar et al., 2006; Stewart et al., 2004), and (c) improving cognitive functioning, academic performance, and physical health (Bartholomew & Jowers, 2011; Fedewa & Ahn, 2011; Hillman et al., 2008). Furthermore, classroom-based activities encourage students to use more senses to allow the brain to retain more information, which is based on the famous quote "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand" stated by Ben Franklin (Franklin, n.d.).

Although little has been published on the effects of physical activity on academic performance of students with disabilities, available research showed that physical activity positively influenced academic performance (e.g., language arts and mathematics, Everhart et al.,

2012) and academic engagement (e.g., correct responses to a directive given by the teacher, Oriel et al., 2011) of students with disabilities. In addition, studies exist that examined the relationship between motor functions and academic achievement in students with disabilities (Westendorp et al., 2011; Wuang et al., 2008). Westendorp et al. (2011) found specific positive relationships between gross motor skills and academic performance in children with learning disabilities, particularly between reading and locomotor skills and math and object-control skills. In addition, Wuang et al. (2008) found that verbal comprehension and processing speed indexes were significant predictors of gross and fine motor function of students with mild intellectual disability. Both studies argued the necessity of specific interventions facilitating both motor and academic abilities in children with disabilities.

Teaching both academic core content, particularly English/Language Arts, and physical activity to students with an intellectual disability is necessary because these students commonly have language delays or impairments (Westling & Fox, 2009), as well as limited engagement in physical activity compared with their peers without disabilities (Rimmer & Rowland, 2008). Teaching academic core content combined with physical activity affords students with an intellectual disability the opportunity to learn both contents during the same time and to use the same part of the brain to learn both contents. In addition, physical activity can possibly serve as natural reinforcement for students with an intellectual disability to learn core content (Karl et al., 2013).

Peer Tutoring

Although the simultaneous prompting procedure has been commonly delivered by adults, peer tutoring has both academic and social benefits as an effective strategy for teaching students with disabilities (Jimenez et al., 2012; Kalef et al., 2013; Ley Davis et al., 2022). Peer tutoring

occurs when instructional content is delivered by a student instead of a teacher (Olson & Platt, 2000). When peer tutoring is used, the tutor can obtain teaching skills and experiences with a student with a disability, while the teacher can focus on other tasks or students. Research has shown that peer tutors have had a high degree of procedural fidelity in implementing the simultaneous prompting procedure (Britton et al., 2017; Heinrich et al., 2016). For example, Tekin-Iftar (2003) examined the effects of peer-delivered simultaneous prompting instruction in teaching community signs to students with developmental disabilities. Results showed that the peer-delivered instruction was reliable, and the target students acquired the community signs. Furthermore, peer tutors have been successful in embedding nontargeted information when using systematic instruction (e.g., Fetko et al., 2013). Fetko et al. (2013) examined the effects of peer-delivered simultaneous prompting instruction in teaching a chained leisure skill (i.e., UNO card game) to middle school students with moderate to severe disabilities that included nontargeted information (i.e., science core content) as instructive feedback. Results showed that all participants met or made progress toward the mastery criterion on the leisure skill and two of the three participants acquired all four nontargeted information.

Peer tutoring also has been used to teach physical activity to students with disabilities. Peer tutoring in inclusive physical education encouraged students with disabilities to increase academic learning time in physical education (Depaepe, 1985; Klavina & Block, 2008; Webster, 1987; Wiskochil et al., 2007), to improve motor skill acquisition (e.g., catching the ball; Ward & Ayvazo, 2006), to increase moderate-to-vigorous physical activity levels (Lieberman et al., 2000; Temple & Stanish, 2011), and to increase motivation, self-efficacy and performance (Ensergueix & Lafont, 2010; d'Arripe-Longueville et al., 2002; Legrain et al., 2003). Despite the benefits of peer tutoring and the effectiveness of simultaneous prompting, limited research exists

investigating the effects of peer-delivered simultaneous prompting instruction on academic core content knowledge of students with disabilities within the context of physical education (Collins et al., 2021), and no such studies addressed English/Language Arts content. Peer support in physical education setting not only can provide high quality one-on-one support to students with mild to moderate intellectual disability, but also can be practical in a large physical education class without additional cost. According to the previous studies (Britton et al., 2017; Heinrich et al., 2016), trained peer tutors successfully delivered a simultaneous prompting procedure because this procedure was easy to implement. In addition, there is a need for high quality single-case design studies using peer tutoring approaches with students with disabilities in physical education (Kalef et al., 2013).

Purpose and Research Questions

Based on the need for more research and the potential benefits of a peer-delivered simultaneous prompting procedure in teaching academic core content combined with physical activity, the purpose of this dissertation study was to determine the effects of a peer-delivered simultaneous prompting procedure to teach academic core content (i.e., locative prepositions; English/Language Arts) combined with movement skills (i.e., run, hop, gallop, leap, and slide) to students with mild to moderate intellectual disability. This study sought to answer the following primary research questions.

1. What are the effects of a peer-delivered simultaneous prompting procedure on the acquisition of academic core content knowledge (i.e., locative prepositions) of students with mild to moderate intellectual disability?
2. What are the effects of a peer-delivered simultaneous prompting procedure on the acquisition of movement skills of students with mild to moderate intellectual disability?

3. What are the effects of a peer-delivered simultaneous prompting procedure on the generalization of the acquired core content knowledge to new materials in classroom setting?

In addition, this study aimed to address four secondary research questions.

1. To what extent do peer tutors implement the simultaneous prompting procedure with high levels of procedural fidelity?
2. What are the teachers' opinions on the procedures and outcomes of the intervention?
3. What are the peer tutor's opinions on the procedures and outcomes of the intervention?
4. What are the target students' opinions on the procedures and outcomes of the intervention?

Significance

This study is important because it will contribute to the body of literature addressing a peer-delivered simultaneous prompting procedure and combining core content with physical activity in the following ways. First, although many studies have demonstrated the effectiveness and efficiency of a simultaneous prompting procedure when embedding nontarget information into the target activity (Heinrich et al., 2016; Karl et al., 2013; Tekin-Iftar et al., 2003), there is limited research incorporating academic core content and physical activity for students with intellectual disability (Collins et al., 2021; Park et al., 2021). This study will provide valuable insight on how to combine academic core content standard and physical activity using a simultaneous prompting procedure for students with mild to moderate intellectual disability.

Second, although peer tutoring has been used in adapted physical education, none of the previous single-case studies reviewed by Kalef et al. (2013) met all 20 quality indicators and only one study (i.e., Houston-Wilson et al., 1997) involved systematic instruction, namely

system of least prompts procedure. This dissertation was designed to address the quality indicators outlined by CEC (2014) and What Works Clearinghouse (WWC, 2022). In addition, there is limited research showing the effectiveness of teaching core content combined with physical activity using a peer-delivered simultaneous prompting (Collins et al., 2021; Park et al., 2021). Through the peer tutors' social validity data, this study will provide the peer tutors' perceptions on their experience teaching and interacting with students with mild to moderate intellectual disability, which may provide further evidence to show the effects of peer tutoring on social interactions between peer tutors and students with disabilities.

Third, teaching locative prepositions can be beneficial as students with mild to moderate intellectual disability engage in physical activity or team sports. For example, individuals may need the knowledge of locative prepositions to engage in effective team sports (e.g., "pass the ball to the right over your teammate") and such knowledge can promote their engagement in those activities with their peers. In addition, prepositions are important parts of conventions of standard English that all students need to learn according to Common Core Standards and learning prepositions is an important communication and language skill (Coventry & Garrod, 2004).

Finally, according to a neuropsychological perspective and previous studies (Westendorp et al., 2011; Wuang et al., 2008), it is evident that there is a positive relation between motor ability and academic performance of individuals with intellectual disability, and there is a need for well-developed interventions to facilitate both motor ability and academic achievement. This study attempts to address both academic performance and motor skills of students with intellectual disability by directly teaching academic content combined with physical activity.

Delimitations of this Study

There are several delimitations to this study. First, the selection of target students will be based on teacher nomination in a rural elementary school. All target students will have mild to moderate intellectual disability. Due to the nature of single-case research, generalization to other populations and setting can be difficult to infer (Baer et al., 1968; Stokes & Baer, 1977). Therefore, further replications will be essential to determine the effects of a peer-delivered simultaneous prompting procedure in a physical activity on the acquisition of both academic core content and motor skills of students with different disabilities, with different age groups, and across different settings (e.g., urban setting).

Second, although this study will examine the effects of a peer-delivered simultaneous prompting procedure on the acquisition of both academic core content and motor skills, this study will focus on teaching academic core content to students with mild to moderate intellectual disability. Because it may be difficult for students with an intellectual disability to learn core content knowledge while they are learning motor skills simultaneously (Park et al., 2021), peer tutors will focus on teaching academic core content standard and will utilize physical activity as a motivation for target students to be engaged in the learning. Similarly, the target students will learn specific locative prepositions, which are parts of speech that communicate a positional relationship between objects (Tyler & Evans, 2003), as the target academic content; therefore, data will be interpreted within this context. Third, I will conduct the intervention at the gym of the target elementary school. Although classroom-based physical activity has been used as a way to integrate physical activity with academic concepts in the classroom setting to increase not only physical activity level but also academic achievement of elementary students (Kibbe et al., 2011), it will be difficult to implement a peer-delivered simultaneous prompting procedure

combined with physical activity in the classroom because many factors (e.g., classmates, setting, teachers, content) can affect reliability and validity of this study.

Definition of Terms

The following terms will be important to understand within the context of this dissertation. This section includes definitions of these terms.

Academic core content. The appropriate content standards for each grade or proficiency level to provide a uniform set of learning standards for every public school; content areas may include Arts Education, CTE and Career Pathways, Computer Science, English Language Arts, English Language Development, Guidance, Healthful living, Information and Technology, Mathematics, Science, Social Studies, and World Languages.

Constant time delay. A type of response prompting procedures; uses single controlling prompt delivered after a preset interval that remains at constant interval across sessions (Snell & Gast, 1981; Touchette, 1971; Walker, 2008).

Functional skills. Skills that everyone needs in our lives related to communication, choice making, safety, self-care, leisure and recreation, and vocational skills.

Generalization. A behavioral change may be said to have generality if it proves durable over time, if it appears in a wide variety of possible environments, or if it spreads to a wide variety of related behaviors (Baer et al., 1968)

Graduated guidance. A type of response prompting procedures; uses various levels of physical guidance as needed on moment-to-moment basis (Wolery et al., 1992).

Instructional feedback. Presenting extra information following students' responses during direct instruction. Students are not expected to respond to this information (Werts et al., 1996).

Intellectual disability. Intellectual disability means significantly subaverage general intellectual functioning, existing concurrently [at the same time] with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance. Intellectual disability comprises four categories based on IQ scores, including IQ 50 to 70 referring to mild intellectual disability, IQ 35 to 49 referring to moderate intellectual disability, IQ 20 to 34 referring to severe intellectual disability, and IQ lower than 20 referring to profound intellectual disability (IDEA, 2004).

Most-to-least prompting. A type of response prompting procedures; uses most-to-least intrusive prompt hierarchy across sessions (e.g., physical, model, verbal, independent; Demchak, 1989).

Motor skill. A motor skill is a learned ability to cause a predetermined movement outcome with maximum certainty (e.g., walking, running, and riding a bike).

Nontargeted information. Additional stimulus that is not targeted for direct instruction; learners are not asked to respond to the additional stimulus and are not reinforced if they do (Werts et al., 1995).

Peer-delivered instruction. Instruction delivered by peers with the support of the classroom teacher. The classroom teacher's role changes from delivering instruction to establishing, monitoring, and improving peer-teaching activities (Utley et al., 1997).

Peer support. Peer support arrangements involve one or more students without developmental disabilities providing social and/or academic support to a classmate with a disability in a general education classroom (Carter & Kennedy, 2006)

Peer tutoring. Instructional content is delivered by a student instead of a teacher (Olson & Platt, 2000).

Physical activity. Bodily movement that is produced by the contraction of skeletal muscles and that substantially increases energy expenditure. Physical activity can be defined in terms of its frequency, duration, and intensity (CDC, 2013).

Procedural fidelity. Procedural fidelity refers to the degree to which a research plan was implemented as intended, and has long been considered an important component of behavioral research (Billingsley et al., 1980; Horner et al., 2005; Wolery, 2011).

Progressive time delay. A type of response prompting procedures; uses single controlling prompt delivered after a preset interval that increases progressively across sessions (Walker, 2008).

Response prompting procedure. A specific type of systematic instruction, which consists of three basic components including the antecedent, the behavior, and the consequence, that reflects the principles of applied behavior analysis. Six specific and distinct response-prompting procedures include (a) graduated guidance, (b) most-to-least prompting, (c) system of least prompts, (d) progressive time delay, (e) constant time delay, and (f) simultaneous prompting. (Collins, 2012).

Simultaneous prompting. A type of response prompting procedures; uses daily probe trials to assess student learning, followed by daily training trials using single controlling prompt delivered after a 0-s delay interval (Gibson & Schuster, 1992; Morse & Schuster, 2004).

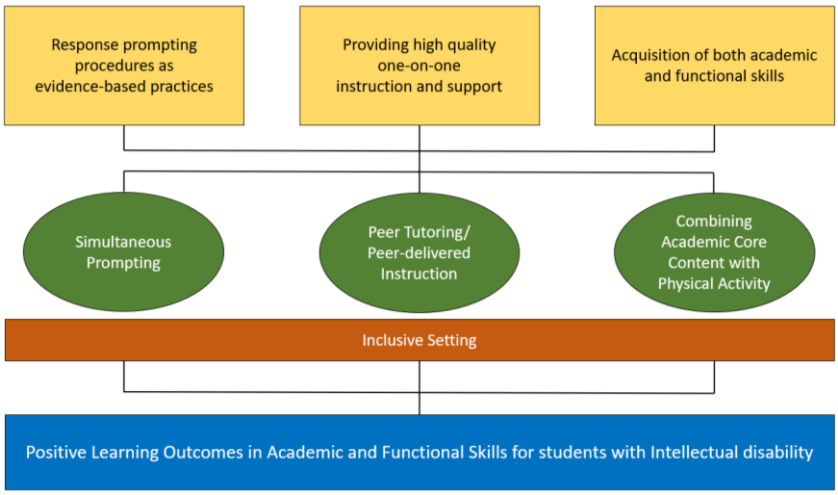
System of least prompts. A type of response prompting procedures; uses least-to-most intrusive prompt hierarchy within sessions (e.g., independent, verbal, model, physical; Doyle et al., 1988).

CHAPTER 2: REVIEW OF LITERATURE

This chapter will include a detailed synthesis of relevant literature that provides the rationale and framework for conducting the present study. The purpose of this study was to examine the effects of a peer-delivered simultaneous prompting procedure to teach academic core content to students with mild to moderate intellectual disability when combined with physical activity. To encourage students with intellectual disability to have positive learning outcomes in academic and functional skills in inclusive academic setting, it is necessary to deliver effective evidence-based interventions including simultaneous prompting, peer tutoring, and activity-based instruction. Simultaneous prompting procedure is not only effective but also easy to teach academic core content. Peer tutoring can have benefits in social interactions between peers with and without a disability and can provide high quality one-on-one instruction and support to students with intellectual disability. Figure 1 below reflects the logic model that outlines the conceptualization of this study and shows how this chapter is organized.

Figure 1

Logic Model



The first section of this chapter addresses the foundation of response prompting procedures including various types of response prompting procedures and their implementation. It also includes description of literature supporting the effectiveness of response prompting procedures, particularly the simultaneous prompting procedure in teaching either discrete or chained tasks to students with disabilities. The second section consists of literature showing how peer tutoring/peer-delivered instruction was implemented combined with response prompting procedures, and in the inclusive physical education setting. Finally, the last section includes the rationale of combining academic core content with physical activity and the research supporting the combination of academic core content and physical activity in school settings.

Response Prompting Procedures

Response prompting procedures, such as constant time delay, system of least prompts, and simultaneous prompting, are evidence-based practices, which are based on the principles of applied behavior analysis (Collins, 2012). To implement response prompting procedures effectively in educational settings, it is important to understand what components are included in response prompting procedures and how controlling prompts are delivered. According to Collins et al. (2018), basic components of response prompting procedures consist of an attentional cue, an instructional stimulus (e.g., task direction), a response, and a consequence. Before delivering any type of response prompting procedures, it is important to secure a learner's attention by using either a general (e.g., Let's begin instruction") or a specific (e.g., "If you are ready to learn, put your hand in the air") attentional cue. After securing the learner's attention, the instructor presents an instructional stimulus, which may be verbal, signed, written, or pictorial. Controlling prompts (e.g., independent, verbal, model, and physical) are inserted between the stimulus and the learner's response to assist the learner in performing a correct response and to receive a

positive consequence. Response prompting procedures provide an effective way to teach core content and functional skills to students with moderate and severe disabilities (Collins, 2007). There are six types of response prompting procedures depending on how and what controlling prompts are delivered, and they include (a) system of least prompts, (b) most-to-least prompting, (c) graduated guidance, (d) constant time delay, (e) progressive time delay, and (f) simultaneous prompting.

The purpose of the dissertation study was to examine the effects of using a peer-delivered simultaneous prompting procedure to teach academic core content embedded in the physical activities to students with mild to moderate intellectual disability in inclusive settings. Before providing an in-depth literature review on the simultaneous prompting procedure, I present a brief review on other response prompting procedures used to teach core content and functional skills to students with disabilities.

System of Least Prompts

The system of least prompts procedure involves the use of least-to-most prompts hierarchy as controlling prompts (e.g., independent, verbal, model, and physical) within sessions. The system of least prompts can be used to teach chained tasks where a learner can complete known steps but wait for assistance on unknown steps. In addition, this procedure is also suited for students with lower learning pace (Collins et al., 2018). Implementation steps of system of least prompts include: (a) securing a learner's attention and delivering task direction; (b) waiting a preset number of seconds (e.g., 3 s) for the learner to respond independently; (c) if the learner responds incorrectly or there is no response, providing the least prompt (e.g., verbal); (d) if no response or if the learner makes an error again during the preset time period (e.g., 3 s), repeating the previous step using the next level of prompt (e.g., model); (e) continuing until the learner can

respond independently; and (f) delivering verbal praises (Doyle et al., 1988). The system of least prompts is considered as a near errorless procedure in teaching new skills by providing the least intrusive prompts necessary (Collins, 2007).

Research has demonstrated the effectiveness of system of least prompts on discrete responses and chained tasks, including community and daily living, social and leisure, vocational, self-care, and motor skills across individuals from preschool to adult with intellectual disability and autism spectrum disorder. First, system of least prompts has been effective in teaching nonacademic content, including play behaviors for young children with disabilities (Bateman & Schwartz, 2022; Qiu et al., 2019). For example, Bateman and Schwartz (2022) evaluated the effects of implementation of the system of least prompts to teach pretend play skills to three preschoolers with autism spectrum disorder in an inclusive preschool program. The dependent variable was engagement in functional pretend play behaviors (e.g., driving a fire truck, using a wooden block as a car) during free choice. Participants were given the opportunity to play independently. If they did not play independently or functionally, the interventionist provided least to most prompts with the hierarchy including independent, providing a choice, model prompts, and hand-over-hand prompts as a controlling prompt. Using a multiple baseline across participants design, researchers found that the intervention of system of least prompts increased participants' functional pretend play behaviors. Qiu et al., (2019) also showed the improvement of independent play behaviors of four young children with disabilities with the implementation of system of least prompts.

In addition, Manley et al. (2008) used the system of least prompts to teach two telephone skills to three elementary students with cognitive disabilities. The two telephone skills included (a) placing phone calls (i.e., 12 steps), and (b) leaving recorded voice mail messages (i.e., 11

steps). Researchers used a multiple probe design with probe trials across participants to assess the effectiveness of the system of least prompts procedure in teaching the targeted functional skills. The classroom teacher implemented the procedure and delivered hierarchy of prompts (i.e., a direct verbal prompt, a direct verbal plus model prompt, and a direct verbal plus physical prompt) with high procedural reliability. Results demonstrated that all three participants met the criterion of 100% steps of both tasks for 3 days and two of the participants maintained acquired skills for both tasks over time, however, none of participants generalized their skills acquired through the system of least prompts procedure across settings (e.g., fast food and buffet restaurants, public library, grocery stores, discount department stores, speech therapy room, cafeteria, office) and materials (e.g., nontrained telephones).

Second, researchers have implemented system of least prompts as part of an intervention package to support the functional skill development of students with disabilities. Slocum and Ault (2022) examined the use of video modeling and the system of least prompts in teaching individuals with intellectual disability to participate in a community activity. Participants were three students with intellectual disability (ages 12–23 years old) who regularly attended a faith community. Researchers used a multiple probe across behaviors design replicated across participants. The dependent variable was the percentage of independent responses on steps of the task analyses. Task analyses varied depending on participants (e.g., participating as a congregant during worship services, participating as a server, and putting the prayer shawl on correctly and saying the blessing). During the intervention, the interventionist used a video model of the entire task presented immediately prior to performing the task combined with a system of least prompts. Results showed that all participants reached the mastery criterion on all three task

analyses within a faith community setting. In addition, all participants generalized their knowledge and skills learned from the intervention in other settings.

Similarly, Reyes et al. (2022) used video self-modeling and system of least prompts to teach three transitional routines to an 8-year-old student with Down syndrome who had extensive support needs in inclusive settings. The dependent variables were the percentage of steps completed independently in both a transitional school routine in classroom/school settings and a transitional routine in special area classes. Participant watched a video self-model prior to the transition and during the transition, with support from the researcher who provided a least to most prompts hierarchy if the participant did not perform a step independently in 5–10 s. Results of this multiple probe across routines design showed a functional relation between the intervention package and dependent variables.

Third, there was evidence on the effectiveness of system of least prompts on academic skills of students with disabilities. Hudson et al. (2014) examined the effects of a system of least prompts intervention delivered by peers on listening comprehension for students with moderate intellectual disability. Three upper elementary students with moderate intellectual disability and two peer tutors without disabilities participated in the study. The researchers used a multiple probe design across participants design to determine the degree to which the system of least prompts improved the number of points for correct comprehension responses and independent correct comprehension. The hierarchy of prompts was (a) reading the text again, (b) reading the sentence that contained correct answer again, (c) saying the correct answer, and (d) saying and pointing to the correct response option on the response board. Results showed that all participants' correct and independent correct responses increased after receiving the intervention.

In sum, the system of least prompts procedure was effective in teaching core content and functional skills to students with disabilities (Bateman & Schwartz, 2022; Hudson et al., 2014; Manley et al., 2008; Qiu et al., 2019; Reyes et al., 2022; Slocum & Ault, 2022). A benefit of the system of least prompts is that it allows students to respond independently by providing the least controlling prompt first (Collins, 2007).

Most-to-Least Prompting

The most-to-least prompting involves using instructive prompt hierarchy with most to least prompts across sessions (e.g., physical, model, verbal, and independent). Implementation steps of most-to-least prompting include: (a) securing a learner's attention and delivering task direction; (b) immediately using most instructive prompt necessary for the learner to perform correct response, praising all correct responses; (c) after several sessions, moving to next-less-instructive prompt level in hierarchy; (d) repeating step c; (e) continuing until the learner can respond independently; and (f) delivering verbal praises (Demchak, 1989).

Most-to-least prompting is effective in teaching new skills (both functional and academic skills) to students with disabilities because the most prompt will be delivered to assist the students to respond correctly. Rakap and Balikci (2017) used the most-to-least prompting to teach three functional skills to a child with autism during ongoing classroom activities, routines, and transitions in a preschool program. The participant was nonverbal and used a picture schedule. The targeted functional skills included using pictures to request, using a spoon to eat, and removing coat and putting it in the cubby. The researchers used a hierarchy of the most-to-least prompting, consisted of hand-over-hand assistance, hand-over-wrist assistance, and hand-over elbow assistance. Results from this multiple probe design study showed that the participant learned and maintained all three behaviors at a high level of independent performance.

Yilmaz et al. (2010) examined the effects of most-to-least prompting on teaching simple progression swimming skill for three 9-year-old boys with autism. Researchers used a multiple baseline across participants design to investigate the effectiveness of the intervention. Results indicated that all participants improved their swimming skill after receiving the most-to-least prompting procedure. During the baseline condition, none of the participants completed at least one step of the task analysis; whereas during the intervention condition, all participants completed all steps of the task analysis successfully. All participants also maintained the swimming skill for 4 weeks.

