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Effectiveness of a Metacognitive Shopping Intervention for Adults with Intellectual Disability Secondary to Down Syndrome

Abstract

Background: The purpose of this study was to examine the effects of a metacognitive strategy-training intervention on the shopping performance of adults with intellectual disability secondary to Down syndrome.

Method: A single subject ABA design across six participants was employed and included a 2-week baseline data collection period, followed by an 8-week intervention phase, and a 2-week follow-up data collection period 1 month after intervention end. Time, frequency, and level of assistance required by the participants to demonstrate targeted shopping skills were measured during baseline, intervention, and follow-up probe phases.

Results: As a group, the participants experienced statistically significant improvements in time ($\chi^2 = 144.25$, $px^2 = 38.00$, $px^2 = 207.08$, $pZ = -8.50$, $pd = 0.92$), frequency ($Z = -4.07$, $pd = -2.60$), and level of assistance ($Z = -9.39$, $pd = -2.44$). Results calculated for individual participant performance mirrored group results.

Conclusion: The findings of this study suggest that the intervention effectively improved the participants' shopping performance. Further research is warranted.

Comments

The authors report no potential conflicts of interest.

Keywords

occupational therapy, instrumental activities of daily living, strategy-training

Cover Page Footnote

This study was completed in fulfillment of the capstone requirement for the post-professional degree of Doctor of Occupational Therapy from Columbia University. The study was registered with ClinicalTrials.gov (NCT04020302), and all of the participants and their parents provided informed written consent.

Credentials Display

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Down syndrome (DS) is a genetic condition, caused by trisomy of chromosome 21, that affects over 200,000 individuals in the United States (de Graaf et al., 2016; Presson et al., 2013). This condition is associated with the presence of characteristic physical traits (e.g., distinct facial features, short stature, and hypotonia), as well as observable patterns of strengths and weaknesses in cognitive function. Individuals with DS typically present with intellectual disability (ID), with the majority falling in the mild to moderate range (Contestabile et al., 2017). ID is characterized by significant limitations in both general mental abilities (e.g., reasoning, abstract thinking, problem-solving, and judgement) and adaptive behavior (American Psychiatric Association [APA], 2013). Adaptive behavior refers to the everyday conceptual, social, and practical skills necessary for independent living in community settings (Tasse et al., 2016). Adults with ID secondary to DS often present with an adaptive behavior profile that includes relative strengths in socialization skills along with relative difficulties in financial management, cooking, community mobility, time use, functional academics, and shopping skills (Matthews et al., 2018; Tomaszewski et al., 2018).

It is believed that the aforementioned adaptive behavior deficits are associated with differences in functional brain connectivity patterns (Pujol et al., 2015). Specifically, functional magnetic resonance imaging (fMRI) studies of adults with DS have demonstrated significant volume reduction in the frontal lobes and anterior cingulate cortex, both of which are implicated in metacognitive ability (Fleming & Dolan, 2012). Metacognition is a complex cognitive process that is frequently referred to as “thinking about thinking” (Rhodes, 2019, p. 168). It involves the ability to be aware of, monitor, and control one’s own performance (Norman et al., 2019). Impaired metacognition is associated with reduced independence and can lead to difficulty performing higher-level instrumental activities of daily living (IADL), such as meal preparation, financial management, community mobility, and shopping (Lamash, 2018). Shopping in particular is a critical IADL skill for this population, as it promotes autonomy, social inclusion, and community participation (Wilton et al., 2018). Without the ability to be an autonomous consumer, adults with ID cannot exert independence in decision-making regarding seemingly simple but highly meaningful choices, such as what to eat and wear.

A review of occupational therapy literature revealed no empirical studies investigating the effectiveness of interventions designed to improve shopping skills in adults with ID secondary to DS. However, the search did yield three occupational therapy studies examining shopping interventions for other clinical populations, including adults with schizophrenia (Kim et al., 2020), adolescents with autism spectrum disorder (Lamash & Josman, 2019), and children with learning disabilities (Karunakaran et al., 2018). All of the identified studies, regardless of the clinical population targeted, investigated the use of metacognitive strategy-training either in isolation or in combination with another targeted shopping intervention. Metacognitive strategy-training is an intervention that aims to improve occupational performance by explicitly teaching clients to use processing strategies (Giles, 2018; Katz et al., 2011). Processing strategies are used to organize incoming information for more efficient processing (Toglia, 2011). Examples of common processing strategies include the use of external aids (e.g., graphic organizers, smart phone apps, and visual cuing cards), as well as internal strategies, such as visualization, self-questioning, and verbalization of task steps.

