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Using Constant Time Delay and eCoaching to Teach Employment Skills to Young Adults with Autism Spectrum Disorder and Intellectual Disability in a Community Work Environment

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Using Constant Time Delay and *e*Coaching to Teach Employment Skills to Young Adults with Autism Spectrum Disorder and Intellectual Disability in a Community Work Environment

by

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Abstract

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The goal of secondary education is to prepare students for greater levels of independence, especially in the areas of continued education and community employment. However, despite underlying potential, young adults with autism spectrum disorder (ASD) and comorbid intellectual disability (ID) are vastly underrepresented in the area of postsecondary employment. This could be attributed to the unique characteristics and learning needs of these students, or it may be a function of the lack of effective, evidence-based teaching practices, implemented with fidelity.

The purpose of this study was to examine the effectiveness and participant perceptions of implementing the constant time delay (CTD) procedure, using a four second delay interval between presentation of the stimulus and providing a controlling prompt, when teaching students with ASD and ID during community-based instruction (CBI). Additionally, *e*Coaching, using bug-in-ear (BIE) technology, was used to coach the teacher interventionist. A multiple probe design across participants was used to evaluate the effects of the CTD with *e*Coaching intervention package on participants' ability to independently sort and arrange clothing in sequential order by size in a local department store. The procedural fidelity of the teacher interventionist implementing CTD while receiving *e*Coaching, which consisted of real-time praise and corrective feedback, also was measured. Utilizing *e*Coaching while applying the CTD procedure resulted in consistently high rates of procedural fidelity. Correspondingly, the results demonstrated that young adult students rapidly acquired, generalized, and maintained the newly learned sorting skills up to three weeks post-intervention. All participants highly rated the CTD with *e*Coaching intervention package in terms of its effectiveness and desire for continued teaching and learning use of the procedure. Last, the discussion focuses on implications for practical application and future research.

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Dedication

This manuscript is dedicated to my husband, Brian. You are my best friend, and your love, support, and encouragement throughout this project (and always) means more than words can express. I would also like to dedicate this work to my three amazing children, Katelyn (9), Gavin (6), and Christa (1). Katelyn, your patience and compassion for others is truly inspirational and I love watching you help others. Gavin, you always know how to make those around you laugh, and completion of this project marks a turning point in a regular conversation between us. When you ask me if I'm "Dr. Mommy yet," while reminding me how much I've been reading and writing to obtain that title, I will proudly answer "YES!" Christa, although you will not remember this journey when you're older, all of my professors, colleagues, and study participants will remember you and your ability to light up any room!

I would also like to dedicate this work to my mother, Betsy, who shaped my work ethic, and my father, Bob, who read every single paper I wrote during grad school. You have both always believed in me, and I will be forever grateful for your love and support. Finally, I dedicate this work to my late grandmother, Christa, who inspired my love of learning and passion for teaching. I know you're smiling down.

Chapter 1

Introduction

Graduating from high school is a major developmental milestone, as it marks the beginning of transitioning into adulthood and increasing levels of independence. While this is a time of excitement and promise for most, students with disabilities tend to face many challenges, especially when it comes to continuing education and obtaining competitive employment (Bennett & Dukes, 2013; Test et al., 2009). In particular, individuals who have autism spectrum disorder (ASD) and comorbid intellectual disability (ID) are vastly underrepresented in the area of postsecondary employment (Bennett & Dukes, 2013; Roux et al., 2013; Van Laarhoven, Winiarski, Blood, & Chan, 2012; Walker, Uphold, Richter, & Test, 2010). In fact, in analyzing data from Wave 5 of the National Longitudinal Transition Study 2 (NLTS2), Roux et al. (2013) found that lower functioning adults with ASD (i.e., secondary diagnosis of ID) have decreased conversational skills and are less likely to obtain employment, in comparison to their higher functioning counterparts. These findings could be attributed to the unique characteristics and learning needs of individuals with ASD and ID, or the paucity of quality interventions on employment training for this population of learners (Bennett & Dukes, 2013; Hendricks, 2010; Roux et al., 2013). Despite obstacles and limited conversational abilities, Roux et al. (2013) highlighted the underlying potential for employability among low functioning young adults with ASD. More positive employment outcomes may result from increasing the application of evidence-based practices used to instruct adolescents with ASD and ID during secondary years when individualized transition services are provided (Bennett & Dukes, 2013: Roux et al., 2013; Test et al., 2009).

Since 1983, amendments to the Individuals with Disabilities Education Act (IDEA) have mandated accessibility to transition services for adolescents with disabilities, using postsecondary employment as the accountability measure (Hendricks, 2010; Kohler & Field, 2003). Such transition services are designed to identify appropriate postsecondary goals in each student's Individualized Education Program (IEP), specifically in the areas of employment and independent functioning (IDEA, 2004). Transition planning entails setting achievable postsecondary goals and providing students with the tools needed to accomplish desired outcomes. It is well documented that accessibility to effective transition services positively influences postsecondary outcomes (Bennett, Frain, Brady, Rosenberg, & Surinak, 2009; Test et al., 2009). However, there is a tremendous need for increased implementation of evidence-based instruction during employment training for students with disabilities (Bennett & Dukes, 2013; Bennett, Ramasamy, & Honsberger, 2013).

In examining the postschool outcomes of students with disabilities, Test et al. (2009) found several influential predictors for obtaining postsecondary employment. One predictor was participation in an employment-based transition program. Providing students with training and work experience during secondary years resulted in more favorable postschool employment outcomes (Test et al., 2009). A second predictor was community experience. Learning in the natural environment had positive postsecondary effects for students with disabilities (Hendricks, 2010; Test et al., 2009). A third predictor pertained to using evidence-based teaching procedures and doing so with fidelity. While there is limited research on employment training, specifically for students with ASD and ID (Bennett & Dukes, 2013; Hendricks, 2010; Roux et al., 2013), implementing evidence-based instructional procedures is recommended (Bennett & Dukes, 2013;

Horner et al., 2005; Swain, Lane, & Gast, 2015). Furthermore, it is imperative to consistently implement these procedures with fidelity (Horner et al., 2005).

Given these predictors of postsecondary employment (Test et al., 2009), the growing number of adolescents diagnosed with ASD approaching adulthood (Hendricks, 2010; Roux et al., 2013), and difficulties individuals with ID typically have acquiring, maintaining, and generalizing skills (Grigal, Hart, & Migliore, 2011), there is a compelling reason to explore further evidence-based instructional practices to implement during employment-based transition training. Adolescents with ASD and ID represent a unique population of students who require systematic instruction and repetition to perform independently acquired tasks within the desired environment (Bennett & Dukes, 2013; Taylor et al., 2002). These learners have distinct characteristics and learning needs that must be taken into consideration. In sum, strengthening the quality of education and services during the critical transition period is essential to promoting positive postsecondary employment outcomes for adolescents and young adults with ASD and ID (Bennett & Dukes, 2013; Test et al., 2009).

Response prompting procedures have been shown empirically to enhance learning in students with ASD and ID (Brandt, Weinkauf, Zeug, & Klatt, 2016; Hall, Schuster, Wolery, Gast, & Doyle, 1992; Swain et al., 2015). By definition, response prompting is the systematic presentation and eventual removal of prompts while receiving praise for independent correct responses (Swain et al., 2015; Wolery et al., 1992). Swain et al. (2015) identified several types of response prompting procedures, including constant time delay (CTD), graduated guidance, progressive time delay (PTD), simultaneous prompting (SP), and system of least prompts (SLP). Of the listed teaching approaches, SP, PTD, and CTD stand out as being especially effective in teaching adolescents with ASD and ID (Brandt et al., 2016; Coleman, Hurley, & Cihak, 2012;

Miller & Test, 1989; Riesen, McDonnel, Johnson, Polychronis, & Jameson, 2003; Swain et al., 2015). These three variations of response prompting are similar in that they are all considered near-errorless approaches that ensure correct student responses to discriminative stimuli (Brandt et al., 2016; Swain et al., 2016). Comparative studies have resulted consistently in mixed findings as to which procedure it the *most* effective and efficient (Riesen et al., 2003; Schuster, Ault, Collins, & Hall, 2014; Walker, 2008). However, of the three procedures, CTD tends to predictively have positive learner outcomes when used to teach students with ASD and ID (Ault, Gast, & Wolery, 1988; Seward, Schuster et al., 2014). Moreover, outcome data tend to contain few student errors when the CTD procedure is used (Swain et al., 2015).

Constant Time Delay

CTD is a near-errorless learning strategy that involves systematic fading of the controlling prompt to the discriminative stimulus (Hughes, Fredrick, & Keel, 2002; Riesen et al., 2003). This instructional procedure is employed in two sequential phases (Ault et al., 1992). During the initial phase, a zero second time delay occurs. Hence, the discriminative stimulus and controlling prompt are presented to the student with a zero second delay interval; thus, providing ample opportunity and encouragement for a correct student response (Ault et al., 1992). Subsequent to two successful trials with a zero second delay interval (i.e., the student performs 100% of the steps of a task correctly with prompts), instructional staff transition to Phase Two. During the second phase, the discriminative stimulus is presented to the student. However, the controlling prompt is withheld for a predetermined duration of time (i.e., four seconds). If the student provides an incorrect response or fails to respond within the fixed time interval (i.e., four seconds), instructional staff revert to a zero second time delay, to ensure a correct response even if that means a prompted correct. The CTD procedure differs from other time delay procedures (i.e., progressive time delay) in that the presentation of the controlling prompt occurs within a consistent and predictable time frame and remains constant throughout the intervention (Snell & Gast, 1981). The predictable nature of this instructional strategy has been shown empirically to enhance skill acquisition in students with ASD and ID, while also promoting generalization of the target skills (Brandt et al., 2016; Bozkurt & Gursel, 2005; Seward et al., 2014).

CTD is an instructional procedure that has been used effectively to teach students with ASD and ID in various learning environments (e.g., special education classroom, inclusive general education classroom, vocational classroom, and in the community setting; Ault et al., 1988; Jameson, McDonnell, Johnson, Riesen, & Polychronis, 2007; Bozkurt & Gursel, 2005; Branham, Collins, Schuster, & Kleinert, 1999; Swain et al., 2015). Application of the CTD procedure commonly has taken place in either (a) a classroom setting (Schuster et al., 1992; Swain et al., 2015; Wolery, Ault, Gast, Doyle, & Griffen, 1991) or (b) a realistic environment (e.g., home economics classroom) located within the school (Chandler, Schuster, & Stevens, 1993; Schuster, Gast, & Wolery, 1988). Community-based settings (e.g., restaurant, bank, post office) have been used in some studies to measure generalization of newly learned skills following CTD instruction (Branham et al., 1999; Swain et al., 2015). Empirical research supports teaching students with ASD and ID in community-based settings, and community-based instruction (CBI) is even considered a "best practice" approach to teaching students with developmental delays (Bennett & Dukes, 2013; Branham et al., 1999). CBI provides students with the opportunity to perform designated skills (e.g., employment skills, community skills) in the environment where they would naturally take place (e.g., department store, grocery store).

Given the troublingly low employment rates of young adults with disabilities and the positive outcomes that result from learning in the natural environment (Test et al., 2009), it is reasonable to believe that implementing an evidence-based instructional procedure during CBI would enhance skill acquisition in students with ASD and ID. The CTD procedure has more than three decades of research supporting its effectiveness; however, the author was unable to find a published study that specifically measures acquisition of employment skills during CBI as a result of CTD instruction. Chandler et al. (1993) used CTD to teach employment skills to students with mild and moderate disabilities, yet instruction did not take place during CBI. Branham et al. (1999) and Swain et al. (2015) used the CTD procedure within a community setting to teach students with ASD and ID; however, employment skill acquisition was not the focus of either study. Though use of the CTD procedure has resulted in positive learning outcomes when used to teach students with ASD and ID (Hall et al., 1992; Seward et al., 2014; Walker, 2008), errors in procedural fidelity also have been reported (Brandt et al., 2016). Consequently, student outcomes may be influenced by limited methods of monitoring and possible discrepancies between strategy implementation (Kretlow & Bartholomew, 2010). In contrast, utilizing cutting-edge technology, such as *e*Coaching, trained professionals can provide instructional staff with immediate, real-time feedback while using the CTD procedure during CBI.

***e*Coaching**

Over the past 50 plus years, we have witnessed major advances in the field of education (Ploessl & Rock, 2014), including technology advances and the development of innovative ways to provide instructional staff with immediate real time feedback on their performance (Rock, et al., 2012; Rock et al., 2009). Through virtual technology, *e*Coaching enables a trained professional to provide on-the-spot feedback to instructional staff while they are teaching (Rock et al., 2009). Rather than receiving delayed feedback following a face-to-face observation, the *e*Coaching technique provides evidence-based performance feedback that is immediate, positive, corrective, and specific (Scheeler, Ruhl, & McAfee, 2004). Rock and colleagues (2009) reported the recipients of *e*Coaching rated the experience as highly beneficial to their teaching and afforded them [teachers] an opportunity to bridge the research-to-practice gap. Rather than simply learning a new classroom approach, *e*Coaching facilitates use of evidence-based practices, while providing repeated implementation opportunities and continuous high-quality, performance-based feedback to instructional staff. *e*Coaching requires trainees to use Bug-In-Ear technology (BIE), which consists of a Bluetooth headset and stationary camera that actively records the intervention session. A trained professional in the field of education watches in real-time (from a separate location) and gives ongoing feedback and praise as the trainee employs the target strategy (e.g., CTD) in the classroom or designated learning environment (e.g., community setting). BIE technology is very user-friendly without being too intrusive to the teaching and learning process (Rock et al., 2009). Additionally, providing educational staff with feedback in real-time has been shown to effectively increase the use of evidence-based practices and trainees have reported positive growth in their teaching approaches (Rock et al., 2009).

While it seems reasonable to assume that *e*Coaching would be an effective way to promote the use of CTD during CBI, the use of BIE technology to enhance procedural fidelity of this prompt procedure while instructing students with ASD and ID has yet to be empirically validated. Thus, the purpose of this dissertation research was to combine an evidence-based instructional procedure, CTD, with *e*Coaching as an intervention package and measure its effectiveness in a community-based work environment while measuring simultaneously procedural fidelity. The subsequent chapters are formatted as follows. Chapter two provides an extensive 30-year review of the literature on the CTD procedure. Chapter three describes the single case research methodology used for this study. Research questions, specific participant information, and experimental conditions are all described in this chapter. Chapter four contains the results of this study. Research questions are answered and visual analyses of figures are reported. Chapter five entails study conclusions. Finally limitations as well as future research and teaching suggestions are offered.

Chapter 2

Review of the Literature

The 1983 amendments to the Individuals with Disabilities Education Act (IDEA) highlighted the need to improve transition services for students with disabilities (Kohler & Field, 2003). Such services require Individualized Education Programs (IEPs) to include measurable, individualized postsecondary goals, that address training and education, employment, and independent functioning (IDEA, 2004). With the 1997 reauthorization of IDEA (PL-105-17), transition planning became a federal requirement for students with disabilities, starting at the age of 14. However, in accordance with the latest (2004) reauthorization (PL-108-446), the mandated age of transition planning is now 16. Though some states continue to require transition planning at the age of 14, most states follow the federal mandate; implementing transition services just two years shy of the student's typical high school graduation (Cimera, Burgess, & Bedesem, 2014).

Although current federal mandates guarantee transition services for adolescents with disabilities, students identified as having intellectual disability (ID) remain underrepresented in the area of postsecondary employment (Bouck, 2014; Grigal, Hart, & Migliore, 2011; Luftig & Muthert, 2005; Pickens & Dymond, 2015). Indeed, in comparison to other students with disabilities (e.g., learning disabilities, emotional disabilities), students with ID tend to have higher unemployment rates. One reason may be that they struggle acquiring, generalizing, and transferring essential skills needed to attain a job (Bouck, 2014; Caton & Kagan, 2006; Luftig & Muthert, 2005). An additional factor may be lack of exposure to work experiences prior to graduating high school (Pickens & Dymond, 2015).

It is well documented that students with mild or moderate disabilities show favorable outcomes when learning in "natural" environments (i.e., community-based instruction, [CBI]; Branham, Cihak, Alberto, Kessler, & Taber, 2003; Collings, Schuster, & Kleinert, 1999; Chandler, Schuster, & Stevens, 1993). However, limited school district budgets and accessibility to transportation puts constraints on providing CBI to students who need it. Even so, it is essential for school personnel examine the strategic application of evidence-based procedures that guide secondary transition programs in special education if this population is to gain community employment. Exploring the location of instruction (e.g., general education classroom, special education classroom, community setting) in addition to measures of acquisition, maintenance, and generalization of vital transition skills (e.g., life skills, vocational skills) is imperative.

Instructional Practices

All students with disabilities, including those with ID, are entitled to receive educational services in the least restrictive environment (LRE; IDEA, 2004); yet, the most appropriate learning environment may differ based on the individual needs of each learner. Additionally, there are varying perspectives on what constitutes an appropriate educational curricula and classroom setting for learners with ID. While some authorities support a functional skills curriculum (Morse & Schuster, 2000), others advocate exposing students with ID to the general education curriculum in an inclusive setting (Jimenez, Browder, Spooner, & Dibiase, 2012). Providing learning opportunities in the natural environment through CBI also is strongly recommended (Cihak, Alberto, Kessler, & Taber, 2004; Pickens & Dymond, 2015).

Regardless of the curricula and classroom setting, the accumulated research supports specific strategies for promoting acquisition, generalization, and maintenance of newly learned skills. Providing learning opportunities that increase correct student responses (e.g., constant time delay, progressive time delay, simultaneous prompting, system of least prompts, most-to-least prompts) have been shown to enhance overall learning in students with ID (Ault, Gast, & Wolery, 1988; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Swain, Lane, & Gast, 2015). Although research supports positive outcomes for each of these prompt procedures, comparative studies have demonstrated that constant time delay (CTD) is an especially effective and efficient instructional procedure, as measured by participants' acquisition and maintenance of discrete skills (Coleman, Hurley, & Cihak, 2012; Miller & Test, 1989; Riesen, McDonnel, Johnson, Polychronis, & Jameson, 2003).

Constant time delay. CTD is defined as a near-errorless learning method where the instructional staff fades the controlling prompt to the target stimulus while teaching a new skill (Hughes, Fredrick, & Keel, 2002; Riesen et al., 2003). The CTD procedure is implemented in two distinct phases (Ault et al., 1992). During phase one, a zero second time delay occurs, where the discriminative stimulus and controlling prompt are presented with a zero second delay interval (Ault et al., 1988). This means that the instructional staff gives a verbal directive that requires a student response while immediately providing the controlling prompt. The intent is to ensure a correct, prompted, student response (Riesen et al., 2003). After two trials using a zero second delay interval, instructional staff transition to the next phase. During phase two, instructional staff withholds the controlling prompt for a predetermined time delay interval (i.e., four seconds) subsequent to presentation of the target stimulus (Bozkurt & Gursel, 2005). The predetermined time delay interval (e.g., four seconds) is provided when the student fails to respond to the target stimulus. When an incorrect student response is given during this phase, instructional staff immediately interrupts the incorrect response and provides a controlling prompt (e.g., verbal or gestural prompt). Following a correct response to the discriminative stimulus, the teacher provides verbal praise as the student continues to the next step of the task. In comparison to other time delay procedures (i.e., progressive time delay), CTD is unique in that it provides students with a consistent and predictable delay (as opposed to gradual), subsequent to stimulus presentation (Snell & Gast, 1981).

Prior to implementation of the CTD procedure, Snell and Gast (1981) recommend looking for specific student characteristics to select the most appropriate application of the intended instructional method. First, when selecting the type of controlling prompt to be administered, student comprehension abilities must be taken into consideration. Second, students should be capable of waiting for the delay; rather than depending on receiving an immediate prompt. Finally, the instructional arrangement requires that students are compliant when working either one-on-one or in a small group setting with instructional staff (Snell & Gast, 1981). In addition to applying the CTD procedure to students who appear to represent a “good fit,” educators must select achievable, age-appropriate tasks to introduce, while individualizing the length of the delay as well as the type of prompt provided (e.g., verbal, visual). Furthermore, the instructional arrangement (e.g., individual, dyadic, triadic), setting (e.g., community, resource room, inclusive general education classroom), and training of instructional staff are critical interdependent factors when promoting procedural fidelity of CTD implementation.

