Review of Recent Research Using Constant Time Delay to Teach Chained Tasks to Persons with Developmental Disabilities

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Abstract: We reviewed twelve studies that used the constant time delay (CTD) procedure to teach chained tasks to individuals with developmental disabilities from years 1996–2006. Variables analyzed include types of tasks that have been taught with the procedure, how effective CTD has been in teaching participants, and whether researchers have investigated maintenance, generalization, and social validity variables. Results across studies indicate that CTD is an effective strategy for teaching chained tasks to individuals with developmental disabilities including food preparation, purchasing skills, and leisure skills. Furthermore, the generalization data indicated that skills learned through CTD procedure generalized across settings, materials, and persons. Implications for practitioners and future researchers are discussed.

Issues of adaptive competence and functional independence have been identified as particularly challenging for individuals with developmental disabilities (Niccols, Atkinson, & Pepler, 2003). Consequently, educational programming for students with developmental disabilities must include functional skills. Functional skills are those required in domestic, vocational, and community environments in which every individual will be required to operate. Functional skills facilitate independence and are crucial if individuals with developmental disabilities are going to have access to least restrictive environments. The Individuals with Disabilities Act 2004 (IDEA) requires that all students have access to the general education curriculum. Consequently, there is an increasing focus on teaching functional skills in general education classrooms. The challenge for teachers is how to identify and use instructional strategies that are effective for teaching functional skills that would result in generalized outcomes for students with developmental disabilities. Consequently, teachers need information about instructional strategies that are validated, and efficient in terms of time and use. Time delay is one of such strategies.

The “time delay” is the amount of time between a teacher’s cue for a student to engage in a target behavior (e.g. “Allison, pick up the shoe”) and the delivery of a prompt (a gesture by the teacher towards the shoe). Time delay is a response prompting, near errorless learning approach that provides frequent opportunities for the student to respond and for the teacher to provide immediate feedback or consequences for student responses. Time delay procedures begin with 0 s (seconds) delay trials. When the student is successful with the 0 s delay trial, a predetermined time (a delay) is inserted between the task request and the prompt (Kratzer, Spooner, Test, & Koorland, 1993). During 0 s delay trials the student receives assistance from the teacher and the delay intervals provide opportunity for the student to perform the desired response independently. When teaching for acquisition or learning a new task, prompts are usually provided simultaneously with the task request. This minimizes errors and increases the student’s success.

There are two types of time delay proce-
dure: constant time delay (CTD) and progressive time delay (PTD). In CTD, the time interval between the cue to perform a task and the controlling prompt is delivered after a specified amount of time has elapsed (e.g., 2, 3 or 4 s wait time). This time interval remains constant throughout the remaining trials until criterion is attained (Kratzer et al., 1993; Schuster, Morse, Ault, Doyle, & Crawford, 1998). Wolery et al. (1992) found that the most frequent delay duration used was 4 s. In the PTD procedure, however, the time interval between the cue and the prompt is varied as student responding increases. For example after successfully completing the 0 s trial, the delay interval could be extended to 2 s. If the student does not initiate a response within 2 s, the teacher provides prompting and the student is reinforced for waiting for the prompt instead of performing an incorrect response. Both time delay strategies allow the student to progressively transfer stimulus control from the prompt (i.e., responding correctly after the prompt) to the stimulus (responding correctly before the prompt).

