Abstract: This study examined the effectiveness of the constant timed delay procedure for teaching two young adults with autism to read, define, and state the contextual meaning of keywords on product warning labels of common household products. Training sessions were conducted in the dyad format using flash cards. Results indicated that both participants successfully acquired the skills and generalized them across materials. Even though participants could not attain criterion on generalization across setting probes before the study ended, there were improvements in performance. The implications of the findings for future research and practice are discussed.

The acquisition of domestic skills is one of the predictors of successful life outcomes for persons with developmental disabilities including autism. Domestic skills constitute basic skills used on daily or regular basis and are essential for independent functioning within the home. The performance of these skills are likely to expose adolescents and young adults with autism to countless number of situations within the home environment that are inherently dangerous (Gast, Wellons, & Collins, 1994) including using an electric burner, responding to emergency situations, handling breakable objects, handling medications, cleaning products, and other irritants. Local and national surveys of parents and special education teachers of high school students with special needs indicated that about 67% of participants identified the need to acquire skills for responding safely to potentially hazardous products as being very important (Collins, Wolery, & Gast, 1991). Issues of safety are therefore one of the major concerns of parents and teachers of persons with autism (Self, Scrudder, Weheba, & Crumrine, 2007) while they prepare their children towards independence.

It is therefore apparent that if adequate measures are not taken to teach skills that teach adolescents and young adults with autism and other developmental disabilities how to make safe responses to products in their environments, concerns for safety may hinder efforts to promote independent living skills and participation in daily living activities. The literature is replete with researchers having taught several facets of safety skills including pedestrian crossing (Collins, Stinson, & Land, 1993), gun safety (Himle, Miltenberger, Flessner, & Gatheridge, 2004), making emergency phone calls (Orzen, 2008), pedestrian skills (Batu, Ergeneton, Erba, & Akmanoglu, 2004), and disposing of broken materials (Winterling, Gast, Wolery, & Farmer, 1992) to persons with moderate to severe intellectual and related disabilities including autism.

In addition to teaching safety skills directly, the importance of functional reading instruction for adolescent students with autism has been suggested by Duran (1996). Functional reading entails learning to read words that one would encounter in different environments. According to Duran (1985), the most essential reason for teaching an individual
with autism to read is for him/her to move around in his/her environments. Consequently if persons with autism are to attain independence, they have to master a range of skills that ensure being safe at home. One of the skills they have to master is how to read labels on common household products. However, only a few studies (Collins, Branson, & Hall, 1995; Collins & Griffen, 1996; Collins & Stinson, 1994) directly taught reading of product labels to adults and youths with developmental disabilities (Collins & Stinson).

Collins and Griffen (1996) used a 5 s constant time delay procedure (CTD) to teach four elementary age students with moderate intellectual disability key words on product warning labels and the correct motor responses to make towards products containing those words. Unlike in a previous study (Collins & Stinson, 1994) in which keywords were taught with flash cards, Collins and Griffen used warning labels on actual products. Generalization was programmed through the use of multiple exemplars during instruction with generalization measures conducted across settings and products. Collins and Griffen reported that the CTD procedure was effective in teaching the students to read the key words and make the appropriate motor responses. However, only three of the four participants could generalize the behaviors across materials and settings. Collins and colleagues (1995) trained peer tutors to teach four of their peers with moderate intellectual disability to read key words on labels of cooking products with the definitions provided as nontargeted information in a high school setting. The results indicated that the peer tutors successfully delivered the 5 s CTD instructional procedure effectively and the students with intellectual disabilities mastered reading of target key words and generalized the behaviors across materials, settings and persons.

In a similar study, Collins and Stinson (1994) used the progressive time delay (PTD) procedure to teach adolescents with moderate cognitive disabilities to read and define a number of key words on product warning labels using flashcards. Instruction on the definition of the key words was delivered as nontargeted information. The investigators found that while the participants mastered the key words and learned definitions through observational feedback, none of the participants reached criterion on generalization probes.