In a two-group controlled design, Lamash and Josman (2019) compared the effectiveness of a combined metacognitive strategy-training and virtual shopping practice intervention with traditional occupational therapy intervention methods to improve shopping performance in 56 adolescents with ASD 11 to 19 years of age. Intervention group participants received metacognitive strategy-training,

which incorporated group discussions about executive function components, identification of potential metacognitive strategies for shopping, and implementation of strategies during a virtual-reality shopping task. The participants in the control group received traditional occupational therapy services consisting of systematic shopping skill instruction using role playing, simulations, and visual aids. The results indicated that, compared to the control group, the participants in the intervention group experienced significant improvements in accuracy, efficiency, and strategy usage during performance of a shopping task.

Another study, using a two-group pretest-posttest design, compared the effectiveness of a performance-based, metacognitive strategy-training intervention known as the CO-OP approach (Polatajko & Mandich, 2004) with money handling skills training to improve shopping performance in 31 youth with learning disabilities 10 to 14 years of age (Karunakaran et al., 2018). The participants receiving CO-OP were taught to apply self-generated strategies during shopping tasks, while those receiving money handling skills training were taught traditional money management techniques. Although both interventions resulted in improved shopping skills, the participants assigned to the CO-OP group experienced significantly higher improvements compared to those who received training in money handling skills.

In the third study, Kim et al. (2020) used a nonequivalent control group pretest-posttest design to investigate the effects of a grocery shopping intervention on executive function and IADL performance (e.g., shopping, financial management, meal preparation, medication management) in 20 adults with schizophrenia. They found that the participants who received the grocery shopping intervention, which consisted of practicing shopping strategies during real-life grocery shopping tasks, showed significantly greater improvements across both outcomes compared to the waitlist control group.

While promising, the findings of the aforementioned studies cannot be generalized to adults with ID because study participants possessed average to above-average intelligence. Despite some similarities with the clinical populations included in the previously noted studies, adults with ID experience global limitations in intellectual functioning beyond executive dysfunction resulting in impaired use of functional literacy, mathematics, language, self-determination, and social and practical skills (APA, 2013). There is an unmet need to examine the effectiveness of metacognitive strategy-training interventions designed to improve shopping skills in adults with ID that can target their specific cognition needs.

Outside of the occupational therapy literature, the majority of intervention studies aimed at improving shopping skills in adults with ID emerged from the field of education (Bouck et al., 2013; Bouck et al., 2017; Burckley et al., 2015; Gil et al., 2019). Unlike the metacognitive strategy-training interventions described in the occupational therapy literature, the interventions reported in the education studies primarily used technology-based prompting systems, which provided users with picture, video, or audio prompts at each step of a task to support skill acquisition. These prompting systems were often used in combination with the system of least prompts (Wolery et al., 1992), a progressive cueing system that presents cues in a hierarchical manner (i.e., least to most specific) until an appropriate response is produced. While these interventions have been successful, they generally do not result in transfer of learning because self-monitoring skills are not explicitly targeted (Miller & Taber-Doughty, 2014; Reeve & Brown, 1985). Self-monitoring skills enable one to evaluate one's own performance and detect errors while engaging in a task (Goupil & Kouider, 2019; Toglia, 2011).

Moreover, because training conditions must remain invariant, response prompting interventions do not address the ability to manage novelty and perform complex tasks in unpredictable environments, such as grocery shopping in a busy supermarket (Gick & Holyoak, 1987; Giles, 2018). To effectively target performance of such tasks, interventions should use an alternative approach that promotes generalization and transfer of learned skills by facilitating the development of self-monitoring skills. One such approach is metacognitive strategy-training.

Toglia's (2011) Dynamic Interactional Model (DIM) is a widely known occupational therapy practice approach that uses metacognitive strategy-training. In the DIM, cognition is viewed as a product of the dynamic interaction between the person, activity, and environment. Therefore, a primary postulate of the DIM is that functional change can be facilitated by enhancing the client's self-awareness and use of metacognitive strategies. Developed as an extension of the DIM, the multicontext approach promotes generalization and transfer by providing clients with opportunities to practice self-monitoring skills, strategy generation, and application of strategies across a variety of meaningful activities and environments. Although the multicontext approach was initially developed for adults with traumatic brain injury, it has recently been applied to other populations, including adults with schizophrenia (Kaizerman-Dinerman et al., 2018; Kaizerman-Dinerman et al., 2019) and adolescents with attention deficit hyperactivity disorder (Levanon-Erez et al., 2019). However, the principles of the multicontext approach have not yet been used to improve shopping performance in adults with ID secondary to DS.