Empirical research suggests the CTD procedure is both effective and efficient when used on a one-on-one basis (Branham, Collins, Schuster, & Kleinert, 1999; Miller & Test, 1989) and when applied with pairs or small groups of students (Griffen, Wolery, & Schuster, 1992; Hall, Schuster, Wolery, & Gast, 1992; Wolery, Ault, Gast, Doyle, & Griffen, 1991). Researchers also have employed the CTD procedure during embedded instruction, across learning domains (e.g., academics, functional skills, vocational training), and environments (e.g., general education classroom, special education classroom, community-based instruction). The described studies have conclusively yielded positive student outcomes in the acquisition of a new skill or skills (Jameson, McDonnell, Johnson, Riesen, & Polychronis, 2007; Jimenez et al., 2012; Morse & Schuster, 2000). Moreover, a variety of individuals have acted as interventionists' responsible for implementing the CTD procedure, including special education teachers (Swain et al., 2015) and paraprofessionals (Jameson et al., 2007; Riesen et al., 2003). Despite the documented successes of the CTD procedure, little has been reported on the experience and training of teaching staff prior to implementing the CTD procedure. Accordingly, feedback (e.g., praise, corrective or contingent instruction) received by instructional staff throughout the intervention is unknown. Thus, it is unclear whether or not the CTD procedure has been consistently implemented with fidelity, which can directly influence student achievement (Kretlow & Bartholomew, 2010).

The purpose of this review is threefold. The first purpose is to determine the effectiveness and efficiency of implementing the CTD procedure when educating students identified as having ID. The second purpose is to examine critically methodological implications of empirical studies on CTD, and identify ways to enhance replication and generalizability of the approach. The third purpose is to examine the accumulated literature on the procedural application of CTD. More specifically, it is to investigate the implementation of CTD across settings, skills learned, and interventionists.

Methodology

Procedures

Search procedures. An extensive review of the literature was conducted on the use of a specific prompt procedure, Constant Time Delay (CTD), with persons with ID. Peer-reviewed research spanning a thirty-year period (1987-2017) was included in the search. A preliminary search was conducted using the Educational Resources Information Center (ERIC) and EBSCOhost databases available through the university library website, as well as Google Scholar. Keywords in the initial search included full and truncated versions of *constant time delay, time delay, intellectual disability, mental retardation, embedded instruction, high school, transition, independent functioning, postsecondary preparation, employment,* and *prompt procedures*. A secondary search was conducted by scanning reference lists of published, peer-reviewed articles and electronically retrieving copies of those studies that met the inclusion criteria.

Inclusion/exclusion criteria. Documented initial search procedures cumulatively yielded just over 50 peer-reviewed studies. After reviewing the title and keywords, the number of articles was reduced to 34. Next, each abstract was analyzed, further reducing the number of studies to a total of 19. Only studies that measured the effectiveness of a time delay procedure, included participants with developmental delays, and appeared to include the targeted age range (e.g., between the ages of eight and twenty-one), even if not specified, were chosen for additional examination. Following full text analysis, the final selection of an article was based on the following inclusion criteria: (a) study participants included individuals identified as having ID; (b) the study specifically measured the effects of using the CTD procedure or the effectiveness of CTD versus another prompting approach (e.g., progressive time delay [PTD], simultaneous prompting); and (c) time delay procedures were used, while implementing functional, vocational, or academic skills instruction with students between the ages of eight and twenty-one.

Articles were excluded from the review based on the following criteria: (a) participants were identified as having a disability other than ID (e.g., learning disability); (b) time delay procedures were implemented with children younger than age eight (e.g., early intervention); and/or (c) if the study measured embedded instruction only, rather than simultaneously measuring the effectiveness of CTD during embedded instruction; and finally, (d) specific prompting procedures *other* than CTD were measured (e.g., progressive time delay, simultaneous prompting).

Analysis of the literature. A total of 19 peer-reviewed studies met the inclusionary criteria for the present review of the literature, all of which employed single-subject research designs. Table 1 presents content across these 19 studies. Specifically, the purpose, detailed participant information (i.e., number of participants and specific disability identification), the students' educational placement and study's intervention setting, instructional staff responsible for employing the time delay procedure, along with the numeric delay of seconds used, specific research design, and study results are shown.

Table 1. Content across Studies

Article	Purpose	Participants	Setting	Teaching Staff	Design	Results
Ault et al., (1988)	Compare effectiveness and efficiency of CTD vs. PTD in teaching community-sight word reading	3 students with moderate ID, ages 8-11	Educated in self-contained classroom. Intervention: 1:1 in classroom	Teacher; 5-s delay for CTD; up to 8-s delay for PTD	Parallel treatments design across sign words, across subjects	Both procedures were effective in promoting acquisition & maintenance of community-sign words. CTD was more efficient for some, but not all participants.
Bozkurt & Gursel, (2005)	Examine the effectiveness of CTD when teaching mealtime	3 adolescents with moderate ID, ages 14-17	Special education classroom	Researcher with experience teaching	Multiple probe design with probe	All participants acquired, maintained, and generalized the newly learned skills.

	preparation skills to students with ID			special education	conditions across behaviors	
Branham et al., (1999)	Determining efficiency of CTD procedure when learning community skills	3 secondary students identified as having moderate ID, ages 14-20	Educated in inclusive environment participated in CBI 2x/weekly, & received a functional life skills curriculum. 1:1 for intervention, which took place in the classroom and during CBI	Teacher; 3-s delay	Multiple probe design; 3-s CTD procedure	The CTD procedure was effective in teaching 3 community skills across 3 instructional techniques. All skills were successfully generalized to the community setting.
Chandler et al., (1993)	Effectiveness of using CTD to teach employment skills; used a 5-s delay	4 high school students with mild-moderate ID (16-18 years)	Received CBI weekly, attended inclusive classrooms, and received job skill training. Intervention sessions took place in classroom and in school cafeteria	Special Education Teacher	Multiple probe design	All participants acquired new employment skills while maintaining a low rate of errors (3.2%).
Coleman, Hurley, & Cihak, (2012)	Compare effectiveness and efficiency of 2 CTD interventions: Teacher-directed & computer-directed instruction	3 students with moderate ID, ages 10-12	Self-contained classroom for students with moderate-severe disabilities	Teacher vs. Computer	Alternating treatments design	Both CDT instructional methods were effective; however, teacher-directed proved to be more efficient (i.e., students reached criterion in fewer sessions).
Griffen et al., (1992)	1) Determine the effectiveness of using CTD when teaching chained tasks in triads. 2) Measure if observational learning would occur	3 students with moderate ID, ages 10-13	1:3 (triadic) for intervention; Educated in self-contained classroom.	Teacher; 5-s delay	Multiple probe across students and tasks	CTD was effective in group setting. Each student acquired one skills following direct instruction using CTD. Additionally, each observer acquired additional steps with more than 85% accuracy.

Hall et al., (1992)	Assess effectiveness of using a dyadic group format coupled with CTD to teach chained cooking skills	4 high school students with moderate ID, ages 16-18	All students educated in self-contained classroom setting. Research conducted in a staff member's home, close proximity to school. Probe sessions: 1:1 format; Instructional sessions: dyads.	Graduate Student; 4-s delay	Multiple probe across behaviors; 4-s CTD procedure	CTD procedure used within a dyadic instructional arrangement effectively taught 3 new cooking skills to all participants. Dyadic teaching was thought to reduce cumulative training time for participants.
Hua et al., (2013)	Effectiveness of using CTD on vocabulary acquisition and retention, and expository reading comprehension	4 young adults with ID, ages 19-21	Participants enrolled in post-secondary education program for young adults with ID; intervention in small conference room	Graduate Student	Alternatin g treatments design	Implementation of CTD resulted in increased vocabulary acquisition and retention. There was no improvement, however in comprehension of the expository texts.
Jameson et al., (2007)	Comparison of the effectiveness of 1:1 embedded instruction in the general education classroom and 1:1 massed practice in sped classroom	4 middle school students with ID, ages 13-15	Educated in at least 2 inclusive classes daily in addition to sped class. During intervention, 1:1 instruction in each setting	Special Education Teacher and Para-professional	Alternatin g treatment design	Both instructional settings were effective, yet there were differences in efficiency. 2 students reached criterion more rapidly in massed trial sessions; 1 while receiving embedded instruction; and 1 was equally efficient in both settings.
Jimenez et al., (2012)	Examine the effectiveness of peer-mediated embedded instruction using CTD on correct responses by students with ID	5 students with moderate ID, ages 11-14; 6 typically-developing peer tutors, all age 11	General education science class; typically-developing peers implemente	Peer-mediated instruction	Multiple probe across 3 science units	Intervention resulted in positive effects for all 5 participants with ID in the areas of science vocabulary and content knowledge.

			d instruction			
Miller & Test, (1989)	Comparison of CTD and most-to-least prompt procedure on acquisition of laundry skills	4 students with moderate ID, all age 18	All participants enrolled in CBI training class. Intervention sessions took place in the laundry rooms located at the students' school	Graduate Student; 2-s delay	Multi-element, alternating treatment within subject design	Both CTD and most-to-least prompt procedures were effective, resulting in all 4 participants reaching criterion and maintaining skills. CTD delay was, however, the more efficient procedure when examining instructional time and errors during sessions.
Morse & Schuster, (2000)	Effectiveness of using CTD while teaching students to grocery shop during CBI	*6 elementary-aged students with moderate ID, ages 8-12	Educated in self-contained classroom; Generalization data collected during CBI	Special Education doctoral Student & special Education Teacher	Multiple probe across participants design	**6 students reached criterion; 2 showed notable gains, but the study ended due to the end of the year; and 2 didn't not start intervention. For those who met criterion, all 6 demonstrated very high maintenance and generalization skills.
Riesen et al., (2003)	Compare the effectiveness of CTD and simultaneous prompting within embedded instruction	4 middle school students with moderate to severe ID, ages 13-14	General education classroom	Para-professional; 3-s delay	Adapted alternating treatment design	Results were mixed. All 4 students successfully acquired target skills, yet the rate of acquisition was better for 2 students using CTD, whereas the other 2 were more successful with the simultaneous prompting procedure. Students were able to generalize target skill in general education classroom.
Schuster et al., (1988)	Effectiveness of using CTD when teaching 3 chained cooking skills	4 high school students with moderate ID, ages 14-17	Educated in self-contained class; Intervention: 1:1 sessions in home economics room	Graduate Student; 5-s delay	Multiple probe design	All students learned and maintained chained cooking skills with overall percentage of errors at 8.4%.
Schuster et al., (1992)	Comparison of simultaneous prompting and CTD while	4 students with moderate ID, ages 10-11	1:1 for intervention in classroom	Graduate Student; 4-s delay	Parallel treatments design	Both procedures were effective; however, simultaneous prompting was more efficient and

	learning to read grocery words					resulted in fewer student errors. Maintenance data yielded mixed results. 2 students had higher levels of maintenance with SP; 2 students maintained skills with CTD.
Swain et al., (2015)	Compare the efficiency of CTD and SP when teaching functional sight words	4 students with moderate ID, or dual diagnosis of moderate ID and ASD, ages 8-11	2 students educated in self-contained classroom; 2 students educated in both self-contained and inclusive settings. Intervention: 1:1 in self-contained class, with gen. sessions at McDonalds	Teacher; 5-s delay	Adapted alternating treatments design	CTD was more efficient with number and percent of errors through criterion. Sessions through criterion: CTD more efficient for 2/4; SP more efficient for 1/4; and equal for 1/4. Trials through criterion: lower for CTD for 2 participants; equal for 1, and lower for SP for 1. All students successfully generalized target skills.
Wolery et al., (1991)	Effectiveness of using CTD during small group (dyadic) instruction while learning domestic and vocational chained tasks	4 students with moderate ID, ages 10-12	Educated in self-contained classroom. 1:2 dyadic instructional sessions during intervention	Teacher; 5-s delay	Multiple probe design	CTD was effective in teaching chained tasks, and observational learning occurred.
Winterling et al., (1992)	To teach students safety skills using a multicomponent treatment package, which includes the CTD procedure	4 students with moderate ID, ages 17-21	Educated in self-contained classroom. Intervention: 1:1 in home economics kitchen & traditional classroom	Teacher; 5-s delay	Multiple probe design	The CTD procedure effectively promoted acquisition of safety skills. Maintenance data at 1 week were good, yet at 1 month, data were mixed.

Results

Following an extensive review of 30-years of research on the CTD procedure, three notable themes emerged that warrant further discussion. The first theme relates to the effectiveness and efficiency of CTD in comparison to other prompt procedures (e.g., simultaneous prompting, progressive time delay). The second theme pertains to the implementation success in CTD small group (i.e., dyadic, triadic) settings. The third theme involves procedural application of the CTD procedure across settings, target skills, and instructional staff.

Comparative Research on Time Delay

Over 30 years of research documents the fact that time delay prompt procedures effectively enhance educational outcomes for learners with ID (Gast & Snell, 1981). Although time delay includes both CTD and progressive time delay (PTD), the procedural implementation differs greatly between the two methods (Ault et al., 1988). Simultaneous prompting (SP) and most-to-least prompting are two additional approaches used to teach target skills to students with ID (Miller & Test, 1989; Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). Within the literature reviewed, five studies explicitly compared CTD to another instructional procedure (e.g., PTD, SP, most-to-least prompting; Ault et al., 1988; Miller & Test, 1989; Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). Specifically, using either an alternating treatments design (Miller & Test, 1989; Riesen et al., 2003; Swain et al., 2015) or a parallel treatments design (Ault et al., 1988; Schuster et al., 1992), researchers compared the effectiveness and/or efficiency between two established prompt procedures, one of which was CTD.

CTD and PTD. Of the 19 articles included in this review, only one compared the effectiveness and efficiency of CTD and PTD (Ault et al., 1988). Ault and colleagues (1988) used a parallel treatments design to measure the effectiveness of the two instructional methods when teaching community-sign reading to students identified as having moderate ID. Researchers additionally evaluated the number of sessions and percentage of student errors made before reaching criterion. Both methods produced enhanced acquisition of community-sign words in all participants and follow-up maintenance data showed overall high sustainability. Furthermore, low error rates were reported across both prompting procedures. However, one distinct difference between the two methods emerged from the efficiency data. All three participants reached criterion with higher rates of efficiency when the CTD procedure was employed in comparison to PTD. Between the three distinct measures, one participant was consistently more efficient across domains, while the other two participants reached criterion with higher rates of efficiency on two of the three measures (Ault et al., 1988).

In sum, both progressive and constant time delay procedures effectively promote acquisition and maintenance of target skills in students identified with ID (Ault et al., 1988). Additionally, both methods are near-errorless learning approaches to intervention. Even so, the efficiency data between the two time delay methods differ. When CTD is employed, participants reach criterion more rapidly in comparison to PTD. It seems reasonable that, while both methods are effective, CTD may be more efficient than PTD (Ault et al., 1988).

CTD and SP. The initial method of implementation is very similar for both CTD and SP procedures. While both approaches begin by providing a controlling prompt immediately following presentation of the discriminative stimulus, CTD differs in that after the first two discrete trials, prompting delivery shifts from a zero second time delay interval to occurring after a pre-determined delay of time, which typically is measured in seconds (e.g., four seconds; Swain et al., 2015). Of the 19 articles reviewed, three studies compared the effectiveness of CTD and SP procedures (Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). Interestingly, and unlike other research that uses the prompt procedures while teaching chained tasks (Griffen, Wolery, Schuster, 1992; Wolery et al., 1991), all three comparative studies on CTD and SP measured the acquisition of reading skills (Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). Furthermore, the effectiveness of both prompt procedures was demonstrated across all three studies. However, there were some notable methodological differences as well as mixed findings regarding efficiency and maintenance data.

Though the method of delivery for SP is explicitly described and remains constant, differences exist in the setting, target skill to be acquired, and instructional staff implementing the intervention. While the CTD procedure reflects many of the same methodological characteristics, one distinct variation is waiting a predetermined number of seconds before the controlling prompt is given, following presentation of the stimulus. For example, while the controlling prompt remains to be paired with the stimulus for the duration of the SP procedure (Swain et al., 2015), a predetermined time delay is presented when implementing the CTD procedure (Branham et al., 1999). Hence, after the first two trials of the controlling prompt being given at a zero second delay interval, the same prompt is given, if needed, after a delay of several seconds (e.g., four second delay). Of the reviewed research, three studies compared the two prompt procedures (i.e., SP and CTD). In these studies, there were differences in both the setting and person responsible for implementing the intervention.

Of the three comparative studies, intervention settings included both inclusive general education classrooms using embedded instruction (Riesen et al., 2003) and self-contained special education classrooms (Schuster et al., 1992; Swain et al., 2015). The teaching staff responsible for implementing the intervention included a familiar paraprofessional (Riesen et al., 2003), a graduate student responsible for conducting the research (Schuster et al., 1992), and a familiar teacher (Swain et al., 2015). Delay of the controlling prompt, following stimulus presentation also differed. In addition to the methodological differences across studies comparing CTD and SP procedures, efficiency and maintenance data yielded mixed results as well.

Positive outcomes were demonstrated across participants in all three studies (n = 12); however, the rate of acquisition and number of errors differed between prompt procedures (Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). For example, Schuster and colleagues (1992) found SP to be both more efficient and to result in fewer errors in comparison to CTD across all four participants. In contrast, when comparing the two methods within embedded instruction, Riesen et al. (2003) found that two students demonstrated higher rates of acquisition with CTD, while the other two were more successful with SP. Moreover, when acquiring functional sight words, Swain et al. (2015) reported that CTD resulted in fewer errors. With regard to the number of sessions needed to reach criterion, CTD was more efficient for two participants, whereas SP was more efficient for one and there was no difference in rate of acquisition for the fourth participant (Swain et al., 2015).

In sum, CTD and SP are both effective instructional methods in terms of skill acquisition and maintenance for students with ID (Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). However, the rate of acquisition and number of errors differs across studies that compared these two learning procedures. A review of three comparative articles on CTD and SP revealed mixed findings pertaining to efficiency data. Both methods were found to result in positive learning outcomes and are considered to be near-errorless learning procedures.

However, the rate of skill acquisition varied between participants when comparing CTD and SP in regard to participants' ability to perform the target skill independently (i.e., unprompted) and will further be discussed.

CTD and most-to-least prompting. Similar to other researchers, Miller and Test (1989) examined the acquisition and efficiency of CTD, but compared the approach with the most-to-least prompt procedure. Both methods were used while promoting acquisition of laundry skills in a laundry room within the school environment. Using a two second delay when employing the CTD procedure, a graduate student systematically instructed students on how to perform the laundry-washing sequence. Similar to previous studies, both procedures enhanced effective acquisition and maintenance of target skills. When analyzing instructional time and occurrence of errors during intervention sessions, CTD proved to be the more efficient of the two methods (Miller & Test, 1989).

In conclusion, several instructional methods (e.g., CTD, PTD, SP, most-to-least prompting) have been empirically shown to enhance both acquisition and maintenance of target skills when implemented with students with ID (Ault et al., 1988; Miller & Test, 1989; Riesen et al., 2003; Schuster et al., 1992; Swain et al., 2015). Comparative research examining CTD and other techniques has demonstrated not only the effectiveness, but also the efficiency and minimal occurrence of errors when implementing the CTD procedure (Ault et al., 1988; Miller & Test, 1989; Swain et al., 2015). Even so, to enhance generalizability of the procedure, it is important to measure the effectiveness of implementation across instructional arrangements. For that reason, it is important to examine how and when the CTD procedure should be used.