Literature indicates that individuals with developmental disabilities could be successfully taught skills that enable reading and definition of words found on product labels using the time delay procedures. Although studies have been conducted with persons with intellectual disabilities, no studies exist on young adults with autism to teach reading product warning labels using the CTD procedure. It is therefore necessary to replicate the previously mentioned studies (Collins & colleagues, 1994; 1995; 1996) with persons with other disabilities to corroborate or refute the findings of these studies.

The decision to conduct a study that measures reading, definition, and understanding of the types of responses to make when using household products was based on the observations of Collins (1994/95), Collins and Stinson (1994), Collins et al. (1995), and Collins and Griffen (1996), that the ability to read and generalize the reading of sight words alone do not signify that the individual understood those words. Instead, learners should be taught definitions and given the opportunity to demonstrate their understanding of those definitions. In addition, Collins (1994/95) suggested that as individuals move on to adulthood and independent living situations, they are taught words on warning labels that show them how the products should be used.

The general procedures used in the current study were the same as those used in Collins and Stinson (1994/95) except that the CTD procedure was used instead of the PTD because of indications in the research literature that the CTD procedure may be more efficient than the PTD procedure (Collins & Griffen; 1996) and simpler to implement. The time delay procedure has a long record of success for teaching a variety of behaviors to individuals with developmental disabilities (Schoen & Sivil, 1989), including autism (Ault et al., 1988). CTD has also been effective in teaching a variety of safety and functional reading skills as well as sight word reading (Alig-Cybrinski, Wolery, & Gast, 1990; Collins et al., 1995; Collins & Griffen, 1996; Cuvo & Klutt, 1992; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Knight, Ross, Taylor, & Ra-
Instructions were conducted in dyads for the learners to read words on flash cards and the definitions were also delivered as targeted information. The key words taught were selected from the list used by Collins and Stinson. In the current study, two young adults with autism were taught to read, define, and state the contextual meaning of the key words as they appear on product warning labels. The questions that guided the study were whether (a) young adults with autism will be able to read key words found on product warning labels and acquire the contextual meaning using the CTD strategy, and (b) the acquired skills will be generalized to real products.

Method

Participants

Participants were two young adults with autism recruited from a day transition program. Jen is a 24 year old female who has been enrolled in the transition program for two years. She was medically diagnosed as having moderate autism and had received educational services through high school. She was employed part-time and so was attending the transition center for part of the day and on days she was off work. Naget was a 23 year old female with moderate autism and physical disability. She was also enrolled in the transition program but comes to the center each day with an aide because of difficulties with ambulation. At the time of the study they were capable of demonstrating the following skills: (a) verbal imitation skills, (b) adequate vision and hearing, (c) ability to stand up to 15 minutes in the aisle of a store, and (d) ability to wait up to five seconds for a verbal prompt. Additional inclusionary criteria include ability to: (a) repeat target words following a verbal model, and (b) match printed target words to corresponding words on product warning labels.

Setting

All training sessions were conducted in a dyad at a table in one of the classrooms between 10:00 and 11:00 am three days a week while nonparticipating students engaged in their scheduled activities in an adjacent room. The training setting typically comprised the trainer and the two participants except on selected days when the fourth author came in to collect interobserver agreement and procedural integrity data.

Materials and Trainers

The target words (comprising a blend of upper- and lower case letters in 48 point Tahoma font) were printed on 3” x 10” white cards. Cue cards containing an example of each word as used on a product label (underlined), the definition of the words and contextual examples were printed on another set of 3” x 10” cards. Actual household products with warning labels were used for generalization probes. All training sessions were conducted by the first author.