In addition to improved functional skills, most-to-lease prompting has also resulted in increased academic skills in students with disabilities. Axe et al. (2022) compared the effects of functional communication training and most-to-least prompting on the levels of problem behavior and academic learning of an 11-year-old Caucasian female with Down syndrome. Dependent variables were the percentage of 10-s intervals with problem behavior (i.e., throwing objects and hitting) and the frequency of non-physically prompted academic responses (i.e., picking up a puzzle piece and putting it into the correct space in the puzzle). In an ABCBC multiple treatments design, data showed the participant's problem behaviors decreased under the presence of both interventions, whereas academic responses increased more when most-to-least prompting was delivered. Furthermore, Davenport and Johnston (2014) used most-to-least prompting to teach numeracy skills to three preschool children with disabilities in a multiple baseline across participants design. Results showed that all participants acquired numeracy skills during the intervention condition. In addition, all participants maintained their skills until the research ended and generalized the skills to a different adult (i.e., the classroom teacher) successfully.

The above studies showed that most-to-least prompting was effective in teaching children with disabilities functional skills (Rakap & Balikci, 2017), swimming skills (Yilmaz et al., 2010), and numeracy skills (Davenport & Johnston, 2014), and in decreasing problem behaviors of individuals with disabilities (Axe et al., 2022). Because most-to-least prompting uses the most instructive prompt necessary for a learner to perform correct response, this procedure has been used effectively to teach a number of chained tasks (e.g., leisure skills, Vuran, 2008; learning pedestrian skills, Batu et al., 2004; food preparation skills, Kayser et al., 1986; banking skills, McDonnell & Ferguson, 1988).

Graduated Guidance

Graduated guidance uses various levels of physical guidance as needed on a moment-to-moment basis and begins with the greatest degree of assistance necessary for the individual to complete a task. After delivering the most physical prompts, the degree of assistance will be faded to the least physical prompts (e.g., hand to wrist to arm to elbow or full physical, partial physical, and shadowing; Demchak, 1989). Unlike most to least prompting, if the individual fails to respond or begins to make an error, an instructor can move up to a level of the physical guidance needed to make correct response (Collins et al., 2018). Due to the characteristic of graduate guidance, this procedure has been used to increase the behavioral repertoires of students with disabilities.

Gruber and Poulson (2015) implemented graduated guidance to teach yoga poses to children with developmental delays. The participants were two boys and one girl with autism spectrum disorder. Researchers used a multiple baseline across participants design. The dependent variable was the independent repeating yoga poses modeled on the DVD. While the DVD was playing, parents of participants delivered the graduated guidance to teach yoga to their

child. Results demonstrated that there was a functional relation between the dependent variable and the intervention. In another study, Ivy et al. (2018) used graduated guidance to teach spoon use to children with severe multiple disabilities, including visual impairment. Researchers recruited three children with severe multiple disabilities. The dependent variable was the independent completion of steps of spoon usage (i.e., hold, put to bowl, scoop, raise, bite, and lower). Researchers used a multiple probe across participants design. Researchers provided full physical guidance with verbal prompts to teach all steps of the task analysis of spoon usage. Results showed that all participants performed the task analysis independently more during the intervention phase compared to the baseline phase, however, all participants failed to reach100% accuracy of the task analysis.

The graduated guidance was also used to teach students with intellectual disability. Jimenez and Alamer (2018) examined the effects of graduated guidance on iPad accessibility skill acquisition for three high school students with severe intellectual disability in a multiple probe across participants design. The dependent variable was iPad accessibility skills. Each participant was to learn two skills (i.e., pinch in and pull out for participant 1; double tap and drag images for participant 2; pinch in and drag images for participant 3). Researchers faded the graduated guidance from full finger support, light finger support, and hand as shadow support to independent. Results indicated that all participants acquired iPad accessibility skills with 100% accuracy.

The above studies supported that the graduated guidance was an effective way to teach chained tasks (e.g., yoga, Gruber & Poulson, 2015; spoon usage, Ivy et al., 2018; iPad accessibility skills, Jimenez & Alamer, 2018) to students with an intellectual disability and autism spectrum disorder.

Time Delay

Time delay consists of constant time delay and progressive time delay. Constant time delay uses a single controlling prompt delivered after a preset interval that remains at constant interval across sessions, whereas progressive time delay uses a single controlling prompt delivered after a preset interval that increases progressively across sessions (Snell & Gast, 1981; Walker, 2008). The term, time delay, was first described by Touchette (1971) as a way to teach visual discrimination tasks to students with severe disabilities. The time delay procedure has been used as an effective and a nearly errorless learning procedure. Because time delay requires using only a single controlling prompt instead of using hierarchy of prompts (e.g., most to least prompting, system of least prompts), teachers or implementers may select this procedure if they are equally effective in teaching a particular task (Collins et al., 2018). Implementation steps of time delay include (a) securing a learner's attention, (b) delivering task direction, (c) immediately delivering a prompt, (d) delivering task direction and waiting a predetermined interval (e.g., 3 s) for the learner to respond independently (i.e., constant time delay), (d) delivering task direction and waiting progressively increased number of seconds across sessions (e.g., 1 s during second session, 2 s during third session, 3 s during all subsequent sessions) for the learner to respond independently (i.e., progressive time delay), (e) delivering a controlling prompt, and (f) delivering verbal praises on correct responses (Walker, 2008). Both time delay procedures are evidence-based response prompting procedures that have been shown to be effective in teaching both discrete skills and chained tasks to students with moderate to severe disabilities across settings (Wolery et al., 1992). Whereas discrete tasks are defined by a fixed beginning and end, usually with a change of states (e.g., throwing a ball, pressing a button),

chained tasks have no clearly defined beginning and end (e.g., playing a basketball, steering a car, hand washing; Everitt et al., 2013).

Francis et al. (2020) implemented progressive time delay to teach peer imitation to three preschoolers with disabilities when they played with peers. Researchers recruited 18 peers who played with participants in the same place. A multiple probe across participants was used. The dependent variable was the frequency of unprompted peer imitation behaviors. Researchers provided a 0-s delay prompting first and then increased the delay interval to 3 s and 6 s. Results demonstrated a functional relation between the dependent variable and progressive time delay. In another study, Chen et al. (2001) investigated the effectiveness of a progressive time delay procedure in teaching gross motor skills to adults with a severe intellectual disability. Using a multiple probe design across three motor skills and replicated across participants, researchers used the progressive time delay procedure with a 0 s to 5 s delay to teach three motor skills, including tee-ball batting (8 steps), softball pitching (7 steps), and croquet striking (8 steps). Results showed that the progressive time delay procedure was effective not only in teaching three different motor skills to participants with a severe disability but also in maintaining the acquired skills. Finally, Agri and Batu (2020) examined the effectiveness of progressive time delay on teaching a pedestrian skill to three individuals (ages 10–11) with mild intellectual disability. The dependent variable was the percentage of correct steps of crossing the street (out of six steps). Progressive time delay was delivered with 0 s delay then moved to 2 s, 4 s, and 6 s delay. In the multiple probe across participants design, data showed that all participants acquired the target skill and maintained it after the intervention ended. Participants also were able to apply the skill to a real environment.

In addition to improving functional and independent skills in individuals with disabilities, research also has shown the effectiveness of time delay on improved academic skills. Collins et al. (2011) used a constant time delay procedure to teach core content of language arts, science, and math adding functional content (i.e., language arts: finding information in the news; science: cooking or dressing appropriately according to the weather; math: calculating sales tax). Three middle school students with functional mental disabilities ages 14–15 years old participated in this study, and the special education teacher and paraprofessional conducted all instructional sessions using the constant time delay procedure. Researchers used a multiple probe design across behaviors replicated across participants. The dependent variables were the percentage of correct responses on core content and functional content of language arts, science, and math. Results showed that all three participants met the mastery criterion for both contents in the language arts and science areas and one participant met criterion for both contents in math due to the time constraints. Rohena et al. (2002) compared between 4-s Spanish constant time delay strategy and 4-s English constant time delay strategy to examine their respective effectiveness in teaching English sight words. The participants of this study were four middle school students with moderate intellectual disability in an urban school. The experimental design was a multiple probe across participants with parallel treatments design. Results of the study showed that all participants responded 100% of correct sight words in Spanish constant time delay at least two sessions, while three participants responded 100% of correct sight words in English constant time delay at least three sessions. Both constant time delay procedures were equally effective regardless of the language.

More recently, Kroesch et al. (2020) implemented constant time delay to teach the pictorial sequencing of three social studies topics to two 18-year-old students. A researcher and a

special education teacher delivered the intervention combining constant time delay with the technology. Researchers used a single-case multiple probe across behaviors design to determine the effects of constant time delay. Dependent variables were percentage of steps independently sequenced and verbally stated for each topic. Topics consisted of rights of the bill of rights, policy making process, and how a president is elected. The interventionists first used 0 s delay with the gestural prompt to teach sequencing pictures to participants and verbal and gestural prompt to teach verbal explanation on sequences, then used 3 s delay with the same procedure of 0 s delay procedure. Results showed that there was a functional relation between the intervention and sequencing pictures.

In sum, existing literature shows that both time delay procedures are effective in teaching functional skills and core content to students with disabilities (Heckaman et al., 1998; Norman et al., 2001; Taylor & Harris, 1995). In addition, both time delay procedures allow students to respond independently by delivering a controlling prompt after a predetermined interval.

Simultaneous Prompting

Simultaneous prompting procedure consists of daily probe trials to assess a student's learning and daily training trials to deliver a controlling prompt. Implementation steps of daily training trials, which will be delivered after daily probe trials, include (a) securing a learner's attention, (b) delivering task direction, (c) immediately delivering a controlling prompt, and (d) providing verbal praises or error correction depending on the learner's response (Gibson & Schuster, 1992; Morse & Schuster, 2004). Simultaneous prompting involves delivering a prompt immediately following presentation of task direction and is an errorless teaching method (Gibson & Schuster, 1992). There is strong evidence supporting the effectiveness and efficiency of simultaneous prompting as a teaching procedure to teach not only discrete tasks (Collins et al.,

2007) but also chained tasks (Dollar et al., 2012) to individuals with disabilities. Ozen et al. (2017) used simultaneous prompting and computer-assisted instruction with four Turkish preschool students with developmental disabilities. Researchers used a multiple probe design across target skills, replicated across participants to examine the effectiveness of implementing simultaneous prompting procedure combined with computer-assisted instruction to teach participants to point to the pictures of household items. Target pictures for one member of a dyad is the nontargeted information for the second member of the dyad. Results showed that participants maintained and generalized their acquired knowledge across adult implementers. They also learned nontargeted information through observational learning. Moreover, simultaneous prompting has been used as an efficient way to deliver nontargeted information along with a target content (Collins, 2007). Nontargeted information is content that is not targeted for direct instruction although students may acquire at least some of this content from repeated exposure through observational learning (e.g., Falkenstine et al., 2009) or through its presentation as instructive feedback at the end of instructional trials (Collins et al., 2019).

Discrete Tasks

Studies have shown the effectiveness of the simultaneous prompting procedure in teaching discrete tasks to students with moderate and severe disabilities since the early 1990s (Schuster et al., 1992). For example, Collins et al. (2007) compared three instructional formats using simultaneous prompting with verbal prompts and two types of content (i.e., functional content, core content) in teaching sight words to students with cognitive disabilities. The participants were four students with moderate to severe disabilities across elementary, middle, and secondary schools in the same rural county. The dependent variables were the percentage of correct responses of functional content sight words and the percentage of correct responses of

core content sight words. Simultaneous prompting procedure was delivered across three types of instructional format (i.e., massed trials, distributed trials, embedded trials) to teach one set of words (i.e., one functional sight word and one core content sight word per set). Special education teachers conducted the simultaneous prompting procedure with massed trials in the special education resource room. In massed trials, teachers taught one set of words several times with short pauses (i.e., 0 to 8 s) between trials. Teachers conducted the simultaneous prompting with distributed trials and embedded trials in the general education classroom. In distributed trials, there was long breaks (i.e., 10 s to several minutes) between trials. Embedded trials were used to teach one set of words by embedding words in the general education curriculum. Collins et al. used an adapted alternating treatments design replicated across three instructional conditions and across four participants. Results showed that all participants reached criterion on both core content and functional content sight words for one day, regardless of the instructional setting or format, and three older participants maintained their learning over 3 months; however, the differences of the effects of simultaneous prompting procedure across three instructional conditions were minimal.

Aljohani et al. (2022) implemented simultaneous prompting to teach three children with autism spectrum disorder to expressively label pictures of sports teams or cartoon characters. Researchers used a parallel treatment design nested in a multiple probe session to compare the effectiveness of between simultaneous prompting procedure and error correction procedure. Results showed that both procedures were effective in teaching expressive labels to the participants. Most recently, Aldosiry (2023) taught five students with intellectual disability letter-sound correspondence and number recognition using the combination of simultaneous prompting and constant time delay. Participants were five female students with mild or moderate

intellectual disability. In this concurrent multiple probe across participants design, data showed that all participants acquired their target skills, and three participants maintained their skills with 100% accuracy whereas two participants met more than 90 % accuracy.

In another study, Waugh et al. (2009) examined the effectiveness of simultaneous prompting to teach letter-sound correspondences and blending skills to read CVC and CVCC words to three elementary students with moderate intellectual disability. Researchers used a changing criterion design replicated across participants. The dependent variables were the number of correct responses on letter-sound correspondences and the number of correct reading of new words consisting of these letters. The intervention condition was divided by five sets that included 3, 5, 7, 8, and 10 sounds and 1, 2, 3, 4, and 5 instructional words, respectively. Results of this study showed that all students were able to identify letter-sounds and to blend the sounds to read instructional words correctly. In addition, during the generalization condition, all students were able to read at least one novel word.

In addition to being effective, the simultaneous prompting procedure has been found to be more efficient when compared with the constant time delay procedure. For example, Head et al. (2011) compared simultaneous prompting and constant time delay procedures to examine the effectiveness and efficiency in teaching state capitals to high school students with learning and mild intellectual disability. The participants were four males whose IQs ranged from 73 to 103. The experimental design was an adapted alternating treatments design nested within a multiple probe design. Researchers measured effectiveness as the percentage of correct responses of state capitals and collected efficiency data regarding the number of sessions for reaching criterion, the number and percent of daily probe errors, and the amount of time required to reach criterion. Results of the study indicated that both procedures were effective to teach state capitals to the

participants, but simultaneous prompting was slightly more efficient than the constant time delay procedure because of fewer errors occurred during instructional and maintenance phases.

The above studies supported that the simultaneous prompting procedure was an effective way to teach discrete tasks (e.g., sight words, letter-sound correspondences and blending skills, state capitals, and labeling) to students with an intellectual disability and autism spectrum disorder. Additionally, the simultaneous prompting procedure was shown as an efficient intervention that helped students to reach criterion faster than the constant time delay procedure (Head et al., 2011).

Chained Tasks

Simultaneous prompting also has been used effectively to teach chained tasks due to its ease of implementation using a controlling prompt and to promote errorless learning (Schuster et al., 1992). Fetko et al. (1999) examined the effects of simultaneous prompting on the completion of a chained vocational task of four young adults with severe intellectual disability who attended an in-school vocation training program. The age of participants ranged from 17 to 20 years old, and their IQ scores ranged from 25 to 36. During training session using a simultaneous prompting procedure, participants were taught to open a locker secured with a keyed lock including 15 steps. Researchers used a multiple probe across participants design to assess if the simultaneous prompting procedure was effective in teaching the chained task to the participants. Results showed that three out of the four participants reached criterion during the intervention session and they maintained their learning with 100% accuracy during the subsequent school year. Furthermore, all four participants generalized the skill and were able to apply to different lockers and locks. Similarly, Maciag et al. (2000) also used a simultaneous prompting procedure to teach a vocational skill to adults with moderate and severe intellectual disability. Ten adults

(five with moderate intellectual disability, five with severe intellectual disability) who worked in a vocational training center participated in this study. Ten participants were grouped in pairs based on similarities of skills including their job flexibility skills, ability to work with one another, and their adaptive behavior skills. The research team used a multiple probe across participants design to determine the effectiveness of the intervention. Participants were taught to use a 15-step vocational process to construct shipping boxes using a glue adhesive. Results showed that four of the five dyads met the criterion with 100% accuracy during the intervention probe sessions.

In another study, Dollar et al. (2012) implemented simultaneous prompting to teach chained tasks to two adults (i.e., a 24-year-old female, a 62-year-old male) with severe intellectual disability at their home environment in a one-on-one format. The female participant was taught three leisure skills including (a) five steps of task analysis for using an iPod, (b) seven steps of task analysis for using a CD player, and (c) 14 steps of task analysis for operating a DVD player. The male participant was taught three independent living skills including (a) five steps of task analysis for folding T-shirts, (b) four steps of task analysis for hanging pants, and (c) three steps of task analysis for folding underwear. To examine the effects of simultaneous prompting, the researchers used a multiple probe design across three behaviors for each participant. Results indicated that both participants reached mastery for all of the targeted skills and maintained the skills 1, 2, and 4 weeks after simultaneous prompting was terminated.

In addition to improving leisure and vocational chained skills, researchers have demonstrated the effectiveness of simultaneous prompting on supporting academic chained skills of students with disabilities. Creech-Galloway et al. (2013) examined the effects of a simultaneous prompting procedure (with verbal and physical prompts) presented on an iPad to

teach the 32-step task analysis for solving a problem with the Pythagorean Theorem (i.e., “Use the Pythagorean theorem to solve for ‘c,’” when presented with a picture of a right triangle with side ‘a’ and side ‘b’ values) to students with moderate and severe disabilities. Four students with moderate intellectual disability aged from 15 to 17 participated in the study. In this multiple probe across participants design study, data showed that all participants had 0% levels of responding prior to intervention and three of the four participants reached the mastery criterion (i.e., 100% in three sessions). All participants responded 100% correctly during the maintenance condition.

More recently, Heinrich et al. (2016) used simultaneous prompting with verbal prompts to teach both discrete skills (i.e., math shapes, computer and biology, sight words) and chained skills (i.e., mathematical equations, Internet search, and Punnett square) of the STEM (science, technology, engineering, and math) content to three high school students with moderate intellectual disability in an inclusive setting. Each participant was taught one discrete skill and one chained task based on their individualized education program (IEP) goals (e.g., identify geometric figures and solve linear equation in one variable, using technology to publish and research a topic on the Internet, identify meaning of vocabulary words and fill out Punnett square). Two paraprofessionals and a peer tutor implemented the simultaneous prompting procedure in the general education classroom. The research design was a multiple probe across participants design, with concurrent demonstration across two skills (i.e., discrete and chained skills) per participant. Results showed that all participants reached criterion for their targeted discrete task and chained task during intervention sessions and maintained their skills at 100% criterion for one month after the end of the intervention session.

The aforementioned studies supported the effectiveness of the simultaneous prompting procedure in teaching chained tasks (e.g., a vocational skill, a leisure skill, an independent skill, a math skill) to students with moderate and severe intellectual disability. In addition, simultaneous prompting can be implemented effectively by either paraprofessionals or peers (Heinrich et al., 2016).

Embedding Nontargeted Information into Target Content

According to Collins (2007), embedding nontargeted information in the target content or activity is an effective way to increase the efficiency of simultaneous prompting procedure by teaching both content during the same time. In the traditional sense, the nontargeted information has been presented at the end of the instruction to teach students to spell sight words they were taught to read (Gast et al., 1991), to define words while teaching to read (Shelton et al., 1991), and to state additional factual information related to the target information (Wolery et al., 1991). Tekin-Iftar and colleagues (2003) examined the effects of a simultaneous prompting procedure on the expressive identification of first aid materials and instructive feedback regarding the reasons of the first aid materials usage to middle school students with mild intellectual disability. The participants of this study were three students attending a public special school and the teacher conducted all probe sessions (i.e., full probe sessions and daily probe sessions) and daily training sessions in a one-on-one setting. Researchers used a multiple probe design across three first aid material sets and replicated this process with all participants. Each set consisted of three first aid materials (e.g., plaster, bandage, and thermometer) and three instructive feedback (e.g., “We put the plaster and gauze on the cut,” “We wrap the bandage around the injured area,” and “We take our temperature with the thermometer”). Results of the study showed that all participants met criterion (i.e., 100% correct responding for 3 consecutive days) on all three sets

of first aid materials during the intervention and maintained their learning with 100% accuracy 1, 2 and 4 weeks after instruction. Two participants also maintained all instructive feedback with 100% accuracy.

In another study, Fetko et al. (2013) used a peer-delivered simultaneous prompting procedure to teach science core content embedded in a chained leisure skill (i.e., UNO card game). Three middle school students with moderate to severe disabilities (ages from 12 to 14 years) and three middle school peers without disabilities participated in the study. The science core content included the following: (a) a host is an organism in which a parasite lives; (b) a meter is the basic unit for volume in the Metric system; (c) and asteroid is a giant, rocky ball of ice that orbits the sun; and (d) chromosomes are threadlike structures in the nucleus that contains genetic information. A chained task of playing UNO consisted of seven steps, including (a) cut deck in half, (b) shuffle cards, (c) deal seven cards to each player, (d) remain cards middle, (e) flip first card, (f) wait for turn, and (g) lay down card or draw. Researchers used a multiple probe design across students to examine the effects of a peer-delivered simultaneous prompting procedure in teaching the targeted chained leisure skill. Peer tutors delivered the simultaneous prompting procedure using verbal and gesture prompts. Results showed that two of the three participants met 100% of criteria during intervention and maintained their skill for 15 sessions and 5 sessions, respectively, after the intervention ended. The remaining participant showed progress but did not meet the criterion by the end of the school year.

Another way to embed nontargeted information into target content is to teach targeted academic core content within functional activities that are related to core content. For example, Karl et al. (2013) used a simultaneous prompting procedure to teach targeted core content in reading (i.e., interpreting the meaning of jargon, dialect, or specialized vocabulary of a passage),

math (i.e., calculating the math problems related to percent), and science (i.e., describing the effects of forces) within the functional activity of baking a cake to secondary level students with moderate intellectual disability. The participants were three males and one female ages 15–18 years old with functional mental disabilities. The classroom teacher conducted the simultaneous prompting procedure using verbal and model prompts during daily training sessions by simulating cooking activities to teach core content in: (a) reading, by learning specialized vocabulary on the back of cake mix boxes; (b) mathematics, by calculating the price of the groceries; and (c) science, by describing the laws of motion through a cooking activity. The dependent variable was the percent of correct responses of the target core content. The researchers used a multiple probe design across behaviors replicated across participants. All participants reached criterion in targeted core content and reached 100% accuracy during a generalization session across materials and settings, and three participants reached 100% during maintenance probe sessions. However, researchers did not measure the participants' acquisition of the functional activity (i.e., nontargeted information).

In conclusion, the simultaneous prompting procedure has been used to not only teach both targeted core content and nontargeted core content simultaneously, but also teach academic core content within functional activities. Embedding nontargeted information into the target information or the target instruction encourages participants to learn more than one content and has a positive effect on promoting the learning of the target content (Karl et al., 2013); however, more studies are needed to implement the simultaneous prompting procedure to combine various academic core content (e.g., Mathematics, English/Language Arts, Science) with physical activity. Additionally, using peer-mediated simultaneous prompting may offer both academic

and social benefits as an effective strategy for teaching students with disabilities (Jimenez et al., 2012; Kalef et al., 2013).

Summary

There is a growing body of research to support the effectiveness and efficiency of the simultaneous prompting procedure. Simultaneous prompting procedure is one type of response prompting, which is an evidence-based practice, based on applied behavior analysis (Collins et al., 2018). Simultaneous prompting has been used to teach both discrete tasks (e.g., sight words, Collins et al., 2000; letter-sound correspondences and blending skills, Waugh et al., 2009; and state capitals: Head et al., 2011) and chained tasks (e.g., vocational skills, Fetko et al., 1999; Maciag et al., 2000; leisure skills, Dollar et al., 2012; a mathematical skill, Creech-Galloway et al., 2013) to students with moderate to severe disabilities. In addition, simultaneous prompting has been implemented to teach targeted core content with nontargeted information as instructive feedback (Tekin-Iftar et al., 2003) or by embedding in activities, which can be related (Collins et al., 2019) or unrelated (Fetko et al., 2013) to the targeted core content. By presenting nontargeted information in the consequent event during instructional sessions, students with disabilities are presented with more content further enriching their educational experience by not only presenting core and functional content, but also addressing individualized goals and skills.