CTD Implemented in Group Settings

Much of the empirical research on the CTD procedure consists of individual (i.e., one to one) staff/student ratios (Branham et al., 1999; Gast et al., 1992; Jameson et al., 2007). Although learning outcomes are positive, procedural delivery requires a substantial amount of staff time, which could negatively influence the feasibility of implementation and replication. Conversely, the effectiveness of CTD in small group settings (e.g., dyadic, triadic) was measured in three of the reviewed studies (Griffen et al., 1992; Hall et al., 1992; Wolery et al., 1991). It appears that from the teacher's prospective, implementation of the procedure is more plausible; however, data measuring the effectiveness and efficiency of dyadic and triadic teaching arrangements using CTD warrant further analysis in order to determine if the procedure should be used in such student groupings.

Of the 19 articles reviewed, researchers in three of the studies measured the effectiveness and efficiency of the CTD procedure when applied in a group setting (e.g., dyadic or triadic; Griffen et al., 1992; Hall et al., 1992; Wolery et al., 1991). Group implementation of the CTD procedure yielded positive findings in both acquisition effectiveness and efficiency of newly learned skills. Additionally, observational learning occurred, further enhancing skill acquisition among participants. That is, small group instruction enhanced not only repetition of target skills, but also gave each learner the opportunity to observe repeatedly a peer completing a sequence of steps in chained tasks (Griffen et al., 1992), thus, promoting greater performance accuracy and more rapid skill acquisition (Hall et al., 1992). Although learning outcomes during small group instruction using the CTD procedure were overwhelmingly positive (Griffen et al., 1992; Hall et al., 1992; Wolery et al., 1991), comparable methodological techniques emerged when analyzing published studies that may limit generalizability of the outcomes of these investigations. First, the CTD approach was implemented when teaching chained tasks across all studies using small groups (Griffen et al., 1992; Hall et al., 1992; Wolery et al., 1991). Second, instruction during intervention sessions consisted of teaching vocational and domestic skills rather than academic skills. Finally, all participants received instruction in a self-contained classroom setting. Accordingly, it is unknown whether the CTD procedure would be an effective instructional procedure to use in small groups when teaching other skills (e.g., academic) or outside of the self-contained classroom (e.g., general education classroom, community setting).

Overall, the empirical literature documents both the effectiveness and efficiency of implementing the CTD procedure in small group settings (i.e., dyadic, triadic). Benefits include efficient use of instructional staff while increasing the occurrence of student observational, near-errorless learning in the classroom (Griffen et al., 1992; Hall et al. 1992). Although the positive effects of using the CTD procedure in group settings has been demonstrated, generalizability of findings remains questionable since the reviewed research exclusively measured the acquisition of chained vocational and domestic skills by students educated in self-contained settings (Griffen et al., 1992; Hall et al., 1992; Wolery et al., 1991). Therefore, differing classroom settings, target skills, and instructional staff responsible for implementing the CTD method, deserve further examination.

CTD Procedural Application

In contrast to group implementation, researchers have explored the one-to-one use of CTD across a variety of learning environments. Instructional settings within the school include self-contained classrooms (Ault et al., 1988; Coleman et al., 2012; Griffen et al., 1992), inclusive general education learning environments (Jameson et al., 2007; Jimenez et al., 2012; Riesen et al., 2003), and direct application-based settings within the school environment (e.g., laundry room, cafeteria; Chandler et al., 1993; Gast et al., 1992; Miller & Test, 1989). Additionally, the CTD procedure has been used during community-based instruction (CBI; Branham et al., 1999; Morse & Schuster, 2000). Accordingly, an analysis of specific target skills, the teaching staff responsible for implementing the CTD procedure, and various learning environments will follow.

Self-contained classrooms. The CTD procedure was implemented in self-contained special education classrooms in six of the studies reviewed (Ault et al. 1988; Bozkurt & Gursel, 2005; Coleman et al., 2012; Griffen et al. 1992; Wolery et al. 1991). The special education teacher was responsible for implementing the intervention in half of these studies (Ault et al., 1988; Griffen et al., 1992; Wolery et al., 1991). Using a comparative, alternating treatments research design, Coleman and colleagues (2012) examined the effectiveness and efficiency of teacher versus computer procedural implementation of CTD. Findings revealed that although both methods were effective, teacher-led instruction resulted in more efficient skill acquisition (Coleman et al., 2012). These results mirror earlier research that demonstrated the effectiveness and efficiency of teacher-directed instruction using the CTD procedure (Ault et al., 1988; Griffen et al., 1992; Wolery et al., 1991). Furthermore, skill acquisition when using the CTD method within the self-contained setting also was successful when a researcher (i.e., graduate student) was responsible primarily for implementing the intervention (Bozkurt & Gursel, 2005; Schuster et al., 1992). Thus, it would appear that CTD is an effective approach to use within more restrictive learning environments (Ault et al., 1988; Bozkurt & Gursel, 2005; Coleman et al., 2012; Griffen et al., 1992; Schuster et al., 1992; Wolery et al., 1991).

General education classrooms. There were three empirical studies that examined the effectiveness of CTD within embedded instruction in an inclusive learning environment

(Jameson et al., 2007; Jimenez et al., 2012; Riesen et al., 2003). All student participants (*n*= 13) acquired target academic skills in the general education classroom; however, efficiency data were mixed (Jameson et al., 2007; Riesen et al., 2003). When comparing instructional settings (i.e., general vs. special education classrooms), Jameson et al. (2007) found one of four students reached criterion more rapidly during embedded instruction, while two were more efficient in the special education classroom, and the fourth participant remained equally efficient across both settings. Similarly, Riesen and colleagues (2003) had mixed efficiency findings when comparing prompting approaches (i.e., CTD vs. SP) within embedded instruction, resulting in two students acquiring target skills more efficiently in each setting. Unlike research on CTD in self-contained settings, when the CTD procedure is paired with embedded instruction in the general education classroom, paraprofessionals or typically developing peers were responsible for procedural implementation. Furthermore, it appears that CTD is an effective instructional procedure, yet efficiency data remained mixed across inclusive and restrictive educational settings.

School-based vocational training. Eight of the reviewed studies focused on using the CTD procedure while teaching target vocational and domestic skills within the school environment (e.g., special education classroom, laundry room, home economics classroom; Bozkurt & Gursel, 2005; Branham et al., 1999; Chandler et al., 1993; Griffen et al., 1992; Miller & Test, 1989; Schuster et al., 1988; Winterling et al., 1992; Wolery et al., 1991). Four studies focused on the effectiveness of using CTD to teach food preparation skills (Bozkurt & Gursel, 2005; Griffen et al., 1992; Schuster et al., 1988; & Wolery et al., 1991), three studies relied on the CTD procedure while teaching domestic skills (e.g., laundry, basic banking, and safety skills; Branham et al., 1999; Miller & Test, 1989; & Winterling et al., 1992), and Chandler et al. (1993) employed the time delay procedure for employment skill training. Participants in all of these described studies (n = 25) successfully acquired their target skills as a result of the CTD intervention. Furthermore, maintenance and generalization data were consistently positive across studies (Bozkurt & Gursel, 2005; Branham et al., 1999; Miller & Test, 1989), with low percentages of student errors reported (Schuster et al., 1988). All in all, research has shown CTD to be an effective instructional method for persons with ID and applicable across vocational and domestic skill training.

CBI. The CTD procedure was used outside of the school environment in four of the reviewed studies (Branham et al., 1999; Hall et al., 1992; Morse & Schuster, 2000; Swain et al., 2015). There are several unique procedural implications and findings across settings that warrant further discussion. The first finding relates to a comparative study, where Branham et al. (1999) measured acquisition and generalization of three community skills (e.g., mailing a letter, cashing a check, and crossing the street), across various instructional arrangements (e.g., classroom simulation paired with CBI, video modeling and CBI, and classroom simulation paired with both video modeling and CBI), and between two time delay procedures (CTD and PTD). Results showed CTD effectively enhanced the learning of all target skills across the three measured instructional techniques with 100% skill generalization. Moreover, CTD was the more efficient procedural method when compared to PTD (Branham et al., 1999). The second finding pertains to using the CTD procedure when learning chained cooking skills in dyads within an unfamiliar home environment (Hall et al., 1992). Using CTD, all participants successfully acquired and maintained newly learned cooking skills. Although the learning atmosphere was noted to be more comparable to the kitchen of each participant's home environment, promoting generalization, such generalization data were not collected. Thus, it is unknown whether or not participants applied acquired skills in their own homes or if they were only successful in the home of their paraprofessional. The third finding relates to participants using a community setting as a means of skill generalization, as opposed to implementing the CTD procedure during CBI for initial instruction (Morse & Schuster, 2000; Swain et al., 2015). In both studies, all students successfully generalized target skills within the community setting, thus demonstrating promising generalization data when using the CTD procedure as an instructional technique. Overall, applying the CTD procedure within the natural environment (i.e., during CBI) was shown to be beneficial to learners (Branham et al., 1999; Hall et al., 1992; Morse & Schuster, 2000; Swain et al., 2015).

In sum, the reviewed literature highlights the fact that the CTD procedure is an overall effective prompt procedure to use while instructing individuals with ID (Ault et al., 1988; Chandler et al., 1993; Jimenez et al., 2012). When comparing two similar time delay procedures (i.e., CTD and PTD), efficiency data have repeatedly shown CTD to result in fewer trials to criterion as well as lower student error rates (Ault et al., 1988; Swain et al., 2015). Furthermore, CTD has proven to be an effective instructional procedure across interventionists (e.g., teachers, paraprofessionals, graduate students, and typically developing school-aged students; Bozkurt & Gursel, 2005; Branham et al., 1999; Jameson et al., 2007; Jimenez et al., 2012). Finally, CTD has been successfully implemented in both individual and small group settings (i.e., dyadic and triadic; Griffen et al., 1992; Wolery et al., 1991) and across various learning environments (e.g., special education classroom, general education classroom, during CBI; Ault et al., 1988; Bozkurt & Gursel, 2005; Jameson et al., 2007; Branham et al., 1999).

Discussion

This review of research on the use of CTD prompt procedure while teaching new skills to students with ID has contributed to existing literature by examining this evidence-based instructional procedure from several unique angles over a 30-year span. CTD is a near-errorless technique that has been found to effectively promote the acquisition, maintenance, and generalization of academic and functional reading, vocational, and domestic skills among individuals with ID. Analyses of comparative research between CTD and other common prompt procedures (e.g., PTD, SP, most-to-least prompting) further substantiates the efficacy of the CTD procedure. More specifically, although both PTD and most-to-least prompting were found to be effective instructional practices, CTD proved to be more efficient, as measured by the number of trials needed to reach criterion. Data comparing CTD and SP generated mixed efficiency results; however, there are significant methodological differences between the two procedures. For example, when employing the SP procedure, the discriminative stimulus is presented concurrently with the controlling prompt, indefinitely (Schuster et al., 1992). Conversely, CTD occurs in two phases, with the initial phase of two trials resembling SP. With a zero second delay interval followed by instructional staff refraining from presenting the controlling prompt for a predetermined time delay (e.g., four seconds; Schuster et al., 1988) following presentation of the target stimulus. Thus, when the CTD procedure is employed, students are given increased opportunities to respond independently to the discriminative stimulus.

Findings suggest the CTD procedure is a highly generalizable instructional technique with overwhelmingly positive outcomes for students with ID. This time delay procedure has been effectively implemented across a range of learning domains (e.g., special education classroom, general education classroom, vocational classroom, and during CBI) as well as instructional staff (e.g., teacher, paraprofessional, typically developing peer). Even so, the literature reviewed revealed a need for increased use of the CTD procedure within natural learning environments (e.g., community-based instruction) when instructing learners with ID.

Rather than exclusively using the desired learning environment for generalization probes (Morese & Schuster, 2000; Swain et al., 2015), using an instructional approach (i.e., CTD) that has been shown to be both effective and efficient, may increase the use of independent functioning when implemented during new skill acquisition within the natural environment. Individuals with disabilities require additional training and assistance as they adequately prepare to enter the workforce (Bennett, 2013); however, the effectiveness of applying the CTD procedure in the natural environment has not been thoroughly investigated.

The CTD procedure was prevalent in the literature during the late 1980s and into the 1990s. However, of the 19 reviewed studies, only five met criteria between 2005-2017. With an increase in the use of technology-based prompting (e.g., video modeling, video instruction) over the past decade, the shift in the literature may be reflective of a change in prompt procedure preference. However, CTD has a strong evidence-base demonstrating its effectiveness, as measured by increased student learning within the ID population. Thus, further research is warranted to explore the independent functioning and generalizability of vocational skills across settings (e.g., home or work environment). Accordingly, and based on the findings from this review, there are several promising implications for future research.

Future Implications

Based on findings from the present review and the need to promote vocational skills within the ID population, there are several future research implications. First, the effectiveness of using the CTD procedure should be measured within the natural learning environment, during CBI, for adolescents or young adults with ID as they acquire essential skills to increase post secondary independence (e.g., employment readiness). Traditionally, this population struggles with independently acquiring essential employment readiness skills (Bennett, 2013) and consequently struggles to gain employment (Chandler et al., 1993). Hence, it seems reasonable to assume that learning such vital skills from familiar staff in the natural community work environment would be of great importance. CTD would be an appropriate, evidence-based instructional technique to introduce in this setting. Second, one possible way to enhance knowledge and procedural fidelity during CBI is to combine *e*Coaching with BIE technology and the CTD procedure. Thus, instructional staff would be trained on the time delay procedure prior to application and continuously provided with effective, real-time unobtrusive feedback from a trained specialist for the duration of the intervention. Use of *e*Coaching with BIE technology may provide instructional staff with the necessary tools to support their adolescents and young adults during CBI.

Implications for practitioners include using CTD as an instructional technique across learning domains for students with ID. Specifically, CTD should be implemented when teaching reading, vocational, and domestic skills. Based on the outcome of the present review, it seems important to further recommend employing the CTD procedure across learning environments (e.g., special education classrooms, general education classrooms, vocational settings, and during CBI). In sum, research has shown CTD to be a highly effective, evidence-based intervention procedure for individuals with ID. CTD has resulted in new skill acquisition as a result of an various interventionists (e.g., teachers, paraprofessionals) implementing the procedure. Therefore, continued use should continue to enhance learning outcomes for students with ID. Finally, the ultimate goal of intervention is the maintenance and generalization of skills in the natural environment. Accordingly, the use of emerging technology with instructional staff during CBI may increase the acquisition, maintenance, and generalization of vital skills to increase postsecondary independence within the community as well as increase the preparation for paid employment.

Chapter 3

Methodology

Chapter Overview and Research Questions

This chapter presents background information on the research topic as well as the methodology for the dissertation research. By definition, constant time delay (CTD) is a near-errorless prompt procedure that entails systematic fading of a controlling prompt subsequent to presentation of the discriminative stimulus (Hughes, Fredrick, & Keel, 2002; Riesen, McDonnel, Johnson, Plychronis, & Jameson, 2003). This procedure is employed in two distinct, sequential phases: (a) a zero second delay, where the target stimulus and controlling prompt are presented with a zero second delay interval, followed by (b) presentation of the controlling prompt using a predetermined, fixed time delay (e.g., four seconds; Ault, Gast, & Wolery, 1988; Bozkurt & Gursel, 2005). Empirical research shows CTD to be an effective instructional procedure to use with students who have autism spectrum disorder (ASD) and intellectual disability (ID; Ault et al., 1988; Seward, Schuster, Ault, Collins, & Hall, 2014).

The CTD procedure has been implemented successfully across various learning environments (e.g., special education classroom, inclusive general education classroom, vocational classroom, and in the community; Ault et al., 1988; Jameson, McDonnell, Johnson, Riesen, & Polychronis, 2007; Bozkurt & Gursel, 2005; Branham, Collins, Schuster, & Kleinert, 1999). The students' classroom or a separate location within the school (e.g., home economics classroom) have primary been the locations of implementation while measuring the effectiveness of CTD (Chandler, Schuster, & Stevens, 1993; Schuster, Griffen, & Wolery, 1992; Swain, Lane, & Gast, 1988). Community-based settings (e.g., restaurant, bank, department store) typically have been used to measure skill generalization following initial instruction using CTD (Branham et al., 1999; Swain et al., 2015). Following an extensive review of the literature, researchers failed to find evidence demonstrating the utilization of the CTD procedure to teach employment skills in a community-based environment. Furthermore, existing research contains little information on interventionists' procedural implementation when using CTD, making it unclear whether CTD consistently has been employed with fidelity. Ackerlund, Brandt, Weinkauf, Zeug, and Klatt (2016) found that teachers made errors during implementation when using CTD to teach students with ASD. As a result, student outcome data could be influenced by discrepancies in procedural implementation (Kretlow & Bartholomew, 2010).

Given the paucity of research on using CTD to teach employment skills and the fact that community-based instruction (CBI) is considered a "best practice" approach to teaching students with developmental delays (Bennett & Dukes, 2013; Branham et al., 1999), it was plausible to believe application of an evidence-based instructional procedure (i.e., CTD) during CBI would enhance skill acquisition among adolescents and young adults with ASD and comorbid ID. Additionally, bug-in-ear technology could be used to provide praise and corrective feedback in real-time to the special education teacher interventionist as he/she actively implemented the CTD procedure to teach employment skills to young adults with ASD and ID during CBI.

The purpose of the present research was to investigate how to ameliorate problems associated with the transition process by striving to implement the CTD procedure with fidelity while teaching a new employment skill in the natural, community-based work environment. In doing so, a special education teacher interventionist used CTD to teach students how to sort clothing by size (i.e., small, medium, large, extra-large) in a department store, while a doctoral student researcher coach provided praise and corrective implementation feedback through *e*Coaching, using BIE technology. CTD implementation fidelity was measured in addition to student performance. Specifically, acquisition, maintenance, and generalization data were collected across four student participants diagnosed with ASD and comorbid ID as they were taught one multi-step employment task (sorting and hanging clothing in accordance to size). The following research questions were addressed:

1. What is the functional relationship between providing immediate, real-time *e*Coaching through Bug-in-Ear technology and implementing the constant time delay procedure (CTD) with fidelity, when used by a special education teacher to instruct young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD) as they learn a multi-step employment task in a community-based work environment?
2. What is the functional relationship between teacher implementation of the constant time delay (CTD) procedure (e.g., providing a four second time delay between presentation of the target stimulus and controlling prompt; Bozkurt & Gursel, 2005) in a community-based work environment and acquisition of a multi-step employment skill (e.g., sorting and hanging clothing by similar size), while decreasing the number of required prompts, among young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD)?
3. What are the perceptions of the special education teacher participant, as measured by both a five-point Likert scale and an open-ended questionnaire (see Appendix C), regarding receiving real-time coaching and feedback via Bug-in-Ear (BIE) technology, while implementing the constant time delay procedure (CTD) to teach a multi-step employment task to young adults with mild or moderate

intellectual disability (ID) and autism spectrum disorder (ASD) during community-based instruction?

4. What are the perceptions of the young adult participants, as measured by a visual Three-point Likert scale (see Appendix C), on learning a new multi-step employment skill from their teacher during community-based instruction?

Participants

A total of five individuals participated in this study; one special education teacher who was the interventionist and four young adult students enrolled in a special education program specifically for students with autism spectrum disorder (ASD). All student participants had a primary diagnosis of ASD and comorbid intellectual disability (ID) in the mild or moderate range. Students ranged in age from 17 to 20 years, and participated in community-based instruction (CBI) multiple times a week. The special educator was the students' familiar teacher and job coach. Demographic information such as gender, race, ethnicity, and socioeconomic status did not influence the inclusion or exclusion criteria for any participants in the study; however, each of the two types of participants (students and the teacher) met specific inclusionary criteria.

Student participants. The four student participants were between the ages of 17-and 20-years-old and all had a diagnosis of ASD and comorbid ID (see Table 2). Although assessment measures varied across students, all student participants had the same disability diagnoses. None of the participants had previous exposure to CTD. Prerequisite skills exhibited by all students (according to teacher reports) included the ability to (a) wait at least 4 seconds for a prompt, (b) attend to stimuli for a minimum duration of 5 minutes, and (c) be willing to work to with their teacher in a community-based work environment.