Target Behaviors

Target behaviors included reading of target key words on product warning labels on a flash card, defining of the targeted key words and statement of their contextual meaning, and generalization of the skills to actual products. Each word was defined as stating what the word means in isolation within the context of warning labels. For example, when one of the participants was asked what the word flush meant, the participant replied “to flush the toilet.” This was a wrong definition within the context of product warning labels so the participant was taught to say “to wash with plenty of water.” Contextual meaning was defined as the ability of the participant to state the kind of response to make when a phrase or sentence as it appears on a product is read out. For instance, when the participant was asked “what does flush eyes with water mean?” the expectation was that she would be able to say “it means to rinse your eyes with plenty of water if the product gets in to your eyes.” Similarly, when asked what attention meant in the phrase “seek medical attention,” one of the participants defined it in terms of a person engaging in attention seeking behaviors. The target words for Jen were store, flush, ingest/ingestion, flammable, and caution, while for
Naget, they were immediately, prolonged, induce, irritant/irritation, avoid, and external. The target words and meanings used during training and generalizations are presented in Tables 1 and 2.

### TABLE 1
Target Word Definitions and Contextual Examples

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Contextual Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store</td>
<td>Store means to keep</td>
<td>“Store in original container” means not to pour the product in a different container.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>Ingestion means to swallow a product</td>
<td>“In case of ingestion, seek help” means if you swallowed this product, you need to get help because the product can harm you.</td>
</tr>
<tr>
<td>Flush</td>
<td>Flush means to rinse with plenty of water</td>
<td>“Flush eyes with water” means to rinse your eyes with water if you get the product in your eyes.</td>
</tr>
<tr>
<td>Caution</td>
<td>Caution means to be careful</td>
<td>“Caution, for external use only” means be careful not to get the product into your mouth, eyes or ears.</td>
</tr>
<tr>
<td>Avoid</td>
<td>Avoid means to try not to do something</td>
<td>“Avoid touching eyes and food” means to try not to get the product in your eyes or on your food.</td>
</tr>
<tr>
<td>External</td>
<td>External means outside your body</td>
<td>“For external use only” means product must not get into your mouth, ears, or eyes.</td>
</tr>
<tr>
<td>Immediately</td>
<td>Immediately means now</td>
<td>“Call the doctor immediately” means if the product hurts you call the doctor soon.</td>
</tr>
<tr>
<td>Prolonged</td>
<td>Prolonged means a long time</td>
<td>“Keep from prolonged breathing” means it is dangerous to breathe around the product for a long time.</td>
</tr>
<tr>
<td>Flammable</td>
<td>Flammable means can cause fire</td>
<td>“Flammable, keep away from heat” means it can cause fire so not to get the product close to the stove or oven.</td>
</tr>
<tr>
<td>Induce</td>
<td>Induce means to make something happen</td>
<td>“Do not induce gagging” means that if you swallow the product, do not force to throw up.</td>
</tr>
<tr>
<td>Contamination</td>
<td>Contamination means it is not good for a product to touch something</td>
<td>“Contamination of food” means it is not good for the product to touch food.</td>
</tr>
<tr>
<td>Irritant</td>
<td>Irritant is something that can hurt you</td>
<td>“Eye irritant” means the product can hurt your eyes.</td>
</tr>
</tbody>
</table>

Dependent Variables

The first dependent variable was the ability to read the key words identified for each participant. The second variable was the ability to state the meaning of the key word, while the third variable involved the explanation of the keyword in context as used on warning labels of household product. The dependent measure was the percentage correct of reading, defining, and stating the contextual meaning of the keywords within 5 s of their presentation. For example when a word is presented and the trainer says “read this word,” the participant had 5 s to read it otherwise it is recorded as incorrect. All correct responses were recorded on a checklist containing the words and the dependent variables.

Experimental Design

A single-subject A-B-C design was used to evaluate the effectiveness of the CTD procedure in teaching key words on product warning labels across two participants with autism. The key words on product warning labels identified by Fletcher and Abood (1988) as high frequency words on household product labels were used to assess participants’ knowledge of those key words in a one-to-one format.
The study comprised four phases including (a) screening, (b) baseline probe, (c) intervention, and (d) generalization. The study started after parental and participant consents were sought. The trainer conducted one session for the dyad per day, three mornings per week. During all probe and training sessions, praise was delivered for participation and cooperation on a continuous schedule during the initial sessions. However, the praise schedule was thinned to a variable ratio of 5 (VR3) in subsequent sessions.