Touchette (1971) was the first researcher to investigate using the time delay procedure to teach three severely retarded students to discriminate between objects of different color and form. Since then it has been used to teach students with varied disabilities including learning disabilities (Stevens & Schuster, 1987); mental retardation (Bozkurt & Gur淼, 2005; Knight, Ross, Taylor, & Ramasamy, 2003; Malley, Datillo, & Gast, 2002); multiple disabilities (Wolery et al., 1992); developmental disabilities (Schoen & Sivil, 1989), and autism (Ault, Wolery, Gast, Doyle, & Eizenstat, 1988). CTD has also been effective in teaching a variety of tasks such as sightword reading (Gast, Ault, Wolery, Doyle, & Belanger, 1988; Knight et al., 2003), spelling (Stevens & Schuster, 1987), numeral identification (Ault et al., 1988), verbalization (Matson, Sevin, & Box, 1993), cooking (Schuster, Gast, Wolery, & Guilltman, 1988), banking (Donnel & Ferguson, 1989), and laundry skills (Miller & Test, 1989), purchasing skills (McDonnel, 1987), snack and drink preparation (Bozkurt & Gur淼, and in minimizing disruptive behaviors (Heckaman, Alber, Hooper, & Heward, 1998).

Although there have been many studies conducted using the CTD, there have been only two reviews (Schuster et al., 1998; Wolery et al., 1992). Wolery and colleagues reviewed studies that used the CTD procedure to teach discrete tasks from the year 1978 to 1992. The authors defined discrete tasks as “behaviors that have a relatively short duration, are taught as a single unit, and do not involve a task analysis” (p. 242). Examples of discrete tasks include sight word reading, spelling, initiating verbalization, manual signing, etc. The disability groups included in the review were learning disabilities, behavior disorders, and developmental disabilities. Learning disabilities made up 45% of all disability types. In addition, 10 of the 36 studies reviewed were unpublished masters or doctoral theses. The investigators concluded that the CTD was effective for teaching skills to almost all participants in the studies reviewed.

Schuster et al. (1998) also reviewed studies using the CTD to teach chained tasks. Chained tasks were defined as tasks that involve a series of behaviors linked together to form a complex skill. Examples of chained tasks include baking cookies, dressing, purchasing, etc. Chained tasks often require some degree of task analysis to identify the required steps in the process. In their review, Schuster et al. did not establish any inclusion criteria for disability types. However, since chained tasks are mostly used for individuals with moderate to severe disabilities, the majority of participants in the studies reviewed were individuals with moderate to severe developmental disabilities.

The two reviews discussed above (Schuster et al., 1998; Wolery et al., 1992) have undoubtedly provided us with an understanding of the trends on the use of CTD for teaching individuals with disabilities. However, since the publication of these two articles, there has been more research on the use of CTD for teaching individuals with disabilities, especially those with developmental disabilities. Therefore, there is a need to know the current status of CTD research.

We reviewed studies that used the CTD instructional procedure to teach functional skills specifically to individuals with developmental disabilities from 1996 through the first half of 2007. Our focus for this review was to evaluate the effectiveness and social validity.
data, and the measures taken by researchers to ensure generalized outcomes for participants. We answered the following questions in this review: (a) what is the effect of CTD? (b) what steps have the researchers taken to ensure that training resulted in generalized outcomes for the participants? and, (c) have the investigators measured social validity?

Method

A computer search was conducted using the PsycInfo and ERIC databases with the following descriptors: time delay, constant time delay, delayed prompt, delayed cue, chained responses, chained tasks, functional skills, disability, developmental disability, mental retardation, autism, and severe disability. The studies were included for analysis based on three criteria. First, that a CTD procedure was used to teach a chained task. CTD was defined as an instructional procedure involving trials of 0 s delay between the task direction and the controlling prompt in initial stages followed by fixed second delay trials. In this respect, studies in which variable amounts of delay seconds were used at any point after the 0 s delay trials were excluded. Second, the study must have had at least one participant with a developmental disability. The third criterion was that the study was published in a peer-reviewed journal within the time frame 1996 to 2006. Ancestral search did not reveal any further studies. Twelve studies that met the criteria were analyzed. We excluded a study by Wall and Gast (1997a) because the CTD was used to train caregivers and not individuals with developmental disabilities. See Table 1 for details of studies included and variables analyzed.