Table 2. Student Participant Demographics

Name	**Age and Gender**	**Disability**	**Assessment Information**	**Verbal Communication**
Dantae	17 Male	ASD and ID	RIAS Nonverbal SS=40	3-4 word phrases and sentences
Brian	18 Male	ASD and ID	UNIT full-scale IQ=67	Single word utterances
Matthew	17 Male	ASD and ID	DAS general cognitive ability SS=59	Sentences and frequent echolalia
Dionte	20 Male	ASD and ID	Vineland-II composite SS range: 52-62	2-3 word utterances

Dantae was a 17-year-old African American male who communicated using three- to four-word phrases and sentences. According to the Reynolds Intellectual Assessment Scales (RIAS), the standard score for Dantae's nonverbal intelligence is 40. Dantae's verbal intelligence could not be assessed.

Brian was an 18-year-old white male who communicated using single-word utterances (e.g., "yep" and "nope"). He uses short phrases to communicate his needs, "I want bathroom, please." According to the Universal Nonverbal Intelligence Test (UNIT), Brian has a full-scale IQ score of 67.

Matthew was a 17-year-old white male who communicated using sentences and displayed a frequent occurrence of echolalia. The UNIT was unable to be administered due to extreme inattention and inability to make eye contact with the examiner. The Differential Ability Scale (DAS) measured Matthew's general cognitive ability with a standard score of 59.

Dionte was a 20-year-old African American male who communicated using two- to three-word utterances (e.g., "Hardee's Tuesday?"). According to the Vineland Adaptive Behavior Scale, Second Edition (Vineland-II), Dionte's composite standard scores were as follows: adaptive behavior: 56, adaptive functioning within the communication domains: 52, and daily living: 62.

Special education teacher. Robert, the special education teacher interventionist, was employed with the school district for five consecutive years at the time this research was conducted. Robert earned a bachelor's degree in business before becoming a certified special education teacher. At the time of the study, Robert was working toward a master's degree in education, with a concentration in special education. Robert was a high school special educator who taught a self-contained class and led community-based instruction. Emphasis was on postsecondary transition and employment in the classroom and during CBI. Robert attended every CBI outing at the department store, and was the interventionist responsible for applying the CTD procedure, while receiving corrective feedback and praise from the doctoral student researcher coach, via BIE technology, across all intervention sessions.

Setting

All data collection sessions took place in a local department store. Participants began going to the store once a week for CBI, approximately one month prior to the onset of the study. During that time, students helped unload delivery trucks. At the beginning of the study, participants began traveling to the department store twice a week, for three hours each day. All data collection took place on the department store sales floor. More specifically, two designated racks in the men's department were used during all baseline, intervention, and maintenance sessions. One rack contained men's athletic t-shirts and the other contained men's athletic shorts. All articles of clothing were on hangers and all hangers had a round knob attached, identifying the clothing size. There were three randomly placed hangers for each size, including small, medium, large, and extra-large. The clothing rack was in the front corner of the department store, away from the store entrance. The first generalization session took place in the described area of the store, yet the rack included a greater quantity of clothing (i.e., five articles of clothing for each size). The second generalization session took place in the women's department within the same department store. A similar clothing rack was used; however, the rack contained a total of twelve articles of women's long sleeved shirts.

Materials

Each baseline, intervention, and maintenance session required twelve distinct articles of men's athletic apparel, three athletic shirts of each size: small, medium, large, and extra-large. All shirts were hanging on the rack prior to each session, however they were not arranged by size. Clothing required for generalization probes varied. For Generalization 1, the athletic shirts and sales rack were consistent; however, there were five of each size as opposed to three. Generalization 2, required twelve women's shirts, three size smalls, three size mediums, three size larges, and three extra-large blouses. Generalization 2 also took place in a different area of the store and, therefore, required a sales rack in the women's department. Additionally, the teacher followed a task analysis that was collaboratively created by the researcher and the special education teacher. One was specific to Generalization 1 (see Appendix B), and the other task analysis was used across all other conditions (see Appendix B). Using traditional paper/pencil method with data sheets on a hand-held clipboard, the teacher continuously recorded the number of prompted and unprompted corrects made by the student across all sessions. Data sheets included each specific step of the task (e.g., "Pick up hangers with "M" label attached") and the number of opportunities the student had to complete that step (i.e., one opportunity per article of clothing to "pick up" and to "place") during each data collection session. The researcher also developed data sheets to measure procedural fidelity of the interventionist (i.e., teacher implementation). Two doctoral-level student coders used these sheets for data collection purposes across all intervention sessions.

Using *e*Coaching with BIE technology requires the use of several electronic devices. First, a 32GB iPad mini, generation 2 was used to gain Internet connection and to provide live recording through a secure, private WebEx virtual room. The built-in camera was used to actively record and stream the sessions. The iPad mini was placed in close proximity (i.e., within five feet) to teacher and student participants during each data collection session. Second, an Archeer Bluetooth Headset Wireless earpiece 4.1 Ultra Light Headphone with Microphone was worn by the teacher during each session for the duration of the study, which enabled the qualified specialist to provide continuous verbal feedback in real-time. Third, the selected tripod that held the iPad mini 2 during data collection was a Neomark® Flexible Octopus Style iPad Tripod with iPad tablet holder universal iPad tablet tripod mount holder adapter (12.5-20 cm Adjustable width). Fourth, the doctoral student researcher coach used an Apple MacBook Pro 13-inch (256 GB hard drive, 2.7 GHz dual-core Intel Core i5 processor, 8 GB 1866 MHz LPDDR3 RAMc) laptop computer in a separate area of the department store. The laptop was used by the doctoral student researcher coach and also was connected to the Internet as she initiated each WebEx meeting/data collection session. Fifth, the doctoral researcher coach wore a pair of Beats Solo HD Wired On-Ear Headphones with a built-in microphone during all intervention sessions. This equipment enabled her [the coach] to hear the training sessions and actively provide praise and corrective feedback to the special education teacher interventionist. Finally, an Apple iPhone 7 (CDMA/GSM 32GB) was used to provide wifi connectivity through a “personal hotspot.” This was a modification made in response to the department store having no wifi connectivity. The researcher used the iPhone to establish the required wifi connection for both the iPad mini 2 and the laptop, which permitted WebEx access.

Independent Variables

An intervention package was introduced and replicated across four tiers during CBI. More specifically, subsequent to training (see Appendix D), the special education teacher interventionist introduced the CTD procedure while teaching a new employment skill (i.e., sorting men's athletic clothing by size) to each student participant. Concurrently, he [the teacher interventionist] received immediate feedback on procedural implementation of CTD through *e*Coaching, using BIE technology. A special education doctoral researcher acted as the "coach" for the entirety of the research project. *e*Coaching was used consistently during all intervention sessions to deliver praise and corrective procedural feedback to the teacher interventionist in real-time as he actively implemented the CTD procedure while instructing the student. Using the CTD procedure with *e*Coaching during CBI was an intervention package that required use of the time delay procedure in the natural environment, while instructing each young adult learner how to complete a new multi-step employment skill.

Dependent Variables

Teacher data. Implementation fidelity of the CTD procedure was measured as the special education teacher interventionist taught each young adult participant to learn a sequenced job task: sorting and arranging clothing by size. Two doctoral-level student coders watched recorded WebEx intervention sessions and independently logged teacher data (see Appendix B) across three opportunities for each of the eight task analysis steps. Subsequent to presentation of the discriminative stimulus, the teacher interventionist correctly implemented the CTD procedure when he provided the controlling prompt: (a) immediately during each step of the zero second delay sessions; (b) precisely at a four second delay when the student did *not* respond to the discriminative stimulus; or (c) immediately, in response to the student giving an incorrect response (e.g., picking up a size small hanger rather than a size large). Following presentation of the discriminative stimulus, the teacher interventionist incorrectly implemented the CTD procedure when he: (a) withheld the controlling prompt during Phase 1, at a zero second delay interval; (b) provided the controlling prompt before or after the predetermined four second delay interval; or (c) failed to respond with the controlling prompt when the student provided an incorrect response to the discriminative stimulus (see Table 3 for operational definitions of dependent variables).

Table 3. Operational Definitions of Dependent Variables

Dependent Variables	Coding Symbol	Definition
Correct use of CTD Procedure	C	Following presentation of the discriminative stimulus, Teacher provides student with controlling prompt (i.e., verbal and gestural prompt) when either: 1. The student does *not respond (NR)* within 4 seconds of presentation of the discriminative stimulus, OR The student gives an *incorrect response (-)*. For example, he places a size large hanger where a size small belongs.
Incorrect use of CTD Procedure	I	Following presentation of discriminative stimulus, Teacher incorrectly implements CTD procedure by failing to wait 4 seconds before providing the controlling prompt. For example, Student does not respond and Teacher provides controlling prompt after 2 seconds.
Correct Response	+	The student completed the designated step of the chained task with no errors.
Incorrect Response	-	The student performed a step out of sequence or insufficiently completed the designated step of the task.
No Response	NR	The student did not initiate a step within 4 seconds.

Student data. Student outcome data were collected across all baseline, intervention, generalization, and maintenance conditions. All sessions began when the special education teacher interventionist verbally instructed the student to "sort by size." A minimum of three baseline sessions (range 3 to 6) were conducted with each of the four student participants. According to Kratochwill et al. (2013), single-case research designs must have at least three data points in each phase to meet the What Works Clearing House (WWC) Standards for single-case research with reservations, though five data points are preferred. However, Horner et al (2005) specify that fewer data points (e.g., three) are acceptable when there is no "substantive trend" present. All baseline data in this research were stable prior to the onset of intervention, not trending in the direction predicted by the intervention (Horner et al., 2005). Data were collected intermittently prior to the introduction of the independent variable (Gast & Ledford, 2014). Guided by a task analysis, the special education teacher interventionist collected student performance data on each step of the sorting task. During each probe session, students had a total of three opportunities to complete each of the eight steps (e.g., pick up medium shirt), totaling 24 possible opportunities for a response per session. The special education teacher interventionist collected student data across all sessions and a trained doctoral student coded 43% of all sessions, ensuring interobserver agreement on student performance. Since CTD is a near-errorless procedure, student data were distinguished between prompted and unprompted corrects (see Table 3). Unprompted corrects were coded as a "correct response," meaning the student independently responded to the discriminative stimulus and completed a specific step of the task with no prompts, initiating the response within four seconds and completing the corresponding action within nine seconds. If the student initiated a response to the discriminative stimulus incorrectly (1), or did not initiate the correct response within four seconds followed by the corresponding behavior within nine seconds (2), the teacher interventionist intervened by interrupting the student and prompting him to achieve the correct response. The described scenarios were coded as either an "incorrect response (1)" or "no response (2)," meaning the student required a prompt from the teacher to perform the step correctly. Each participant reached criterion when he completed successfully all steps of the task analysis, unprompted, with 100% accuracy over two consecutive data sessions.

Perceptions of all participants were measured through social validity questionnaires. The special education teacher's perceptions were reported through close-ended, five-point Likert scale questions as well as open-ended questions (see Appendix C). The effectiveness and level of comfort with using *e*Coaching during CBI while actively applying the CTD procedure were reported. Young adult student perceptions were collected through a three-point visual Likert scale questionnaire (see Appendix C). Student participants evaluated the effectiveness of the intervention as well as their experience learning within the community setting with their special education teacher as the interventionist.

Experimental Design

A multiple probe design (Gast & Ledford, 2014), replicated across four participants was used to evaluate the effectiveness of using the CTD procedure while the special education teacher interventionist received *e*Coaching via BIE technology during CBI when student participants were taught a new multi-step job task. As each young adult participant increased the number of correct independent responses to the task analysis as a result of teacher-led instruction, using CTD instruction paired with BIE technology during CBI, without increasing desired responses to steps prior to intervention, experimental control was demonstrated (Horner et al., 2005; Horner, Swaminathan, Sugai, & Smolkowski, 2012; Kratochwill et al., 2013). A description of the experimental conditions will follow. Prior to instruction across all phases, the teacher interventionist asked the student, "are you ready?" just before giving the initial directive. During the first phase, baseline, the teacher interventionist verbally instructed student participants to "sort by size" while physically motioning toward a rack of men's athletic apparel without giving any additional directions or prompts. During the second phase, the independent variable was introduced. Intervention consisted of the special education teacher interventionist using CTD during CBI, while receiving corrective feedback and praise from the doctoral student researcher "coach" in real-time through BIE technology. Student participants received three opportunities to complete each of the eight sequential steps of the task analysis, resulting in a total of 24 possible opportunities per data session. The controlling prompt was provided at a zero second delay interval after presentation of the target stimulus. This time delay was consistent across tiers during the first two intervention sessions. On the third intervention session, the special education teacher interventionist implemented a pre-determined four-second time delay. The four second delay interval remained constant across tiers until each student reached criterion, completing all 24 attempted opportunities correctly, unprompted, with 100% accuracy over two consecutive data sessions. This research met the WWC Standards, with reservations (Kratochwill et al., 2013), and demonstrated a functional relationship between the independent and dependent variables, as measured over time, and across four participants.

Procedures

Pre-baseline. Prior to baseline data collection, the special education teacher interventionist participated in technology training to become familiar with *e*Coaching and using BIE technology. The training took place at the same Department Store location that was used for the duration of the study. During this time, the teacher interventionist tested all necessary electronic devices (e.g., the iPad mini 2 and Bluetooth headset). The teacher interventionist practiced logging into WebEx and both sound and recording checks were conducted successfully.

Baseline. During baseline data collection, the teacher interventionist directed the student participant toward a rack of men's athletic clothing. The rack included three size small shirts, three size medium shirts, three size large shirts, and three extra-large shirts. The teacher interventionist instructed the student to "sort by size," while motioning toward the rack of clothing. After delivering the general verbal directive, no additional prompts or praise statements were given. During baseline data collection, the teacher interventionist was not provided with corrective feedback and praise from the doctoral student researcher coach, as he was not implementing the instructional procedure during that time. All baseline sessions were recorded and student performance was coded. A minimum of three baseline data points were recorded for each student, ensuring data were stable and not presenting an accelerating trend in the direction predicted by the intervention (Horner et al., 2005).

Following baseline data collection, the special education teacher interventionist received one-on-one training on using the CTD procedure. Following the training protocol (see Appendix D), the doctoral student researcher coach led the training session, which consisted of direct instruction, modeling the instructional approach, and a comprehension check. The special educator interventionist completed successfully the training session by role-playing and correctly implementing the CTD procedure at both zero- and at four-second delay intervals.

Intervention. Prior to each intervention session, the doctoral student researcher coach manipulated the clothing rack, controlling for the quantity of each size athletic shirt (three shirts for each size were consistently provided). Additionally, the researcher randomized the arrangement of the shirt sizes. Upon arrival at the department store, student participants went to the back of the store and worked on previously mastered job tasks (e.g., unloading the truck). A brief technology test was conducted prior to each session just before the special education teacher interventionist walked to the back of the store to get the student. Upon arrival at the designated rack in the men's department, the special education teacher interventionist asked the student, "are you ready?" After the student's response, the intervention session began when the teacher interventionist instructed the student to "sort by size," while motioning toward the rack of clothing. During the two initial intervention sessions with each student participant, the teacher presented the controlling prompt (e.g., verbal and gestural prompts) with a zero second delay after presentation of the discriminative stimulus. With the zero second delay intervals, the teacher interventionist provided continuous verbal and gestural prompts to ensure a correct student response. While the zero second delay intervals did not provide an opportunity for unprompted correct responses, prompted correct responses were ensured. The independent variable was introduced in this manner (i.e., CTD with zero second delay interval) consecutively, across the two initial intervention sessions for each student participant. Subsequent to the first two sessions that produced prompted correct responses with 100% accuracy, the teacher interventionist initiated a pre-determined delay interval of four seconds between presenting the stimulus and providing the controlling prompt. Thus, the student had four seconds to initiate the desired response and nine seconds to complete the corresponding step of the task analysis. If the student did not respond within the allotted four-second delay, the teacher interventionist provided a controlling prompt, and the student response was therefore recorded as a "prompted correct." If the student initiated an incorrect response within the four second delay interval (e.g., placed an XL shirt in front of a M shirt), the teacher interventionist immediately intervened by interrupting the student, while providing a prompt, thus encouraging a “prompted correct” response. When the student initiated the desired response within the four second delay interval, it was recorded as an “unprompted correct.” When an unprompted correct response occurred, the teacher seamlessly moved to the next step of the task analysis, providing one verbal directive to the student (e.g., “pick up medium.). As the student became familiar with the steps of the task and began to initiate each step, the teacher gradually faded verbal directives and instructed the student to “keep going,” while consistently waiting four seconds for the student to respond to each succeeding step. The special education teacher provided students with verbal praise (e.g., “Way to go, Matthew!”) after correct responses throughout, regardless of required prompting.

Throughout all sessions, while using *e*Coaching with BIE technology, the doctoral researcher coach observed from a separate location within the department store by means of live stream through a private WebEx meeting. Continuous praise and corrective implementation feedback were given to the teacher in real-time throughout all intervention sessions. For example, if the teacher failed to initiate a controlling prompt immediately following the introduction of the discriminative stimulus during sessions with a zero second delay interval, the coach instructed the teacher to “prompt.” Moreover, the coach provided specific praise when the teacher implemented the CTD procedure with fidelity (e.g., Excellent gestural prompting!). All intervention sessions were recorded and interobserver agreement was maintained across both teacher implementation and student achievement data, ensuring reliability across all participants and conditions (Horner et al., 2005).

As part of their regularly scheduled transition program, the young adult participants traveled to the department store with their special education teacher twice each week. Data collection took place on the designated job training days. During experimental conditions and consistent with natural daily task frequency, data collection occurred up to six times a day. After two consecutive sessions, students were given a brief break and took a short walk around the department store with their teacher or other support staff. During that time, the researcher manipulated the side-by-side clothing racks in preparation for additional intervention sessions.

Implementation fidelity of the teacher interventionist was measured by two doctoral-level student coders. One of the doctoral-level observers coded teacher implementation fidelity data across all intervention sessions and the other doctoral-level observer coded 30% of all intervention sessions, maintaining a mean interobserver agreement level of 98%. Additionally, the teacher interventionist was responsible for coding 100% of student performance data and one of the doctoral level observers coded 76.6% of all intervention sessions, with an average interobserver agreement of 97.2%. The formula used to calculate the percentage of interobserver agreement (Gast & Ledford, 2014) follows: the number of agreements divided by the number of agreements plus disagreements, multiplied by 100. Data were considered reliable with at least 85% interobserver agreement. If agreement fell below 85%, coders retrained until they were at least 85% reliable.

Generalization. Two independent generalization sessions were conducted, both of which took place in the department store. Generalization 1 consisted of sorting athletic apparel in the men's department. However, the number of clothing articles presented increased in comparison to experimental conditions. Instead of being provided with three articles of clothing for each size, students were provided with five pieces of clothing per size. Thus, Generalization 1 measured the students' ability to complete the sorting skill when presented with greater amounts of clothes compared to intervention conditions. Generalization 2 took place in the women's department of the store. Students were presented with unfamiliar clothing (i.e., women's collared blouses), located in an unfamiliar area of the department store (i.e., women's department). During Generalization 2, students were evaluated on their ability to sort independently and arrange a rack of clothing with the same number of clothing articles as presented during experimental conditions. In doing so, students' ability to generalize the vital sorting skill to other clothing departments within the store were measured.