**Procedure**

**Screening.** During these sessions, the trainer first delivered an attentional cue (“[name]”, look), held up the flash card with target word, and asked the participant to read the word. The participant was given 5 s to read it. The trainer then asked the participant to give the definition (“what does this word mean?”) and give the participant 5 s to respond. Each participant was given two trials per word. Correct responses were followed by praise while incorrect or nonresponses were ignored. After screening, unknown words and definitions were ranked from most to least.

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**TABLE 2**

Excerpts from Generalization Probe Product Warning Labels

<table>
<thead>
<tr>
<th>Product</th>
<th>Extracts From Labels with Target Words Italicized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scouring Powder</td>
<td>Avoid contact with eyes, Caution: causes moderate eye irritation</td>
</tr>
<tr>
<td>Bleach</td>
<td>If swallowed, do not induce vomiting</td>
</tr>
<tr>
<td>Laundry detergent</td>
<td>Prolonged contact with metal such as silver may cause pitting</td>
</tr>
<tr>
<td>Laundry stain remover</td>
<td>Caution: eye irritant, Harmful if swallowed</td>
</tr>
<tr>
<td>Rubbing alcohol</td>
<td>For external use only</td>
</tr>
<tr>
<td>Insecticide</td>
<td>Caution: avoid contact with eyes, skin, or clothing</td>
</tr>
<tr>
<td>Lens cleaner</td>
<td>Flammable, content under pressure</td>
</tr>
<tr>
<td>All-purpose cleaner</td>
<td>Caution: causes eye irritation</td>
</tr>
<tr>
<td>Tub and shower cleaner</td>
<td>Caution: eye and skin irritant</td>
</tr>
<tr>
<td>Hand washing liquid</td>
<td>Caution: not for contact lenses</td>
</tr>
<tr>
<td></td>
<td>Avoid contact with eyes, Do not ingest</td>
</tr>
<tr>
<td></td>
<td>If accidentally ingested, rinse mouth immediately with water</td>
</tr>
<tr>
<td></td>
<td>Seek medical attention</td>
</tr>
<tr>
<td></td>
<td>Store in original container</td>
</tr>
<tr>
<td></td>
<td>Do not store on side</td>
</tr>
<tr>
<td></td>
<td>In case of contact with eyes, flush with water and get immediate medical attention</td>
</tr>
<tr>
<td></td>
<td>For prolonged use, wear rubber gloves</td>
</tr>
<tr>
<td></td>
<td>Avoid getting into eyes</td>
</tr>
</tbody>
</table>

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frequently used on the product warning labels word list (Fletcher & Abood, 1988). The trainer then selected 12 target words for the dyad (6 target words divided into 3 word pairs per participant) for instruction.

**Probe condition.** Three probes were administered to each participant individually before and after training of each set of word pairs. Each word was presented on two trials. For each given word, participants were expected to state and define it. Later, the trainer read out an example of each word as used on the product label and the participant was asked to give the contextual meaning. The probe trials were conducted in the same way as the screening trials. First, the trainer delivered an attentional cue to the participant (“Jen, are you ready?) in order to secure the attention of the participant to the task. Next, the flash card was presented followed by a task direction to (a) read the word, (b) what does it mean? and, (c) what does this sentence/phrase mean? The participant was given 5 s to read the word, and another 5 s to define the word, and yet another 5 s to give the contextual meaning. Praise was delivered for correct responses while all incorrect or nonresponses were ignored.