Peer Tutoring/Peers-delivered Instruction

Peer tutoring occurs when instructional content is delivered by a student instead of a teacher (Olson & Platt, 2000). A great amount of literature has supported the effectiveness of peer tutoring in academic settings because there are several benefits that peer tutoring have, including: (a) student can be successful and effective tutors; (b) tutors gain academically from teaching skills to their peers; (c) students meet their needs and pairs can be individualized

according to these needs; (d) proportion of time students are engaged in academic instruction can be increased; (e) teachers gain time and can engage students more in social and academic work in their classrooms; and (f) a positive social interaction between peers can be developed (Greenwood et al., 1989; McGee et al., 1992; Passe & Beattie, 1994; Trapani & Gettinger, 1989; Utley et al., 1997). Research also supported the effectiveness of peer tutoring for students with moderate to severe disabilities. Brock and Huber (2017) reviewed studies using peer support arrangements to determine if peer-delivered instruction met CEC criteria (CEC, 2014). They found that the procedure is determined as an evidence-based practice for promoting social interactions for secondary students with severe disabilities in academic settings. A recent study by Ley Davis et al. (2022) implemented peer-delivered instruction to teach mathematical word problem solving skills to four middle school students with extensive support needs. Results showed a functional relation between the instruction and the mathematical word problem solving skills. In addition, peer tutors were able to conduct the procedure with high procedural fidelity. Furthermore, peer tutoring has been widely used in combination with response prompting procedures in teaching various skills to students with mild to moderate disabilities, and in inclusive physical education settings.

Peer-delivered Response Prompting Procedures

Although peer tutoring has been considered as an effective way in improving social interactions between tutors without a disability and tutees with a disability in inclusive settings, the effectiveness of peer tutoring can be extended to teaching both core content and functional skills when combined with response prompting procedures (e.g., constant time delay, system of least prompts, simultaneous prompting). Additionally, when using peer-delivered response

prompting procedures, it is important to train peer tutors on the implementation of the procedures to increase procedural fidelity.

Peer-delivered Constant Time Delay

Peers have been trained to use constant time delay to teach students with disabilities. Collins et al. (1995) examined the effects of a peer-delivered constant time delay procedure on word recognition and definition of key words from the actual labels of cooking products. Four rural high school students with moderate intellectual disability were the target participants, and 26 students of an 11th grade Advanced English class who attended the same high school with the target participants served as peer tutors. A researcher and the special education teacher trained the peer tutors during their Advanced English class time. The researchers used a multiple probe design across cooking product word sets replicated across four students to examine the effects of the peer-delivered constant time delay intervention. The dependent variables were the percentage of correct responses to target words and the percentage of correct responses to definition of the target words. Results showed that all participants met the criterion (i.e., 100%) in reading and in defining words across three sets of words, and generalized their learning to reading a novel cooking product label (45% to 90%) and defining the words they learned from the intervention during a cooking activity (32% to 100%). The average of procedural fidelity was 91.7% and all procedural errors were related to the failure to deliver praise after receiving a correct answer. In addition, the intervention delivered by peer tutors was efficient in teaching how to read and define word sets to the target students with disabilities, as the students only needed an average of five sessions to meet the criterion per word set. During the study, participants with disabilities had positive social interactions (e.g., smiled or laughed, made jokes or conversation with peer tutors) with peer tutors, which reinforced their learning.

In another study, Jimenez et al. (2012) used a peer-mediated constant time delay to teach inquiry science as well as the use of a knowledge chart to students with moderate intellectual disability in inclusive settings. Six students without disabilities who were 11 years old, in sixth grade, served as peer tutors and five students with disabilities who were 11–14 years old, in sixth and seventh grades, were the target students. The research team trained peer tutors on the constant time delay using PowerPoint slides and peer tutors were asked to practice the constant time delay procedure using sample materials until they met the criteria of procedural fidelity (i.e., 85% accuracy). The researchers used a multiple probe design across participants to examine the effects of a peer-mediated constant time delay procedure on the number of correct science responses and use of a KWHL (i.e., K = what do you Know? W = What do you want to know? H = How will you find out? L = what did you Learn?) chart. Results of the study indicated that all target students increased not only the number of correct science responses but also the number of correct responses on the KWHL chart. The average of peers' procedural fidelity was 98%.

Both studies showed the effectiveness of a peer-delivered constant time delay in teaching academic skills (word recognition and definition of key words, Collins et al., 1995; science vocabulary, Jimenez et al., 2012) to students with moderate intellectual disability. Furthermore, both students demonstrated that peers delivered the constant time delay procedure with high procedural fidelity.

Peer-delivered System of Least Prompts

Peer tutoring also has been combined with system of least prompts to teach academic skills such as letters (Collins et al., 2001) and listening comprehension (Hudson et al., 2014), as well as to increase social interactions (Ackerman et al., 2021; Milam et al., 2021) of students with disabilities. Ackerman et al. (2021) implemented peer-delivered system of least prompts to

increase social communication skills of four elementary and middle school students with autism spectrum disorder or intellectual disability (ages 13–21). Two high school students served as peer mediators and received a 1.5-hr training session from the researcher on implementation of the procedure through role-playing. The dependent variable was independent social communication behaviors, defined as the initiations of the interactions with peers or responses to peers verbally with more than two words. During the intervention, the two peer mediators implemented the planned behaviors on the task analysis to elicit the specific behaviors for participants with disabilities. Results of this multiple probe across students design study showed the peer-mediated system of least prompts was effective in that there was a functional relation between the dependent variable and the independent variable across three out of the four participants.

Hudson et al. (2014) examined the effects of a system of least prompts intervention delivered by peers on listening comprehension of students with moderate intellectual disability. Three upper elementary students with moderate intellectual disability and two peer tutors without disabilities (i.e., 1 male, 1 female) participated in the study. The primary researcher provided individual training sessions to three peer tutors who met the attendance criterion and two of three peer tutors who showed the ability to deliver the intervention during role-play sessions with the researcher served as peer tutors for this study. Hudson et al. used a multiple probe across participants design to determine the degree to which the peer-delivered system of least prompts improved the number of points for correct comprehension responses and independent correct comprehension. The hierarchy of prompts was to (a) read the text again, (b) read the sentence that contained correct answer again, (c) say the correct answer, and (d) say and point to the correct response option on the response board. Results showed that independent correct

responses of all target participants with disabilities increased after receiving the intervention. Peer's procedural fidelity data collected during baseline and intervention sessions was 95%, which was acceptable.

Similarly, Collins et al. (2001) used a peer-delivered system of least prompts procedure to teach three secondary students with moderate disabilities to write letters including the following four components: (a) heading, (b) greeting, (c) content body, and (d) closing within a secondary composition class setting. Three rural high school students with moderate intellectual disability, ages 16–19, participated in the study. Students without disabilities who were enrolled in a composition class served as peer tutors for their 12th grade portfolios. The responsibility of peer tutors changed from assisting the participants with disabilities with spelling to assisting the English teacher in implementing the instructional procedure. Research team trained the English teacher to use the least prompts procedure and the English teacher practiced the procedure with the peer tutors. The hierarchy of the prompting they used included (a) independent, (b) verbal direction, (c) gesture, (d) model, and (e) physical guidance. Results of this multiple probe across students design study showed that target students with moderate intellectual disability made progress and reached the criterion. During the baseline condition, none of the participants completed writing four components of a letter. After receiving the system of least prompts intervention, all participants were able to write the letter including four components. Further, the procedural fidelity for the teacher's and peers' implementation of the procedure was high (95%).

The studies by Hudson et al. (2014) and Collins et al. (2001) indicated that peer-delivered system of least prompts procedure was effective in teaching academic content skills such as listening comprehension and writing letters including necessary components. In addition, peer-delivered system of least prompts procedure can benefit students with disabilities by increasing

their social communication skills with peers (Ackerman et al., 2021). Such intervention also provides promises in allowing teachers to teach more content during the same time with assistance from peer tutors (Collins et al., 2001).

Peers-delivered Simultaneous Prompting

In addition to peers being effective implementers for delivering constant time delay and system of least prompts procedures, several studies have shown the effectiveness of peer-delivered simultaneous prompting procedure on academic and functional skills of students with mild to moderate disabilities. First, Fetko et al. (2013) used a peer-delivered simultaneous prompting procedure to teach science core content embedded in a chained leisure skill (i.e., UNO card game). Three middle school students with moderate to severe disabilities (ages from 12 to 14 years) and three middle school peers without disabilities participated in the study. The teacher and a paraeducator trained peer tutors on the importance of the study and the simultaneous prompting procedure guidelines. In addition, the teacher provided peer tutors the list of nontargeted information along with praise statements. The science core content included the following: (a) a host is an organism in which a parasite lives; (b) a meter is the basic unit for volume in the Metric system; (c) an asteroid is a giant, rocky ball of ice that orbits the sun; and (d) chromosomes are threadlike structures in the nucleus that contains genetic information. A chained task of playing UNO consisted of seven steps, including (a) cut deck in half, (b) shuffle cards, (c) deal seven cards to each player, (d) remaining cards middle, (e) flip first card, (f) wait for turn, and (g) lay down card or draw. Researchers used a multiple probe across students design to examine the effects of the peer-delivered simultaneous prompting procedure on a chained leisure skill and science core content facts. Peers delivered the simultaneous prompting procedure using verbal and gesture prompts. Peers' procedural fidelity was 96% during baseline,

96% during daily probe sessions, 95% during daily training sessions, and 100% during maintenance. Results showed two of the three target participants with disabilities met 100% of criteria during intervention and maintained their skill when the intervention ended.

In addition, Tekin-Iftar (2003) conducted a peer-delivered simultaneous prompting procedure to teach community signs to students with developmental disabilities. Participants of this study were four normally developing female peer tutors, and two female and two male peer tutees with developmental disabilities aged from 10 to 13 years old. The study took place in a one-on-one teaching arrangement at the counselor's office in the peers' school, which was a public school. Peer tutors received training on how to implement the simultaneous prompting procedure with verbal description, role modeling, guided practice, and performance feedback. The research design was a multiple probe design across training sets replicated across participants with disabilities. Results demonstrated that the peer-delivered simultaneous prompting procedure was effective in teaching expressively identifying community signs to students with developmental disabilities. In addition, all participants maintained acquired skills over time and generalized the skills across persons. The peer-delivered simultaneous prompting used in this study had a high procedural fidelity and interobserver agreement score, which means that peer tutors implemented the simultaneous prompting procedure as they were trained.

More recently, Collins et al. (2021) used a peer-delivered simultaneous prompting procedure to teach health related contents to students with moderate intellectual disability. Three students with moderate intellectual disability participated in this study, and one male student without disability served as the peer tutor. The dependent variables were the number of correct responses on the targeted and nontargeted information. Targeted information was related to the benefits of the exercise and nontargeted information was related to the examples of the exercise.

The peer tutor delivered verbal prompt immediately after delivering questions and delivered the nontargeted information at the end of each session. Results of this multiple probe across participants design study showed two of the three participants met the criteria on targeted information and all participants learned some of the nontargeted information. Finally, Park et al. (2021) trained three female students without disabilities to deliver a simultaneous prompting procedure to teach physical activity and related information to four students with mild to moderate intellectual disability. The first author trained the peer tutors. The dependent variables were the eight steps for shooting a basketball and the nontargeted information addressed the benefits of playing basketball. During the intervention, peer tutors first delivered nontargeted information and then the controlling prompt (i.e., model prompt) right after each steps' directions. Researchers used a multiple probe across participants design and found that all participants improved their basketball shooting skills and one of participants showed improvement in learning the nontargeted information.

The aforementioned studies indicated that peer-delivered simultaneous prompting procedure was effective in teaching a leisure skill (Fetko et al., 2013), community signs (Tekin-Iftar, 2003), health content (Collins et al., 2021), and a physical activity of basketball shooting (Park et al., 2021) to students with developmental or intellectual disabilities. In addition, peer-delivered simultaneous prompting procedure was also efficient by adding nontargeted information into targeted activity or content (Collins et al., 2021; Park et al., 2021), which allows participants with disabilities to be exposed to more content.

Peer Tutoring in Inclusive Physical Education

Inclusion has become prevalent in many countries over the past few years to provide same learning opportunities to students with disabilities. Research on inclusion has been

conducted to find effective ways to include students with disabilities into a general education classroom. Qi and Ha (2012) analyzed empirical studies on inclusive physical education (PE) from 1990 to 2009. They reviewed 75 studies that met the inclusion criteria and found that only 12 (16%) studies examined the effects of different inclusive strategies during PE. The remaining studies addressed stakeholders' perspectives on inclusive PE (65%) and the effects of inclusion on students with and without disabilities (19%). Of the 12 studies involving intervention strategies, eight used peer tutoring to improve students' motor performance (Houston-Wilson, Dunn et al., 1997; Houston-Wilson, Lieberman et al., 1997; Ward & Ayvazo, 2006), motor engagement (Klavina & Block, 2008; Lieberman et al., 1997, 2000; Wiskochil et al., 2007), activity engagement time (Klavina, 2008), or interaction between tutors and tutees (Klavina & Block, 2008); and four studies involved using trained paraprofessionals (Murata & Jansma, 1997), collaborative team approach (Heikinaro-Johansson et al., 1995), embedded instruction (Valentini & Rudisill, 2004), or cooperative learning (Grenier, 2006) to facilitate inclusion of students with disabilities. Block and Obrusnikova (2007) also conducted a literature review to analyze research articles pertaining to inclusion of students with disabilities in PE from 1995 to 2005. They found that the 38 reviewed studies addressed six areas including (a) support, (b) effects on peers without disabilities, (c) attitudes and intentions of children without disabilities, (d) social interactions, (e) academic learning time in PE of students with disabilities, and (f) training and attitudes of general PE teachers. Results of the review supported that peer tutoring in inclusive PE encouraged students with disabilities to increase academic learning time in PE (Depaepe, 1985; Klavina & Block, 2008; Webster, 1987; Wiskochil et al., 2007), to increase moderate-to-vigorous physical activity levels (Lieberman et al., 2000; Temple & Stanish, 2011), and to increase motivation, self-efficacy and performance (d'Arripe-Longueville et al., 2002;

Ensergueix & Lafont, 2010; Legrain et al., 2003). The prevalence of using peer tutoring in inclusive PE in the above reviewed studies may be due to the benefits of peer tutoring in that it not only can provide high quality one-on-one support to students with disabilities, but also can be practical in a large PE class without additional cost.

Research studies exist that examined the effects of peer tutoring in inclusive physical education setting. First, Huston-Wilson, Dunn et al. (1997) evaluated the effects of untrained and trained peer tutors in teaching the motor performance, which included horizontal jump, catch, overhand throw, forehand strike, and sidearm strike, to students with developmental disabilities in integrated physical education classes. Six students with developmental disabilities and six peers were assigned to one of the two protocols. Protocol 1 included baseline, assistance by an untrained peer tutor, and assistance by a trained peer tutor, whereas protocol 2 included baseline and assistance by a trained peer tutor. Peer tutors received two 30-min sessions of training regarding use of appropriate cueing, feedback, and task analysis of motor skills. Results of the study showed that the motor performance of students with developmental disabilities who were assisted by trained peer tutors were higher than those who were assisted by untrained peer tutors.

In another study, Lieberman et al. (2000) evaluated the effects of trained peer tutors on the physical activity levels of eight deaf students ages 10 to 12 in inclusive elementary physical education classes. Eight students without disabilities participated in the study as peer tutors. Peer tutors received the training by the researcher on Sign Language related to physical fitness instruction and on various teaching techniques. After receiving training sessions, they had several sessions for practice with students with and without deafness. The dependent variable was moderate to vigorous physical activity. The researchers used a delayed multiple baseline design across eight deaf participants. Results showed that after the introduction of peer tutoring,

participants increased their moderate to vigorous physical activity from 22% to 41.5%, and peer tutors also increased their moderate to vigorous physical activity from 19% to 37.9%.

Furthermore, Wiskiochil et al. (2007) examined the effects of trained peer tutors on the academic learning time–physical education (ALT–PE) scores of children with visual impairments. The participants were four students with visual impairments (two with low vision and two who were blind) with no other disabilities. Two to four students without disabilities participated in this study as peer tutors. Peer tutors and tutees received a 2-hour training session including information on low vision and blindness, communication, guiding techniques, and various teaching and feedback techniques. The researchers used an interval recording method (i.e., 6 s of recording and 6 s of observation) to determine the amount of ALT–PE, which was defined as percentages of motor appropriate behaviors. Through a delayed multiple baseline across the participants design, results demonstrated that ALT–PE scores improved for all participants with visual impairments after receiving peer tutoring during the inclusive physical education.

In a more recent study, Gobbi et al. (2017) compared the benefits of a peer-tutored physical education program versus school physical education program for students with intellectual disability in a mixed-model design study. The participants were 23 high school students with intellectual disability. All participants participated in both programs and data were collected immediately after the end of each program. Dependent variables were physical activity, perceived exertion, and enjoyment. Participants reported that peer-tutored physical program was more beneficial on having enjoyment, perceived exertion, and time to engage in intensity physical activity compared to school physical education.

Peer tutoring was also used to increase interactions of students with disabilities with peers. Klavina and Block (2008) assessed the effects of peer tutoring on physical, instructional, and social interaction behaviors between elementary school age students with severe and multiple disabilities and peers without disabilities. Peer tutors received three 30-min training sessions from the researchers. This study was conducted in an inclusive general physical education setting under three instructional support conditions for students with severe and multiple disabilities, including (a) teacher-directed, (b) peer-mediated, and (c) voluntary peer support. During teacher-directed condition, the adapted physical education teacher provided the assistance to students with disabilities to be able to interact with students without disabilities. During peer-mediated condition, trained peer tutors assisted students with disabilities to interact with other students in the general physical education class, whereas during voluntary peer support condition, every student had the opportunity to interact with students with disabilities through collaborative games. Researchers analyzed recorded data using the Computerized Evaluation Protocol of Interactions in Physical Education. Results of this delayed multiple baseline design study showed that during the peer-mediated and voluntary peer support conditions, students with disabilities were more likely to interact with peer tutors and other peers than with the teacher. In addition, when students with disabilities interacted with peer tutors or other peers, the instructional (e.g., prompting, feedback) and physical (e.g., activity engagement) interaction behaviors increased, while social (e.g., positive or negative social interactions) interactions remained low.

In sum, peer tutoring in inclusive physical education class was effective to teach motor performance (Huston-Wilson, Dunn et al., 1997), to increase physical activity (Lieberman et al., 2000) and ALT–PE (Wiskiochil et al., 2007), and to promote interactions with peers (Klavina &

Block, 2008) for students with disabilities. Peer tutoring had a positive effect on instructional and physical interaction between students with disabilities and peer tutors in inclusive physical education class. All studies reviewed above emphasized on training peer tutors on instructional strategies and characteristics of disabilities (e.g., hearing and visual impairments). Although all of studies conducted training sessions to train peer tutors by teachers or researchers, most of studies did not present specific steps on how they trained train peer tutors, which makes it difficult for future researchers to replicate the training session. In addition, there was no procedural fidelity data of training sessions. More studies are needed to use the peer tutoring to teach various academic core content (e.g., mathematics, English/language arts, science) combined with physical activity.

Summary

Peer tutoring/peers-delivered instruction has been used in combination with several response prompting procedures (i.e., constant time delay, system of least prompts prompting, simultaneous prompting procedure) and in inclusive physical education settings. The use of peer tutoring/peers-delivered instruction has provided meaningful experiences for peer tutors without disabilities and peer tutees with disabilities (Greenwood et al., 1989; McGee et al., 1992; Passe & Beattie, 1994; Trapani & Gettinger, 1989; Utley et al., 1997). The effectiveness of peer-delivered response prompting procedures is evident in studies that aimed to teach both academic core content (Collins et al., 1995) and functional activity (Fetko et al., 2013) of students with disabilities. In addition, peer-delivered response prompting procedures has shown effective in embedding nontargeted information (Collins et al., 2021; Park et al., 2021; Tekin-Iftar, 2003).

In addition to the effective application of peer tutoring in response prompting implementation, research on inclusive physical education classes has used the peer tutoring

strategy to promote positive outcomes for students with disabilities and their peer tutors (Qi & Ha, 2012). Peer tutoring was effective in improving motor development (Huston-Wilson, Dunn et al., 1997) and in increasing physical activity (Lieberman et al., 2000) and ALT–PE (Wiskiochil et al., 2007). Peer tutoring also promoted instructional and physical interaction between the tutors and tutees during the inclusive physical education class (Klavina & Block, 2008). Finally, research suggests that when using peer tutoring/peer-delivered instruction, it is important for peer tutors to be trained before delivering instructional procedure to students with disabilities. Trained peer tutors resulted in more positive effects than untrained peer tutors (Huston-Wilson, Dunn et al., 1997).

Combining Academic Core Content with Physical Activity

Literature addressing both academic performance and physical activity has emphasized that it is important for students to engage in physical activity because there is a positive relationship between physical activity and academic achievement (Castelli et al., 2007; Fedewa & Ahn, 2011; Sallis et al., 1999; U.S. Department of Health and Human Services, CDC, 2010). To explain the relationship between physical activity and cognition, researchers proposed numerous mechanisms. These mechanisms can be categorized into two broad categories, including neuropsychological mechanisms (Diamond, 2000) and learning/developmental mechanisms (Leppo et al., 2000; Pica, 1997).

From a neuropsychological perspective, there are several explanations for the co-occurrence of motor and cognitive performance. First, motor and cognitive functions are coupled through using the same brain structures (Diamond, 2000). For example, the cerebellum is involved in both motor and cognitive functions and the prefrontal cortex plays an important role in cognitive functioning as well as in motor performance through the strong neural connections

between these two brain areas. Dysfunction of these brain structures or the neural pathways may express itself in motor problems as well as in cognitive problems (Diamond, 2000). A second explanation is that motor and cognitive functions seem to follow a similar developmental timetable with an accelerated development between 5 and 10 years of age (Anderson, 2002; Gabbard, 2008). A final factor that may account for the co-occurrence of motor and cognitive functions is that both functions have several common underlying processes such as sequences (Hartman et al., 2010) and monitoring and planning (Roevers & Kauer, 2009; Sergeant, 2000). From a learning/developmental perspective, movement and physical activity provide learning experiences that aid, and may even be necessary for, proper cognitive development. Authorities have suggested young children be engaged in physical activity to stimulate cognitive development (Leppo et al., 2000; Pica, 1997).

Despite the developed explanations of mechanisms of relationships between physical activity and cognition, more research is needed to establish a strong relationship between physical activity and cognitive performance. In the following section, I present a brief review of literature addressing positive relationships between physical activity and academic achievement.

Relationships Between Physical Activity, Fitness, and Academic Achievement

A growing body of literature has established a strong link between engagement in physical activity and academic performance. Research indicated that student engagement in physical activity resulted in higher test scores and that students showed more attention in the classroom (Castelli et al., 2007; Fedewa & Ahn, 2011; Sallis et al., 1999; U.S. Department of Health and Human Services, CDC, 2010).

A research study conducted by the California Department of Education (CDE; 2001) attempted to identify the relationship between physical fitness and academic achievement. In this

study, reading and mathematics scores from the Stanford Achievement Test were individually matched with the fitness scores (Fitnessgram; Cooper Institute for Aerobics Research, 1999) of 353,000 fifth graders, 322,000 seventh graders, and 279,000 ninth graders. There was a positive relationship between physical fitness and the Stanford Achievement Test across all three grade levels, such that higher levels of fitness were associated with higher academic achievement.

Similarly, Hillman et al. (2005) investigated the relationship between age, aerobic fitness, and cognitive function by comparing high- and low-fit pre-adolescent children and adults. Fifty-one participants (24 children and 27 adults) were placed into one of the four groups (i.e., high-fit children, high-fit adults, low-fit children, and low-fit adults) according to age and level of physical fitness. Researchers measured participants' physical fitness (i.e., aerobic capacity, muscle fitness, flexibility fitness, and body composition) using the Fitnessgram, and measured their cognitive function by neuroelectric (i.e., Electroencephalogram recordings) and behavioral responses to a stimulus discrimination task. Participants engaged in a visual oddball paradigm, which required them to press a button with their right thumb as quickly as possible to an infrequently presented target stimulus (i.e., 20% probability), whereas no response was required when presented nontarget stimulus. Target stimulus comprised a black and white line drawing of a cat, and the nontarget stimulus was a black and white line drawing of a dog. Results demonstrated that high-fit children had a larger population of neurons, which was being recruited for the task, than low-fit children and both adult groups. Additionally, both high-fit groups had faster neurocognitive processing than both low-fit groups. In measurement of a visual oddball paradigm, high-fit children responded faster to target stimuli than low-fit children. These findings indicated that there was a positive relationship between physical fitness and cognitive function including attention, working memory, and response speed.