Maintenance. Maintenance data were collected at one, two, and three weeks post-intervention. During maintenance sessions, the special education teacher interventionist individually led each student to a clothing rack in the men's department of the department store. Similar to intervention sessions, the rack contained 12 articles of men's athletic clothing, 3 for each size, and sizes were randomized on the rack. During maintenance sessions, the teacher motioned toward the target clothing rack, while verbally instructing the student to "sort by size." No additional prompts or verbal directives were given. Maintenance sessions were recorded through WebEx for coding purposes only and the teacher did not receive any *e*Coaching through BIE technology. The teacher interventionist measured the student's ability to perform independently the desired sorting task and one doctoral level student coder ensured reliability in the data. Specifically, student performance during maintenance was measured by the same task analysis used during intervention data collection (see Appendix B). Maintenance data measured the independent sustainability of the newly acquired job skill at one, two, and three weeks post-intervention.

Procedural Fidelity

Procedural fidelity was assessed continuously to determine if the special education teacher interventionist reliably implemented the intervention throughout the study (Horner et al., 2005). Correct and consistent implementation of the CTD procedure was measured throughout all intervention sessions. Using live Internet streaming through a private WebEx meeting and recording of all intervention sessions enabled doctoral-level student coders to collect procedural fidelity data across 100% of intervention sessions. Interobserver agreement was calculated across 30% of the intervention sessions with a mean reliability of 98% (range 91.6% to 100%). Coders used the CTD Teacher Data sheet (see Appendix B) to record the special education teacher Interventionist's ability to implement accurately the instructional procedure. Each intervention session consisted of 24 opportunities for the teacher to use CTD. Measuring procedural fidelity of CTD revealed the special education teacher's ability to accurately and consistently apply the time delay procedure during CBI, while teaching a new job skill to student identified as being comorbid with ASD and ID.

Data Collection and Analysis

Reliability. Interobserver agreement on student performance exceeded the 20% minimum requirement across conditions, according to WWC Standards for single-case designs (Kratochwill et al., 2013). In all, interobserer agreement was calculated on student performance across 43% percent of all baseline, intervention, generalization, and maintenance sessions. The special education teacher interventionist actively collected student performance data (see Appendix B) during all conditions while a second observer (i.e., doctoral-level student coder) viewed and coded 45% of all sessions, consistently maintaining at least 85% interobserver agreement. Student performance data were 97.8% (range 87.5% to 100%) reliable across all tiers and phases within. Individual student participant reliability data will follow. First, reliability data were collected on Dantae's performance for 50% of his sessions across phases. Dantae's data were 100% reliable across all phases. Second, reliability data were collected on Brian's performance for 31% of his total number of sessions. In all, Brian's data were 100%

reliable. Third, Matthew's reliability data were collected for 33% of his sessions across phases. Across conditions, Matthew's data were 95.8% reliable (range 87.5% to 100%). Finally, reliability data were collected on Dionte's performance for 58% of his total number of sessions. Dionte's data were 97.1% reliable (range 87.5 to 100%) across phases.

Additionally, two trained doctoral-level student coders acted as independent observers. One doctoral-level student coder was responsible for coding 100 percent of intervention sessions evaluating the special education teacher interventionists' procedural fidelity when using CTD. The second doctoral-level student coder viewed 30 percent of all intervention sessions, ensuring reliability in data measuring CTD implementation fidelity. Data measuring the procedural fidelity of the CTD procedure were 98% reliable (range 91.6% to 100%), exceeding the average agreement range in single-case designs (Kratochwill et al., 2013). Doctoral-level student observers dedicated two days a week to code data, ensuring that all data were coded prior to each day of intervention. When agreement estimates fell below 85%, doctoral-level student observers were retrained until they reached the target level of reliability. Interobserver agreement was measured by dividing the total number of agreements by agreements plus disagreements, multiplied by 100 (Gast & Ledford, 2014).

Data analysis. Student achievement data are displayed graphically across tiers (see Figure 1) and a description of the methods of analyses used to measure experimental control will follow. The WWC Standards for analyzing single-case designs (Kratochwill et al., 2013) guided data analyses for this study. The median level percentage range was reported to determine the stability of student data. Additionally, the mean and median of each data series were calculated. The trend direction (Gast & Ledford, 2014) was analyzed, specifically comparing accelerating and decelerating trend directions that illustrate the percentage of unprompted versus prompted correct responses across tiers. The immediacy of effect (Horner et al., 2012; Kratochwill et al., 2013) evaluated the change in level between the last three data points in the baseline phase and the first three data points of the intervention phase, across all four tiers. Calculating the percentage of non-overlapping data point values (PND; Gast & Ledford, 2014) was not applicable, as there were no overlapping data points from the baseline phase to the intervention phase. In analyzing teacher data, the mean implementation fidelity of CTD across intervention sessions was reported and is depicted in Figure 1. Social validity surveys were administered to all participants, quantitatively measuring teacher and student perceptions of the teaching and learning process offered by the intervention package.

Social Validity

Two social validity surveys were administered, following recommended criteria from Horner and colleagues (2005). One survey was for the special education teacher interventionist and the other for student participants. Specifically, the special education teacher's perceptions of both the CTD procedure and *e*Coaching using BIE technology to teach a new job skill during CBI were measured through both closed- and open-ended social validity forms (see Appendix C). The teacher answered five close-ended questions using a five-point Likert scale, and, in addition, answered three open-ended questions (see Appendix C). All questions evaluated the teacher's perceptions of the intervention package, including the effectiveness and level of comfort using both the CTD procedure and BIE technology while on a CBI job training outing.

Using a visual three-point Likert scale (see Appendix C), student participants reported their perceptions of the learning process. Close-ended questions were specific to the new job skill acquired during CBI (at the department store) and teacher implementation of instruction. There were a total of five close-ended questions. All questions were read aloud to each participant and students were instructed to circle the face (happy, sad, neutral) that best described their response.

Chapter 4

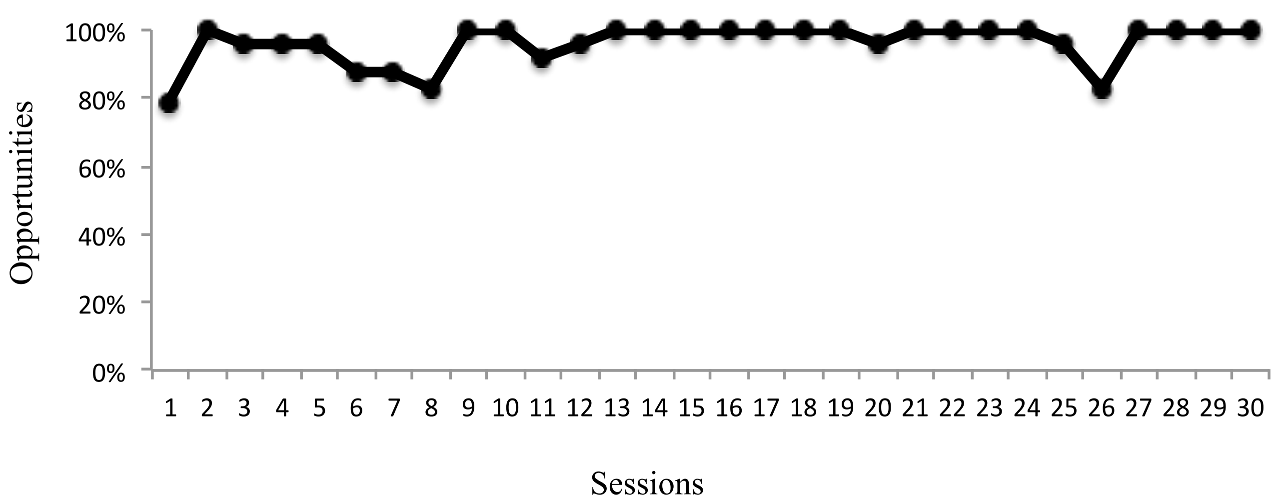
Results

The results of this study are presented sequentially, in three sections, by corresponding research questions. The first section addresses the data on research question one, "What is the functional relationship between providing immediate, real-time *e*Coaching through Bug-in-Ear technology (BIE) and implementing the constant time delay procedure (CTD) with fidelity, when used by a special education teacher to instruct young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD) as they learn a multi-step employment task in a community-based work environment?" The second section presents the data on research question two, "What is the functional relationship between teacher implementation of the constant time delay (CTD) procedure (e.g., providing a four second time delay between presentation of the target stimulus and controlling prompt; Bozkurt & Gursel, 2005) in a community-based work environment and acquisition of a multi-step employment skill (e.g., sorting and hanging clothing by similar size), while decreasing the number of required prompts, among young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD)?" The third section presents data on research questions three and four, addressing social validity. The third section first addresses the data on research question three, "What are the perceptions of the special education teacher participant, as measured by both a five-point Likert scale and an open-ended questionnaire (see Appendix C), regarding receiving real-time coaching and feedback via Bug-in-Ear (BIE) technology, while implementing the constant time delay procedure (CTD) to teach a multi-step employment task to young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD) during community-based instruction?" Finally, the third section presents the data on research question four, "What are the perceptions of the young adult participants, as measured by a visual three-point Likert scale (see Appendix C), regarding learning a new multi-step employment skill from their teacher during community-based instruction?"

Intervention Fidelity

Figure 1 depicts the functional relationship between receiving real-time *e*Coaching through BIE technology while implementing the CTD procedure in a community-based setting. As illustrated in Figure 1, when provided with continuous corrective feedback and praise in real-time via BIE technology, the teacher interventionist employed CTD with high procedural fidelity. Figure 1 shows the median level of teacher implementation of CTD. Accordingly, CTD was implemented with 100% procedural fidelity (range, 79% to 100%). Data were stable across 100% of the intervention sessions, maintaining at least a 21% range during the condition. As depicted in Figure 1, the mean percentage measuring procedural fidelity of CTD with support of *e*Coaching across intervention sessions was 96%.

Figure 1. Procedural fidelity of CTD with coaching by session.

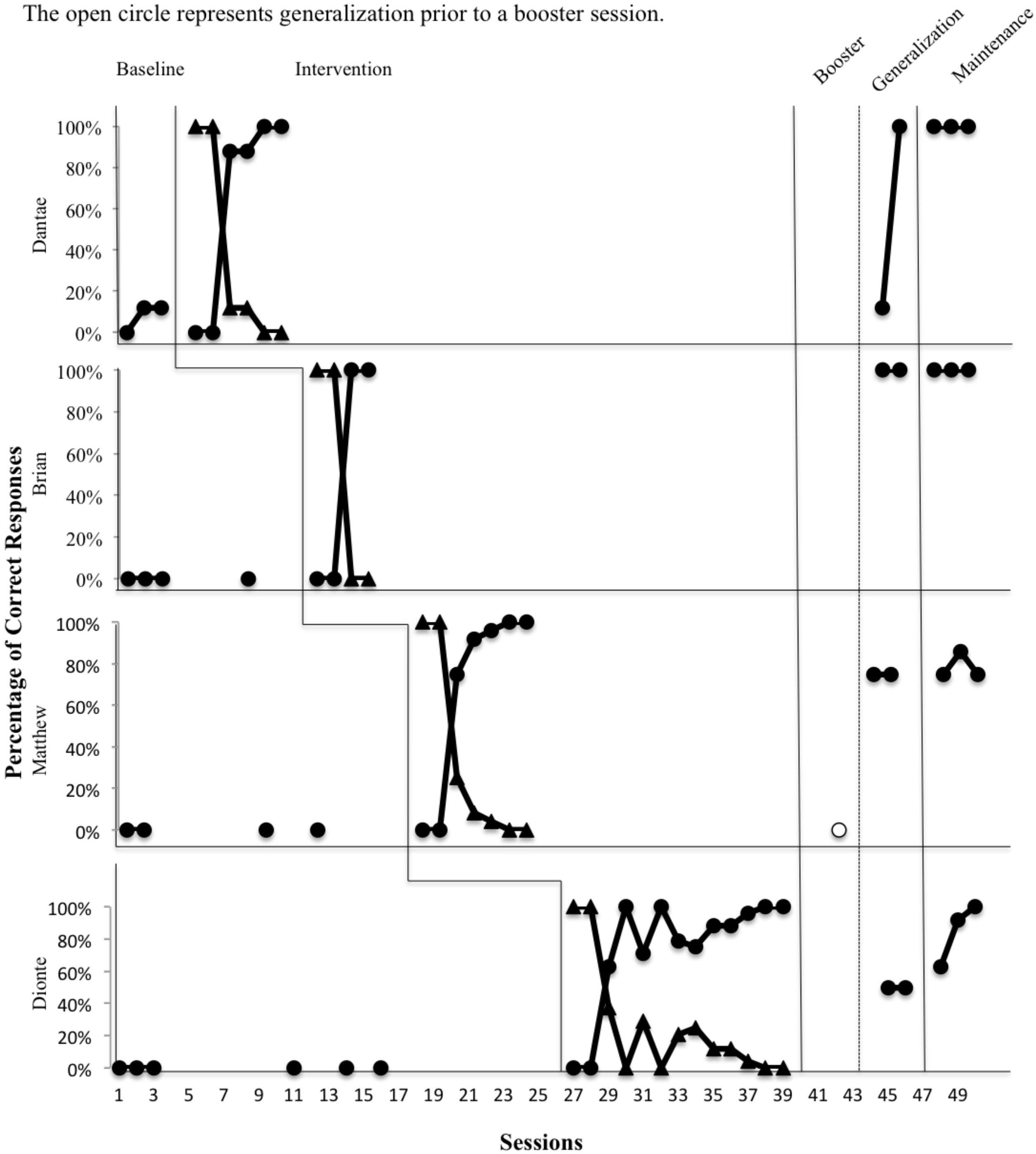


Effectiveness of CTD

Figure 2 illustrates the effectiveness of applying the CTD procedure in a community-based setting while the interventionist is receiving real-time coaching and feedback through BIE technology. Specifically, Figure 2 depicts the percentage of prompted and unprompted correct responses for each student participant across baseline, intervention, generalization, and maintenance conditions. Each student participant sorted men's athletic apparel by size on a clothing rack in a department store. As evidenced in Figure 2, student performance during baseline probe conditions was consistently low (range, 0% to 12%). During intervention, criterion was reached when 100% of the steps in the sorting task were completed independently, requiring no teacher prompts across two consecutive data sessions. A total of 30 intervention sessions were conducted across tiers. The number of sessions required for each student participant to reach criterion (range, 4 to 13) is shown in Table 4. Following completion of the intervention, two generalization conditions were measured. As depicted by individual graphs in Figure 2, Generalization 1 shows the number of unprompted student correct responses when instructed to sort a greater quantity of clothing by size. During intervention, students sorted a total of twelve articles of clothing (i.e., three size small, three size medium, three size large, and three size extra-large). However, during Generalization 1, five articles of clothing were randomly placed on the rack, and students were given the same instruction to "sort by size." Figure 2 shows the number of unprompted corrects performed by each student during the second generalization condition as well. Generalization 2 measured the students' ability to perform the sorting task in a different department of the store. Instead of sorting men's athletic apparel, students' ability to independently sort women's blouses was measured. Maintenance data were collected also for each student participant at one, two, and three weeks post-intervention. Maintenance data across tiers are displayed in Figure 2. Similar to previous conditions, generalization and maintenance sessions began once the teacher interventionist instructed the student participant to "sort by size." Results measuring the effectiveness of the CTD and *e*Coaching intervention package will follow and are presented corresponding to the staggered introduction of the independent variable across student participants.

Dantae. The first graph in Figure 2 depicts Dantae's percentage of prompted and unprompted correct responses while sorting clothing by size. Prior to introduction of the independent variable, Dantae never completed more than 13% of the task analysis steps correctly and baseline data remained stable during that condition. The CTD with *e*Coaching intervention package was introduced initially with a zero second delay interval between presentation of the target stimulus and the controlling prompt (Bozkurt & Gursel, 2005). Dantae received both verbal and gestural prompts during the first two intervention sessions to complete correctly all steps of the sorting task. The closed triangles in the first graph of Figure 2 represent Dantae's completion of the sorting task when provided with teacher prompts. Closed circles represent the percentage of Dantae's unprompted correct responses. As depicted in the first graph of Figure 2, the number of prompted corrects began decelerating in Sessions three and four, while the number of unprompted corrects simultaneously showed an accelerating trend direction. The immediacy of effect (Horner, Swaminathan, Sugai, & Smolkowski, 2012) was calculated, revealing a mean difference of 88% between Baseline and Intervention conditions when a four second delay interval was used. By Session five, Dantae completed all steps of the sorting task with no teacher prompts. Performance data remained stable at 100% accuracy, with no variability in the succeeding session. Dantae reached criterion after six instructional sessions. Overall, when being instructed with a four second delay interval, data remained stable with extremely low

Figure 2. Percentage of steps completed correctly across student participants. Closed circles represent unprompted corrects. Prompted correct responses are represented by closed triangles. The open circle represents generalization prior to a booster session.



variability (6%). Dantae's median level across intervention data during four-second delay intervals was 92% (range, 88% to 100%). Similarly, the mean level was 92% across all instructional sessions with a four second delay.

Two generalization probes were conducted. As shown on the first graph of Figure 2, Dantae independently completed 12% of the steps correctly during Generalization 1. During Generalization 2, Dantae independently completed all steps of the task analysis with 100% accuracy. Maintenance data were collected at one, two, and three weeks post-intervention. As depicted in the first graph of Figure 2, Dantae maintained the newly acquired sorting skill up to three weeks post-intervention. Across maintenance conditions, data remained stable at 100% unprompted correct responses with no variability.

Brian. The second graph in Figure 2 displays Brian's percentage of prompted and unprompted correct responses. Baseline data were flat (i.e., no correct responses) and remained stable across all four trials. The CTD with *e*Coaching intervention package was introduced with a zero second time delay interval for the first two consecutive intervention sessions. The closed triangles in the second graph of Figure 2 represent Brian's completion of the sorting task when provided with teacher prompts. Subsequent to the first two trials, Brian completed 100% of the steps to the sorting task independently when the discriminative stimulus was presented at a four second delay interval. Data remained stable with no variability in the succeeding session. The second graph of Figure 2 illustrates Brian reaching criterion after his fourth instructional session. Brian's data were unique in that subsequent to instruction with a zero second delay interval, he required no teacher prompts to complete successfully 100% of the steps in the sorting task. As depicted in the second graph of Figure 2, Brian's achievement was consistent across both generalization conditions. During Generalization 1, Brian began immediately sorting clothing according to size with 100% accuracy and that behavior was replicated across the second generalization condition. Similarly, the second graph of Figure 2 shows that Brian maintained the sorting skill up to three weeks post-intervention. Maintenance data were stable with no variability as Brian completed successfully 100% of the steps, unprompted.

Matthew. The third graph in Figure 2 displays Matthew's percentage of prompted and unprompted correct responses. Baseline data were flat (i.e., no correct responses) and remained stable with no variability across all five trials. When the CTD with *e*Coaching intervention package was introduced with a zero second delay interval between the presentation of the target stimulus and the controlling prompt (Bozkurt & Gursel, 2005), Matthew completed all of the steps of the task analysis with both verbal and gestural prompts. Prompted correct responses are illustrated by the closed triangles in the third graph of Figure 2. Closed circles represent unprompted correct responses. During Phase 2 of the CTD Intervention package, when there was a four second delay between presentation of the discriminative stimulus and controlling prompt (Bozkurt & Gursel, 2005), Matthew initially completed 75% of the steps correctly without teacher prompts. As depicted in the third graph of Figure 2, Matthew's percentage of unprompted correct responses revealed an accelerating trend at the onset of intervention, while the percentage of prompted correct responses displayed a decelerating trend. Additionally, the immediacy of effect (Horner et al., 2012) showed a mean difference of 88% between Matthew's baseline and intervention conditions. During Phase 2 of CTD instruction (i.e., four second delay interval), Matthew's performance data were stable, with low variability (7%). The median level across intervention data during Phase two with a four second delay interval was 96% (range, 75% to 100%). Matthew's mean level was 93% across all intervention sessions that consisted of a four second delay interval. Matthew reached criterion after a total of seven intervention sessions and subsequently began generalization.