**CTD condition.** Training sessions were also conducted for the participants simultaneously using the CTD procedure. Trials for each participant were arranged in random order. Each session consisted of 24 trials so each participant had 12 trials during each session and six trials per target word. Praise was delivered on a continuous schedule for each correct response before or after the prompt until 90% correct criterion was reached in a session. Once 90% accuracy criterion was met, praise was thinned to a schedule of VR3 for the next two sessions. When one of the participants in the dyad reached criterion before the other, she remained on the VR3 schedule until the other participant also met criterion. This was meant to facilitate overlearning and maintenance (Collins & Stinson, 1994; Wolery et al., 1992) as well as additional observational exposure to nontargeted words and definitions. Instructional trials of target words were conducted as follows: First, the trainer delivered an attentional cue and presented the flash card with the target word, second, the task directions were delivered (“read the word,” what does it mean?, “what does the sentence ______ mean? For example, “what does the phrase ‘avoid touching eyes and food’ mean?”), third, the trainer immediately read out the word, gave the definition, and the contextual meaning (controlling prompt at 0 s delay). After 4 trials, a 5 s delay interval was inserted in the instructional sequence before the controlling prompt was delivered if necessary. When the participant responded correctly, praise was delivered but incorrect responses were ignored. Review trials were conducted on previously acquired word pairs while the participants worked on a new set of word pairs. Each participant in the dyad was required to read his/her target word, state the definition, and give the meaning when the trainer reads the word in a phrase/sentence as found on products.

**Generalization.** Two types of generalization data were collected: generalization across materials and settings of the reading and contextual meaning of target words were assessed in a one-to-one format. The criterion for successful generalization was 90% correct during a single session. Generalization across materials was assessed using actual household products. Products were placed on a table and presented to the participant one at a time. The trainer explained the use of the product and asked the participant if she recognized any word on the warning label. For example, if the product were a dishwashing liquid, the trainer would say, “this is a dishwashing detergent, it is called *Dawn*.” When the participant read a word correctly, praise was delivered and the participant was asked to give the contextual meaning. Again, praise was delivered when a correct response was provided.

Generalization across settings and follow-up probes were conducted two weeks after training in a grocery store to determine if participants recognized target words on the product warning labels from the grocery shelves and if they could still give the contextual meanings. Participants were taken to a local grocery store and asked to read and state the contextual meaning of words on warning labels of products selected at random. A maximum of three products per word were evaluated.
Interobserver Agreement

The fourth author independently collected data simultaneously for 33% of the training sessions for each participant. Interobserver agreement was calculated by dividing the number of agreements by the sum of agreement and disagreement and multiplying the dividend by 100. During the probe condition, the mean percentage of interobserver agreement for student responding was 100% for both participants and 98% with a range of 95–100% during CTD condition. The only interobserver disagreements were in relation to whether the participant provided the definition before or after the prompt.

Procedural Integrity

Procedural integrity data was collected for 33% of total sessions. A checklist of the steps involved in the training was created and scored by the fourth author. These steps include questions regarding whether (a) the trainer secured the attention of the participant, (b) the task direction was given, (c) the prompt was appropriately delivered, (d) trainer waited for 5 seconds before presenting the prompt, and (e) the trainer presented the reinforcer appropriately. The implementation was rated as either “yes” or “no.” A “yes” indicated fidelity and a “no” infidelity. The percentage of yes checked was calculated. The mean procedural integrity data across in the probe condition was 96% with a range of 92–99% and 98% (range of 96–100%). The procedural deviations were with regards to the presentation of the correct word set and waiting for 5 s prompt delay interval.

Results

Effectiveness and Efficiency

The mean percentage correct of prompted and unprompted responses for both participants across all instructional conditions (reading, definition, contextual meaning) are presented in Figures 1 and 2. During the probe condition the percentage of correct responding for both participants for word reading was zero and 10, and zero for definition and contextual meaning probes respectively. After implementing the CTD procedure, responses increased to 100% for reading, 95% and 98% for definition, and 90 and 91% for contextual meaning correspondingly for all 12 target words for both participants. Although both participants reached criterion in each of the instructional conditions for all 12 word pairs, they required a total of 136 trials for reading, 141 for definition, and 156 trials for contextual meaning to reach criterion. The mean number of sessions to CRF criterion was 3.0 for reading, 4.0 for definitions, and 4.5 for contextual meaning (range = 3–7, 4–8, and 4–9 correspondingly). The number of errors made by participants during instruction was minimal, comprising mostly of nonwait errors: three for Jen and four for Naget.