Coe et al. (2006) examined the effects of physical education class enrollment and physical activity on the academic achievement of middle school children. Researchers randomly assigned 214 six-grade students from a single public school in western Michigan to one of two groups. One group was enrolled in physical education during the first semester (August to mid-January), and the other group was enrolled in physical education during the second semester (mid-January to June). Coe et al. measured physical activity level by the 3-d physical activity recall (3DPAR). The 3DPAR asked each student to record his or her previous day's activities for 3 consecutive days with scores of 1 (no activity), 2 (some activity), or 3 (activity meeting Healthy People 2010 guidelines; i.e., more than 30 min of moderate activity for at least 5 days of a week and more than 20 min of vigorous activity for at least 3 days of a week). Researchers also assessed participants' academic achievement using grades from four core academic classes (i.e., mathematics, science, English, and world studies) and standardized test scores (i.e., Terra Nova standardized test scores). Results showed that students who either performed some or met Healthy People 2010 guidelines for vigorous activity had significantly higher grades ($p < 0.05$) than students who performed no vigorous activity. Although moderate physical activity did not affect grades, higher grades were associated with vigorous physical activity.

In another study, Castelli et al. (2007) conducted a detailed analysis of the relationship between the components of physical fitness (e.g., aerobic capacity, muscle fitness, and body composition) and academic performance (e.g., mathematics and reading) among third- and fifth-grade students. The participants were 259 third- and fifth-grade students. Researchers used the Fitnessgram (Cooper Institute for Aerobics Research, 1999) to measure muscle fitness, aerobic capacity, and body composition, and used the Illinois Standards Achievement Test (i.e., ISAT, administrated annually to third- through eighth-grade students in Illinois public schools) to assess

participants' academic achievement for mathematics and reading. Results of the correlation analyses demonstrated that there was a positive relationship between aerobic capacity and academic achievement.

Similarly, Welk et al. (2010) observed significant relationships between physical fitness and state-wide academic achievement tests in Texas. Welk et al. examined the associations between physical fitness and academic performance. Researchers measured physical fitness using the Fitnessgram (Cooper Institute for Aerobics Research, 1999) and academic and school performance using the age-specific standard on the Texas Assessment of Knowledge and Skills (TAKS) assessment. In addition, they measured attendance and delinquency by computing the percentage of the average daily attendance over the full year and the percentage of youth cited for some form of delinquency over the year (i.e., substance abuse, weapons, violence, or truancy). The sample of the data included 36,835 students (i.e., elementary: n = 19,948; middle: n = 8,916; high: n =1,373). Data from 6,222 schools in 1,052 districts and 248 of the 254 counties across the state were included. Researchers used partial correlations to show the overall relationships of physical fitness and academic and school performance. Results indicated positive grade-level associations between academic achievement and two indicators of the Fitnessgram (i.e., cardiovascular fitness and BMI).

Physical activity level also has a positive relation with academic achievement. Asigbee et al. (2018) examined the effects of regular physical activity and proper nutrition together on academic achievement using the Early Childhood Longitudinal Study (ECLSK-8) data set. The ECLSK-8 data set included seven waves of data, the fall and spring of the kindergarten year, the fall and spring of the first grade, the third grade, the fifth grade, and the eighth grade, representatively. The number of participants of this data set started from 21,260 (in the initial

wave) to 9,720 (in the final wave). Researchers measured nutrition using a questionnaire, which asked the participants to respond if they ate healthy food or unhealthy food. Researchers also measured physical activity using a questionnaire, which asked participants to respond on how long they engaged in physical activity. Academic achievement was measured by standardized test scores. Using a linear regression analysis with a Jackknife resampling correction, Asigbee et al. analyzed the relationship among nutrition, physical activity, and academic achievement. Results showed that regular physical activity level and proper nutrition had a significant effect on academic achievement scores.

According to the findings of the above literature reviewed, there is a strong link between physical fitness (CDE, 2001; Castelli et al., 2007; Welk et al., 2010) or physical activity (Asigbee et al., 2018; Coe et al., 2006) and academic performance. In addition, physical fitness was related to cognitive function including attention, working memory, and processing speed (Hillman et al., 2005).

Effects of Physical Activity on Academic Performance

In addition to exploring the relationship between physical activity and academic achievement, researchers also have examined the immediate effects of engagement in the physical activity on academic achievement. It is important to examine the effects of physical activity on academic performance to identify how physical activity may influence academic outcomes.

McNaughten and Gabbard (1993) examined the influence of physical exertion on mathematical performance of 120 six grade students. The participants were randomly assigned to one of four groups, two control and two experimental (i.e., a Solomon Four-group Design). Both experimental groups engaged in physical exertion (i.e., walking) of varying durations (i.e., 20,

30, and 40 min) at different times (8:30 A.M., 11:50 A.M., and 2:20 P.M.) of the day. The intensity of the walking was moderate (120 to 145 bpm). Researchers measured mathematical performance using a 90-s mathematical computation test. The researchers used separate 2 by 3 repeated measure analyses of variance to compare means of mathematical performance of each group. Results of the study showed significant differences in the math score according to the duration of physical exertion. Specifically, scores were significantly higher at 30- and 40-min duration in compared to the 20-min duration.

In another study, Caterino and Polak (1999) examined the effects of physical activity on concentration of second, third, and fourth grade children. Children in each grade were randomly assigned to one of two treatment groups (i.e., classroom activity or physical activity). Children who were assigned to classroom activity received teachers' approved grade-appropriate weekly lesson plans, whereas children who were assigned to physical activity received 15 min of physical activity including stretching and aerobic walking in the gymnasium. Both groups took the Test of Concentration (Woodcock-Johnson & Johnson, 1989) immediately after treatment. Data analysis consisted of a two-way analysis of variance. Results indicated that physical activity group in fourth grade showed better performance on the Test of Concentration after engaging in a 15-min physical activity. There were no significant differences between both activity groups in second and third group because of several factors including developmental factors, types of activity researchers provided, or a test of concentration.

In addition to exploring the effects of physical activity on academic achievement of a general student population, studies exist that targeted students with disabilities. Oriel et al. (2011) determined the effects of participation in aerobic exercise on academic engagement of 24 young children with autism spectrum disorder (ages 3–6). Aerobic exercise consisted of 15 min

of running/jogging as a group. Dependent variables included (a) correct academic responses, (b) incorrect academic responses, (c) stereotypic behaviors, and (d) on-task behavior. Oriel et al. used the Wilcoxon signed rank test to compare difference between a treatment condition and a control condition. The analysis of the data revealed a statistically significant difference ($p < .05$) in correct responding, indicating engagement in aerobic exercise was effective in increasing the frequency of correct responses of the participants with autism spectrum disorder.

Similarly, Everhart et al. (2012) examined the effects of daily structured physical activity on academic engagement in mathematical and language arts learning activities of students with an intellectual disability. Seven primary grade students and six intermediate elementary grade students participated in this study. The daily structured physical activity included a 10-min aerobic dance session and a 10-min TaeBo expert leading movement activity. Students completed language arts and mathematical seatwork. Researchers used a multiple probe across students design to analyze the effects of the physical activity. According to the visual analysis of the data, most of the intermediate grade level students consistently improved academic work, whereas most primary grade level students showed inconsistent performance. Researchers explained that the reason why primary grade students did not make academic progress was due to the difficulty in participating in the structured physical activity. Primary grade students might have lower motor skill levels compared to intermediate grade students.

Based on the findings of aforementioned studies, engagement in physical activity can bring positive effects on academic performance for students with and without disabilities. Results of these studies support that engagement in physical activity can improve academic performance in mathematics (Everhart et al, 2012; McNaughten & Gabbard, 1993) and language arts (Everhart et al, 2012), concentration (Caterino & Polak, 1999), and academic engagement

(Oriel et al., 2011). Providing students with mild to moderate intellectual disability with physical activity offers great promise.

Teaching Core Content using Physical Activity

Because of an increasing emphasis on standardized testing and academic achievement, educators may implement physical activity interventions to directly support academic instruction (Bartholomew & Jowers, 2011). Scrabis-Fletcher (2016) suggests integrating common core content into physical education not only to provide meaningful learning experiences to all students but also to allow them to be exposed to more than one content during the same time by providing a variety of examples of embedding core content into physical activity (e.g., bowling, soccer, movement pattern, and obstacle course). Teachers are encouraged to integrate more core content into physical activity because studies showed that using physical activity to teach common core content has resulted in higher levels of interest in learning core content of students as well as in increased physical activity throughout the entire school day (Erwin et al., 2009; McMullen et al., 2014).

Erwin et al. (2009) examined the effects of integrating physical activity with mathematics content on math class and school day physical activity levels of elementary students. Four teachers and 75 students participated in this study. Physical activity was measured by the pedometers. Students from 13 classes were taught mathematics content modified to integrate physical activity and five classes were taught without the integration of physical activity. Results of this multiple baseline design study showed that students who attended physical activity integration classes engaged in more physical activity not only during the math classes but also throughout the school day. In addition, physical activity intensity of students of physical activity integration classes was higher than students of original mathematics classes.

More recently, McMulen et al. (2014) explored classroom teachers' perceptions of incorporating physical activity breaks into the classroom. Twelve elementary and high school classroom teachers participated in this study. Researchers used semi-structured interviews and teachers' reflective journals to collect qualitative data. Data were analyzed by conducting systematic searches for patterns across data types. Researchers found several themes including (a) the need for and threats to classroom control, (b) a preference for breaks with connections to academic content, and (c) the importance of implementation ease and student enjoyment. The findings indicated that activity breaks need to be connected to academic content, be easy for teachers to implement, and enjoyable for students.

Further, classroom-based physical activity was effective in increasing students' on-task behaviors in the class. Goh et al. (2016) used a classroom physical activity intervention, TAKE 10! program, to increase on-task behavior of elementary school students. TAKE 10! program consisted of a variety of 10-min activities that was related to the classroom curriculum. Nine classes with 210 students participated in this study. Goh et al. defined on-task behavior as attention on teacher and active engagement in the appropriate tasks assigned by the teacher. On-task behavior was measured using direct observation. During the intervention condition, the teachers chose one of the TAKE 10! programs (examples of activities and supplementary materials can be found from http://www.take10.net). One example activity they used was "Invisible Jump Rope;" this activity required students to pretend to hold a jump rope and to respond to math addition problems posed by their teacher while jumping. Using a two-way repeated measures analysis of variance, researchers found that classroom-based physical activity, TAKE 10! program, was effective in improving students' on-task behavior in the classroom.

In sum, teaching academic core content using physical activity may be effective because several studies showed the positive relation between physical activity and cognitive function (Hillman et al., 2005) and academic achievement (Castelli et al., 2007; Coe et al., 2005; Welk et al., 2010), and immediate effects of engagement in physical activity on academic performance (Everhart et al., 2012; Oriel et al., 2011). When teaching academic core content using physical activity, there are some considerations including ease of implementation, enjoyable for students, and connection between core content and physical activity. Previous research often used physical activity to teach core content targeted on students without a disability and the physical activity program was group-based intervention for a whole class or a group of students, which might not be appropriate in teaching students with disabilities. To address this, it is necessary to implement individualized systematic instruction to teach both academic core content and physical activity to students with disabilities.

Summary

Engagement in physical activity has a positive influence on academic achievement of students with and without disabilities in two ways. First, a growing body of literature has supported a strong relationship between physical activity and cognitive functioning (Castelli et al., 2007; Fedewa & Ahn, 2011; Sallis et al., 1999; U.S. Department of Health and Human Services, CDC, 2010). Physical activity can affect the brain, resulting in magnifying the ability of neurocognitive processing, which is related to working memory and process (Hillman et al., 2005). Second, when embedding core content into physical activity, students are able to interact with instructional materials in a more meaningful and concrete way (e.g., visually or physically), yielding greater understanding, interest, and retention of knowledge (Chen et al., 2011; McMullen et al., 2014). A review of prior research teaching academic core content using

physical activity shows a need for individualized systematic instruction to teach both academic core content and physical activity to students with disabilities.

Summary of the Review of Literature

Provisions of the No Child Left Behind Act (NCLB, 2001) and the Individuals with Disabilities Education Act (IDEA, 2004) require schools to achieve high academic standards, in addition to teaching functional skills to students with disabilities. There is strong evidence supporting the effectiveness and efficiency of simultaneous prompting procedure as an intervention procedure to teach both academic content and functional skills by adding nontargeted information into targeted instruction (Collins, 2007). Additionally, peers have been trained to deliver the simultaneous prompting procedure with high fidelity to teach students with mild to moderate disabilities functional skills (e.g., community signs, Tekin-Iftar, 2003; leisure skill, Fetko et al., 2013) and academic skills (e.g., heath content, Collins et al., 2021). Peer tutoring also was effective in teaching physical activity (Lieberman et al., 2000) and motor performance (Houston-Wilson et al., 1997) to students with disabilities in inclusive physical education class.

Engagement in physical activity regularly is important to students with disabilities in that physical activity can increase the quality of life by reducing developing chronic diseases rate in adulthood (Strong et al., 2005). In addition, physical activity has a strong relationship with academic performance, resulting in higher test scores and students showing more attention in the classroom (Castelli et al., 2007; Fedewa & Ahn, 2011; Sallis et al., 1999; U.S. Department of Health and Human Services, CDC, 2010). Teaching core content using physical activity presents great promise in supporting students with mild to moderate disabilities.

Although research supports the effectiveness of using simultaneous prompting procedure to teach academic core content embedded in a functional activity, there exist several limitations from current literature. First, there are limited studies that implemented the simultaneous prompting procedure to teach academic core content combining with a functional skill and there was limited research using a simultaneous prompting procedure to teach academic core content embedded in physical activity for students with mild to moderate intellectual disability. Second, many of the existing studies using peer tutoring/peer-delivered instruction lacked procedural fidelity data collection during the peer tutor training sessions and the intervention sessions. Procedural fidelity data will be used to determine if peer tutors received trainings and implemented the procedure as planned. Furthermore, there is a need for quality single-case design studies using peer tutoring approaches with students with disabilities in physical education (Kalef et al., 2013).

CHAPTER 3: METHOD

In this study, I used a single-case, multiple probe across participants design (Horner & Baer, 1978; Ledford & Gast, 2018) to examine the effects of a peer-delivered simultaneous prompting procedure to teach academic core content (i.e., locative prepositions; English/Language Arts) combined with physical activity (i.e., movement skills: run, hop, skip, slide, and gallop) to students with mild to moderate intellectual disability. The independent variable consisted of three components, including peer support, simultaneous prompting, and activity-based instruction. The purpose of this study was to investigate the effects of the peer-delivered simultaneous prompting procedure on the target participants' (a) acquisition of target core content knowledge, (b) acquisition of the nontargeted information knowledge, and (c) knowledge generalization across materials and settings. This study also evaluated the trained peer's implementation fidelity of the simultaneous prompting procedure, as well as the perceptions of target participants, peer tutor, and teachers about the intervention. This chapter consists of information about the participants, setting, experimenter and data collectors, materials, variables and data collection, experimental design, procedures, social validity, procedural fidelity, and data analysis.

Participants

Recruitment of participants of this study was through purposive sampling. The special education teacher and elementary Exceptional Children compliance facilitator of the participating school nominated students with disabilities as the target participants and students without disabilities as peer tutors.

Target Participants with Disabilities

Target participants included five students with a mild to moderate intellectual disability. All students were between the age of 5 to 12 years old. Inclusion criteria for the target participants included having (a) an identified mild to moderate intellectual disability based on state's disability eligibility guidelines, (b) the ability to pay attention to instruction for at least 15 min, (c) the ability to follow multi-steps verbal directions, (d) the ability to tact, (e) the ability to imitate an action, (f) fine motor skills, (g) a regular attendance in the school (i.e., having no more than five absences in the previous school year), (h) signed informed parental consent, and (i) student assent, if appropriate. A preferred inclusion criterion was to include students with limited to no physical activity movement skills related to running, hopping with the left foot, hopping with the right foot, galloping, leaping, and sliding. See Appendices A and B for the parental consent form and student assent form, respectively.

Maggie was a 12-year-old Caucasian female student with moderate intellectual disability (IQ = 45) in the fifth grade. According to the special education teacher, she struggled with focusing on task and following teacher directions. The special education teacher often needed to provide continuous prompts for her to learn tasks such as tracing or reading CVC words. Maggie also lacked comprehensive skills when engaging in reading stories or solving story-based mathematics word problems compared to her peers without disabilities.

Laiyah was a 6-year-old African American kindergarten female student with a developmental disability and a mild intellectual disability (IQ = 69). She received speech therapy from a speech specialist at the same school where the study took place during the study. Laiyah could appropriately communicate with others verbally using words and sentences.

Vaughn was a 6-year-old Caucasian male student attending kindergarten. He had a diagnosis of developmental disability with a mild intellectual disability (IQ = 82) and speech impairment. He was able to follow directions but had difficulties in requesting something he wanted or tacting objects verbally.

Ethan was a 5-year-old Caucasian male student in kindergarten with a diagnosis of autism and mild intellectual disability (IQ = 110). Although he had difficulties in interacting with classmates, he followed directions delivered by teachers and could complete tasks independently.

Aydan was a 10-year-old African American male in the third grade with a mild intellectual disability (IQ = 65). According to the special education teacher, he was able to read and write letters and words independently and to focus on and complete tasks with verbal prompts. He had difficulties adjusting to new environments, including people, places, or new tasks. The special education teacher mentioned that he cried when he felt uncomfortable.

All target participants were able to walk, run, and move their body without physical restrictions. However, all students lacked some skills in galloping, hopping, leaping, and/or sliding at the beginning of the study (refer to the pretest scores of the movement skills in Chapter 4).

Peer Tutor

One student without a disability participated in this study to serve as a peer tutor. Inclusion criteria for the peer tutor included a student who (a) was attending the same school with the target participants, (b) had not had experience teaching students with a disability prior to the study, (c) had not had experience implementing a simultaneous prompting procedure prior to the study, (d) could follow instruction, (e) had a regular attendance in the school (i.e., having no more than five absences in the previous school year), (f) had signed informed parental consent,

and (g) provided student assent. In this study, the peer tutor received training on how to implement a simultaneous prompting procedure and data collection until meeting a mastery criterion, at which point the peer served both as an interventionist and as a data collector.

The peer tutor was a fourth grade Caucasian female student. According to her teacher, the peer tutor had been serving as a helper for her classmates and teachers and showed high academic performance. In addition, she expressed a great interest in serving as a peer tutor after learning about the study. Her mother also mentioned that she often helped her little brother in many ways at home.

Setting

The study took place in two rooms and a hallway of the elementary school in a rural area in a southeastern state of the United States. Room A was a multi-purpose room and included four tables (i.e., 30 in × 71.9 in × 29 in), more than 10 chairs, and book selves. The size of the room was sufficient for the target participants to learn movement skills. The school had been using this room as a multi-purpose room for flea market to exchange books or for small group activities (e.g., Halloween party, birthday parties, and indoor exercise). When Room A was occupied for other functioning, Room B was used to conduct the study. Room B was approximately a quarter size of Room A, and Room B included one table, two chairs, and a refrigerator that teachers put their food in. Room B's arrangement looks like a small office, so movement skills occurred in the hallway. Except for the movement skills, the peer tutor conducted both training and probe sessions in Room B when Room A was unavailable. The primary experimenter walked with the peer tutor and target participants when they needed to transition from their classroom to either Room A or Room B for training and/or probing sessions.

Experimenter and Data Collectors

As a doctoral candidate in special education, I served as the experimenter. I received a master's degree in adapted physical activity and had 3 years of experience teaching adapted physical activities (e.g., locomotor skills, object-control skills, adapted inline skating) to students with disabilities. I had experiences conducting studies using peer-delivered simultaneous prompting. In the first study (Collins et al., 2021), I used peer-delivered simultaneous prompting procedure to teach health-related core content learning (i.e., benefits of physical activity and examples of physical activity) to students with moderate intellectual disability. In addition, I also used peer-delivered simultaneous prompting to teach basketball shooting along with benefits of playing basketball as nontarget information to students with mild to moderate intellectual disability (Park et al., 2021). All participants in both studies learned contents delivered by peer-delivered simultaneous prompting. In this dissertation, I trained the peer tutor how to implement both training and probe sessions, and collected interobserver agreement data, procedural fidelity data, and social validity data.

Another doctoral student enrolled in the special education program served as a secondary data collector. The secondary data collector collected procedural fidelity data to ensure that I provided the training sessions for the peer tutor to implement the intervention and to collect data as planned using a checklist (described under Procedural Fidelity section). I trained the secondary data collector regarding the procedural fidelity data collection method by explaining verbally, modeling, role-playing, and feedback.

Materials

The materials necessary for this study included one tennis ball, two paper boxes (12" x 12" x 12"), and a 12" roulette wheel. The boxes were placed on a table to allow for the target

participants to position the tennis ball according to the meaning of the prepositions (i.e., between, besides, above, below, and beneath the boxes). A roulette wheel comprising six slots was used to inform the way of the movement activities for the target participants to reach the box. Each slot represented a different movement activity (i.e., running, hopping with a left foot, hopping with a right foot, galloping, leaping, sliding). For generalization measure, materials included items typically available within the classroom (e.g., a pencil, a book, a chair, a table).

Dependent Variables and Measurement

There were three dependent variables in this study. The first dependent variable was the number of independent correct physical responses (i.e., actions) to verbal prompts related to the target core content knowledge. During probe sessions, the target students were asked to respond to verbal prompts that included the target prepositions (e.g., “Put the ball between the box.”). The second dependent variable was the number of independent correct tacts (i.e., tacting of prepositions) related to the location of a ball (e.g., “Where is the ball?” “Between the box.”). During each probe session, the peer tutor presented a participant with two trials for each of the five target prepositions to assess the first dependent variable (i.e., 10 trials per participant) and two trials for each target preposition to assess the second dependent variable (i.e., five prepositions and 10 trials per participant). The peer tutor recorded correct, incorrect, or no response on the data sheet depending on the response of the target participant within a 5-s interval. The range of performance for both dependent variables was 0 to 10.

The third dependent variable was the number of steps each target participant performed correctly for each movement skill (i.e., running, hopping, galloping, leaping, and sliding). I measured each target participant’s motor performance in pretest and posttest format using the Test of Gross Motor Development (TGMD; Ulrich, 2000). TGMD consists of two subtests (i.e.,

locomotor subtest, object control subtest) that measure gross motor abilities that develop early in life. Each movement skill includes several behavioral components that are presented as performance criteria (i.e., four behavioral components of performance criteria for *run*, four for *gallop*, five for *hop*, three for *leap*, and four for *slide*). If a participant performed a behavioral component correctly, I marked it a "1;" if the participant performed a behavioral component incorrectly, I marked it a "0." The range of score for run is 0 to 4, the range of score for gallop is 0 to 4, the range of score for hop is 0 to 5, the range of score of leap is 0 to 3, and the range of score for slide is 0 to 4. After completing this procedure for each of pretest and posttest trials, I totaled the scores of each trial to obtain a raw skill score for each movement skill for the pretest and posttest, respectively. See Appendix H for the illustrated guide for administering and scoring movement skills of the TGMD.

Experimental Design

I used a single-case, multiple probe across participants design (Horner & Baer, 1978; Ledford & Gast, 2018) to examine the effects of a peer-delivered simultaneous prompting procedure. Experimental conditions included baseline, intervention, and generalization. According to the What Works Clearinghouse (WWC) guideline (2022), the target participant with the most stable and lowest level of baseline data on the first dependent variable (i.e., core content knowledge) across at least six sessions entered the intervention first, while the remaining students continued to receive intermittent probe sessions in the baseline condition. When the trend and/or the level of the first target participant's data increased, the second target participant with a stable and low level of baseline data began the intervention in a staggered manner. Prior to entering the intervention condition, there were at least three consecutive baseline probe sessions for a participant while a previous participant was receiving the intervention. Additionally, after

three consecutive baseline data, the target participant begun the intervention without a delay. The same procedure applied to entering the remaining target students into the intervention condition.