Results

Demographics

Subjects. Fifty-six individuals with developmental disabilities participated in the 12 studies reviewed. Thirty-four of the 56 (65.4%) were males, 18 (34.6%) were females, and the gender of 4 (7%) participants was not specified. The participants varied in age. The teenage group (13–19 years) represented the largest group (n = 24), followed by elementary age students (6–12 years; n = 18), and adults (above 19 years) representing the smallest group (n = 14). The functioning levels reported for all participants were in the moderate to severe mental retardation except for one participant who was reported to be functioning in the mild mental retardation range (Dipipi-Hoy & Jitendra, 2004). Researchers in some studies reported some of their participants as having comorbid conditions of Down syndrome (Bozkurt & Gursel, 2005; Graves, Collins, Schuster, & Kleinert, 2005), autism (Wall & Gast, 1997b; Yilmaz, Birkan, Konukman, & Erkan, 2005), and cerebral palsy (Dipipi-Hoy & Jitendra) along with mental retardation.

Settings. The studies were conducted in a variety of settings. Two of the 12 studies were conducted in elementary school setting, and another two in secondary school setting. Also, five studies took place in two settings: one in home and school, two in school and community settings, another one in home and community settings, yet another one in home and university unit. Others studies were conducted in single settings: one in a university unit, two in residential facility (2 of 12), and three in rehabilitation facility.

Trainers. Interventions were conducted mostly by adults. Investigators in three of the 12 studies utilized classroom teachers as trainers, in another four, the trainers were researchers, and in one study, the trainer was a caregiver. In two other studies, the investigators reported collaborations between the researcher and classroom teacher (Morse & Schuster, 2000), and researcher and parents (Dipipi-Hoy & Jitendra, 2004). Finally, in two other studies the investigators did not specify the status of the trainers (Wall & Gast, 1997b, 1999). Overall, this data shows that in six of the 12 studies, the trainers were teachers, parents and/or caregivers.

Target behaviors and instructional format. Six categories of target behaviors were taught in the 12 studies reviewed. The most frequent skill category taught was leisure and recreation in 4 of 12 studies (Wall & Gast, 1997b; Wall, Gast, & Royston, 1999; Yilmaz et al., 2005; Zhang, Cote, Chen, & Liu, 2004). Food preparation skills were taught in three studies (Bozkurt & Gursel, 2005; Fiscus, Schuster, Morse, & Collins, 2002; Graves et al., 2005). Researchers in other studies examined pur-
<table>
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<tr>
<th>Authors</th>
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<td>Bozkurt &amp; Gursel (2005)</td>
<td>1. 14y, Mod. MR 2. 16y, Down 3. 17y, Mod. MR</td>
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<td>Rehabilitation center</td>
<td>4</td>
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<td>Fiscus et al. (2002)</td>
<td>8y–12 y Mod/Sev MR</td>
<td>Food preparation</td>
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<td>5</td>
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<td>3 of 4 participants acquired skill. 4th participant did not meet criterion on first skill</td>
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<td>Graves et al. (2005)</td>
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<td>5</td>
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<tr>
<td>Morse &amp; Schuster (2000)</td>
<td>1. 12y, MR (4) 2. 8y, MR (1) 3. 9y, Autism (1) 4. 9y, Down (1) 5. 5y, MR (1) 6. 6y, Autism (2)</td>
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<td>4</td>
<td>Multiple probe</td>
<td>6 students learned and generalize skills. 2 students improved their skills but did not complete the study. 2 could not start the study at all due to end of school year</td>
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<td>Stonecipher et al. (1999)</td>
<td>1.12y, Mod. MR 2. 9y, Mod. MR(3) 3. 9y, Mod. MR 4. 9y, Mod. MR</td>
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<td>Wall &amp; Gast (1997b)</td>
<td>1. 15y. Autism 2. 16y. Autism 3. 37y. Mod. MR 4. 43y, Sev. MR</td>
<td>Leisure Skills</td>
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<td>Wall &amp; Gast, (1999)</td>
<td>1. 16y Mod. MR 2. 17y Mod. MR 3. 18y Mod. MR(3) 4. 19y Mod. MR(2) 5. 20y Mod. MR(4) 6. 22y Mod. MR</td>
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<td>4</td>
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<td>Wall et al. (1999)</td>
<td>1. 20y, Sev. MR 2. 21y, Autism 3. 20y Sev. MR 4. 20y, Sev. MR</td>
<td>Leisure skills</td>
<td>Secondary school</td>
<td>4</td>
<td>Multiple probe</td>
<td>All participants learned 2 or 3 leisure skills. Increase in choice making and social behaviors</td>
</tr>
<tr>
<td>Yilmaz et al. (2005)</td>
<td>1. 9y, Autism (3)</td>
<td>Aquatic play skill</td>
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<td>4</td>
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<td>All participants acquired the aquatic play skills</td>
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chasing skills (Dipipi-Hoy & Jitendra, 2004; Morse & Schuster, 2000), gift wrapping (Stonecipher, Schuster, Collins, & Grisham-Brown, 1999), vocational skills (Wall & Gast, 1999) and motor skills (Zhang, Gast, Horvat, & Dattilo, 2000).