Generalization

The generalization across materials data indicated that both participants reach criterion at 91% and 93% respectively. However, both participants could not reach criterion on generalization across settings data before the study was terminated due to the ending of the semester. Even then, both were able to attain 50% responding (read and give the contextual meaning of trained words on real products in the grocery store) before the study ended.

Discussion

The primary purpose of this study was to determine if the CTD procedure would be effective for teaching two young adults with autism to read, define key words on product warning labels, and generalized the learned skills to real products in the natural environments. The findings indicate that the 5 s CTD procedure was effective in teaching two young adults with autism to read, define and give the contextual meanings of target key words on product warning labels.

The findings of the current study are in line with previous studies that used the CTD procedure for teaching sight word vocabulary to persons with moderate to severe developmental disabilities (Collins et al., 1995; Collins, Evans, Creech-Galloway, Karl, & Miller, 2007; Collins & Griffen, 1996; Cuvo & Klatt, 1992). The participants also successfully read and
stated the contextual meaning of some of the target words when presented with actual products. Although the participants did not reach criterion during generalization across settings, the data path indicated an increase in response levels. It is therefore reasonable to conclude that CTD procedure was effective in facilitating generalization of the target skills. It is however arguable if both participants would have reached criterion on setting generalization. This finding contrasts with those in Collins and Stinson (1994), since it was only one of the four participants who reached criterion on generalization. This may be due to the fact that in the current study, all instructional conditions (reading, defining, and stating contextual meaning) were taught directly while Collin and Stinson taught definitions and contextual meaning as nontargeted information. Although observational learning was not directly assessed, it was evident that both participants learned some of each other’s words. This was evident in the fact that during some of the trials, a participant would provide the response when it was apparent the other could not make the correct response. This observation was also reported by their regular instructors.

It was interesting to note that even though the participants, when they heard the words read to them had ideas about them, they did not understand the words as they were used on product warning labels. For example when the word “Flush” was read, one participant said “to flush the toilet.” Similarly, attention was defined as “wanting social attention” from someone else. This was one of the reasons it was important for us to teach definition and contextual meaning as target behavior.

Limitations

In spite of the encouraging results of this study and others cited throughout this study, the findings are limited because the A-B-C design was used with only a single dyad. This did not allow for a functional relationship to be established. The results would have had a

Figure 1. Jen’s percent correct during probe, CTD, and generalization conditions.
stronger impact if the study was replicated across other dyads. Future replications using multiple baseline across participants with autism is required. Another limitation is that there was not enough time to follow through with collecting generalization across setting and a follow-up data due to the end of the school year. One other limitation was that the amount of information participants acquired from observational learning was not assessed. Future research should assess information learned by young adults with autism through observational learning when taught key words on product warning labels in dyad format.

Implications for Research and Practice

In this study, the target key words on the product warning labels were printed in 48 point Tahoma font on a 3” by 10” card. Generalization would be enhanced if the suggestion made by Collins and Stinson (1994–1995) including (a) using actual products for the training, (b) scanning labels from actual products onto the flash cards, (c) taking photograph of product labels and teaching from the photos instead of flashcards were adopted. It is also important that the target words are taught in context because definitions alone do not indicate to the participant the type of safety responses they have to make when handling household products. Practitioners have to realize that even if their students could read key words on product warning labels, they still have to help them develop an understanding of what those warnings meant and the type of responses they have to make when confronted with the situations described on the product warning labels.

![Graph](image)

△ Reading; □ Definition; ○ Contextual Meaning

CTD = Constant Time Delay; Gen. = Generalization

Figure 2. Naget’s percent correct during probe, CTD, and generalization conditions.
References


Received: 8 February 2010
Initial Acceptance: 10 April 2010
Final Acceptance: 15 July 2010