Procedures

Pre-assessment

Prior to the baseline condition, I conducted a pre-assessment to determine the target participants' current level of preposition knowledge and to determine the target prepositions for this study. I conducted the pre-assessment in the target participants' special education classroom using a tennis ball and two boxes as the materials, in the absence of other students. Based on the list of commonly used prepositions in the article by Hicks et al. (2016), I chose 14 prepositions that can be shown using two boxes and a ball (i.e., above, behind, below, beneath, beside, between, in, inside, next to, on, outside, over, under, and underneath) and conducted the pre-assessment with the target participants. Specifically, I asked each target participant to both receptively respond to verbal prompts containing a preposition (e.g., "Put the ball *above* the box.") and expressively tact an object's location (e.g., "Where is the ball?") for each of the 14 prepositions. First, I asked the target participant to respond physically to the verbal prompt (e.g., "Put the ball *above* the box.") with each of the 14 prepositions in random order. Second, I placed the tennis ball in a location that represented a preposition and then asked the participant to tact the location of the ball (e.g., "Where is the ball?") for each of the 14 prepositions in random order. The purpose of this arrangement was to prevent the participants from learning about tacting or acting out the prepositions by simply being exposed to my verbal prompt or my action. Based on the target participants' responses on both performing the physical response to verbal prompt and tacting the ball's location, I targeted five prepositions (i.e., above, below, beneath, between, and beside) for instruction. Selection of the five prepositions was based on target

participants' lack of knowledge of these prepositions. First, four target participants did not respond expressively when asked of the location of the ball. One participant was able to tact the preposition of "between" when the ball was placed between two boxes. Second, three participants did not respond through action when asked to place the ball where it needed to be placed. One of remaining participants was able to place the ball beneath and between the boxes and another participant was able to place the ball beside the box. During the pre-assessment, I only provided general feedback (e.g., "Thanks for trying") without error correction or response specific praise in order to determine what prepositions needed to be targeted for instruction. See Appendix G for the pre-assessment data collection form.

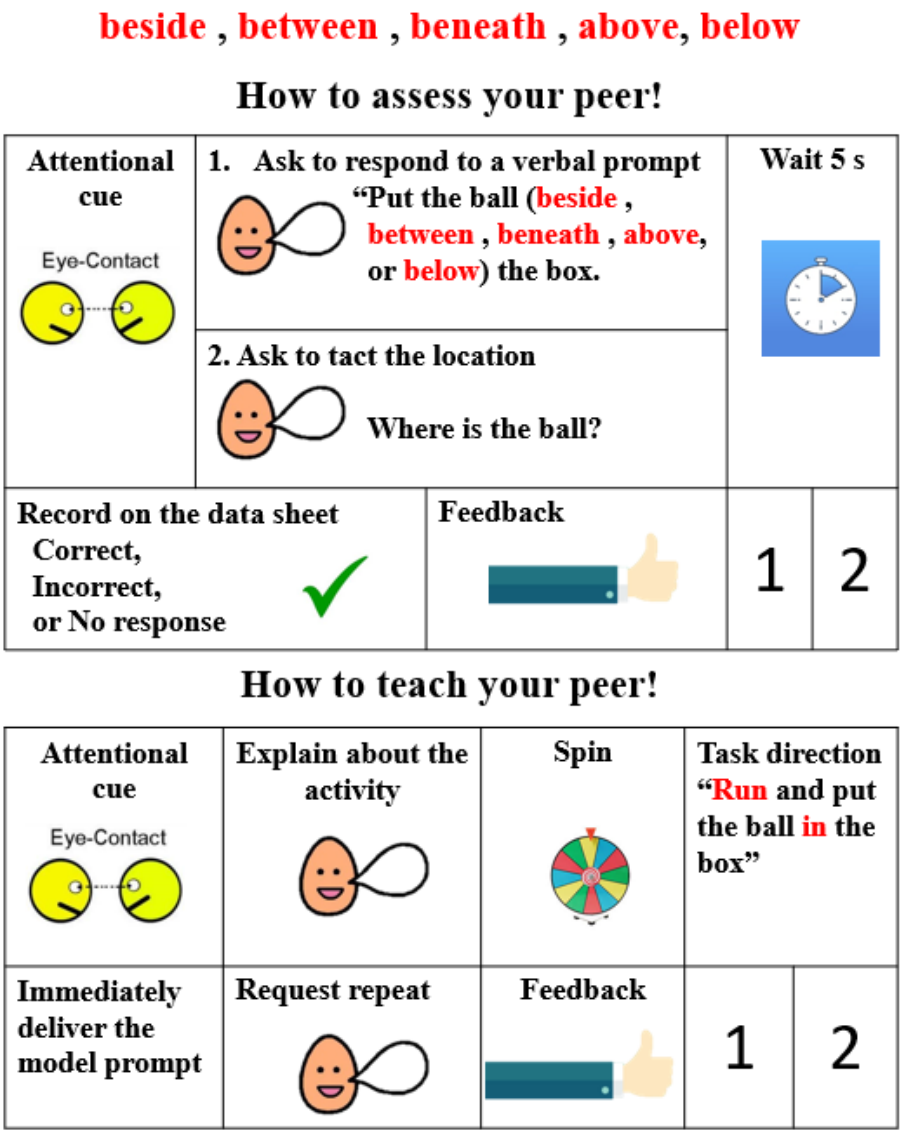
Peer Tutor Training

Prior to collecting baseline data, I conducted two 30-min training sessions to train the peer tutor on the data collection and simultaneous prompting procedures. I provided verbal explanation and modeling to the peer tutor on how to conduct the daily probe session and the daily training session. Then peer tutor had the opportunity to practice what she learned by role playing with me until meeting 100% accuracy in implementing both the daily probe and the daily training procedures. Specifically, I served as the role of peer tutor first to show her how to perform data collection and implementing the procedure, and then the peer tutor roleplayed the peer tutor role to demonstrate her understanding of the procedures. If the peer tutor performed a step incorrectly, I provided a model prompt with verbal explanation until the peer tutor performed each step with 100% accuracy. The peer tutor received a portable instructional card that served as a visual reminder of both the daily probe session and the daily training session. See Figure 2 for the visual reminder. A secondary observer collected procedural fidelity data of my

training and the peer's demonstration of the skills (refer to the Procedural Fidelity section later in this chapter).

Figure 2

Visual Reminder for the Peer Tutor to Conduct Daily Probe and Training Sessions



Baseline

The peer tutor collected baseline data for a minimum of five sessions until data were stable. For each probe session, the peer tutor first delivered an attentional cue to the target student (e.g., saying the student's name or "Look at me"). After securing the student's attention, the peer tutor asked the target student to respond physically to a verbal prompt (e.g., "Put the ball *above* the box.") and then wait 5 s for the target student to respond to the verbal prompt until all five prepositions were assessed in random order. The peer tutor then placed the tennis ball in a location to reflect a specified preposition (e.g., *below* a box) and asked the target student to expressively tact the location of the ball given a specific verbal prompt (e.g., "Where is the ball?") and then wait 5 s for the target student to respond verbally until all five prepositions were assessed in random order. The same procedure was repeated again to assess each preposition for a total of two times for both physical responses (i.e., action) and tacting of the location. After probe sessions, the peer tutor offered general verbal praise, such as "thank you for your participation" or "thank you for your response" as a consequence regardless of the response provided by the target student without any prompting or error correction. Baseline data were collected in the multi-purpose room (Room A) or the secondary room (Room B) and the peer tutor used the transition time between the morning warm-up activity and the first instructional period of the day to collect baseline data and it took no more than 3 min per target participant (i.e., no more than 15 min across five target participants). After the peer tutor conducting the first probe session for the first and second dependent variables, I measured the movement skills (i.e., running, hopping, galloping, leaping, and sliding) of the target participants using TGMD. During the baseline condition, there was no additional instruction or error correction on prepositions. In

addition, the special education teacher and paraprofessional mentioned that they did not provide any instruction on prepositions in the classroom.

Peer-delivered Simultaneous Prompting

The peer-delivered simultaneous prompting procedure consisted of the peer tutor delivering daily probe sessions and daily training sessions (Collins et al., 2019). Daily probe sessions occurred in the same manner as those in baseline in the multi-purpose room or the secondary room prior to conducting daily training sessions for each target student.

The peer tutor delivered the daily training sessions in the following way. First, the peer tutor prepared and set up the materials (i.e., a tennis ball, two paper boxes, a spinning roulette wheel) for the activity in the multi-purpose room or the hallway and then delivered a general attentional cue to the target student (e.g., "Are you ready?" "Look at me."). The peer tutor waited for an affirmative reply from the target student. After receiving the affirmative reply, the peer tutor explained the activity (i.e., Today, we are going to learn prepositions along with movement skills). Then, the target student spun the roulette wheel to determine the target movement skill and then the peer tutor delivered the task direction (e.g., *Run* and put the ball *above* the box) with model prompt immediately following the task direction. After delivering the model prompt, the peer tutor asked the target student to repeat the model prompt. If the target student performed incorrectly, the peer tutor provided error correction by providing another model prompt. If the target student performed correctly, the peer tutor provided a praise such as "good job!" and then delivered the nontarget information by stating "you put the ball _____ (e.g., above) the box." After that, the peer tutor repeated the procedure to teach other prepositions. Each of the five prepositions was presented in random order to the target student. After teaching all five prepositions once, the target student spun the roulette wheel again to determine a different target

movement skill and the peer tutor repeated the aforementioned training procedure for the five prepositions in random order for a second time. At the end of each intervention session, the peer tutor provided an overall praise such as “Thanks for your work!” Each training session lasted approximately 10 min for each target participant. A target participant met the mastery criterion when they achieved 10 out of 10 correct responses across three consecutive sessions on the primary dependent variable to end the intervention session.

Generalization

Generalization data were collected at least once during baseline, and once during intervention across target participants. For the generalization measure, the peer tutor used materials familiar to the target students (e.g., a pen, a pencil, a marker, books) and collected data in the same manner as in the baseline condition. The purpose of the generalization measure was to determine target students’ ability to apply their knowledge of learned prepositions using different materials (e.g., pen and books, instead of ball and boxes).

Social Validity

I collected social validity data using questionnaires consisting of statements and open-ended questions to gather perceptions from the special education teacher, the peer tutor, and the target participants about the goals, procedures, and/or effects of the intervention at the conclusion of the study. For the special education teacher, the questionnaire consisted of five statements on a five-point Likert scale (i.e., 1 = strongly disagree to 5 = strongly agree) and two open-ended questions. For the peer tutor, the questionnaire consisted of three statements on a five-point Likert scale (i.e., 1 = strongly disagree to 5 = strongly agree) and two open-ended questions. Finally, for the target participants, the questionnaire consisted of three statements on a three-point Likert scale (i.e., yes, no, not sure) and three open-ended questions. Statements and

questions on the social validity questionnaires addressed respondents' opinions regarding the importance of the goals (i.e., learning prepositions), the acceptability and usefulness of the peer-delivered simultaneous prompting procedures, and significance of the results of the study. I used an adaptation of case study methods (Baxter & Jack, 2008) for data analysis with data reduction process involving only one round of coding and a final analysis. See Appendix D for the social validity questionnaires.

Interobserver Agreement and Procedural Fidelity

Interobserver Agreement

I collected interobserver agreement (IOA) data on the first two dependent variables (i.e., physical responses to verbal prompts and tacting the location of an object) for at least 30% of data collection sessions (e.g., once a week) across all experimental conditions and target participants. I measured IOA using an item-by-item comparison and calculated it by dividing the number of agreements (comparing my data and the peer tutor's data) by the total number of agreements plus disagreements and multiplying by 100 (Wolery et al., 1988).

Procedural Fidelity

To measure the peer tutor's procedural fidelity on implementing both probe sessions and training sessions, I collected procedural fidelity data during 100% of the daily probe sessions and the daily training sessions conducted by the peer tutor for each target participant. I used a checklist for the peer tutor's delivery accuracy of the daily probe sessions on the following steps: (a) delivering the attentional cue, (b) delivering the correct question, (c) waiting 5 s for the target student to respond, and (d) delivering the appropriate consequence (e.g., praise for attempting a response). I used another checklist for the peer tutor's delivery accuracy for the daily training sessions on the following steps: (a) delivering the attentional cue, (b) asking the target participant

to spin the wheel, (c) delivering the general task direction, (d) immediately delivering the correct model prompt with movement skills, (e) requesting the target student to repeat the correct prompt, (f) delivering the appropriate consequence (praise or error correction), and (g) delivering the corresponding nontargeted information as instructional feedback. I calculated the peer tutor's procedural fidelity data by dividing the number of correct tutor behaviors by the number of applicable tutor behaviors and multiplying by 100 (Billingsley et al., 1980). See Appendix E for the procedural fidelity checklists of peer tutor's delivery behavior of daily probe sessions and the daily training sessions.

In addition to measuring the peer tutor's behavior, I also measured the procedural fidelity of the training procedures provided to the peer tutor. The second data collector collected the procedural fidelity data during peer tutor training sessions. The second data collector used a peer training procedural fidelity sheet (Appendix F) for accuracy on the steps. I calculated the procedural fidelity data by dividing the number of correct training behaviors by the number of required behaviors and multiplying by 100 (Billingsley et al., 1980).

Data Analysis

I graphed the first two dependent variables (i.e., correct physical responses following verbal prompts and correct responses on tacting the location of the object) during each phase of the study and the percentage of the peer tutor's procedural fidelity of the simultaneous prompting procedure during the intervention condition in a multiple probe design format. I conducted a visual analysis to determine trend, level, variability, immediacy of intervention effect, consistency across participants, and functional relation between the dependent and independent variables. In addition, I analyzed social validity data, IOA data, and procedural fidelity data using descriptive analyses.

CHAPTER 4: RESULTS

In this chapter, I reported the results related to this study. First, I presented the results for IOA. Then, I reported the results for each dependent variable (i.e., action of preposition to verbal prompts [targeted academic skill], tacting of prepositions [nontargeted academic skill], and movement skills). Finally, I reported the peer tutor's procedural fidelity, as well as the social validity data gathered from the special education teacher, the peer tutor, and target participants.

Interobserver Agreement

I collected interobserver agreement (IOA) data on the first two dependent variables (i.e., physical responses to verbal prompts and tacting the location of an object) across 100% of all probe sessions and compared data with the peer tutor's data using an item-by-item analysis. I calculated the IOA data by dividing the number of agreements between observers by the number of agreements plus disagreements and multiplying by 100 (Wolery et al., 1988). The mean IOA was 99.1% (range = 98%–100%) across all probe sessions and participants, with 98.9% (range = 98.6%–99.2%) for baseline, 99.2% (range = 98.6%–99.4%) for intervention, and 99.1% (range = 98%–100%) for the generalization condition. The mean IOA was 99.4% (range = 98.8%–100%) for Maggie, 99.2% (range = 99.0%–99.3%) for Laiyah, 98.5% (range = 98.0%–98.9%) for Vaughn, 98.8% (range = 98.3%–99.2%) for Ethan, and 99.3% (range = 98.6%–100%) for Aydan.

Targeted Skill: Action to Verbal Prompt

The closed circle data points in Figure 3 present the results of participants' action to verbal prompts (e.g., "Put the ball between the boxes") across the experimental conditions. The

closed squares represent the generalization data of action of targeted prepositions using materials such as pen, pencil, marker, and books.

Maggie

During baseline, Maggie responded at most one correct action (out of 10) with an overall mean of 0.38 (range 0–1). Data path of the baseline condition for her showed no trend and high stability with a very low level of responding. During the first intervention phase (i.e., phase 1), the peer tutor taught Maggie all five prepositions, and she did not show any progress in her action to verbal prompts. Maggie responded at most one correct action with an overall mean of 0.75 (range 0–1) during phase 1. Data path of the phase 1 intervention for Maggie showed no trend and high stability with a very low level of responding. Because it was difficult for Maggie to acquire all five prepositions in one session, I determined for the peer tutor to provide a more focused instruction with a reduced number of prepositions to allow for repeated exposure. During the second intervention phase (i.e., phase 2), the peer tutor taught Maggie only two prepositions (i.e., *between* and *beside*) per session with five repetitions per preposition. Maggie responded with at least two correct actions with an overall mean of 3.46 (range 2–6). Data path during phase 2 of the intervention showed an overall increasing trend and no overlap data with baseline and phase 1 data. When Maggie responded to both target actions (i.e., *between* and *beside*) correctly for both opportunities across three consecutive sessions, Maggie moved to phase 3. During phase 3, Maggie received instruction on four prepositions, including the two previously mastered prepositions (i.e., *between* and *beside*) and two new prepositions (i.e., *above* and *below*). Data path during phase 3 of the intervention showed a decreasing trend during the first part of phase 3 and then returned to level of the first data point of phase 3 during the last two sessions. All data of phase 3 overlapped with the data of phase 2 (mean = 4.4, range = 3–5).

During phase 3, because Maggie also experienced difficulty in acquiring four prepositions in one session and data did not show adequate progress, the decision was for the peer tutor to teach two prepositions (i.e., *above* and *below*) instead in the next phase of intervention. During the fourth intervention phase (i.e., phase 4), data path for Maggie showed no clear trend and moderate stability with middle level of responding (mean = 5.2, range = 4–6). She responded to six correct actions and did not meet mastery for the change of phase (i.e., 8 out of 10 across three consecutive sessions with all four target prepositions from phases 2–4 being correct).

Generalization data were collected once during baseline and twice during the intervention (i.e., phase 4) for Maggie. Generalization data for Maggie showed that she did not produce any correct action during baseline whereas she had four and five correct actions (mean = 4.5, range = 4–5), respectively, during phase 4 of the intervention, showing a mean improvement of 4.5 correct responses from the baseline performance.

Laiyah

During baseline, Laiyah responded at most three correct actions (out of 10) with an overall mean of 1.08 (range 0–3). Her baseline data path showed no trend and low variability with a low level of responding. During the intervention condition, she made consistent progress across phases of the intervention. Overall, Laiyah's intervention data path across phases showed a steady increasing trend with an overall mean of 5.18 (range 2–8) across phases. Specifically, during phase 1, she received instruction on two prepositions (i.e., *above* and *below*) and met mastery in eight sessions in phase 1 (mean = 3.1, range = 2–4). During phase 2, she was taught four prepositions (i.e., *above*, *below*, *beside*, and *beneath*) and did not meet mastery (i.e., eight out of 10 correct actions; mean = 5.5, range = 4–6). Like Maggie, Laiyah also had difficulty acquiring four prepositions in one session, which led to phase 3 where she learned only the two

newly added prepositions (i.e., *beside* and *beneath*) during phase 2 for repeated exposure. During phase 3, Laiyah met mastery by responding eight correct actions across three consecutive sessions with all four target prepositions from phases 1–3 being correct (mean = 6.7, range = 5–8). Laiyah did not continue with the intervention due to the end of the school year.

There were three generalization data points during baseline, and two generalization data points during intervention (i.e., phase 3) for Laiyah. During baseline, Laiyah responded at most one correct action with an overall mean of 0.67 (range 0–1). During phase 3 of the intervention, she responded five and seven correct actions with an overall mean of 6 (range 5–7), indicating a mean increase of six correct actions from that of the baseline condition.

Vaughn

During baseline, Vaughn responded at least 1 correct action with an overall mean of 1.79 (range 1–4). His baseline data path showed a very slight decreasing trend and low variability with a low level of responding. During phase 1 of the intervention, Vaughn received instruction on two prepositions (i.e., *beneath* and *between*) and he showed high stability with a middle level of responding and met mastery with three sessions (i.e., four out of 10 correct responses with both target prepositions being correct; mean = 3.75, range = 3–4). During phase 2 of the intervention, he received instruction on two prepositions (i.e., *below* and *above*) for three sessions. Although the data during phase 2 showed an overall increasing trend (mean = 4.7, range = 4–5), Vaughn did not meet mastery (i.e., eight out of 10 correct responses with all four target prepositions from phase 1 and phase 2 being correct) due to the end of the school year. Overall, Vaughn's intervention data reflect a mean of 4.14 (range 3–5), indicating a mean increase of 2.35 from baseline to intervention.

Generalization data were collected four times during baseline and once during intervention for Vaughn. During baseline, Vaughn's mean correct actions were 2.76 (range 2–4), with an overall slight decreasing trend. During the intervention condition (phase 2), he had four correct actions. Vaughn's generalization data point during intervention overlapped with his baseline data, showing no changes in his performance.

Ethan

During the baseline condition, Ethan consistently had six or seven correct actions (out of 10) with an overall mean of 5.38 (range 4–7). His baseline data path showed no trend and high stability with a middle level of responding. During the intervention phase (i.e., phase 1), Ethan received instruction on two prepositions (i.e., *above* and *below*) and produced at least eight correct actions; he achieved 10 correct actions in three sessions (mean = 9.17, range = 8–10). Ethan's intervention data path showed an overall increasing trend with high level of responding. In addition, when compared to baseline data, there was no overlapping data supporting an immediacy of effects of the intervention.

Generalization data for Ethan were collected two times during baseline and once during intervention. Ethan responded with six correct actions during both baseline generalization probes, whereas he improved his performance in action to verbal prompts by responding with nine correct actions during intervention.

Aydan

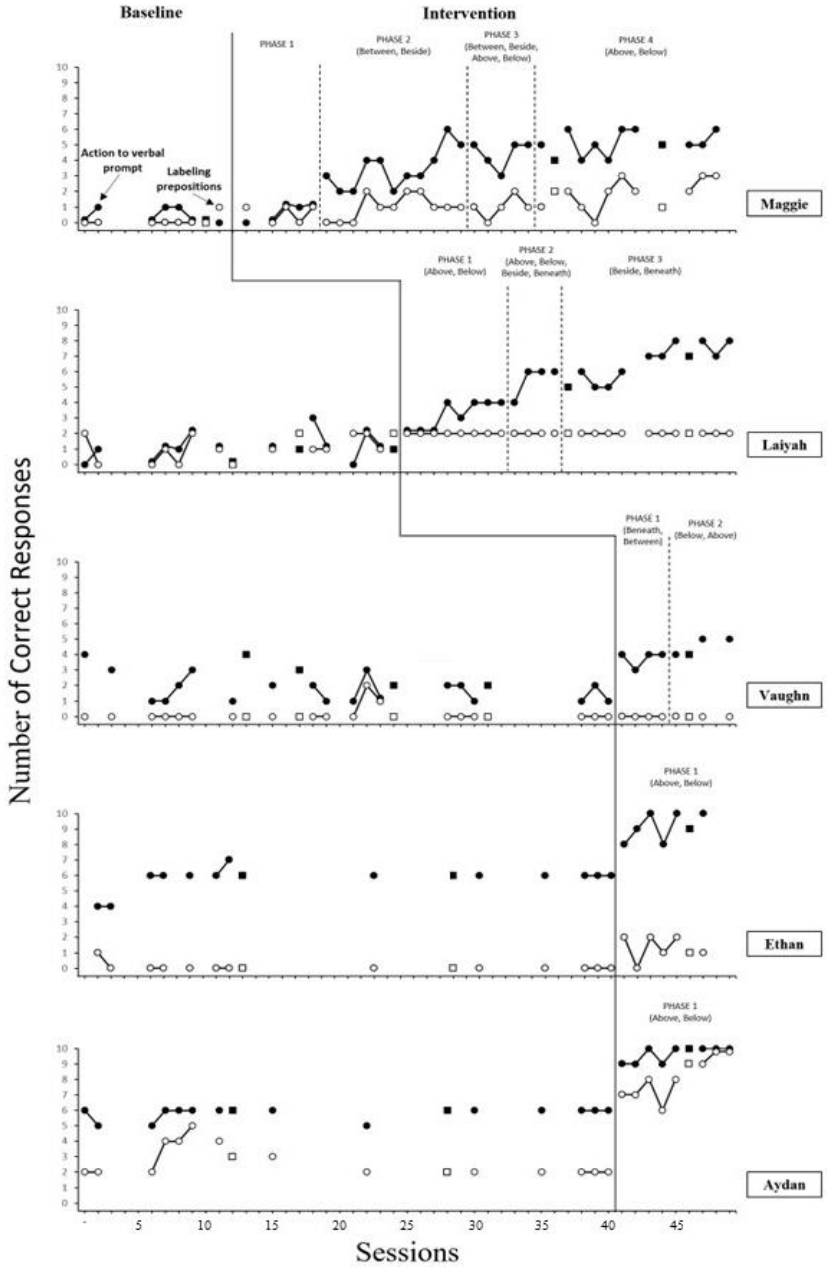
Aydan's data patterns are similar to the data of Ethan during both baseline and intervention conditions, except that Aydan met the mastery criterion (10 out of 10) across three consecutive sessions (mean = 5.79, range = 5–6 for baseline data; mean = 9.63, range = 9–10 for intervention data). Like Ethan, Aydan also received instruction on two prepositions of *above* and

below and showed immediacy of effects of the intervention with no overlapping data between baseline and intervention.