Several behaviors were taught in three instructional formats: 1:1; dyads; and small group. Researchers in some of the studies used two levels of training formats. For example, Dipipi-Hoy and Jitendra (2004) trained mothers, who in turn trained their daughters. Similarly, Wall and Gast (1997b) trained caregivers, who also trained the individuals in their care. As a result, four categories were reported: 1:1 only (9 of 12), 1:1 plus dyad (2 of 12), small group only (1 of 12) (Stonecipher et al., 1999).

**Procedural Parameters**

*Number of 0 s delay sessions and delay intervals.* Zero second delay sessions were implemented in all but one study (Dipipi-Hoy & Jitendra, 2004). In a study by Yilmaz et al. (2005), the number of 0 s delay trials implemented was not specified even though the investigators reported using them. Investigators in 5 of 12 studies implemented 0 s delay trials during two sessions and in two studies 0 s delays were used during three sessions. Zero second delay was used in four sessions in one study (Stonecipher et al., 1999), while in two other studies the 0 s delays were varied based on the task and rate of student response. For example, Bozkurt and Gursel (2005) reported using one or two 0 s sessions depending on the task, and participant involved, while Graves et al. (2005) used the 0 s delay until the students achieved 100% correct responses for two consecutive sessions.

The delay intervals used in the studies ranged from 2 s to 5 s. The majority of studies used the 4 s delay interval (7 of 12) followed by 5 s delay interval (4 of 12), and 2 s delay interval (1 of 12). It is evident from the analysis that regarding the number of sessions during which 0 s was used; the majority of the studies used 0 s delays for two sessions. Similarly, the 4 s delay interval was the most frequently used.

The 0 s delay sessions were used for acquisition and subsequent delay intervals were used for maintenance.

*Control prompts.* The control prompts used in the reviewed studies varied in type and form. A control prompt is a form of assistance meant to increase the probability of correct responding. Four types of prompts were used: verbal, visual, physical, and modeling. However, these prompts were provided in different combinations such as verbal and model prompts (Bozkurt & Gursel, 2005; Fiscus et al., 2002; Stonecipher et al., 1999), verbal plus physical prompts (Wall et al., 1999), physical prompt only (Zhang et al., 2004; 2000) model prompt only, verbal prompt only (Dipipi-Hoy & Jitendra, 2004; Morse & Schuster, 2000), verbal plus visual prompts (Wall & Gast, 1997b, 1999), and video model plus verbal prompts (Graves et al., 2005). Researchers in
one study did not specify the type of prompt used (Yilmaz et al., 2005).