During Generalization 1, Matthew reverted back to behavior that mimicked his responses during Baseline, performing 0% of the steps in the task analysis correctly. As a result, a booster session took place, employing a four second delay interval to retrain Matthew. The generalization probe prior to the booster session is depicted in the third graph of Figure 2 by an open circle. Additionally, a dotted line separates the booster session from succeeding generalization sessions. Subsequent to the booster session, the third graph of Figure 2 shows Matthew independently completed the steps of the sorting task with 75% accuracy during Generalization 1. Data remained stable at 75% accuracy during the second generalization session. Matthew maintained the skills at one, two, and three weeks post-intervention, with a mean percentage of unprompted correct responses equaling 79%.

Dionte. The fourth graph in Figure 2 displays Dionte's percentage of prompted and unprompted correct responses. Baseline data were flat (i.e., no correct responses) and remained stable, with no variability across all six sessions. The CTD with *e*Coaching intervention package was introduced with a zero second delay interval between the presentation of the target stimulus and the controlling prompt (Bozkurt & Gursel, 2005). Dionte required verbal and gestural prompts to accurately complete the steps of the sorting task. The closed triangles in the fourth graph of Figure 2 represent Dionte's completion of the sorting task when provided with teacher prompts. Closed circles represent the percentage of unprompted correct responses. As evidenced by the fourth graph of Figure 2, Dionte's immediacy of effect (Horner et al., 2012) revealed a mean difference of 78% when the intervention was introduced with a four second delay interval. Additionally, the fourth graph of Figure 2 depicts an accelerating trend direction for unprompted responses, while prompted responses simultaneously show a decelerating trend direction once the four-second delay interval was applied. Dionte reached criterion after a total of 13 intervention sessions. The median level across four-second delay interval intervention data was 88% (range, 63% to 100%). Although there was greater variability, Dionte's data remained stable, as 90% of Dionte's intervention data fell within the 25% range of the median level (Gast & Ledford, 2014). The mean level across Dionte's instructional sessions with a four second delay was 87%.

The fourth graph of Figure 2 depicts Dionte's data across generalization conditions. He performed 50% of the steps correctly during Generalization 1 and Generalization 2. The fourth graph of Figure 2 illustrates Dionte's ability to maintain the newly acquired sorting skill up to three weeks post-intervention. As shown, Dionte completed the sorting task with 63% accuracy during week one of the follow-up session. At two weeks, Dionte's accuracy improved to 92%, and three weeks following training, Dionte independently completed the steps of the task analysis with 100% accuracy. Dionte's mean percentage of unprompted correct responses at one, two, and three weeks post-intervention was 85%, and as illustrated in the third graph of Figure 2, maintenance data revealed an accelerating trend direction.

Table 4. Performance Data across Student Participants

Student	No. intervention sessions	Mean level with 4-s delay	% of corrects 3 week follow-up
Dantae	6	92%	100%
Brian	4	100%	100%
Matthew	7	93%	75%
Dionte	13	87%	100%

In sum, and as evidenced by the four staggered graphs in Figure 2, change in the dependent variables were shown to be a function of manipulating the independent variables. As depicted in Figure 2, low variability was reported across all student performance data. Table 4 further illustrates the results of the CTD with *e*Coaching intervention package. As shown in Table 4, the mean number of intervention sessions required for each participant to reach criterion was 7.5 (range, 4 to 13). Individual participant mean levels with a four second delay interval ranged between 87% and 100%. Additionally, all participants maintained the newly learned sorting skills up to three weeks post-intervention.

Social Validity

Social validity forms were administered to all participants at the conclusion of intervention. The interventionist completed a teacher survey, which included close-ended Likert scale questions as well as open-ended questions. Each student participant completed a student survey consisting of close-ended three-point visual Likert scale questions. All social validity measurement tools were guided by recommendations made by Horner et al. (2005), and the results will follow.

Teacher survey. The teacher answered five close-ended questions using a five-point Likert scale. Additionally, three open-ended questions were answered (see Appendix C). Results indicated that the CTD with *e*Coaching intervention was both an effective and efficient instructional approach. Specifically, the teacher "strongly agreed" that using CTD resulted in more rapid skill acquisition than if another instructional method had been implemented. Receiving corrective feedback and praise in real-time through BIE technology also was given the highest rating, when measuring level of comfort receiving such coaching and its effects on implementing CTD with fidelity. Furthermore, open-ended responses indicated a preference for *e*Coaching as a way to strengthen teaching practices and provide educators with new "tools" while not overwhelming the students by having a person physically present during instruction. The newly acquired skill (i.e., sorting clothing by size) was rated to be a beneficial employment readiness skill for student participants and the teacher indicated that he has plans for continued use the CTD procedure while instructing students with ASD and ID.

Student survey. A visual three-point Likert scale questionnaire (see Appendix C) was administered to each of the student participants at the conclusion of intervention. There were a total of five questions on each student survey and students responded by circling a happy face, a neutral face (straight line for the mouth), or a sad face. All questions were read aloud to the students by familiar instructional staff. Results indicated that all four students liked learning the new sorting skill and enjoyed being instructed during CBI at the department store. However, when asked if they would like to learn in a similar manner in the future, three of the four student participants circled the happy face and one circled the sad face. All students indicated that their teacher did a "good job" instructing them during the intervention.

Chapter 5

Discussion

The purpose of this investigation was threefold. The first purpose was to measure procedural fidelity of a special education teacher interventionist as he implemented the constant time delay (CTD) procedure while receiving *e*Coaching through bug-in-ear (BIE) technology. During intervention conditions, CTD was used to teach a new employment skill to young adults with ASD and comorbid ID during community-based instruction (CBI). The second purpose was to study the effects of a CTD with *e*Coaching intervention package on the performance of young adults with ASD and ID in a community-based employment setting. Specifically, skill acquisition, generalization, and maintenance were measured. The third purpose was to evaluate the perceptions of the special education teacher interventionist and student participants after using the CTD with *e*Coaching intervention package to learn a new employment skill during CBI. As such, four research questions were posed.

The first research question, "What is the functional relationship between providing immediate, real-time *e*Coaching through Bug-in-Ear technology and implementing the constant time delay procedure (CTD) with fidelity, when used by a special education teacher to instruct young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD) as they learn a multi-step employment task in a community-based work environment?" focused on procedural fidelity of CTD. Findings revealed that when using *e*Coaching to provide praise and corrective feedback in real-time to the teacher interventionist, CTD was implemented with high rates of procedural fidelity. The second research question, "What is the functional relationship between teacher implementation of the constant time delay (CTD) procedure (e.g., providing a four second time delay between presentation of the target stimulus and controlling prompt; Bozkurt & Gursel, 2005) in a community-based work environment and acquisition of a multi-step employment skill (e.g., sorting and hanging clothing by similar size), while decreasing the number of required prompts, among young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD)?" focused on the effectiveness of the intervention package on student participant acquisition of a new multi-step employment skill. Results showed the CTD and *e*Coaching intervention package increased skill acquisition. Additionally, participants generalized and maintained the newly learned skill (i.e., sorting clothing by size) three weeks following training.

The third and fourth research questions evaluated the perceptions of the special education teacher interventionist as well those of the four student participants. The third research question, "What are the perceptions of the special education teacher participant, as measured by both a 5-point Likert scale and an open-ended questionnaire (see Appendix C), regarding receiving real-time coaching and feedback via Bug-in-Ear (BIE) technology, while implementing the constant time delay procedure (CTD) to teach a multi-step employment task to young adults with mild or moderate intellectual disability (ID) and autism spectrum disorder (ASD) during community-based instruction?" focused on the comfort level with the technology and the overall effectiveness and plans for continued use of the CTD procedure. The results showed that the teacher was comfortable with BIE technology and found it to be beneficial to his instruction. The teacher interventionist also reported that the CTD procedure contributed positively to student learning. The final research question, "What are the perceptions of the young adult participants, as measured by a visual 3-point Likert scale (see Appendix C), on learning a new multi-step employment skill from their teacher during community-based instruction?" focused on the students' perceptions of the newly acquired skill and being instructed by their teacher during

CBI. The results indicated that student participants enjoyed the learning process and the task itself.

In all, the findings of the present study showed that pairing *e*Coaching through BIE technology with CTD instruction resulted in high rates of procedural fidelity of CTD in a community-based employment setting. Additionally, the CTD with *e*Coaching intervention package enhanced job skill acquisition of students with ASD and comorbid ID during CBI. Finally, social validity surveys showed participants rate favorably this teaching and learning process as well as acquisition of the new skill. These findings contribute to the literature in several ways and have research and practice implications for job skill training in young adults with ASD and ID.

Providing praise and corrective feedback in real time by means of *e*Coaching with BIE technology resulted in high implementation fidelity of the CTD procedure. *e*Coaching enabled the special education teacher interventionist to proactively ask procedural questions when necessary (e.g., "Using the four second delay, I only provide a prompt sooner than four seconds when Matthew initiates an incorrect response, right?"). While receiving corrective feedback, the teacher interventionist was notified in real-time when he needed to provide a student prompt that was initially withheld (e.g., "prompt"), which strengthened the procedural fidelity of CTD. Precise praise also was delivered to the teacher interventionist when CTD was being employed with fidelity (e.g., "Excellent job intervening [an incorrect response] and proving a gestural prompt!") . Data revealed that utilizing *e*Coaching with BIE technology while employing CTD in a community-based employment environment resulted in high procedural fidelity of the instructional technique. This extends previous CTD literature by measuring procedural fidelity of CTD and adding the *e*Coaching component. In the present study, the special education teacher interventionist received continuous implementation feedback throughout intervention sessions, which successfully shaped procedural fidelity of the CTD procedure. Results showed a functional relationship between using *e*Coaching while implementing CTD and high rates of procedural fidelity. Accordingly, student performance data showed that the CTD with *e*Coaching intervention package resulted in high rates of student learning across all four participants.

Baseline conditions revealed that, prior to the CTD with *e*Coaching intervention, all four students were unable to sort articles of clothing by size (i.e., S, M, L, XL) on a department store clothing rack. During baseline, Brian, Matthew, and Dionte consistently completed 0% of the steps of the task analysis correctly, whereas, Dantae's baseline data were stable at 12%. Student responses during baseline conditions varied and individual descriptions will follow. Student 1, Dantae, starred at a far wall of clothing during the first baseline session. He slowly pointed and said, "medium" without initiating a correct physical response. During the succeeding sessions, Dantae picked up the size large shirts, walked away, and stood in place, holding the shirts. Student 2, Brian, pointed to the barcode on each tag attached to a shirt, but made no reference to the size. During Brian's final baseline session, he repeatedly spun the entire rack of clothing in a circular motion. Student 3, Matthew, verbally repeated the direction "sort by size" before pointing to each of the twelve articles of clothing on the rack while saying the letter on the hanger indicating the size (e.g., "L," "M," "XL," "S"). For Matthew, these behaviors were consistent across the entire baseline condition. Student 4, Dionte, individually lifted each hanger [in an upward motion] approximately half an inch from the clothing rack before placing it back in its initial location on the same rack. This behavior was consistent across all of Dionte's baseline sessions as well.

Upon introduction of the CTD procedure, each participant completed all of steps of the task analysis correctly when prompted at a zero second delay interval. All four students required both verbal and gestural prompts to complete each step successfully. Students 3 and 4, Matthew and Dionte, relied on multiple prompts (e.g., one verbal and two gestural prompts) during the first intervention session to complete several of the individual steps of the task. However, once a four second delay interval was introduced, all four participants showed mean differences exceeding 77% between baseline and intervention conditions. Overall, CTD proved to be an effective procedure to use when teaching students with ASD and ID how to group and sort clothing according to size. Furthermore, CTD was an efficient instructional approach, as measured by trials-to-criterion.

Data conclusively revealed that all four students generalized the newly learned sorting skills and maintained those target skills over time. More specifically, students independently sorted clothes in an unfamiliar clothing department (i.e., women's department) located within the Marshall's department store, and all students except for Dantae also completed the sorting task when presented with more articles of clothing. Maintenance data were collected at one, two, and three weeks post-intervention. Further details will follow of individual generalization and maintenance sessions that resulted in student performance percentages equaling less that 100%. During Generalization 1, Dantae initiated the sorting sequence by picking up all of the size small shirts. However, he became extremely distracted and lost focus while slowly walking away. In response to Dantae's inattention, the teacher interventionist tapped the rack once with his fingers in an effort to regain attention and focus. The teacher interventionist reported that Dantae appeared to be having an "off" day, as the attempts to redirect his attention were unsuccessful. Additionally, it was noted that there were added distractions when Generalization 1 data were collected (i.e., construction work taking place outside the adjacent window). The same redirection technique (i.e., Teacher tapping the rack with his fingers) also was applied during Generalization 2. During that session, Dantae became distracted twice and visibly started starring and slowly walking away. Following the protocol for redirecting students, the teacher regained Dantae's attention immediately and he successfully completed the sorting task with 100% accuracy.

Dantae maintained the target skills with 100% accuracy up to three weeks post-intervention. During Matthew's first generalization session, his response behavior mimicked that from his baseline condition (i.e., verbally saying the letter presented on each hanger without attempting to sort the articles of clothing). A booster session was provided in response to Matthew's 0% achievement during Generalization 1. During the booster session and following the CTD implementation protocol with a four second delay interval, Matthew's incorrect responses were interrupted immediately and corrected by the teacher interventionist. After minimal prompting at the beginning of the sorting sequence, Matthew required few teacher prompts while correctly performing the remaining steps of the task. Generalization and maintenance data following the booster session showed at least 75% accuracy across sessions. During all post-booster sessions, Matthew made one repeated error. He correctly grouped all articles of clothing according to like sizes; however, Matthew placed the medium shirts in front of the small shirts. Dionte's errors during generalization were very similar to Matthew's errors. During both generalization sessions, Dionte independently picked up each article of clothing by the hanger and grouped it with corresponding sizes (e.g., placed medium shorts next to other size medium shorts). However, Dionte failed to sort articles of clothing according to size (e.g., S, M, L, XL). Instead, similar sizes were grouped together, but not arranged on the rack correctly (e.g., L, M, XL, S). Interestingly, Dionte improved his sorting accuracy in each consecutive weekly maintenance probe and, by the third and final follow-up session, data showed Dionte maintained the sorting skill with 100% accuracy.

In addition to the effectiveness of CTD on employment skill acquisition, teacher and student participants rated CTD as a valuable teaching method. Teacher reports showed that using the CTD procedure resulted in more rapid skill acquisition compared to other previous instructional methods. Teacher reports also indicated that there was a high level of comfort in employing CTD while simultaneously being coached using BIE technology and that *e*Coaching helped strengthen the accuracy of CTD implementation. Furthermore, the teacher rated CTD as a valuable teaching approach and reported he planed to continue using the procedure. Similarly, student reports indicated a preference for receiving prolonged instruction using the CTD procedure.

In sum, results from this study support previous findings that demonstrate the effectiveness of CTD on skill acquisition in individuals with ASD and ID (Bozkurt & Gursel, 2005; Brandt et al., 2016; Seward et al., 2014). This was the first study to apply CTD in a community-based setting when teaching employment skills. All four student participants in the present study acquired the skills as a result of the CTD procedure, maintained the target skills one to three weeks following training, and demonstrated the ability to generalize the sorting skill to novel settings within the department store. Therefore, demonstrating the effectiveness of using CTD during CBI, when teaching an employment skill. Social validity reports revealed the teaching and learning process to be rated as highly desirable by both teacher and student participants. Moreover, providing corrective feedback and praise in real-time though *e*Coaching resulted in high procedural fidelity when implementing CTD during CBI, thus, proving evidence-based teaching procedures can be employed during CBI when paired with *e*Coaching. Given the troubling employment rates of young adults with disabilities and recommendations for implementing effective evidence-based teaching strategies (Test et al., 2009), this study holds promise for individuals with ASD and ID as they transition into the workforce.

Limitations

As with all research, while interpreting the results of this study, there are several limitations that must be taken into consideration. One limitation was the lack of Internet connectivity at the Marshall's department store. Although the researcher was able to gain Internet access through a "personal hotspot" on a mobile device, there were times when the video did not appear due to low bandwidth. Additionally, failure to have Internet access in the department store limited the ability to coach from a remote location. A second limitation was that this study included four participants, all of whom had a diagnosis of ASD and comorbid ID. It is unknown if there would be similar results with young adults with other disability diagnoses. A third limitation was that the effectiveness of the CTD and *e*Coaching intervention package was measured across only one employment skill. It is unknown if other employment-related tasks would mirror the same performance outcomes. The fourth limitation was measuring sustainability over time. Follow-up data were collected up to three weeks post-intervention. Finally, the fifth limitation was failure to measure student error rates during intervention. Although data were collected on both prompted and unprompted correct student responses, these data did not reveal error rates. For example, if a student placed an article of clothing out of sequence (e.g., XL in front of M), and required three prompts to correctly move it to the designated location on the clothing rack, the outcome for that step was coded a "prompted correct." It would have been beneficial to record and report error rates across student participants. Even so, the results of the present study contribute to the existing research in several important ways.

Implications for Research

This study demonstrated a functional relationship between using *e*Coaching with BIE technology and implementing the CTD procedure with fidelity when instructing students with ASD and ID in a community-based work environment. The CTD with *e*Coaching intervention package effectively enhanced participants' acquisition of a new employment skill (i.e., sorting and sequentially arranging clothing according to size) during CBI. Furthermore, student participants generalized and maintained the target skill in a natural community-based setting up to three weeks post-intervention. Student participants reported that they enjoyed learning in this manner and the teacher interventionist planed future use of CTD. Although this study extends the accumulated literature, there are recommendations for future research. First, replicating this study while measuring the effectiveness of the intervention package across multiple department store job skills (i.e., multiple probe replicated across tasks design) would increase the external validity and further extend the utility of the intervention package. Second, measuring the effectiveness of the intervention package in another community-based work environment (e.g., a restaurant) when students are learning other important employment skills (e.g., stocking shelves, custodial duties) would further expand the efficacy of the CTD with *e*Coaching intervention package. Third, in addition to prompted and unprompted correct responses, measuring student error rates would more accurately depict student performance across individual intervention sessions. Finally, using *e*Coaching with BIE technology was shown to be an effective way to provide praise and corrective procedural feedback to the teacher interventionist in the present study. This coaching process can be used to provide praise and performance-related instruction directly to students in community-based work environments. Rather than a teacher interventionist wearing the Bluetooth headset, students with disabilities can directly receive praise and performance feedback in real-time using BIE technology. Providing high-quality performance feedback to learners acquiring employment skills in a community setting will increase levels of independence by physically removing support personnel. Furthermore, continued implementation of evidence-based practices during employment skill training may result in increased postschool employment outcomes (Bennett & Dukes, 2013; Test et al., 2009).

Implications for Practice

The CTD procedure has been validated empirically to be an effective teaching approach to use with students with developmental disabilities for more than 30 years (Ault et al., 1988; Brandt et al., 2016; Branham et al., 1999). This study showed the value of implementing this evidence-based instructional procedure paired with *e*Coaching when teaching students diagnosed with ASD and comorbid ID employment skills in a community-based environment. There is a critical need for using effective teaching strategies with this population of learners, especially when preparing for postsecondary transition (Test et al., 2009). As such, the findings from this study support the continued use of the CTD procedure with similar learners. As with generalizing and applying the methodology of any single case research design, individual student characteristics and needs must be taken into careful consideration. With the intent of implementing CTD, to optimize results, students should demonstrate the following abilities: (a) wait at least four seconds for a prompt, (b) attend to stimuli for a minimum duration of five minutes, and (c) willingly work with instructional staff in a designated learning environment. Finally, adding the *e*Coaching component to training is a proven effective way to promote procedural fidelity of CTD and therefore should be considered by any interventionist using CTD.

References

Ackerlund Brandt, J. A., Weinkauf, S., Zeug, N. & Klatt, K. P. (2016). An evaluation of constant time delay and simultaneous prompting procedures in skill acquisition for young children with autism. *Education and Training in Autism and Developmental Disabilities, 51*(1), 55-66.