Generalization data for Aydan were collected two times during baseline and once during intervention. Aydan's generalization data were identical to Ethan's data, except that he responded with 10 correct actions during the intervention condition.

Figure 3

Number of Correct Responses on Action to Verbal Prompt and Tacting of Prepositions



Note. Closed data points represent the number of correct responses on action to verbal prompt. Open data points represent the number of correct responses on tacting of prepositions. Open data points represent generalization data.

Nontargeted Information: Tacting of Prepositions

The open circle data points in Figure 3 present the results of participants' tacting of prepositions (e.g., "Where is the ball?") across the experimental conditions. The open squares represent the generalization data of using materials such as pen, pencil, marker, and books.

During the baseline condition, data paths for all target participants showed no clear trend and high stability with very low levels of responding (mean = 0.25, range = 0–1 for Maggie; mean = 1.08, range = 0–2 for Laiyah; mean = 0.11, range = 0–2 for Vaughn; mean = 0.08, range = 0–1 for Ethan; mean = 2.71, range = 2–5 for Aydan). Generalization data that were collected during the baseline condition showed similar data pattern, with no clear trend, high stability, and a very low level of responding (mean = 0, no range for Maggie; mean = 1.3, range = 0–2 for Laiyah; mean = 0, no range for Vaughn; mean = 0, no range for Ethan; mean = 2.5, range = 2–3 for Aydan).

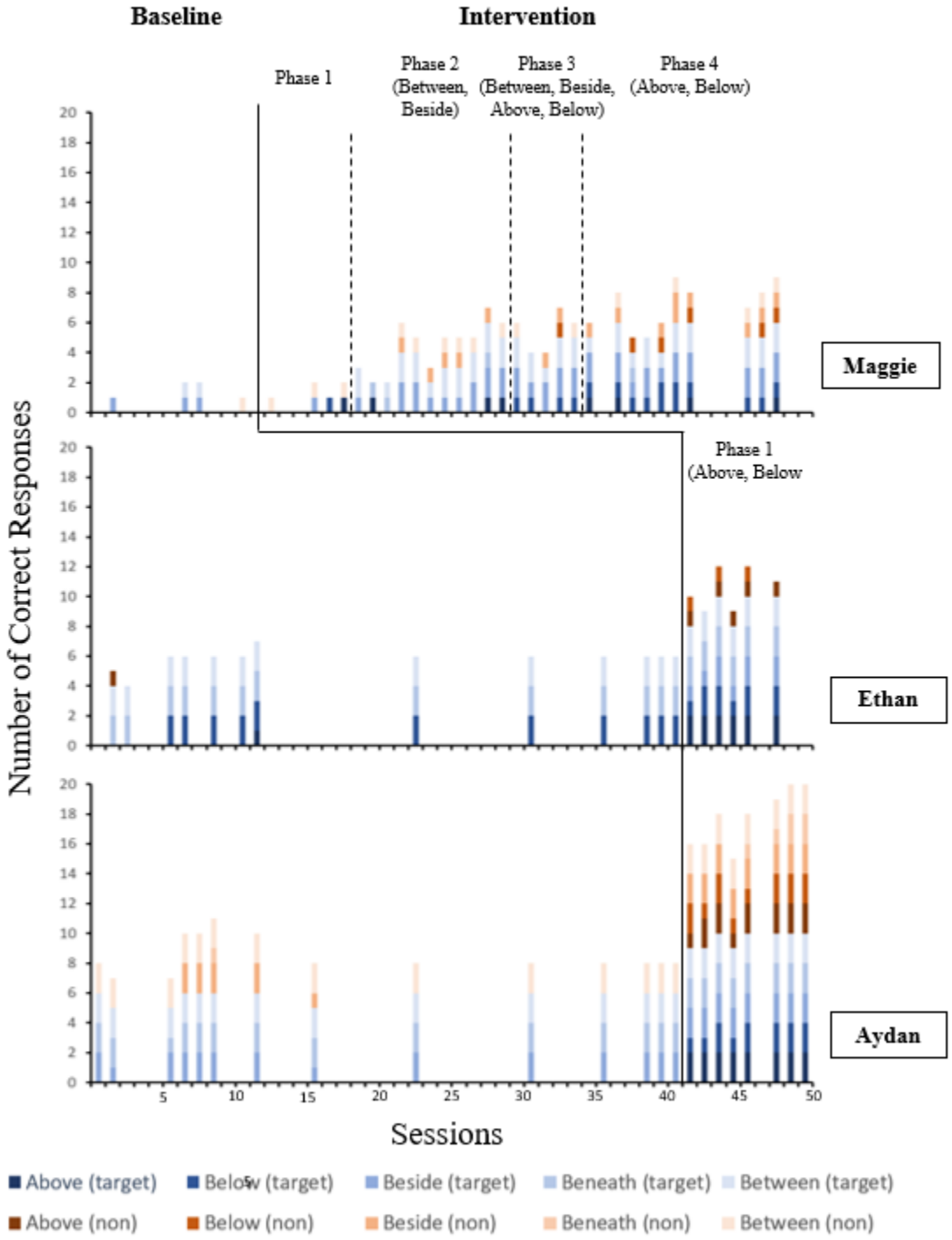
During the intervention condition, three participants (i.e., Maggie, Ethan, and Aydan) showed some improvement in responding to nontargeted information. Maggie's data path of the intervention showed slight increase with an overall mean of 1.23 (range 0-3). Ethan also showed a change of level of responding from almost zero to a correct response of 1 or 2 (mean = 1.33, range = 0–2). Aydan improved his correct responses from baseline to intervention with an overall mean of 8.13 (range = 6–10). For Aydan, there was an immediacy of effects on the nontargeted information with no overlapping data with the baseline data. There were no changes in the level of responding for other participants from baseline to intervention (mean = 2, no range for Laiyah; mean = 0, no range for Vaughn). For the generalization data, Aydan was also the only participant making clear improvement from baseline to intervention by responding with nine correct responses during the one generalization data session. Except for Aydan,

generalization data collected during the intervention condition for other target participants continued to show no trend and high stability with low levels of responding (mean = 1.5, range = 1–2 for Maggie; mean = 2, no range for Laiyah; 0 correct for Vaughn; 1 correct for Ethan).

To further understand the improvement patterns in the nontargeted information for Maggie, Ethan, and Aydan, I reported their corresponding responses between targeted information and nontargeted information on the five prepositions in Figure 4. This graph allows for an analysis of which prepositions the three participants responded correctly regarding targeted and nontargeted information. Based on the data, two patterns exist. First, during the intervention phases, participants were more likely to correctly tact the prepositions they were being taught (particularly when only two prepositions were included in an instructional session). Second, the improvement on nontargeted information (tacting) for the three target participants was generally associated with the prepositions they received direct instruction on targeted information (action), which further support the benefits of including nontargeted information in instruction while learning the targeted information.

Figure 4

Corresponding Responses on Action to Verbal Prompt (Targeted Information) and Tacting of Prepositions (Nontargeted Information) for Maggie, Ethan, and Aydan



Movement Skills

I measured the target participants' movement skills using the illustrated guide for administering and scoring movement skills of the TGMD (See Appendix H). I collected data once during baseline (i.e., pretest) and once at the end of the intervention (i.e., posttest) to determine whether participants acquired the movement skills throughout the sessions via observational learning. There were five different movement skills (i.e., run, gallop, hop, leap, and slide) and each movement skill included a performance criterion. If a participant performed a performance criterion, the participant received one point. Table 1 shows the results of target participants' pretest and posttest scores of movement skills.

According to the results, all target participants improved their scores from pretest to posttest with an increase of 1 point for Maggie and an increase of 2 points for all other participants. The total points all participants earned from five movement skills was 41 for the pretest and 50 for the posttest (pretest = 5, posttest = 6 for Maggie; pretest = 5, posttest = 7 for Laiyah; pretest = 8, posttest = 10 for Vaughn; pretest = 7, posttest = 9 for Ethan; pretest = 16, posttest = 18 for Aydan), which showed an increase of 9 points across participants through observational learning.

Table 1

Pretest and Posttest Assessment Results of Movement Skills across Participants

Participants	Movement Skills	Pretest Score	Posttest Score
Maggie	Run	3	3
	Gallop	0	1
	Hop	0	0
	Leap	1	1
	Slide	1	1
	Total Points	5	6
Laiyah	Run	3	3
	Gallop	1	1
	Hop	0	1
	Leap	1	1
	Slide	0	1
	Total Points	5	7
Vaughn	Run	3	4
	Gallop	1	2
	Hop	3	3
	Leap	0	0
	Slide	1	1
	Total Points	8	10
Ethan	Run	3	3
	Gallop	0	0
	Hop	3	3
	Leap	1	1
	Slide	0	2
	Total Points	7	9
Aydan	Run	4	4
	Gallop	2	3
	Hop	5	5
	Leap	1	2
	Slide	4	4
	Total Points	16	18
Total Points across Participants		41	50

Procedural Fidelity

Data on procedural fidelity were available on peer training sessions, peer-delivered probe sessions, and peer-delivered training sessions. A doctoral student in special education observed me and collected procedural fidelity data to determine the accuracy of the peer training on how to implement the simultaneous prompting procedure and on how to collect data. I calculated the procedural fidelity by dividing the number of observed behaviors by the number of planned behaviors and multiplying the ratio by 100 (Billingsley et al., 1980). Results of the procedural fidelity data on peer training yielded 100%.

I collected peer's procedural fidelity data during 100% of the peer-delivered probe sessions, by observing and recording the peer tutor's accuracy on the following steps: (a) delivering the attentional cue, (b) delivering the task direction, (c) waiting 5 s, and (d) delivering consequence. Using the same calculation method stated above, the mean procedural fidelity for the probe sessions was 96.7% (range = 95.2%–100%).

I also collected peer's procedural fidelity data during 100% of peer-delivered training sessions by recording peer's accuracy on the following training steps: (a) delivering the attentional cue, (b) asking the target participant to spin the wheel, (c) delivering the general task direction, (d) immediately delivering the correct model prompt with movement skills, (e) requesting the target student to repeat the correct prompt, (f) delivering the appropriate consequence (praise or error correction), and (g) delivering the corresponding nontargeted information as instructional feedback. Using the same calculation method stated above, the mean procedural fidelity for the peer-delivered training sessions was 97.5% (range = 94%–100%).

Social Validity

All target participants indicated that they liked working with their peer and they wanted to continue working with their peer in the future. They also responded that they liked learning prepositions while doing physical activity. In the question asking their most favorite parts of the study, two participants mentioned about the peer tutor's smiling face, and they were happy to meet the peer tutor during the study. Responses from the peer tutor indicated that she agreed with the ease of using simultaneous prompting procedure in teaching prepositions and movement skills simultaneously. The peer tutor strongly agreed that she felt she had better friendship with the target participants, and she liked to help her peers with disabilities learn something. In addition, the peer tutor indicated that teachers should use this type of teaching strategy because it helps students with disabilities learn in different ways.

The special education teacher agreed that peer-delivered simultaneous prompting procedure was (a) important when teaching students with disabilities, (b) effective and beneficial in teaching both academic content and physical activity, and (c) effective in improving the social interactions between students with disabilities and their peers without a disability. In addition, as benefits of peer tutoring, the special education teacher responded:

> I feel that one of the benefits of peer tutoring is that students attend better to information that has been modeled by a peer. I think that students are less intimidated when learning from a peer and are more likely to follow their example better. Also, I think that adding a social aspect to learning is always more engaging for the student so you will have more buy in.

When asked about the benefit of teaching core content combined with physical activity, the special education teacher responded that "students attend better when learning is accompanied by

physical movements. The addition of physical movements helps the student to more easily retain and recall the information and makes learning more engaging.”

CHAPTER 5: DISCUSSION

The purpose of this study was to investigate the effects of a peer-delivered simultaneous prompting procedure to teach academic core content (i.e., locative prepositions; English/Language Arts, conventions of standard English) combined with movement skills (i.e., run, hop, skip, slide, and gallop) to five students with mild to moderate intellectual disability. I used a single-case, multiple probe across participants design to determine if a functional relation exists between the intervention (i.e., a peer-delivered simultaneous prompting procedure) and two primary dependent variables (i.e., action to verbal prompts related to prepositions [targeted academic skill], tacting of prepositions [nontargeted academic skill]). I also collected data for movement skills (i.e., run, hop, skip, slide, and gallop) as well as procedural fidelity for both probe and training sessions delivered by the peer tutor. Finally, I collected social validity from the special education teacher, the peer tutor, and target participants to determine their perceptions on the feasibility and effectiveness of the intervention. In this chapter, I interpreted findings related to each research question. I also reported limitations, suggestions for future research, and implications for practice.

Question 1: Effects of Peer-delivered Simultaneous Prompting on Acquisition of Academic Core Content Knowledge (i.e., Locative Prepositions)

Targeted Skill: Action to Verbal Prompt

Results of this study indicated the peer-delivered simultaneous prompting procedure improved their demonstration of locative prepositions by the target participants with intellectual disability. During baseline conditions, all target participants showed no clear trend and low to moderate variability with a low level of responding for Maggie and Laiyah, low to moderate

level of responding for Vaughn, and a moderate but stable level of responding for Ethan and Aydan. After implementing the intervention, four target participants showed either an increasing trend (Maggie and Laiyah) or a clear change in the level of responding with no overlapping data with those in baseline (Ethan and Aydan) in their actions to verbal prompt when instruction targeted two prepositions during a session. Vaughn's intervention data showed a less clear improvement, although his data were more stable with a minimum of three correct responses (out of 10) per session.

Initially, the peer tutor was to implement the simultaneous prompting intervention to teach five target prepositions per session to a target participant. During the five interventions sessions for Maggie to learn all five prepositions per session (phase 1), she did not make any improvement. This could be because acquiring five prepositions in one session was too difficult for her. In addition, according to the special education teacher, Maggie was easily distracted by her surroundings and it was difficult for her to retain what she learned a few hours ago. For these reasons and based on phase 1 data for Maggie, I decided to decrease the number of prepositions being taught from five to two for Maggie in the following phases, as well as for other target participants. Teaching two prepositions per session allowed the peer tutor to repeatedly present each preposition five times instead of two times. This procedural change led to Maggie's performance improvement during phase 2. Increases in the number of correct actions to verbal prompts were replicated across Laiyah, Ethan, and Aydan, supporting three demonstrations of effects at three points in time. Hicks et al. (2015) implemented direct instruction to teach prepositions to three elementary school students with intellectual disability. During the intervention, a primary experimenter taught one preposition using direct instruction with examples and nonexamples to a participant who showed the most stable data during the baseline.

Once the participant made progress on the preposition learning, the experimenter taught the second preposition. As supported by Hicks et al. (2015), teaching a small number of prepositions per session to students with moderate intellectual disability might have accelerated their learning.

The benefit of targeting two prepositions with increased repetitions is evident in data during phase 4 (vs. phase 3) for Maggie and phase 3 (vs. phase 2) for Laiyah. In phase 3 for Maggie, the instruction included four prepositions (two previously learned prepositions and two new prepositions). Maggie showed limited progress and did not meet mastery criterion after five sessions, which indicated that it would be more effective to teach a smaller number of prepositions. In phase 4, the peer tutor focused on teaching two prepositions (*above* and *below*) to Maggie per session, because she did not acquire both words when they were presented along with two previously learned prepositions. Despite focusing on two prepositions in phase 4, Maggie's progress remained limited. Maggie may need more sessions to learn "above" and "below." Maggie was one of the target participants who took longer to acquire prepositions than other participants. During Phase 3 and Phase 4, Maggie consistently responded correctly on two prepositions (*beside* and *between*) that she learned during phase 2 and gradually responded correctly on "below" which was taught during phases 3 and 4. This indicates that if Maggie has more time to learn "below" and "above," she may be able to acquire both prepositions eventually. In addition, "above" is the most difficult preposition for all target participants to learn because they needed to place the ball slightly over the box with some distance between a ball and a box to differentiate between "on" and "above."

Similar to Maggie, during phase 2, Laiyah received instruction from the peer tutor on four prepositions (i.e., two learned prepositions from phase 1 [*above* and *below*] and two new prepositions [*beside* and *beneath*]). Laiyah at most made six correct responses (out of 10) during

phase 2, with data suggesting that she continued to struggle with learning the two new prepositions. As a result, during phase 3, Laiyah was taught only two prepositions (*beside* and *beneath*). Although Laiyah showed progress during phase 2, she demonstrated a more steady improvement in her correct action responses on prepositions when instruction focuses on two prepositions per session during phase 4. The study by Hicks et al. (2015) similarly supported Laiyah's data that teaching a small number of prospections was more beneficial in her learning.

Ethan and Aydan were two of the target participants who had the highest and most stable level of correct responses during baseline among the participants. They both had six correct action responses consistently during baseline, indicating that both students already acquired three prepositions (*beside*, *between*, and *beneath*). During the intervention condition, they received the instruction on two prepositions (*above* and *below*) and showed immediacy of effects of the intervention with no overlapping data between baseline and intervention. The reason why Ethan and Aydan mastered both words (*above* and *below*) consistently may be because they have already mastered three prepositions before the introduction of the intervention, and they were able to focus on learning two remaining prepositions. In addition, according to the special education teacher, although Aydan was struggling with social skills and adjusting to new environments, he was able to complete tasks that the special education teacher presented independently. Ethan has the highest IQ score (i.e., 110) among the five target participants. These factors may offer explanations for why both participants had a more consistent and immediate improvement compared to other participants.

Vaughn is the only participant with a less clear progress in his action to verbal prompts. Vaughn made a slight improvement during phase 2 by responding with five correct actions to verbal prompts, which did not overlap with data before phase 2. In the last two sessions, Vaughn

had five correct responses in acting to verbal prompts consecutively. If the intervention would have continued, Vaughn might be able to demonstrate more salient progress.

The use of the modification made to teach two prepositions in one session (instead of five prepositions in one session) for Maggie and presenting only two prepositions per session for all participants in the later phases can be supported by previous peer-delivered simultaneous prompting studies. For example, Collins et al. (2021) added a modification for a target participant who responded correctly when the peer tutor conducted the probe session but was unable to provide correct responses when the special education teacher conducted probe sessions. Researchers applied a modification of having the special education teacher conduct the probe sessions in the presence of the peer tutor. Once the modification was applied, the target participant met the mastery criterion. In addition, Park et al. (2021) used massed trials for the participant who was having difficulty achieving a specific step of a chained task of shooting a basketball. By using massed trials, the target participant practiced the step repeatedly and achieved criterion. These studies and the current dissertation study supported the dynamic feature of single-case research designs for data-based decision making (Ledford & Gast, 2018).

In conclusion, this study examined the effects of the peer-delivered simultaneous prompting procedure in teaching the target participants to put the ball according to the prepositions. Findings on the target participants' action to verbal prompt were consistent with previous research using the peer-delivered simultaneous prompting in teaching a leisure skill (Fetko et al., 2013), community signs (Tekin-Iftar, 2003), health content (Collins et al., 2021), and a chained task of shooting the basketball (Park et al., 2021) to students with developmental or intellectual disability that students with disabilities learned the targeted skills during the intervention.

Nontargeted Information: Tacting of Prepositions

Three of the target participants (i.e., Maggie, Ethan, and Aydan) showed an increase in the number of correct responses on the tacting of prepositions during phase 2 and phase 4 for Maggie and phase 1 for Ethan and Aydan. Maggie's intervention data path showed an overall increasing trend with a mean of 1.23 (range = 0–3), compared to a mean of 0.25 (range = 0–1) during baseline. Ethan showed a change in level of responding from a mean of 0.08 (range = 0–1) and high stability during baseline to a mean of 1.33 (range = 0–2) during intervention. Aydan also improved his correct responses from baseline (mean = 2.71, range = 2–5) to intervention (mean = 8.13, range = 6–10). For Aydan, there was an immediacy of effects on the nontargeted information with no overlapping data with the baseline data. Further analysis of the improvement patterns in the nontargeted information for Maggie, Ethan, and Aydan based on individual prepositions (Figure 4) showed that their improved preposition tacting skills (nontargeted information) was generally with the same prepositions they received direct instruction on targeted information (action), which further support the benefits of including nontargeted information in instruction while learning the targeted information. The rest of the target participants (i.e., Laiyah and Vaughn) did not demonstrate any improvements during the intervention. Laiyah consistently scored two correct responses (two times of *below*) during intervention and Vaughn did not make a correct response throughout the study.

Compared to the targeted information, two target participants (i.e., Laiyah and Vaughn) did not improve the nontargeted information during the intervention. This may be because the peer tutor delivered the nontargeted information only once at the end of each trial when the target participant performed an action correctly (e.g., "Good job! You put the ball _____ the box.") In addition, there was no procedure that involved explicitly asking the target participants to tact

each preposition with feedback or error correction during the intervention probe. For Laiyah and Vaughn, the verbal presentations of preposition tacting in an incidental format without explicit or systematic instruction may be insufficient for them to learn the skill. Laiyah was receiving speech therapy services and Vaughn also had difficulty verbally communicating with others. Both would likely benefit from more explicit instruction on tacting of the target prepositions. This finding is consistent with the finding of Park et al. (2021). In the study by Park et al., four participants with mild to moderate intellectual disability were exposed to nontargeted information (i.e., fine motor, gross motor, and movement knowledge) as instructional feedback while they were learning the chain task of shooting a basketball. Of the four participants, only one participant demonstrated improvement in nontargeted information learning. These findings suggest that some students with intellectual disability may need more repetitions or explicit instruction on nontargeted information. In addition, based on the concept of verbal behavior, the nontargeted information required participants to produce an intraverbal tact (vs. pure tact) based on three controlling antecedents of (a) verbal discriminative stimulus (i.e., “Where is the ball?”), (b) nonverbal discriminative stimulus (e.g., seeing the position of the ball), and (c) the audience. According to Rodriguez et al. (2022), intraverbal tact was observed only when all component skills (i.e., verbal discriminative stimulus, nonverbal discriminative stimulus, and the audience) were mastered. As a result, it may be more difficult and complex for Laiyah and Vaughn who did not master all three controlling antecedents to respond to multiple stimulus. In sum, the targeted skill (i.e., action to verbal prompt on prepositions) involves imitation with simpler discrimination whereas the nontargeted information (i.e., tacting of prepositions) reflects verbal behavior, which is more complicated due to stimulus complexity. Therefore, it is not surprising that some target participants did not make clear progress on the nontargeted information.

Although Laiyah and Vaughn did not demonstrate improvement in the tacting of prepositions, the remaining three participants showed increases in the correct identification of nontargeted information during the intervention phases. Intervention data on nontargeted information for Maggie, Ethan, and Aydan supported that adding nontargeted information, although incidental, may be an effective and efficient way to expose participants with intellectual disability to more content knowledge within the same instructional session. This finding is consistent with the study by Collins et al. (2021). Collins et al. added nontargeted information (i.e., examples of aerobic exercise and stretching) when a peer tutor taught the targeted information (importance of aerobic exercise and stretching) to three participants with moderate intellectual disability. All three target participants showed improvement in responding to both targeted and nontargeted information. It is important to note that in Collins et al. study, the correct answers of nontargeted information were words/phases (e.g., walking) or showing the posture (e.g., upper body stretching) and the delivery frequency of nontargeted information was five times per nontargeted information in one session. In the current study, Maggie, Ethan, and Aydan improved the nontargeted information (i.e., tacting of prepositions) during intervention phases when they were exposed to the nontargeted information five times per prepositions across two prepositions. These findings may suggest that nontargeted information needs to be easy or simple to answer or to be delivered more frequently for participants to learn nontargeted information without explicit instruction.

Overall, adding nontargeted information has been shown as an effective and efficient procedure in teaching science core content (Fetko et al., 2013), a functional activity of baking a cake (Karl et al., 2013), health content (Collins et al., 2021), and information related to a chained task of shooting the basketball (Park et al., 2021). The current study provided additional support

that some target participants were able to learn nontargeted information through incidental learning.