Consequences. The CTD procedure yields five types of responses: (a) unprompted correct response occurs when the student responds correctly before the prompt is given; (b) prompted correct response occurs when the student responds correctly after the prompt is delivered; (c) unprompted incorrect response occurs when the student gives an incorrect response even before the prompt is issued; (d) prompted incorrect response occurs when the student makes an error after the prompt was given; and (e) no response (Wall & Gast, 1997b). In all of the studies, researchers had some consequences for each of these responses, particularly for the unprompted correct responding and prompted correct responding. In the majority of the studies (10 of 12) consequences in the form of verbal praise alone on a continuous or variable reinforcement schedule. However, in one study (Yilmaz et al., 2005) the researchers did not specify the type of reinforcement used.

Outcomes and outcome measures. Outcome measures analyzed in this review include (a) percentage of participants for which the procedure was found to be effective, (b) efficiency measures, (c) maintenance procedures used, and (d) generalization procedures and types of data collected.

Researchers in the majority of the studies (8 of 12) used CTD alone to teach target skills while in four other studies CTD procedure in combination with other procedures was used. Bozkurt and Gursel (2005) measured the effectiveness of CTD in teaching snack and drink preparation skills to children with mental retardation using percent of correct responses as the efficiency measure and found CTD to be effective for all participants. Stonecipher et al. (1999) modified the CTD procedure by using a quadruple instructional arrangement (each participant performs a fourth of the task) to teach four participants gift-wrapping. Three of the four participants who completed the study met criterion on number of sessions to criterion (STC), trials to criterion, training errors to criterion, and training time to criterion efficiency measures. The remaining four studies (Wall et al., 1999; Yilmaz et al., 2005; Zhang et al., 2000, 2004) found the CTD procedure to be effective for all of the participants. Yilmaz et al. (2005) used STC, percentage of training errors to criterion, and amount of training time to criterion efficiency measures. In the Zhang et al.’s (2000) study, the efficiency measure used was skill completion duration, while in another study Zhang et al. (2004) used number of correct responses to criterion.

Four of the 12 studies combined CTD with other procedures. Dipipi-Hoy and Jitendra (2004) trained parents to deliver the CTD instructional procedure in a mother-daughter dyad format and found that all of the three participants learned the target skills to criterion on a percent of correct responses efficiency measure. Also, Fiscus et al. (2002) measured the effectiveness of the CTD procedure while embedding verbal feedback in the prompt and consequent event on the percent of correct responses and STC efficiency measures. The authors reported that three of their students met criterion, while the fourth student did not meet criterion on the first skill before the end of the study. Similarly, Morse and Schuster (2000) evaluated the effectiveness of in vivo training using CTD and simulation training using a pictorial board. The study began with 10 participants, however, only 6 completed training and all 6 met criterion on the measure of percentage of errors to criterion, while two others who started training also improved. In a study by Wall and Gast (1999), the effects of the CTD on the acquisition of target skill and incidental information presented as instructive feedback were measured using error percentage as the efficiency measure. The results reported the participants acquiring the target skill with very low percentage errors; 0.64%, and 0.75%. In another study, Graves et al. (2005) used CTD with video prompting to teach cooking skills to their participants and found that the procedure was effective for all participants.

Effectiveness of CTD

In sum, the CTD has been found to be effective for teaching individuals with developmental disabilities. Of the 12 studies reviewed, researchers in 10 (83.3%) reported that the CTD was effective for all their participants. Two other studies reported 75% effectiveness rate with explanation that at least one partic-
ipant could not complete the study due to time constraints. For example, Morse and Schuster (2000) started with 10 participants and ended the study with 8 participants, and they reported that the CTD procedure has been effective for all 8 participants. Stonecipher et al. (1999) also reported 75% effectiveness rate since the fourth participant could not complete the study but found CTD to be effective for the participants who completed the study. Therefore, the use of CTD for teaching chained tasks to the participants resulted in positive outcomes for the majority of the participants.