Ault, M. J., Gast, D. L., & Wolery, M. (1988). Comparison of progressive and constant time-delay procedures in teaching community-sign word reading. *American Journal on Mental Retardation, 93*(1), 44-56.

Bennett, K. D., (2013). Improving vocational skills of students with disabilities: Applications of covert audio coaching. *TEACHING Exceptional Children, 46*(2), 60-67.

Bennett, K. D., & Dukes, C. (2013). Employment instruction for secondary students with autism spectrum disorder: A systematic review of the literature. *Education and Training in Autism and Developmental Disabilities, 48*(1), 67-75.

Bennett, K. D., Frain, M., Brady, M. P., Rosenberg, H., & Surinak, T. (2009). Differences between employees' and supervisors' evaluations of work performance and support needs. *Education and Training in Developmental Disabilities, 44*(4), 471-480.

Bennett, K. D., Ramasamy, R., & Honsberger, T. (2013). Further examination of covert audio coaching on improving employment skills among secondary students with autism. *Journal of Behavioral Education, 22*, 103-119. doi:10.1007/s10864-013-9168-2

Bouck, E. C., (2012). Secondary students with moderate/severe intellectual disability: Considerations of curriculum and post-school outcomes from the national longitudinal transition study-2. *Journal of Intellectual Disability Research, 56*(12), 1175-1186. doi:10.1111/j.1365-2788.2011.01517.x

Bozkurt, F., & Gursel, O. (2005). Effectiveness of constant time delay on teaching snack and drink preparation skills to children with mental retardation. *Education and Training in Developmental Disabilities, 40*(4), 390-400.

Brandt, J. A. A., Weinkauf, S., Zeug, N., & Klatt, K. P. (2016). An evaluation of constant time delay and simultaneous prompting procedures in skill acquisition for young children with autism. *Education and Training in Autism and Developmental Disabilities, 51*(1), 55-66.

Branham, R. S., Collins, B. C., Schuster, J. W., & Kleinert, H. (1999). Teaching community skills to students with moderate disabilities: Comparing combined techniques of classroom simulation, videotape modeling, and community-based instruction. *Education and Training in Mental Retardation and Developmental Disabilities, 34*(2), 170-181. Retrieved from http://www.jstor.org/stable/23880124

Browder, D., Ahlgrim-Delzell, L., Spooner, F., Mims, P. J., & Baker, J. N. (2009). Using time delay to teach literacy to students with severe developmental disabilities. *Exceptional Children, 75*(3), 343-364.

Caton, S., & Kagan, C. (2006). Tracking post-school destinations of young people with mild intellectual disabilities: The problem of attrition. *Journal of Applied Research in Intellectual Disabilities, 19*, 143-152.

Chandler, W., Schuster, J. W., & Stevens, K. B. (1993). Teaching employment skills to adolescents with mild and moderate disabilities using a constant time delay procedure. Education and *Training in Mental Retardation, 28*(2), 155-168. Retrieved from http://www.jstor.org/stable/23878851

Cihak, D. F., Alberto, P. A., Kessler, K. B., & Taber, T. A. (2004). An investigation of instructional scheduling arrangements for community-based instruction. *Research in Developmental Disabilities, 25*, 67-88. doi:10.1016/j.ridd.2003.04.006

Cimera, R. E., Burgess, S., & Bedesem, P. L. (2014). Does providing transition services by age 14 produce better vocational outcomes for students with intellectual disability? *Research and Practice for Persons with Severe Disabilities, 39(*1), 47-54.

Coleman, M. B., Hurley, K. J., & Cihak, D. F. (2012). Comparing teacher-directed and computer-assisted constant time delay for teaching functional sight words to students with moderate intellectual disability. *Education and Training in Autism and Developmental Disabilities, 47*(3), 280-292.

Gast, D. L., Ault, M. J., Wolery, M., Doyle, P. M., & Belanger, S. (1988). Comparison of constant time delay and the system of least prompts in teaching sight word reading to students with moderate retardation. *Education and Training in Mental Retardation, 23*(2), 117-128.

Gast, D. L., & Ledford, J. R. (2014). Single case research methodology: Applications in special education and behavioral sciences (2nd ed.). New York: Routledge.

Gast, D. L., & Snell, M. E. (1981). Applying time delay procedure to the instruction of the severely handicapped. *TASH, 6,* 3-14.

Griffen, A. K., Wolery, M., & Schuster, J. W. (1992). Triadic instruction of chained food preparation responses: Acquisition and observational learning. *Journal of Applied Behavior Analysis, 25*(1), 193-204. doi:10.1901/jaba.1992.25-193

Grigal, M., Hart, D., & Migliore, A. (2011). Comparing the transition planning, postsecondary education, and employment outcomes of students with intellectual and other disabilities.

Career Development for Exceptional Individuals, 34(1), 4-17. doi:10.1177/0885728811399091

Hall, M. G., Schuster, J. W., Wolery, M., & Gast, D. L. (1992). Teaching chained skills in a non-school setting using a divided half instructional format. *Journal of Behavioral Education, 2*(3), 257-279. Retrieved from http://www.jstor.org/stable/41824010

Hendricks, D. (2010). Employment and adults with autisme spectrum disorders: Challenges and strategies for success. *Journal of Cocational Rehabilitation, 32*, 125-134. doi:10.3233/JVR-2010-0502

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-gubject research design to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179.

Horner, R. H., Swaminathan, H., Sugai, G., Smolkowski, K. (2012). Considerations for the systematic analysis and use of single-case research. *Education and Treatment of Children, 35*(2), 269-290.

Hua, Y., Woods-Groves, S., Kaldenberg, E. R., & Scheidecker, B. J. (2013). Effects of vocabulary instruction using constant time delay on expository reading of young adults with intellectual disability. *Focus on Autism and Other Developmental Disabilities, 28*(2), 89-100.

Hughes, T. A., Fredrick, L. D., & Keel, M. C. (2002). Learning to effectively implement constant time delay procedures to teach spelling. *Learning Disability Quarterly, 25*(3), 209-222. doi:10.2307/1511303

Individuals with Disabilities Education Improvement Act of 2004, PL 108-446, 20 U.S.C. §1400 et seq. (2004).

Jameson, J. M., McDonnell, J., Johnson, J. W., Riesen, T., & Polychronis, S. (2007). Comparison of one-to-one embedded instruction in the general education classroom and one-to-one massed practice instruction in the special education classroom. *Education and Treatment of Children, 30*(1), 23-44.

Jimenez, B. A., Browder, D. M., Spooner, F., & Dibiase, W. (2012). Inclusive inquiry science using peer-mediated embedded instruction for students with moderate intellectual disability. *Exceptional Children, 78*(3), 301-317.

Kohler, P. D., & Field, S. (2003). Transition-focused education: Foundation for the future. *The Journal of Special Education, 37*(3), 174-183.

Krantochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shaadish, R. (2013). Single-case intervention research design standards. *Remedial and Special Education, 34*(1), 26-38. doi:10.1177/0741932512452794

Kretlow, A. G., & Bartholomew, C. C. (2010). Using coaching to improve the fidelity of evidence-based practices: A review of studies. *Teacher Education and Special Education, 33*(4), 279-299. doi:10.1177/0888406410371643

Luftig, R. L., & Muthert, D. (2005). Patterns of employment and independent living of adults graduates with learning disabilities and mental retardation of an inclusionary high school vocational program. *Research in Developmental Disabilities, 26*, 317-325.

Miller, U. C., & Test, D. W. (1989). Comparison of constant time delay and most-to-least prompting in teaching laundry skills to students with moderate retardation. *Education and Training in Mental Retardation, 24*(4), 363-370. Retrieved from http://www.jstor.org/stable/23878520

Morse, T. E., & Schuster, J. W. (2000). Teaching elementary students with moderate intellectual disabilities how to shop for groceries. *Exceptional Children, 66*(2), 273-288.

Pickens, J. L., & Dymond, S. K. (2015). Special education directors' views of community-based vocational instruction. *Research and Practice for Persons with Severe Disabilities, 39*(4), 290-304. doi:10.1177/1540796914566713

Ploessl, D. M., & Rock, M. L. (2014). eCoaching: The effects on co-teachers' planning and instruction. *Teacher Education and Special Education, 37*(3), 191-215. doi:1177/0888406414525049

Riesen, T., McDonnel, J., Johnson, J. W., Polychronis, S., & Jameson, M. (2003). A comparison of constant time delay and simultaneous prompting within embedded instruction in general education classes with students with moderate to severe disabilities. *Journal of Behavioral Education, 12*(4), 241-259.

Rock, M., Gregg, M., Gable, R., Zigmond, N., Blanks, B., Howard, P., & Bullock, L. (2012). Time after time online: An extended study of virtual coaching during distant clinical practice. *Journal of Technology and Teacher Education, 20*(3), 277-304. Retrieved from http://www.editlib.org/p/38623/

Rock, M. L., Gregg, M., Thead, B. K., Acker, S. E., Gable, R. A., Zigmond, N. P. (2009). Can you hear me now? Evaluation of an online wireless technology to provide real-time feedback to special education teachers-in-training. *Teacher Education and Special Education, 32*(1), 64-82. doi:10.1177/0888406408330872

Roux, A., Shattuck, P., & Cooper, P. (2013). Postsecondary employment experiences among young adults with an autism spectrum disorder RH: Employment in young adults with autism. *Journal of the American Academy of Child and Adolescent Psychiatry, 52*(9), 931-939. doi:10.1016/j.jaac.2013.05.019

Schuster, J. W., Gast, D. L., & Wolery, M. (1988). The effectiveness of a constant time-delay procedure to teach chained responses to adolescents with mental retardation. *Journal of Applied Behavior Analysis, 21*(2), 169-178. doi:10.1901/jaba.1988.21-169

Schuster, J. W., Griffen, A. K., & Wolery, M. (1992). Comparison of simultaneous prompting and constant time delay procedures in teaching sight words to elementary students with moderate mental retardation. *Journal of Behavioral Education, 2*(3), 305-325. Retrieved from http://www.jstor.org/stable/23881258

Seward, J., Schuster, J. W., Ault, M. J., Collins, B. C., & Hall, M. (2014). Comparing simultaneous prompting and constant time delay to teach leisure skills to students with moderate intellectual disability. *Education and Training in Autism and Developmental Disabilities, 49*(3), 381-395.

Sheeler, M. C., Ruhl, K. L., & McAfee, J. K. (2004). Providing performance feedback to teachers: A review. *Teacher Education and Special Education, 11*(4). 396-407.

Snell, M., & Gast, D. L. (1981). Applying delay procedure to the instruction of the severely handicapped. *Journal of the Associa- tion for the Severely Handicapped, 6,* 3–14.

Swain, R., Lane, J. D., & Gast, D. L. (2015). Comparison of constant time delay and simultaneous prompting procedures: Teaching functional sight words to students with intellectual disabilities and autism spectrum disorder. *Journal of Behavioral Education, 24*(2), 210-229. doi:10.1007/s10864-014-9209-5

Test, D. W., Mazzottii, V. L., Mustian, A. L., Fowler, C. H., Kortering, L., & Kohler, P. (2009). Evidence-based secondary transition predictors for improving postschool outcomes for students with disabilities. *Career Development for Exceptional Individuals, 32*(3), 160-181. doi:10.1177/0885728809346960

Van Laarhoven, T., Winiarski, L., Blood, E., & Chan, J. M. (2012). Maintaining vocational skills of individuals with autism and developmental disabilities through video modeling. *Education and Training in Autism and Developmental Disabilities, 47*(4), 447-461.

Walker, G. (2008). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders, 38*, 261-275. doi:10.1007/s10803-007-0390-4

Walker, A. R., Uphold, N. M., Richter, S., & Test, D. W. (2010). Review of the literature on community-based instruction across grade levels. *Education and Training in Autism and Developmental Disabilities, 45*(2), 242-267. Retrieved from http://www.jstor.org/stable/23879810

Winterling, V., Gast, D. L., Wolery, M., & Farmer, J. A. (1992). Teaching safety skills to high school students with moderate disabilities. *Journal of Applied Behavior Analysis, 25*(1), 217-227.

Wolery, M., Holcombe, A., Cybriwsky, C., Doyle, P. M., Schuster, J. W., Ault, M. J., & Gast, D. L. (1992). Constant time delay with discrete responses: A review of effectiveness and demographic, procedural, and methodological parameters. *Research in Developmental Disabilities, 13*, 239-266.

Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M. Griffen, A. K. (1991). Teaching chained tasks in dyads: Acquisition of target and observational behaviors. *The Journal of Special Education, 25*(2), 198-220. doi:10.1177/002246699102500205

Branham, Cihak, Alberto, Kessler, & Taber, 2003

Appendix A

IRB Approval Letters and Informed Consent Forms

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

Physical Address

4111 Monarch Way, Suite 203 Norfolk, Virginia 23508 Mailing Address Office of Research 1

Old Dominion University Norfolk, Virginia 23529 Phone(757) 683-3460 Fax(757) 683-5902

DATE:

TO: FROM:

PROJECT TITLE:

REFERENCE #: SUBMISSION TYPE:

ACTION: APPROVAL DATE: EXPIRATION DATE: REVIEW TYPE:

March 3, 2017

Robert Gable, PhDOld Dominion University Institutional Review Board

[962484-4] Using eCoaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction

16-186 Amendment/Modification

APPROVEDMarch 3, 2017 November 17, 2017 Expedited Review

Thank you for your submission of Amendment/Modification materials for this project. The Old Dominion University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this committee. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this committee.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of November 17, 2017.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Danielle Faulkner at (757) 683-4636 or dcfaulkn@odu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Old Dominion University Institutional Review Board's records.

secep

Southeastern Cooperative Educational Programs

Administrative Offices | 6160 KEMPSVILLE CIRCLE • SUITE 300B
NORFOLK, VIRGINIA 23502 | OFFICE (757) 892-6100 • FAX (757) 892-6111

March 6, 2017

Ms. Annemarie Horn
Old Dominion University
Department of Communication Disorder and Special Education
225 Child Study Center
4501 Hampton Blvd.
Norfolk, VA 23529

Re: Application to Conduct Research

Dear Ms. Horn,

This letter serves as notice that your application to conduct research has been approved. You are authorized to conduct the study "Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction". It is noted that the project will involve students enrolled in a SECEP classroom at Lake Taylor High School and SECEP at ODU.

You are asked to meet with Karen Holloway, SECEP Principal, before proceeding to obtain consent and assent of the parent/guardian, SECEP staff, and students; and move forward with the study as outlined. Thank you for considering SECEP's population in your research. We look forward to receiving a copy of your results and any additional information you would like to share with our organization.

If you have further questions or need additional information, please contact me at 757-892-6100.

Sincerely,

Tamra R. Cobb, Ph.D., Coordinator
Professional Development/Quality Assurance

cc: David Sadler, Executive Director
Greg Jacob, Assistant Director of Programs

ADOLESCENT ASSENT FORM
OLD DOMINION UNIVERSITY

A. WHAT IS THIS STUDY ABOUT?

I am asking to observe you (and several other adolescents or young adults) as you learn how to do a new work skill in the community. I have asked your instructional staff to help me observe your progress. We have already informed your parent or legal guardian that we are asking permission for you to participate in this study.

B. WHAT WILL HAPPEN TO YOU?

If you agree to participate, you will work with your instructional staff as you learn a new skill at Marshall's. A teacher will be coaching your instructional staff while measuring your ability to learn new skills. Observations will take place at the same time everyday that you go to Marshall's. You do not have to participate if you do not want to. If you begin to feel frustrated or upset, please let your job coach know.

C. WHAT ARE MY CHOICES?

You can be in this study if you want to, but you don't have to be in it if you don't want to. You don't have to do the study even though your parent or guardian said it is okay. Nobody will get mad at you if you don't want to do this. If you decide to be in this study, and change your mind later, that is okay, too. You just tell your job coach that you have changed your mind. The goal is to help you learn how to do something at Marshall's all by yourself.

D. **ASSENT**

If you would like to participate, you agree to be observed and videotaped while learning new skills at Marshall's. If you agree, please sign both copies of this form. Give your job coach one copy and keep one for yourself. You can contact Dr. Gable at Old Dominion University if you have any questions. His phone number is (757) 683-3157. He will be happy to talk with you at any time.

Youth Signature or Initial ____________________________ Date________________

Signature of Person Obtaining Assent ______________________ Date___________

INFORMED CONSENT DOCUMENT (for Parents)
OLD DOMINION UNIVERSITY

PROJECT TITLE: Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction

INTRODUCTION
The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this research, and to record the consent of those who say YES. Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction. This research will take place during the participants' regularly scheduled community-based instruction (CBI) time at Marshall's.

RESEARCHERS
Responsible Project Investigator: Bob Gable, PhD, Professor in the Darden College of Education at Old Dominion University in Norfolk, Virginia.
Additional Investigator: Annemarie Horn, MSEd, Doctoral Candidate in Department of Communication Disorders and Special Education at Old Dominion University.

DESCRIPTION OF RESEARCH STUDY
In this study, your adolescent/young adult dependent will be taught how to complete a new job skill within the community, while his or her instructional staff member is using a newly learned prompt procedure with a strong evidence base. Instructional staff will receive feedback in real-time as he or she works with the adolescent/young adult participant. A doctoral student from the special education department at ODU will be watching the instructional staff member from a separate location, and provide corrective feedback and praise as he or she [instructional staff] uses the prompt procedure. Additionally, instructional staff member's will collect data using an individualized task analysis, measuring the number of steps the adolescent/young adult participant completes independently during each session. This type of coaching has been successfully used in classrooms across the country, and recipients of such feedback have reported it as very beneficial and not invasive. Additionally, the prompt procedure that is going to be used has a very high success rate in aiding adolescents and young adults as they acquire a new skill.

If you agree to let your adolescent/young adult participate, you will join a study involving research measuring the effectiveness of using individualized, evidence-based teaching practices when working on age-appropriate job skills for your son or daughter. For the research study, instructional staff will collect adolescent/young adult data, while the doctoral student simultaneously measures data on the instructional staff members' correct implementation of the prompt procedure. If you say YES, then your son or daughter's participation will last for approximately four to six weeks. Four adolescent participants and their four CBI instructional staff members will be participating in this study.

EXCLUSIONARY CRITERIA
Your son or daughter should be an adolescent or young adult who has a diagnosis of mild or moderate intellectual disability. He or she can, however have other additional diagnoses (e.g., autism).

RISKS AND BENEFITS
RISKS: The risks for participating in this study are minimal. As with any research, there is some possibility that your son or daughter may be subject to risks that have not yet been identified. In order to minimize a potential breach of confidentiality, a list of subject names and participant IDs will be stored in separate, locked filing cabinets. Only participants first initials and ID numbers will be recorded together. Should a breach of confidentiality occur, all participants will be contacted immediately.

BENEFITS
The main benefit in you giving consent for your son or daughter to participate in this study is for him or her to receive instruction that has been empirically shown to be very effective for other individuals with similar abilities. The evidence-based prompt procedure can be applied across various learning situations, including daily living skills and academics (e.g., reading, math). Indirect benefits include building on research to increase independent employment abilities for adolescents with ID.

COSTS AND PAYMENTS
The researcher wants your decision about participating in this study to be absolutely voluntary. Yet she recognizes that your time and consideration is valuable. In order to compensate you, a $50.00 gift card will be given from the researcher at the conclusion of the research study.

NEW INFORMATION

f the researchers find new information during this study that would reasonably change your decision about allowing your son or daughter to participate, then they will give it to you.

CONFIDENTIALITY

All information obtained about your son or daughter in this study is strictly confidential unless disclosure is required by law. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify your son or daughter.

WITHDRAWAL PRIVILEGE

It is OK for you to say NO. Even if you say YES now, you are free to say NO later and walk away or withdraw from the study -- at any time. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled.

COMPENSATION FOR ILLNESS AND INJURY

If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of harm arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in any research project, you may contact Dr. Bob Gable at 757-683-3157 at Old Dominion University, Dr. Tancy Vandecar-Burdin the current IRB chair at 757-683-3802 at Old Dominion University, or the Old Dominion University Office of Research at 757-683-3460 who will be glad to review the matter with you.