Question 2: Effects of Peer-delivered Simultaneous Prompting on Acquisition of Movement Skills

Acquisition of fundamental movement skills is important for children with moderate intellectual disability to increase physical activity (Zhang et al., 2021). Results of this study indicated a slight increase in movement skills, measured as pretest and posttest scores by the Test of Gross Motor Development (TGMD; Ulrich, 2000), across target participants (pretest = 5, posttest = 6 for Maggie; pretest = 5, posttest = 7 for Laiyah; pretest = 8, posttest = 10 for Vaughn; pretest = 7, posttest = 9 for Ethan; pretest = 16, posttest = 18 for Aydan). Compared to pretest scores, all participants improved at least one point in posttest. However, none of them mastered all performance criteria in at least one of five movement skills, which means that none of them learned at least one of five movement skills through the observational learning throughout the study. One plausible explanation was that there was insufficient time and opportunities for the target participants to learn all performance criteria of each movement skill (i.e., run, gallop, hop, leap, and slide). In the study by Morales et al. (2022), 40 children with autism received an adapted judo program for 6 months with the results showing there were significant differences between the experimental group and control group on movement skills acquisition. According to Morales et al., in order to demonstrate the statistical significance of the intervention in improving movement skills of participants, it was necessary to deliver the intervention at least 6 months. In the current study, the target participants had two opportunities to spin the roulette wheel. Therefore, a target participant had only two opportunities to practice two chosen movement skills. For example, when a target participant randomly selected "*run*"

and "*gallop*" on one day, they would have the opportunity to practice the movement skills of *run* and *gallop* once each. Because the spinning of wheel determined the selection of the movement skills randomly, a target participant might get to practice some movement skills more often than others. In addition to the limited opportunity, target participants also did not have enough time to practice the movement skills. During the intervention session, the target participants performed 10 times across two different movement skills (i.e., five times for each movement skill), which took less than one minute per movement skill. Throughout the study, Maggie, Laiyah, Vaughn, Ethan, and Aydan had 31, 22, 8, 7, and 9 interventions sessions, respectively, which means that they had at most 62, 44, 16, 14, and 18 min of time to perform movement skills, respectively.

In addition to the length of the intervention, improvement in movement skills may also require explicit instruction for students with intellectual disability. Ha et al. (2021) used a family-based explicit instruction to teach fundamental movement skills (e.g., running, jumping, and balancing) to children who were in grades 3 to 5. In addition, Maïano et al. (2019) conducted a systematic review to find the effects of explicit instruction in improving fundamental movement skills for children with intellectual disability. Both studies informed that explicit instruction was effective in improving overall fundamental movement skills of children with a disability. In this study, target participants observed the peer tutor's modeling of a chosen movement skill as part of model prompt for the target task (e.g., "*Run* and put the ball *above* the box"). However, there was no procedure to explicitly teach movement skills to the target participants and there was no error correction for performance, which might have further limited their learning.

Although the target participants did not meet the performance criteria of movement skills, there were some potential benefits for the target participants when adding physical activity into instruction of learning core content. First, three participants (i.e., Maggie, Laiyah, and Ethan)

received zero score in pretest in galloping, hopping and sliding, and sliding, respectively, which means that they did not know how to initiate these movement skills. In the posttest, they received one or two points in each movement skill, suggesting that the one-time model prompt from the peer tutor and an opportunity for them to follow the prompt might have offered some learning in certain performance criteria. Similarly, Vaughn improved his performance in the areas of running and galloping and Aydan improved his performance in the areas of galloping and leaping by one point each. These results indicated that the target participants might have benefited from the observational learning. Second, even though the amount of time was limited, all participants were able to engage in additional physical activity during academic core content learning. There are some benefits of engaging in physical activity during academic learning. Specifically, it allows students either to increase the physical activity level throughout the school or to improve their academic performance (Erwin et al., 2009; McMullen et al., 2014). According to the special education teacher, combining physical activity into academic core content learning can improve students' learning because they attend to the learning better and retain their knowledge longer. Further, it can provide breaks and enjoyment to students, which make them happy throughout the school (McMullen et al., 2014, 2019). In the current study, target participants engaged in a movement skill (e.g., "*Gallop* and put the ball *beneath* the box.") before engaging in the learning of a preposition, which allowed for physical movements and active engagement beyond simple sit-and-do tasks.

Question 3: Effects of Peer-delivered Simultaneous Prompting on Generalized Skills to New Materials in Classroom Setting

For the targeted skill of action to verbal prompt, generalization data were collected at least one across target participants and phases. Specifically, for Maggie, there was one

generalization data point (mean = 0, no range) during the baseline condition and two data points (mean = 4.5, range = 4–5) during the intervention condition. For Laiyah, there were three generalization data points (mean = 0.7, range = 0–1) during the baseline condition and two data points (mean = 6, range = 5–7) during the intervention condition. For Vaughn, there were four generalization data points (mean = 2.8, range = 2–4) during the baseline condition and one data point (mean = 4, no range) during the intervention condition. For Ethan, there were two generalization data points (mean = 6, no range) during the baseline condition and one data point (mean = 9, no range) during the intervention condition. For Aydan, there were two generalization data points (mean = 6, no range) during the baseline condition and one data point (mean = 10, no range) during the intervention condition.

During baseline conditions, all target participants showed no clear trend and low to moderate variability with a low level of responding for Maggie and Laiyah, low to moderate level of responding for Vaughn, and a moderate but stable level of responding for Ethan and Aydan. After delivering the intervention, all participants showed some improvement in generalizing their knowledge to other materials with which they were familiar (a pencil, a book, a chair, a table). Limited generalization data of targeted skill of action to verbal prompt for all participants showed a change in the level and no overlapping between the baseline data and the intervention data except for Vaughn.

For nontargeted skill of tacting prepositions, generalization data were also collected at least one across target participants and phases. Specifically, for Maggie, there was one generalization data point (mean = 0, no range) during the baseline condition and two data points (mean = 1.5, range = 1–2) during the intervention condition. For Laiyah, there were three generalization data points (mean = 1.3, range = 0–2) during baseline and two data points (mean =

2, no range) during the intervention condition. For Vaughn, there were four generalization data points (mean = 0, no range) during baseline and one data point (mean = 0, no range) during the intervention condition. For Ethan, there were two generalization data points (mean = 0, no range) during the baseline condition and one data point (mean = 1, no range) during the intervention condition. For Aydan, there were two generalization data points (mean = 2.5, range = 2–3) during baseline and one data point (mean = 9, no range) during the intervention condition.

During the baseline condition, data paths for the nontargeted skill of tacting prepositions for all target participants showed no clear trend and high stability with very low levels of responding. During the intervention condition, three participants (i.e., Maggie, Ethan, and Aydan) showed some improvement in generalizing their knowledge to other materials. Aydan was the only participant showing clear improvement from baseline to intervention by responding with nine correct responses during the one generalization data session.

Overall, the generalization data showed that some target participants were able to generalize their knowledge of locative prepositions from using a ball and boxes to using other materials often available in the classroom (a pencil, a book, a chair, a table). This finding is consistent with results from Hicks et al. (2006) study where three participants were asked to generalize both their skills of (a) expressively responding to verbal prompts across two different activities, including a scavenger hunt (e.g., placing the same objects used during intervention sessions around the classroom and then expressively responding to verbal prompt “Look beneath the table.”), and (b) requesting a desired reinforcer based on its location and their skill of action to verbal prompts during the morning transition activity (e.g., put their notebooks beneath their chairs after the verbal prompt was delivered). All participants in the Hicks et al. study successfully generalize their knowledge to three different activities. Although three target

participants showed some generalized skills in this study, other target participants (e.g., Vaughn for both actions to verbal prompts and tacting prepositions, and Laiyah for tacting prepositions) did not show improvement in generalization data. This may be because they did not master or demonstrate improvement in the targeted and nontargeted information, which may be difficult for them to generalize the information to other materials.

Question 4: Peer Tutor's Procedural Fidelity Level

The mean procedural fidelity for the probe sessions delivered by the peer tutor was 96.7% (range = 95.2%–100%). Among the four steps of the probe session, one step that the peer tutor sometimes missed was to deliver a consequence (e.g., thank you for your work) after collecting data. Except for this step, the peer tutor completed all other steps consistently with high procedural fidelity. The mean procedural fidelity for the peer-delivered training sessions was 97.5% (range = 94%–100%). Among the seven steps of the training sessions, the peer tutor sometimes missed the first step (i.e., delivering the attentional cue) and the sixth step (i.e., delivering the appropriate consequence [praise or error correction]). When a missing step occurred, I reminded the peer tutor not to skip the steps in the following session. These procedural fidelity data showed that the peer tutor was able to conduct both probe sessions and training sessions with high procedural fidelity after receiving two 30-min training sessions from me before beginning the baseline condition. These results are consistent with the previous studies using a peer-delivered simultaneous prompting procedure (Collins et al., 2021; Park et al., 2021). Collins et al. (2021) provided 30-min training consisting of verbal explanation, modeling, role playing, and performance feedback to the peer tutor. They collected the procedural fidelity data during 27% of all training sessions and the mean procedural fidelity was 99.5% (range = 97%–100%). In addition, Park et al. (2021) provided the same contents of the training program to three

peer tutors twice. Researchers collected the procedural fidelity data during 43% of the probe sessions and 31% of the training sessions. The mean procedural fidelity was 97.5% (range = 97%–98%), and 96.7% (range = 93.2%–100%), respectively. In both studies, after at most one-hour training, the peer tutors were able to conduct the probe sessions as well as the training sessions with high procedural fidelity.

In this study, the peer tutor not only delivered the simultaneous prompting procedure but also collected data with a high level of procedural fidelity. Findings from this study support that with minimum training (one hour at most), peers can effectively support students with disabilities in situations where teacher's attention or time may be limited.

Questions 5–7: Teacher's, Peer Tutor's, and Target Participants' Opinions on the Procedures and Outcomes of the Intervention

Social validity measures collected from the special education teacher, the peer tutor, and target participants indicated overall satisfaction with the intervention. The special education teacher agreed that the peer-delivered simultaneous prompting procedure is important and effective when teaching students with a disability. In addition, the special education teacher agreed that combining physical activity in academic core content learning for students with disabilities is beneficial in that the peer-delivered instructional procedure may lead to better social interactions between students with and without disabilities. Further, physical activity may encourage students with a disability to engage in academic learning because physical activity may provide them different ways and enjoyment in learning academic information. The peer tutor agreed to the ease of implementing the peer-delivered simultaneous prompting procedure combined with movement skills. She also strongly agreed with having better friendship with target participants after teaching. Further, the peer tutor mentioned that the simultaneous

prompting procedure needs to be used in school more often because this was effective and easy to be implemented for students with disabilities. Finally, based on the target participants' responses, there were social, emotional, and academic benefits they received from the intervention. All target participants responded "Yes" on the question asking if they liked to work with the peer tutor. Laiyah and Aydan responded that they liked her smiling face and felt happy during the study. Vaughn and Aydan responded that they learned prepositions from the peer tutor.

These results are consistent with previous studies using a peer-delivered simultaneous prompting procedure (Collins et al., 2021; Park et al., 2021). Both studies collected social validity data from various individuals, including the special education teacher, the physical education teacher, the peer tutor, and the target participants (Collins et al., 2021) and from the special education teacher, the paraprofessional, three peer tutors, and the target participants (Park et al., 2021). Results from these two studies also indicated teachers and the paraprofessional agreed that the peer-delivered simultaneous prompting procedure was effective in teaching academic core contents as well as in improving social skills for both students with and without a disability. Peer tutors who participated in studies agreed with the ease of using the simultaneous prompting procedure, and both peer tutors and the target participants had an opportunity to socially interact with each other during their respective studies.

In sum, the peer-delivered simultaneous prompting procedure was easy to implement by the peers, which often promoted social interactions between peer tutors without disabilities and target participants with intellectual disability based on perceptions from different consumers. Social validity findings from the current study supports the benefits of peer-delivered

simultaneous prompting for students with intellectual disability, which align with prior studies (Collins et al., 2021; Park et al., 2021).

Limitations

This study has several limitations. First, Vaughn, Ethan, and Aydan entered the intervention phase simultaneously due to time constraints. This limited additional replications of effects across multiple points in time to strengthen the intervention effects across five target participants. Further, only one participant (Aydan) out of five met the mastery criterion (i.e., 10 out of 10 correct responses in three consecutive sessions) on action to verbal prompt to end the intervention. Aydan was also the only participant who demonstrated 10 out of 10 on tacting prepositions during the last two intervention sessions. Although the rest of participants demonstrated increases in their action to verbal prompt after the peer tutor delivered the intervention, the intervention effects would have been stronger if all target participants were able to reach the mastery criterion.

Second, due to the end of the school, none of participants entered the maintenance phase for me to evaluate if they can maintain their learning after the intervention ended. Because maintenance data were not available, it is not possible to determine if peer-delivered simultaneously prompting would produce sustained learning.

The third limitation was related to the generalization data collection. Although this study was designed for the peer tutor to collect the generalization data using familiar items (i.e., a pencil, a book, and a chair), the data were limited in that the target participants' performance could be under the stimulus control of the peer tutor.

The fourth limitation relates to the use of consumers' satisfaction rating for the social validity. By asking social validity questions at the end of the study, respondents were more likely

to respond to those questions positively to please the experimenter (Ferguson et al., 2019). As a result, the social validity results might not completely reflect what the respondents truly thought about the intervention.

Finally, among 14 prepositions presented in the pre-assessment data collection form, this study only targeted five locative prepositions that all target participants had difficulty responding correctly and consistently during the pretest. This represents a very small range of locative prepositions.

Suggestions for Future Research

Considering the limitations described above, I offered several suggestions for future research. First, to fully demonstrate a strong experimental control, future researchers are encouraged to collect more data to demonstrate the functional relation between the dependent variables and the independent variable across participants through multiple replications of effects at different points in time. Second, another suggestion for future research is for researchers to collect maintenance data to determine if peer-delivered simultaneously prompting would produce sustained learning. Retaining the knowledge of locative prepositions would allow the target participants to apply the knowledge over time and beyond the duration of the study. In addition to maintenance data collection, future researchers are also encouraged to collect more systematic generalization data across individuals to verify if the target participants generalize their learning when interacting with other individuals or across different natural environments (e.g., classroom, gym, home, and recess). In terms of social validity data, future researchers are encouraged to use alternative and multiple means to gather social validity data more objectively. For example, future researchers may ask target students if they want or like to participate in the study at the middle of the study in casual manner to collect more valid data about the study or interventions

from participants. Researchers also may observe students and teachers in naturally environments to evaluate if they have spontaneously implemented or engaged in the interventions outside the research. Another way is to offer opportunities for target students to choose between the target intervention and another practice when learning prepositions to determine the students' preferences. Finally, it is warranted for future researchers to target other prepositions that were not addressed in this study, particularly those prepositions that are not location based and may be more abstract in nature (e.g., during, through). For example, future researchers may provide examples and nonexamples of a preposition (e.g., "this shows *through*, this does not show *through*") paired with photographs on the computer or iPad. After presenting multiple examples and nonexamples of the preposition through discrimination training, participants can be asked to respond to the preposition paired with a new photograph. This procedure will be effective to teach other prepositions that are more abstract and to promote generalization skills for participants.

In addition to the suggestions for research specifically related to the study limitations, there are additional areas for future research. The first suggestion is to decrease the number of prepositions that are taught to target participants in one session. According to the graph, Maggie was taught five prepositions during phase 1 of the intervention. Due to the difficulty for Maggie to acquire five prepositions at the same time, she was taught two prepositions at one session beginning phase 2 of the intervention. Although Maggie has made some progress (from mean = 0.75 to mean = 3.46) with the focus of two prepositions per session, she did not maintain acquired learning in phase 3 of the intervention when the peer tutor added two more prepositions in instruction. Hicks et al. (2015) taught three prepositions to three students with moderate intellectual disability and they introduced one preposition per session. Compared to Hicks et al.

study, the current study was initially designed to teach five prepositions in one session, which might have confused Maggie. Maggie's data during phase 1 of the intervention informed the decision to teach two prepositions per session in the following phases and for other target participants. A suggestion for future research is to consider learners' unique needs, including IQ, receptive and expressive communication skills, or academic performance, to determine the number of prepositions to present in one session and the number of repetitions required to maximize student learning.

Second, when combining physical activity to teach academic core content, future researchers may consider the way to combine physical activities and academic core content teaching. In this study, I combined movement skills with teaching locative prepositions. Specifically, from the starting line, target participants went to another point and then back to the starting point using a specific movement skill (i.e., run, hop, gallop, slide, and leap) presented on the wheel, then they placed the ball around the boxes according to the target preposition. Prepositions may be further taught using physical activity. For example, target participants may serve as "objects" and then they will be prompted to go "under," "between," "beside," or "on" the props (e.g., a table, a chair, and a box). The researcher or a peer tutor may say to the target participants, "let's go under the table," or "let's go between two boxes." Another example is for target participants to kick or throw a ball over a box or underneath a box. This approach can make physical activity necessary to teach prepositions because if target participants do not engage in physical activity, they will not be able to learn the prepositions. In addition, when combining physical activity with teaching academic core content, future research needs to consider which type of physical activity will be included. Because I planned to measure the performance of the movement skills of the target participants in pretest and posttest, five

movement skills that the target participants did not perform correctly were included in this study. On the contrarily, if the focus is to implement physical activity as a motivator or to increase the physical activity level of participants, physical activity may need to be easy to learn or may be those the participants already knew how to perform.

Third, although, in the current study, nontargeted information (i.e., tacting prepositions) was delivered at the end of the session as instructive feedback, future researchers may consider other ways to add nontargeted information into targeted information to increase both effectiveness and efficiency of nontargeted information acquisition. For example, nontargeted information can be added as a chained task (e.g., writing prepositions) to accomplish a discrete task (e.g., expressively identify prepositions) or related activities (e.g., throwing a ball) with targeted information (e.g., finding appropriate prepositions for throwing). This approach may increase the effectiveness in learning both targeted and nontargeted information because both information could be closely related to each other for learners to learn. In small group activities, nontargeted information can be delivered as observational leaning. A learner could have an opportunity to observe how other learners respond to the stimulus. This approach could potentially increase the efficiency of the learning because depending on how many learners are involved in the small group, a learner may be exposed to multiple opportunities to observe other learners' responses.

Finally, students with intellectual disability could benefit more when they receive instructions from peers in inclusive settings. Although I used a peer tutoring procedure to teach students with an intellectual disability, there was no data showing the effectiveness of the peer tutoring procedure in an inclusive setting. Future research may be conducted to examine the effects of peer tutoring for students with an intellectual disability to improve both academic and

social skills in an inclusive setting (e.g., general education PE class, general education language arts class).

Implications for Practice

Results from this study offer several implications for practice. First, simultaneous prompting procedure can be successfully implemented by a peer to teach prepositions to participants with intellectual disability. Peer-delivered simultaneous prompting procedure has been used in academic settings. According to prior studies (e.g., Collins et al., 2021; Park et al., 2021), it was easy for peer tutors to implement the simultaneous prompting procedure to teach both academic core content and functional skills including physical activity. Throughout the peer-delivered simultaneous prompting procedure, participants with disability are able to acquire the opportunity to interact with their peers without disability. In addition, in this study, the special education teacher mentioned that participants with disability may be more motivated to engage in intervention when the peer tutor implements the intervention. For the peer tutors, in addition to the opportunity to socially interact with their peers with disabilities, they also are able to be a teacher to provide instructional information to individuals with disabilities and support them to maintain their learning. By teaching or supporting individuals with disabilities, peers may feel a sense of accomplishments and self-esteem by observing improved learning in students with disabilities. The peer tutor who participated in this study was very eager to teach prepositions to her peers with intellectual disability. After the daily session ended, the peer tutor and I sometimes sat and spent 5–10 min discussing the sessions and the data she collected. She was passionate about teaching and supporting the learning of the target participants with disabilities. The peer-delivered simultaneous prompting procedure offers classroom teachers

options to share some of teaching responsibilities with peers who are interested in taking on tutoring roles and to plan social activities by pairing students with and without disabilities.

Second, combining academic core content teaching with physical activity in classroom settings offers benefits. By combining academic core content with physical activity, students with intellectual disability are exposed to physical activity, which may increase their physical activity level as well as improve their academic performance. Although a growing body of literature has established a strong link between engagement in physical activity and academic performance, there is limited research that offered specific instructions of interventions describing how to combine academic core content teaching with physical activity. Collins et al. (2021) used a peer-delivered simultaneous prompting procedure to teach health-related academic core content while the peer tutor and the target student with intellectual disability were walking in a gym or a hallway together. In addition, Park et al. (2021) taught physical activity (i.e., shooting the basketball) combining with related information to students with intellectual disability during the physical education class. In this study, the target participants with intellectual disability were taught prepositions with integration of movement skills. Furthermore, locative prepositions can be used frequently in physical activity or team sports (i.e., soccer, baseball, basketball, and football). If the target students with intellectual disability know the concept of locative prepositions, they will be able to have more opportunities to engage in physical activity or team sports with other peers. According to the special education teacher, physical activity helps the target participants engage in learning and retain information more. The active movement aspect of the instruction (e.g., "*Run* to place the ball above the box.") may have also kept the academic instruction more "interesting." McMullen et al. (2019) explored students' experiences who participated in a classroom movement program. The first keyword of

the focus group interviews was an inherent enjoyment of movement. The interviewees responded that the movement program was fun and made them happy throughout the school. Movement skills may be fun an activity not only as itself, but when combined with academic time.

The final implication for practice is that special education teachers may maximize instructional time and learning opportunities by adding nontargeted information into targeted content or activity during each instructional trial, thus increasing the efficiency of instruction. In this study, nontargeted information was preposition tacting. During the instructional session, some target participants were able to learn the locative prepositions as well as how to tact the locations of the ball. In prior studies, nontargeted information was added in the targeted content or activity with various types of contents or activities (setting wrist watch, Falkenstine et al., 2009; cooking activity; Karl et al., 2013; examples of physical activity; Collins et al., 2021; and movement knowledge; Park et al., 2021). Although learning the nontargeted information may be incidental, which may not be sufficient for some students with intellectual disability, integrating nontargeted information into target academic content offers an additional learning opportunity for other students.

Summary

The purpose of this study was to investigate the effects of a peer-delivered simultaneous prompting procedure to teach academic core content (i.e., locative prepositions; English/Language Arts) combined with movement skills (i.e., run, hop, skip, slide, and gallop) to students with mild to moderate intellectual disability. In this multiple probe across participants design, results showed there were three demonstrations of effects of the peer-delivered simultaneous prompting procedure on target participants' actions of selected locative prepositions. Although there was a change in delivering the targeted information during the

intervention (e.g., phase 1 and phase 2 for Maggie), there is a functional relation between the first dependent variable (i.e., action to verbal prompt) and the intervention. This finding consistent with previous research using the peer-delivered simultaneous prompting in teaching a leisure skill (Fetko et al., 2013), community signs (Tekin-Iftar, 2003), health content (Collins et al., 2021), and a chained task of shooting the basketball (Park et al., 2021) to students with developmental or intellectual disabilities.

In addition to teaching the targeted information, this study added nontargeted information (i.e., tacting prepositions) to teach additional information to the target participants. Although only one participant showed immediacy of the effects of the intervention with no overlapping data between baseline and intervention and two participants showed slight increase, adding nontargeted information has been examined as an effective and efficient procedure in teaching science core content (Fetko et al., 2013), a functional activity of baking a cake (Karl et al., 2013), health content (Collins et al., 2021), and information related to a chained task of shooting the basketball (Park et al., 2021). In this study, target participants with intellectual disability received both targeted and nontargeted information combined with movement skills. Movement skills were measured in pretest and posttest. Even though none of the target participants met the performance criteria in each movement skill in the posttest, they were able to initiate one or two movement skills that they did not know how to begin in the pretest.

In this study, the peer tutor served as a data collector as well as an interventionist. As the researcher, I collected the procedural fidelity data to verify if the peer tutor collected data and conducted the intervention as planned. The results of the procedure fidelity data were high, and this result aligns with findings from previous studies using a peer-delivered simultaneous prompting procedure (Collins et al., 2021; Fetko et al., 2013; Park et al., 2021; Tekin-Iftar,

2003). In the social validity data collection, the peer tutor responded that it was easy to implement the procedure after two 30-min training.

In sum, a peer-delivered simultaneous prompting procedure was effective in teaching targeted information (i.e., action to verbal prompt) to all target participants and nontargeted information (i.e., tacting preposition) to three of the five target participants. In addition, the peer tutor delivered the procedure and collected data with high procedural fidelity. All individuals who participated in this study (i.e., special education teacher, peer tutor, and target participants) agreed with the acceptance of the intervention and they also suggested implementing the intervention in various settings for content learning of individual with intellectual disability.