Maintenance and Generalization

Maintenance sessions were reported for all but two of the studies (Stonecipher et al., 1999; Zhang et al., 2004). The authors who reported maintenance data used review trials and thinning of reinforcement schedules. Follow-up sessions were conducted at varied intervals ranging from one to eight weeks. Investigators in 7 of 12 studies reported that the researchers investigated generalization measures. Generalization was measured across settings (Dipipi-Hoy & Jitendra, 2004; Graves et al., 2005; Morse & Schuster, 2000), settings and materials (Bozkurt & Gursel, 2005; Stonecipher et al., 1999), and across trainers (Yilmaz et al., 2005). For example, in a study by Dipipi-Hoy and Jitendra, the participants were able to transfer their purchasing skills to local grocery stores beside the ones in which they were trained. In Graves et al.’s study the participants generalized preparation of macaroni and cheese in microwave to the home setting. In a study by Bozkurt and Gursel, the participants generalized their sandwich and hot drink preparation, and serving skills to different settings using different materials. Finally, in Yilmaz et al.’s study the participants engaged in aquatic games of kangaroo, cycling, and snake in the presence of different trainers.

Social Validity

Of the 12 studies reviewed, investigators in four studies (Dipipi-Hoy & Jitendra, 2004; Morse & Schuster, 2000; Stonecipher et al., 1999; Wall & Gast, 1999) measured social validity. The social validity data was collected by questioning peers without disabilities (Stonecipher et al.), using parent survey (Morse & Schuster), and by asking parents to complete likert questionnaires (Dipipi-Hoy & Jitendra; Morse & Schuster). Some of the information gathered from respondents included perceptions about the overall effectiveness of the intervention, the ease of implementation, and the impact of the intervention on parent-child relationship, and the time involved in implementing the intervention (Dipipi-Hoy & Jitendra). All participants in Dipipi-Hoy and Jitendra’s study reported favorable responses regarding overall effectiveness of the intervention, impact of intervention on parent-child relationship, and time involved in implementing the intervention. Furthermore, one of the student participants noted that breaking the skills into parts, providing sufficient time for learning each step and verbal praise feedback were very helpful, while one thought the ability to use money and purchase items independently was very enjoyable. In a study by Stonecipher et al., the results of the survey indicated that about 94% of the students wrapped gifts, and the parents wanted their children to continue learning how to perform the skill. In Morse and Schuster’s study, parents and participants thought teaching grocery shopping to students with moderate and severe disabilities was very important and the parents expressed satisfaction that their children received grocery shopping skills. Both classroom personnel and parents in Wall and Gast’s study were found to be excited about the opportunity to teach leisure skills or have their children learn leisure skills, and noted positive changes in student behavior and perception as a result of the skills acquired.

Discussion

Results in the 12 studies reviewed showed that the CTD was effective for teaching chained tasks to students with developmental disabilities. Every participant that received the full training cycle using the CTD was able to acquire and maintain the targeted skill. Based on the review, we can conclude that the CTD has been effective for teaching the majority of the participants in the reviewed studies. In addition, the participants were able to gener-
analyze the skills across materials, settings, and trainers.

The results are similar to the reviews conducted by Wolery et al. (1992) and Schuster et al. (1998). Results from the previous reviews indicate that CTD has been effective for teaching a wide range of tasks to individuals of varied ages and with varied developmental disabilities. The generalization data from the past reviews and this review are also similar.

A variety of delay seconds have been used in the CTD procedure, however, the 4 s delay was the most frequently used in the majority of the studies reviewed. This finding is consistent with previous reviews: Wolery et al. (1992) found in their review study that the 3 s and 4 s were the most frequently used while Schuster et al. (1998) reported the 5 s as being the most frequently used. The literature, however, does not specify that any specific delay second is more efficient than the other. Therefore, practitioners should use data from the reviews presented as the gauge for how many delay seconds they should use when teaching chained tasks to persons with developmental disabilities.