VOLUNTARY CONSENT

By signing this form, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Bob Gable at Old Dominion University: 757-683-3157

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair, at 757-683-3802, or the Old Dominion University Office of Research, at 757-683-3460.

And importantly, by signing below, you are telling the researcher YES, that you agree to participate in this study. The researcher should give you a copy of this form for your records.

Caregiver's Printed Name & Signature	**Date**

INVESTIGATOR'S STATEMENT

I certify that I have explained to this subject the nature and purpose of this research, including benefits, risks, costs, and any experimental procedures. I have described the rights and protections afforded to human subjects and have done nothing to pressure, coerce, or falsely entice this subject into participating. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the subject's questions and have encouraged him/her to ask additional questions at any time during the course of this study. I have witnessed the above signature(s) on this consent form.

Investigator's Printed Name & Signature	**Date**

INFORMED CONSENT DOCUMENT (for Instructional Staff)
OLD DOMINION UNIVERSITY

PROJECT TITLE: Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction

INTRODUCTION
The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this research, and to record the consent of those who say YES. Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction. This research will take place during the regularly scheduled community-based instruction (CBI) time at Marshall's.

RESEARCHERS
Responsible Project Investigator: Bob Gable, PhD, Professor in the Darden College of Education at Old Dominion University in Norfolk, Virginia.
Additional Investigator: Annemarie Horn, MSEd, Doctoral Candidate in Department of Communication Disorders and Special Education at Old Dominion University.

DESCRIPTION OF RESEARCH STUDY
In this study, you will learn how to use a prompt procedure that has a strong empirical base while teaching your adolescent or young adult student a new job skill during CBI. In addition to training you on how to employ the procedure, you will receive feedback in real-time as you work with the adolescent/young adult participant. A doctoral student from the special education department will be watching you from a separate location, and provide corrective feedback and praise as you use the newly learned prompt procedure. This type of coaching has been successfully been used in classrooms across the country, and recipients of such feedback have reported it as being very beneficial and not invasive. The purpose is to guide you as you teach your student a new job skill, striving to increase independent functioning in the workplace.

If you decide to participate, then you will join a study involving research measuring the effectiveness of using individualized, evidence-based teaching practices when working on age-appropriate job skills in the workplace. Prior to implementing the prompt procedure, you will complete a two-hour one-on-one training session at Marshall's. Following training, you will begin implementing the specified prompting strategy while teaching the adolescent/young adult student how to complete a job task. A trained doctoral student in the field of special education will use *e*Coaching technology to provide immediate feedback on strategy implementation. For the research study, the instructional staff will collect adolescent data (using a task analysis), while the doctoral student simultaneously measures data on the instructional staff member's correct implementation of the prompt procedure. If you say YES, then your participation will last for approximately four to six weeks during CBI at Marshall's. Four adolescent/young adult participants and their four job coaches will be participating in this study.

EXCLUSIONARY CRITERIA
You should have completed an *e*Coaching training session before participating in this study. Your job title should be instructional staff who is responsible for instructing adolescents or young adults who have a diagnosis of mild or moderate intellectual disability. You must be physically and cognitively capable of implementing the required prompt procedure with the adolescent/young adult.

RISKS AND BENEFITS
RISKS: The risks for participating in this study are minimal. As with any research, there is some possibility that you may be subject to risks that have not yet been identified. In order to minimize a potential breach of confidentiality, a list of subject names and participant IDs will be stored in separate, locked filing cabinets. Only participants first initials and ID numbers will be recorded together. Should a breach of confidentiality occur, all participants will be contacted immediately.

BENEFITS
The main benefit to you for participating in this study is acquiring evidence-based prompting procedures to implement with your students with ID. The evidence-based prompt procedure can be applied across various learning situations, including daily living skills and academics (e.g., reading, math). Indirect benefits include building on research to increase independent employment abilities for adolescents with ID.

COSTS AND PAYMENTS
The researcher wants your decision about participating in this study to be absolutely voluntary. Yet it is recognized that your participation in training will require two hours of your time personal time. In order to compensate for your time, you will receive $50.00 gift card from the researcher at the conclusion of the research study.

NEW INFORMATION
If the researchers find new information during this study that would reasonably change your decision about participating, then they will give it to you.

CONFIDENTIALITY
All information obtained about you in this study is strictly confidential unless disclosure is required by law. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify you.

WITHDRAWAL PRIVILEGE
It is OK for you to say NO. Even if you say YES now, you are free to say NO later and walk away or withdraw from the study -- at any time. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled.

COMPENSATION FOR ILLNESS AND INJURY
If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of harm arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in any research project, you may contact Dr. Bob Gable at 757-683-3157 at Old Dominion University, Dr. Tancy Vandecar-Burdin the current IRB chair at 757-683-3802 at Old Dominion University, or the Old Dominion University Office of Research at 757-683-3460 who will be glad to review the matter with you.

VOLUNTARY CONSENT
By signing this form, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Bob Gable at Old Dominion University: 757-683-3157

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair, at 757-683-3802, or the Old Dominion University Office of Research, at 757-683-3460.

And importantly, by signing below, you are telling the researcher YES, that you agree to participate in this study. The researcher should give you a copy of this form for your records.

Caregiver's Printed Name & Signature	**Date**

INVESTIGATOR'S STATEMENT
I certify that I have explained to this subject the nature and purpose of this research, including benefits, risks, costs, and any experimental procedures. I have described the rights and protections afforded to human subjects and have done nothing to pressure, coerce, or falsely entice this subject into participating. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the subject's questions and have encouraged him/her to ask additional questions at any time during the course of this study. I have witnessed the above signature(s) on this consent form.

Investigator's Printed Name & Signature	**Date**

INFORMED CONSENT DOCUMENT
FOR USE OF PHOTO/VIDEO MATERIALS

STUDY TITLE: Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction

DESCRIPTION:

The researchers would like to electronically record learning sessions of your son or daughter during instruction of a new job skill during Community-based Instruction (CBI). These videos will serve to ensure reliability of the data collected. In addition, they will enable the researchers to share with other professionals the effectiveness of the use of *e*Coaching to teach job skills to adolescents and young adults with intellectual disability.

CONFIDENTIALITY:

Your son or daughter will not be identified by name in any use of the electronic recording sessions. To safeguard the data from unauthorized access, these sessions will be saved using a code name. All sessions will be saved by a code name with password protection and code list ("key") will be maintained in a separate secure location. Even if you agree to be in the study, learning sessions will not be recorded unless you specifically agree to this.

VOLUNTARY CONSENT

By signing below, you are granting to the researchers the right to use your son or daughter's likeness, image, appearance and performance for presenting or publishing these research findings. No use of photos or video images will be made other than for professional presentations or publications. The researchers are unable to provide any monetary compensation for the use of these materials. Be assured that the video recording is voluntary, and your refusal to permit these recordings will involve no penalty or loss of benefits in any way. Also, even if you initially agree to the recordings, you have the right to discontinue the recordings at any time and you will not be penalized in any way nor will there be any loss of benefits.

If you have any questions later on, you may call Dr. Bob Gable at Old Dominion University, at 757-683-3157 and she will be glad to answer your questions. If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin , the current Chair of the Old Dominion University Institutional Review Board, at 757-683-4520, or the Old Dominion University Office of Research, at 757-683-3460.

Adolescent Participant's Printed Name and D.O.B.	**Date**
Parent / Legally Authorized Representative's Printed Name & Signature	**Date**

INFORMED CONSENT DOCUMENT
FOR USE OF PHOTO/VIDEO MATERIALS

STUDY TITLE: Using *e*Coaching while Applying an Evidence-based Prompt Procedure during Community-Based Instruction

DESCRIPTION:

The researchers would like to electronically record learning sessions of you during instruction of a new job skill during Community-based Instruction (CBI). These videos will serve to ensure reliability of the data collected. In addition, they will enable the researchers to share with other professionals the effectiveness of the use of *e*Coaching to teach job skills to adolescents and young adults with intellectual disability.

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If you have any questions later on, you may call Dr. Bob Gable at Old Dominion University, at 757-683-3157 and she will be glad to answer your questions. If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current Chair of the Old Dominion University Institutional Review Board, at 757-683-4520, or the Old Dominion University Office of Research, at 757-683-3460.

Job Coach's Printed Name	
Signature	**Date**

Appendix B

Data Collection Forms

Marshall's Task Analysis: Sorting Clothing by Size

Student (please circle): 1 2 3 4 Session #: ___________

Coder: ____

Begin each session by instructing student to, "Sort by size."

Step	Step of Task	Opportunities			Comments
1	Pick up hangers with "S" label attached				
2	Place "S" hangers in the front portion of rack				
3	Pick up hangers with "M" label attached				
4	Place "M" hangers directly behind "S" hangers				
5	Pick up hangers with "L" label attached				
6	Place "L" hangers directly behind "M" hangers				
7	Pick up hangers with "XL" label attached				
8	Place "XL" hangers directly behind "L" hangers				

Coding Key
+ **Correct response**: the student completed the designated step of the chained task with no errors.
- **Incorrect response**: the student performed a step out of sequence or insufficiently completed the designated step of the task.
NR **No response**: the student did not initiate a step within 4 seconds.

Marshall's Task Analysis: Sorting Clothing by Size Generalization 1

Student (please circle): 1 2 3 4 Session #: ___________

Coder: ____

Begin each session by instructing student to, "Sort by size."

Step	Step of Task	Opportunities					Comments
1	Pick up hangers with "S" label attached						
2	Place "S" hangers in the front portion of rack						
3	Pick up hangers with "M" label attached						
4	Place "M" hangers directly behind "S" hangers						
5	Pick up hangers with "L" label attached						
6	Place "L" hangers directly behind "M" hangers						
7	Pick up hangers with "XL" label attached						
8	Place "XL" hangers directly behind "L" hangers						

Coding Key
+ **Correct response**: the student completed the designated step of the chained task with no errors.
- **Incorrect response**: the student performed a step out of sequence or insufficiently completed the designated step of the task.
NR **No response**: the student did not initiate a step within 4 seconds.

Constant Time Delay Teacher Data

Student (please circle): 1 2 3 4 Session #: __________

Step	Step of Task	CTD Use Per Opportunity			Comments
1	Pick up hangers with “S” label attached				
2	Place “S” hangers in the front portion of rack				
3	Pick up hangers with “M” label attached				
4	Place “M” hangers directly behind “S” hangers				
5	Pick up hangers with “L” label attached				
6	Place “L” hangers directly behind “M” hangers				
7	Pick up hangers with “XL” label attached				
8	Place “XL” hangers directly behind “L” hangers				

Coding Key	
C	**Correct use of CTD procedure**: Following presentation of the discriminative stimulus, Teacher provides student with controlling prompt (i.e., verbal and gestural prompt) when either: 2. The student does *not respond (NR)* within 4 seconds of presentation of the discriminative stimulus, OR 3. The student gives an *incorrect response (-)*. For example, he places a size large hanger where a size small belongs.
I	**Incorrect use of CTD procedure**: Following presentation of discriminative stimulus, Teacher incorrectly implements CTD procedure by failing to wait 4 seconds before providing the controlling prompt. For example, Student does not respond and Teacher provides controlling prompt after 2 seconds.

Appendix C

Social Validity Forms

Teacher Survey

One a scale of 1 – 5, with 1 being strongly disagree and 5 being strongly agree, rate how you feel on each statement.					
I believe using CTD helped the learner acquire a new skill more quickly than if the procedure had not been used.	1	2	3	4	5
I believe the newly acquired skills benefit the learner's employment readiness abilities.	1	2	3	4	5
I believe it was beneficial to receive coaching in real-time during intervention sessions.	1	2	3	4	5
I was comfortable being coached via BIE technology.	1	2	3	4	5
I am going to continue using the CTD strategy while instructing learners with ID.	1	2	3	4	5

Please write as much as you'd like on the following topics.	
How do you feel *e*Coaching and CTD has influenced your performance as a teacher?	
What aspect of this study do you feel benefited you most?	
What aspect of this study do you feel benefited you least?	

Student Survey

Please mark the face showing your answer to each question.

1. Did you like learning the new job skill?

2. Did you like having instruction staff teach you during CBI?

3. Did he/she do a good job as a teacher?

4. Did you like learning how to [insert specific task] at Marshalls'?

5. Would you like to learn this way again?

Appendix D

Teacher Training Agenda and Handouts

Instructional Staff Training Agenda

Coach: Annemarie Horn

Location: Community Based Instruction Setting (i.e. Marshalls's Dept. Store)

Objectives:

- Brief overview of Constant Time Delay literature
    - Historical use of time delay procedure with individuals identified as having an intellectual disability
    - Why this procedure has been shown to be effective with such learners
        - Near-errorless learning
        - Predictable
        - Provides ample wait time for student response
- Learn Constant Time Delay Procedure
    - Phase One: Coach demonstration of presenting controlling prompt at 0-s delay interval following presentation of discriminative stimulus
    - Phase Two: Coach demonstration of using predetermined time delay (i.e., 4-Seconds) before providing controlling prompt
        - Stop incorrect behavior immediately (e.g., Student picks up wrong shirt size), and immediately provide a prompt, ensuring a correct student response
        - Wait 4-s if Student does not initiate a response
- Instructional Staff: Effectively implement Constant Time Delay with feedback provided by coach
- Familiarize staff with Bluetooth technology*
- Complete 3 trials per instructional staff with Bluetooth and webcam
    - Coach will be in another room giving testing feedback
    - Instructional staff will have opportunity to ask questions and receive feedback on implementation of strategies

*Bluetooth headset will be worn and camera will be rolling during baseline data collection; however, no coaching will take place until intervention sessions begin. Instructional staff and coach will do sound checks and practice using technology for coaching purposes.

Constant Time Delay Training Session
3/15/17

- CTD is a near errorless response prompting procedure.
- Includes presentation of a target stimulus and a controlling prompt to ensure the learner responds correctly to the target stimulus.
- This occurs in two sequential phases:
    - **Phase 1**: Teacher presents a target stimulus followed *immediately* by the controlling prompt (0-second time delay).
        - Example: Instructor says, "pick up small" (referring to clothing sizes as labeled on hangers). Immediately, instructor prompts the student (e.g., gives verbal and gestural prompt to pick up "small" hanger)
        - This sequence continues, ensuring few to no student errors as the student successfully completes all steps to the task. After each step, the student is reinforced by the teacher, who provides brief specific praise (e.g., "Good, you picked up small").
    - **Phase 2**: Teacher presents a target stimulus (as presented in Phase 1) and waits a predetermined amount of time (e.g., 4-s) before presentation of the controlling prompt.
        - The teacher reverts back to 0-s delay if the student gives an incorrect response (-), or if he/she fails to respond within 4 seconds (NR).
- The goal is for each student to eventually complete all steps of the task independently, requiring no prompting.

- When student reaches criterion (100% accuracy) for two consecutive data sessions, stop the intervention.

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EDUCATION

PhD in Special Education **2017**
Dissertation Title: "Using Constant Time Delay and *e*Coaching to Teach Employment Skills to Young Adults with Autism Spectrum Disorder and Intellectual Disability in a Community Work Environment"
Old Dominion University, Norfolk, VA

MSED in Special Education with Research Emphasis **2008**
Old Dominion University, Norfolk, VA

BS in Interdisciplinary Studies, *cum laude* **2005**
K-12 Special Education Teaching Endorsement
Radford University, Radford, VA

PROFESSIONAL EXPERIENCE

Child and Adolescent Development Instructor **2013-present**
Special Education Department, Old Dominion University
- Facilitator for nine cumulative sections of child and adolescent development
- Planned and taught both face-to-face and online course sections
- Collaboratively worked with faculty to improve online course development
- Implement interactive teaching approaches
- Assist novice instructors and faculty who teach the course

Students with Diverse Learning Needs in the General Ed. Classroom Instructor
2017-present
Special Education Department, Old Dominion University
- Facilitated asynchronous online instruction
- Course content focused on current laws and inclusive classroom settings
- Promoted use of evidence-based practices in the classroom
- Maintained high levels of communication through distance learners

Graduate Teaching Assistant **2014-2016**
Special Education Department, Old Dominion University
- Fulfilled data manager position for yearlong research study
- Trained fellow doctoral students essential data collection and graphing techniques needed when completing single-subject research

- Led inter-rater reliability training sessions for doctoral students new to research

University Supervisor **2014**
Department of Teaching and Learning, Old Dominion University
- Supervised special education teacher candidates in elementary and secondary classroom settings
- Facilitated monthly seminar sessions
- Provided feedback on digital teaching portfolios

Collaboration and Transitions Instructor **2013**
Special Education Department, Old Dominion University
  - Facilitated face-to-face graduate and undergraduate course sections
  - Course content included effective co-teaching strategies and teacher roles along with developing meaningful transition plans for students
  - Discussion-based classes included role-playing and high levels of collaboration

K-12 High School Special Education Teacher **2011-2012**
Co-Teacher in the English Department, Nevada Virtual Academy, Las Vegas, NV
- Effectively collaborated regularly with both special and general educators
- Mentored novice teachers
- Facilitated virtual teacher training sessions on student assessment and writing IEP's

Elementary Special Education Teacher **2006-2008**
Autism Spectrum Program, Southeastern Cooperative Education Program (SECEP) Chesapeake, VA
- Implemented evidence-based practices in a self-contained classroom environment inclusive to students with autism spectrum disorders
- Trained and collaborated with paraprofessionals and other colleagues

High School Special Education Teacher **2005-2006**
Moderate-Severe Disabilities Classroom, Kingsville Independent School District, Kingsville, TX
- Used integrative teaching methods and technology to individualize instruction and meet the unique needs of students with moderate-severe disabilities
- Introduced Community-Based Instruction (CBI) to students, the school, and the community
- Coached paraprofessionals and educators on inclusive practices and collaboration

RESEARCH EXPERIENCE

Dissertation Research **2017**
Special Education Department, Old Dominion University
- Conducted research in a local special education transition program
- Used a single-subject, multiple baseline research design
- Facilitated use of evidence-based practices during community-based instruction
- Trained interventionist and two doctoral student data coders

Doctoral Researcher **2014-2017**
Special Education Department, Old Dominion University
- Research team member in a study in a local elementary school for at-risk children
- Facilitated training sessions for K-12 teachers involved in the study
- Trained faculty data coders, and tracked inter-observer agreement
- Held the position of Data Manager during a year-long study in the Oral Preschool

PUBLICATIONS

Manuscripts in Preparation

Horn, A., & Bobzien, J. Self-determination and postsecondary success in young adults with intellectual disabilities: A review of the literature
Horn, A., Gable, R., Bobzien, J. Using constant time delay to teach students with mild or moderate intellectual disability: A review of the literature
Horn, A. Video instruction for adolescents with intellectual disabilities: A review of the literature

HONORS AND AWARDS

Recipient of the Kimberly Gail Hughes Research Award, Old Dominion University — 2016-2017
Internationally selected to be a member of the 8th cohort of the Division for Research Doctoral Student Scholars (DRDSS) — 2016-2017
Recipient of The Dr. Rufus and Sara Tonelson Scholarship in Special Education, Old Dominion University — 2015-2016
Member of the Golden Key International Honor Society — 2015-2017
Doctoral Fellowship, Darden College of Education, Old Dominion University — 2014-2017
Recognition for passing Master's Level Comprehensive Exam with Distinction, Old Dominion University — 2008
Awarded for Outstanding Achievement in the field of Special Education, Radford University — 2005
Recipient of Carolyn Brown-Bush Academic Scholarship, Radford University — 2004-2005

TEACHING ENDORCEMENTS
VA Postgraduate Professional License in Emotional Disturbance K-12 (expires 06-30-2020)
VA Postgraduate Professional License in Mental Retardation K-12 (expires 06-30-2020)

PRFESSIONAL MEMBERSHIPS
Council for Exceptional Children (CEC)