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APPENDIX A – THE PARENTAL CONSENT FORMS

UNC CHARLOTTE
Department of Special Education and Child Development
9201 University City Boulevard, Charlotte, NC 28223-0001
t/ 704-687-8828 f/ 704-687-2916 www.uncc.edu

Parent or Legal Guardian Consent for Peer Tutors' Participation in Research

Title of the Project: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability
Principal Investigator: Gwitaek Park, Doctoral student, Special Education and Child Development, University of North Carolina at Charlotte
Faculty Advisor: Ya-yu Lo, Professor, Special Education and Child Development, University of North Carolina at Charlotte

Your child is invited to participate in a research study. Your child's participation in this research study is voluntary. The information provided is to help you decide whether or not to allow your child to participate. If you have any questions, please ask.

Important Information You Need to Know

- The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.
- Your child may participate in this study if he/she is enrolled in the sane elementary school with students with moderate to several intellectual disability. I will teach your child to use a specific teaching method, called a simultaneous prompting procedure, to teach prepositions to his/her peers with moderate to several intellectual disability. A simultaneous prompting procedure is an effective way to teach academic core content to students with disabilities. The instruction will be combined with physical activity (such as running, hopping, galloping, leaping, sliding), which will help your child teach prepositions to students with moderate to several intellectual disability in a fun way.
- We do not believe that your child will experience any risk from participating in this study. The instruction will occur during the transition time between warm-up activity and teaching instruction during P.E. class so your child will not lose his/her learning time.
- Your child will continue to take part in normal classroom learning and activities, even if you decide to not let your child participate in this study.
- Please read this form and ask any questions you may have before you decide whether to let your child participate in this research study.

Why are we doing this study?

The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach prepositions combined with physical activity to students with mild to moderate intellectual disability.

Why is your child being asked to be in this research study?
You are being asked to allow your child to participate in this study because he/she is enrolled in the same elementary school with students with moderate to several intellectual disability.

What will your child do in this study?
Your child will be asked to participate in this study as a peer tutor. Your child will teach prepositions to students with moderate to several intellectual disability and will collect data to ensure that students with disabilities learn the target prepositions. Your child will support students with moderate to several intellectual disability to learn prepositions using a simultaneous prompting procedure, which is an effective teaching strategy. Because the instruction will be combined with physical activity, your child will be able to participate in physical activity (such as running, hopping, galloping, leaping, sliding) during the study. At the end of the study, your child will be asked to respond to a questionnaire to indicate how he/she feels about the study and the instruction that he/she will implement.

What benefits might children experience?
The benefits of participation in this study are providing your child the knowledge of a new instruction (called, a simultaneous prompting procedure) and the opportuntity to interact with their peers with disabilities and to teach them as a peer tutor.

What risks might children experience?
We do not believe that there are any risks for your child's participation because this study will occur as part of routine classroom teaching (specifically, during transition time in P.E. class) and your child will not lose any learning time.

How will information be protected?
We will not use your child's name. Instead, we will use a pseudonym (fake name) and this fake name will be used on any forms we will use in this study. Paper materials will be stored in a locked filing cabinet in the researcher's office and electronic materials will be stored in a University Dropbox folder that the researcher team can access. Only the research team will have routine access to the study information. Other people with approval from the Investigator may need to see the information we collect, including people who work for UNC Charlotte and other agencies as required by law or allowed by federal regulations.

How will information be used after the study is over?
After this study is complete, study data may be shared with other researchers for use in other studies without asking for consent again or as may be needed as part of publishing our results. The data we share will NOT include information that could identify your child.

Will your child receive an incentive for taking part in this study?
Your child will not receive any payment for being in this study.

What other choices are there if I don't want my child to take part in this study?
If you decide not to let your child take part in this study, he/she will still take part in the routine classroom activities as he/she would on a normal day. The classroom teacher will still teach all students the daily lessons. No other information about your child would be collected.

What are my child's rights if he/she takes part in this study?
Participating in this study is voluntary. Even if you decide to allow your child to be part of the study now, you may change your mind and stop your child's participation at any time. You and your child will not lose any benefits to which you are entitled.

Who can answer my questions about this study and participant rights?
For questions about this research, you may contact Gwitaek Park at 980-210-6621, gpark6@uncc.edu or Dr. Ya-yu Lo at 704-687-8716, ylo1@uncc.edu.

If you have questions about research participant's rights, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Office of Research Compliance at 704-687-1871 or uncc-irb@uncc.edu.

Parent or Legally Authorized Representative Consent
By signing this document, you are agreeing to your child's participation in this study. Make sure you understand what the study is about before you sign. You will receive a copy of this document for your records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree for my child to take part in this study.

_____
Participant (Child) Name (PRINT)

_____
Parent/Legally Authorized Representative Name and Relationship to Participant (PRINT)

_____
Signature Date

_____
Name and Signature of person obtaining consent Date

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Parent or Legal Guardian Consent for Target Students' Participation in Research

Title of the Project: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability
Principal Investigator: Gwitaek Park, Doctoral student, Special Education and Child Development, University of North Carolina at Charlotte
Faculty Advisor: Ya-yu Lo, Professor, Special Education and Child Development, University of North Carolina at Charlotte

Your child is invited to participate in a research study. Your child's participation in this research study is voluntary. The information provided is to help you decide whether or not to allow your child to participate. If you have any questions, please ask.

Important Information You Need to Know

- The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.
- Your child may participate in this study if he/she is an elementary student with a moderate to several intellectual disability who is able to respond verbally when spoken to or asked a question. Children in this study will be in their normal classroom with their peers. Your child's peers will be trained by the research team to use a specific teaching method, called a simultaneous prompting procedure, to teach prepositions. A simultaneous prompting procedure is an effective way to teach academic core content to students with a disability. The instruction will be combined with physical activity (such as running, hopping, galloping, leaping, sliding), which will help your child learn prepositions in a fun way.
- We do not believe that your child will experience any risk from participating in this study. The instruction will occur during the transition time between warm-up activity and teaching instruction in the P.E. class so your child will not lose his/her learning time.
- Your child will continue to take part in normal classroom learning and activities, even if you decide to not let your child participate in this study.
- Please read this form and ask any questions you may have before you decide whether to let your child participate in this research study.

Why are we doing this study?

The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach prepositions combined with physical activity to students with mild to moderate intellectual disability.

Why is your child being asked to be in this research study?

You are being asked to allow your child to participate in this study because he/she is an elementary school student with moderate to several intellectual disability and is able to verbally respond to prompts/questions. In addition, your child can use this response mode consistently.

What will children do in this study?

Your child will be asked to participate in daily probe sessions and daily training sessions. Your child's peers will support your child to learn about prepositions using a simultaneous prompting procedure, which is an effective teaching strategy. Because the instruction will be combined with physical activity, your child will be able to participate in physical activity (such as running, hopping, galloping, leaping, sliding) during the study as part of the P.E. class. Before learning about prepositions, your child will be asked to respond to questions, which are to check your child's understanding about the target prepositions.

At the end of the study, your child will be asked to respond to a short survey to indicate his/her experience in the study.

What benefits might children experience?

The benefits of participation in this study are providing your child the knowledge of prepositions and the opportuntity to interact with his/her peers without disabilities and to engage in physical activities.

What risks might children experience?

We do not believe that there are any risks to your child's participation because this study will occur as part of routine classroom teaching.

How will information be protected?

We will not use your child's name. Instead, we will use a pseudonym (fake name) and this fake name will be used on any forms we will use in this study. Paper materials will be stored in a locked filing cabinet in the researcher's office and electronic materials will be stored in a University Dropbox folder that the researcher team can access. Only the research team will have routine access to the study information. Other people with approval from the Investigator, may need to see the information we collect, including people who work for UNC Charlotte and other agencies as required by law or allowed by federal regulations.

How will information be used after the study is over?

After this study is complete, study data may be shared with other researchers for use in other studies without asking for consent again or as may be needed as part of publishing our results. The data we share will NOT include information that could identify your child.

Will my child receive an incentive for taking part in this study?

Your child will not receive any payment for being in this study.

What other choices are there if I don't want my child to take part in this study?

If you decide not to let your child take part in this study, he/she will still take part in the routine classroom activities as he/she would on a normal day. The classroom teacher will still teach all students the daily lessons. No other information about them would be collected.

What are my child's rights if he/she takes part in this study?

Participating in this study is voluntary. Even if you decide to allow your child to be part of the study now, you may change your mind and stop his/her participation at any time. You and your child will not lose any benefits to which you are entitled.

Who can answer my questions about this study and participant rights?

For questions about this research, you may contact Gwitaek Park at 980-210-6621, gpark6@uncc.edu or Dr. Ya-yu Lo at 704-687-8716, ylo1@uncc.edu.

If you have questions about research participant's rights, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Office of Research Compliance at 704-687-1871 or uncc-irb@uncc.edu.

Parent or Legally Authorized Representative Consent

By signing this document, you are agreeing to your child's participation in this study. Make sure you understand what the study is about before you sign. You will receive a copy of this document for your records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree for my child to take part in this study.

_____

Participant (Child) Name (PRINT)

_____

Parent/Legally Authorized Representative Name and Relationship to Participant (PRINT)

_____

Signature Date

_____

Name and Signature of person obtaining consent Date

APPENDIX B – STUDENT ASSENT FORMS

Department of Special Education and Child Development
9201 University City Boulevard, Charlotte, NC 28223-0001
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Assent Form (for Peer Tutors)

Study Title: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability

My name is Mr. Gwitaek Park and I am a doctoral student in Special Education at The University of North Carolina at Charlotte. I am doing a study to see if students in special education can learn prepositions from their peer tutors.

If you want to be in my study, I will ask you to teach students with disabilities prepositions with physical activity when you go to physical education class each day. I will train you on what to do. This is not a test and you will not be graded. We will also ask you some questions about how you like the experience at the end of the study.

Your parents said it was ok for you to be in this study and have signed a form like this one. You do not have to say "yes" if you do not want to be in the study. If you say "no" or if you say "yes" and change your mind later, you can stop at any time and no one will be mad at you. You can ask questions at any time.

I hope that this new way of providing instruction will help students with disabilities learn the prepositions in a fun way, but I can't be sure it will. This study will not hurt you.

When I am done with the study, I will write a report. I will not use your name in the report.

If you want to be in this study, please sign your name.

_____ _____

Participant Name/Signature Date

_____ _____

Signature of Investigator Date

Emancipated Minor (as defined by NC General Statute 7B-101.14) is a person who has not yet reached their 18th birthday and meets at least one of the following criteria: 1) has legally terminated custodial rights of his/her parents and has been declared 'emancipated' by a court; 2) is married, or 3) is serving in the armed forces of the United States.

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Student Assent Form (for Students with a Disability)

Study Title: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability

I would like to do physical activity with my peer tutor in gym class.

My parents said it was ok.

I hope I will learn new things.

I am making an X beside my name to show I like to be in the study.

_____	_____	_____
Participant Name	Participant Mark	Date

_____	_____
Signature of Investigator	Date

Emancipated Minor (as defined by NC General Statute 7B-101.14) is a person who has not yet reached their 18th birthday and meets at least one of the following criteria: 1) has legally terminated custodial rights of his/her parents and has been declared 'emancipated' by a court; 2) is married, or 3) is serving in the armed forces of the United States.

APPENDIX C – THE SPECIAL AND PHYSICAL EDUCATION TEACHER CONSENT FORMS

UNC CHARLOTTE
Department of Special Education and Child Development
9201 University City Boulevard, Charlotte, NC 28223-0001
t/ 704-687-8828 f/ 704-687-2916 www.uncc.edu

The Special Education Consent to Participate in a Research Study

Title of the Project: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability
Principal Investigator: Gwitaek Park, Doctoral student, Special Education and Child Development, University of North Carolina at Charlotte
Faculty Advisor: Ya-yu Lo, Professor, Special Education and Child Development, University of North Carolina at Charlotte

You are invited to participate in a research study. Participation in this research study is voluntary. The information provided is to help you decide whether or not to participate. If you have any questions, please ask.

Important Information You Need to Know

- The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.
- Your participation will include nominating students with moderate to several intellectual disability and peers based on the given selection criteria. Additionally, at the end of the study, one member of the research team will contact you to complete a brief survey/questionnaire to gather your opinion about the intervention.
- Please read this form and ask any questions you may have before you decide whether to participate in this research study.

Why are we doing this study?

The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.

Why are you being asked to be in this research study?

You are being asked to be in this study because you are a special education teacher of students with moderate to several intellectual disability and are able to provide perceptions on the intervention.

What will happen if I take part in this study?

If you choose to participate, we will ask you to nominate students with moderate to several intellectual disability and peers based on the given selection criteria. You will also complete a questionnaire at the end of the study. The questionnaires will ask questions about the effects of a peer-delivered simultaneous

prompting procedure in improving social interaction between participants with a disability and without a disability, academic core content learning, and physical activity of students with mild to moderate intellectual disability. In addition, you will be asked to write on the benefits of having peer tutors and of teaching core content combined with physical activity as a classroom teacher. The questionnaire will task you less than 10 min.

What benefits might I experience?
You will not benefit directly from being in this study. Your students might benefit from the study giving them the knowledge of prepositions and the opportuntity to interact with their peers without disabilities and to engage in physical activities.

What risks might I experience?
We do not believe that there are any risks associated with your participation.

How will my information be protected?
We will not use your name. Paper materials will be stored in a locked filing cabinet in the researcher's office and electronic materials will be stored in a University Dropbox folder that the researcher team can access. Only the research team will have routine access to the study information. Other people with approval from the Investigator, may need to see the information we collect, including people who work for UNC Charlotte and other agencies as required by law or allowed by federal regulations.

How will my information be used after the study is over?
After this study is complete, study data may be shared with other researchers for use in other studies without asking for consent again or as may be needed as part of publishing our results. The data we share will NOT include information that could identify you.

Will I receive an incentive for taking part in this study?
You will not receive any payment for being in this study.

What other choices do I have if I don't take part in this study?
If you decide not to take part in this study, you won't be asked to complete the questionnaire at the end of the study.

What are my rights if I take part in this study?
Participating in this study is voluntary. Even if you decide to be part of the study now, you may change your mind and stop your participation at any time. You and your students will not lose any benefits to which you are entitled.

Who can answer my questions about this study and my rights as a participant?
For questions about this research, you may contact Gwitaek Park at 980-210-6621, gpark6@uncc.edu or Dr. Ya-yu Lo at 704-687-8716, ylo1@uncc.edu.

If you have questions about research participant's rights, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Office of Research Compliance at 704-687-1871 or uncc-irb@uncc.edu.

Consent to Participate

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will receive a copy of this document for your records. If you have any

questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree to take part in this study.

_____
Name (PRINT)

_____
Signature Date

_____
Name & Signature of person obtaining consent Date

Department of Special Education and Child Development
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The Physical Education Teacher Consent to Participate in a Research Study

Title of the Project: Effects of a Peer-Delivered Simultaneous Prompting Strategy to Teach Core Content Combined with Physical Activity to Students with Intellectual Disability
Principal Investigator: Gwitaek Park, Doctoral student, Special Education and Child Development, University of North Carolina at Charlotte
Faculty Advisor: Ya-yu Lo, Professor, Special Education and Child Development, University of North Carolina at Charlotte

You are invited to participate in a research study. Participation in this research study is voluntary. The information provided is to help you decide whether or not to participate. If you have any questions, please ask.

Important Information You Need to Know

- The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.
- Your participation will include completing a brief survey/questionnaire to gather your opinion about the intervention at the end of the study.
- Please read this form and ask any questions you may have before you decide whether to participate in this research study.

Why are we doing this study?
The purpose of this study is to examine the effects of a peer-delivered simultaneous prompting procedure to teach English prepositions combined with physical activity to students with moderate to several intellectual disability.

Why are you being asked to be in this research study?
You are being asked to be in this study because you are a physical education teacher and are able to provide perceptions on the intervention, which will occur in the gym during the physical education class.

What will happen if I take part in this study?
If you choose to participate you will complete a questionnaire at the end of the study. The questionnaires will ask questions about the effects of a peer-delivered simultaneous prompting procedure in improving social interaction between participants with a disability and without a disability, academic core content learning, and physical activity of students with mild to moderate intellectual disability. In addition, you will be asked to write on the benefits of having peer tutors and of teaching core content combined with physical activity as a physical education teacher. The questionnaire will task you less than 10 min.

What benefits might I experience?
You will not benefit directly from being in this study. Your students might benefit from the student giving them the knowledge of prepositions and the opportuntity to interact with their peers without disabilities and to engage in physical activities.

What risks might I experience?
We do not believe that there are any risks to your participation.

How will my information be protected?
We will not use your name. Paper materials will be stored in a locked filing cabinet in the research's office and electronic materials will be stored in a University Dropbox folder that the researcher team can access. Only the research team will have routine access to the study information. Other people with approval from the Investigator, may need to see the information we collect, including people who work for UNC Charlotte and other agencies as required by law or allowed by federal regulations.

How will my information be used after the study is over?
After this study is complete, study data may be shared with other researchers for use in other studies without asking for consent again or as may be needed as part of publishing our results. The data we share will NOT include information that could identify you.

Will I receive an incentive for taking part in this study?
You will not receive any payment for being in this study.

What other choices do I have if I don't take part in this study?
If you decide not to take part in this study, you won't be asked to complete the questionnaire at the end of the study.

What are my rights if I take part in this study?
Participating in this study is voluntary. Even if you decide to be part of the study now, you may change your mind and stop your participation at any time. You and your students will not lose any benefits to which you are entitled.

Who can answer my questions about this study and my rights as a participant?
For questions about this research, you may contact Gwitaek Park at 980-210-6621, gpark6@uncc.edu or Dr. Ya-yu Lo at 704-687-8716, ylo1@uncc.edu.

If you have questions about research participant's rights, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Office of Research Compliance at 704-687-1871 or uncc-irb@uncc.edu.

Consent to Participate

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will receive a copy of this document for your records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree to take part in this study.

_____

Name (PRINT)

_____

Signature Date

_____

Name & Signature of person obtaining consent Date

APPENSIX D – SOCIAL VALIDITY QUESTIONNAIRES

	1 Strongly Disagree	2 Disagree	3 Do Not Know	4 Agree	5 Strongly Agree
Teachers					
Peer-tutor teaching strategy is important when teaching students with a disability.					
Integrating academic core content teaching into physical activity is important when teaching academic content to students with a disability					
Peer-tutor teaching during P.E. had positive effects on social interaction between participants with a disability and without a disability.					
Peer-tutor teaching was an effective way to teach academic core content (such as prepositions) to students with a disability.					
Integrating academic core content teaching into physical activity was an effective way to teach academic content to students with a disability.					
What do you see as the benefit of having peer tutors?					
What do you see as the benefit of teaching core content combined with physical activity?					
Peer tutors					
It was easy for me to teach prepositions to students with a disability using the teaching strategy (called simultaneous prompting procedure).					
It was easy for me to teach prepositions combined with movement skills to students with a disability.					
I feel I had better friendship with my peers with disabilities after teaching.					

What do you like about being a peer tutor?			
Should teachers use peer tutoring strategy in school more often? Why or why not?			
	1 No	2 Not Sure	3 Yes
Target students			
Did you like working with [peer tutor]?			
Would you like to continue working with [peer tutor] in the future?			
Did you like learning prepositions while doing physical activity during P.E.?			
What is the best part of working with [peer tutor]?			
What did you learn from working with [peer tutor]?			
What is the part of working with [peer tutor] that you did not like?			

APPENDIX E – PROCEDURAL FIDELITY CHECKLISTS FOR PEER TUTOR

Probe Sessions

Name_____ Peer Tutor _____

Date_____ Time Begin_____ Time End_____

Please place a check in the appropriate column below.

Prepositions	Attentional Cue	Task Direction	Wait 5 seconds	Correct	Incorrect	No	Conse-quence
Action to response							
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
Tacting prepositions							
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

Procedural Fidelity Score _____ (____/44 x 100)

Notes:

Training Sessions

Name_____ Peer Tutor _____

Date_____ Time Begin_____ Time End_____

Please place a check in the appropriate column below.

	Attentional Cue	Spin	Task Direction	Wait 0 seconds	Deliver Prompt	Request Repeat	Feedback	Non-Target
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Procedural Fidelity Score _____ (____/72 x 100)

Notes:

APPENDIX F – PEER TUTOR TRAINING PROCEDURAL FIDELITY SHEET

Name_____ Peer Tutor _____

Date_____ Time Begin_____ Time End_____

Please place a check in the appropriate column below.

Steps		YES	NO
Training session	1. Explained the tasks using verbal prompt		
	2. Showed the tasks using model prompt		
	3. Role played as a peer tutor		
	4. Role played as a target student		
	5. Used the visual reminder		
	6. Continued training until tutors meeting 100% criterion		

Probe session	1. Explained how to collect the daily probe on target students' behavior following verbal prompts		
	2. Explained how to collect the daily probe on target students' tacting behavior		
	3. Role played as a peer tutor		
	4. Role played as a target student		
	5. Used the visual reminder		
	6. Continued training until tutors meeting 100% criterion		
Total			

Procedural Fidelity Score _____ (____/12 x 100)

Notes:

APPENDIX G – THE PRE-ASSESSMENT DATA COLLECTION FORM

Name_____ Investigator_____

Date_____ Time Begin_____ Time End_____

Preposition	**Student Response (+,-)**		**Preposition**	**Student Response (+,-)**	
	Receptively Response (Tact)			Expressively response (Act out)	
Above			Above		
Behind			Behind		
Below			Below		
Beneath			Beneath		
Beside			Beside		
Between			Between		
In			In		
Inside			Inside		
Next to			Next to		
On			On		
Outside			Outside		
Over			Over		
Under			Under		
Underneath			Underneath		

APPENDIX H – THE ILLUSTRATED GUIDE FOR ADMINISTERING AND SCORING MOVEMENT SKILLS OF THE TGMD

Skill	Materials	Directions	Performance Criteria
Run	60 feet of clear space, and two cones	Place two cones 50 feet apart. Make sure there is at least 8 to 10 feet of space beyond the second cone for a safe stopping distance. Tell the child to run as fast as he or she can from one cone to the other when you say "Go." Repeat a second trial.	1. Arms move in opposition to legs, elbows bent 2. Brief period where both feet are off the ground 3. Narrow foot placement landing on heel or toe (i.e., not flat footed) 4. Nonsupport leg bent approximately 90 degrees (i.e., close to buttocks)
Gallop	25 feet of clear space, and tape or two cones	Mark off a distance of 25 feet with two cones or tapes. Tell the child to gallop from one cone to the other. Repeat a second trial by galloping back to the original cone.	1. Arms bent and lifted to waist level at takeoff 2. A step forward with the lead foot followed by a step with the trailing foot to a position adjacent to or behind the lead foot 3. Brief period when both feet are off the floor 4. Maintains a rhythmic pattern for four consecutive gallops
Hop	A minimum of 15 feet of clear space	Tell the child to hop three times on his or her preferred foot (established before testing) and then three times on the other foot. Repeat a second trial.	1. Nonsupport leg swings forward in pendular fashion to produce force 2. Foot of nonsupport leg remains behind body 3. Arms flexed and swing forward to produce force 4. Takes off and lands three consecutive times on preferred foot 5. Takes off and lands three consecutive times on nonpreferred foot
Leap	A minimum of 20 feet of clear space, a beanbag, and tape	Place a beanbag on the floor. Attach a piece of tape on the floor so it is parallel to and 10 feet away from the beanbag. Have the child stand on the tape and run up and	1. Take off on one foot and land on the opposite foot 2. A period where both feet are off the ground longer than running 3. Forward reach with the arm opposite the lead foot

		leap over the beanbag. Repeat a second trial.	
Slide	A minimum of 25 feet of clear space, a straight line, and two cones	Place the cones 25 feet apart on top of a line on the floor. Tell the child to slide from one cone to the other and back. Repeat a second trial.	1. Body turned sideways so shoulders are aligned with the line on the floor 2. A step sideways with lead foot followed by a slide of the trailing foot to a point next to the lead foot 3. A minimum of four continuous step-slide cycles to the right 4. A minimum of four continuous step-slide cycles to the left

Source: Ulrich, D. (2000). *The test of gross motor development*. Prod-Ed.