Investigators of studies in the current review and those reviewed by Schuster et al. did not teach academic tasks as chained responses. It may be possible to teach some academic tasks as chained responses. We are inclined to agree with the assertion of Collin (2007) that tasks are not in themselves discrete or chained. It is the functioning level of the student which should determine whether a task is taught as chained or discrete task. Consequently, research needs to be conducted to evaluate the effectiveness of using CTD to teach academic tasks as chained response.

Instructional grouping is one of the variables that impacts student learning. The most frequent instructional format used in the studies reviewed is the 1:1 format (92%). However, none of the investigators used a group format to teach persons with developmental disabilities using the CTD. It is evident from the literature that students with developmental disabilities have been found to benefit from both one-to-one instructional and small group formats (Collin, 2007; Logan & Keefe, 1997). Therefore, more research needs to be conducted using CTD in small group instructional formats.

In the reviewed studies, five types of skills were successfully taught using CTD including vocational, leisure, food preparation, gift wrapping, and purchasing. Investigators in five of the 12 studies taught leisure skills. This is contrary to the findings of Schuster et al. (1998) who found only one study in which leisure skills were taught. The indication is that since 1998, there has been a surge in using CTD to teach leisure skills. Another difference between the current review and that of Schuster et al. was in the range of skills taught. In the later, 13 categories of skills were taught in the 20 studies (65%) among which were safety, application of first aid, packing of suitcase, dressing up, cleaning a hotel room, using a duplicating machine, and using a washer and a dryer. In the current review however, five categories of skills were taught in 12 studies (41.7%). One possible reason could be that the number of studies reviewed in the current study is small.

Programming for generalization is an important component when teaching persons with developmental disabilities. A strategy for facilitating generalization is to teach skills that are meaningful and relevant for the learners. Since all of the studies were conducted in the natural settings, it appears that the investigators programmed for generalization even if they did not evaluate generalization data. Even studies that were conducted in the school or clinical settings were carried out in simulated situations (Morse & Schuster, 2000) or in the kitchen areas of the classroom (Fiscus et al., 2002; Graves et al., 2005). In Schuster et al. (1998) however, 11 out of the 20 of the studies were conducted in public schools, while only 6 were conducted in community settings including private home, park, business, bank, and hotel. This indicates that there has been a shift towards conducting studies for individuals with developmental disabilities in natural settings as opposed to clinical settings. This trend supports the assertion that since 1990s more and more investigations are being conducted in natural settings instead of in clinical settings. Teaching in natural settings enhances the meaningfulness and usefulness of skills taught, and improves the quality of life for individuals with developmental disabilities (Collin, 2007).

One of the questions this review sought to
answer was whether the investigators evaluated generalization and social validity. In the current review, investigators in 11 of the 12 studies probed for generalization. However, slightly more studies (14 out of 20; 70%) reported generalization data in Schuster et al.’s (1998) review than in the current review (7 of 12; 58%). One would have expected that more investigators would program for generalization in more recent studies. Similarly, the social validity data in this review is quite low. Investigators in four studies collected social validity data. Future researchers should continue to assess generalization and also investigate social validity.

Implications for Practice
This review has built on the research base established in earlier studies about the efficacy of the CTD instructional procedure and expands the instructional technology base for practitioners. This review further strengthens the support for using CTD procedure to teach chained tasks to persons with developmental disabilities. Practitioners planning to implement the CTD procedure should use natural materials and teach in natural environments. This may promote generalization. Practitioners may consider using 0 s delay intervals for a number of sessions for acquisition of tasks before moving on to higher delay intervals for maintenance and generalization. Indication from the literature is that delay intervals of 4 s and 5 s have been effective for learners with developmental disabilities for maintenance and generalization of learned tasks.

Conclusions
In summary, the reviewed studies support the use of the CTD as an effective instructional strategy for teaching a wide variety of functional skills to individuals with moderate to severe disabilities. CTD is an effective procedure that can be used as a single strategy or in combination with other strategies. Future research should investigate the delay second that is most effective for individuals with moderate to severe disabilities. Researchers should continue to investigate the effects of CTD on generalization and social validity.

References


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