The purpose of this study was to examine the effectiveness of a metacognitive strategy-training intervention to improve shopping performance in adults with ID secondary to DS. The researchers queried whether an 8-week metacognitive strategy-training intervention provided in a community-based setting could increase observable shopping skills in adults with ID secondary to DS.

Method

Research Design

A single subject ABA design was employed in which A represented a 2-week baseline data collection phase, B represented an 8-week intervention data collection phase, and C represented a 2-week data collection phase at a 1-month follow-up probe. The study was approved by Columbia University's Institutional Review Board and the program director of a day facility for individuals with developmental disabilities. The study was registered with ClinicalTrials.gov (NCT04020302), and all of the participants and their parents provided informed written consent.

Participants

Adults with ID secondary to DS were recruited from a convenience sample of participants attending a day facility for individuals with developmental disabilities. The participants were included in the study if they were 18 to 65 years of age, possessed a diagnosis of ID secondary to DS, spoke English, and were granted parental permission. The participants were excluded if they possessed a severe behavioral disorder that would prevent cooperation with the study protocol. Parents of interested participants determined whether their adult children had difficulty with shopping skills based on a brief phone interview with the first author.

Outcome Measures

The participants were observed as they composed a three-item shopping list based on a selected recipe and available food stocks and then as they shopped for identified items at a local grocery store. A recording sheet developed by the authors was used to measure the time, frequency, and/or level of assistance required by the participants to demonstrate six targeted shopping skills (see Appendix). In

addition, qualitative observations of performance (e.g., the order in which items were found, whether or not the participant asked for assistance, and visual scanning approach) were recorded in a designated section on the recording sheet.

Throughout the observations, a stopwatch was used to measure the amount of time required for the participants to compose a shopping list, locate correct items on the shopping list, compare prices to select the lowest price, and purchase groceries with sufficient funds. Scores were recorded in min, with lower scores indicating faster speed of task completion.

Frequency scores were calculated by tallying the number of instances the participants were observed to use the store aisle signage to locate needed items without cues. Frequency scores ranged from 0 to 3 to reflect the number of items on the shopping list. A score of 0 indicated that the participant did not use store aisle signage to locate any items on the shopping list, while a score of 3 indicated that the participant used store aisle signage to locate all listed items.

Lastly, a 5-point ordinal scale was used to measure the level of assistance required by the participants to perform the following shopping skills: composing a shopping list, retrieving a shopping cart, locating correct items on the shopping list, comparing prices to select the lowest price, and purchasing groceries with sufficient funds. Total scores for each shopping skill ranged from 1 to 5, with a score of 5 indicating *greater independence*. The following criteria were used to determine level of assistance:

- Full assistance: The therapist completes the task for the participant in its entirety
- Partial assistance: The participant performs part, but not all, of the task
- Direct cueing: The therapist provides specific instructions or feedback about performance
- Indirect cueing: The therapist provides general information regarding performance, without explicitly stating what is to be done
- Independent: The participant performs the task completely, without cueing or assistance

Intervention

Intervention was provided once per week for 8 weeks. The intervention format alternated between individual and group sessions, such that the first week of intervention was provided in a group format, the second week was provided in an individual format, and so forth. Each session was 90 min and consisted of awareness training, facilitation of strategy generation, facilitation of error detection, reinforcement of self-monitoring techniques, and opportunities for the participants to practice self-monitoring techniques. The sessions were modelled after Toglia's (2011) multicontext approach and were structured into three phases: preshopping, shopping, and postshopping. In addition, the sessions included shopping activities of similar complexity with graded task progression to promote generalization of shopping skills and strategies.

Preshopping Phase

During the 15-min preshopping phase, the participants met the interventionist at the day facility and were provided with a recipe. The participants were then asked to create a shopping list based on the recipe and available food stocks. To facilitate strategy generation, the interventionist provided the participants with cues in order from general to specific (e.g., "Can you think of any strategies that will help you make the shopping list? How will you know what you need to buy? Do you think we have cheese? Where can you look to find cheese? Should you check in the refrigerator or the pantry?"). After the shopping list was finalized, the interventionist employed guided anticipation techniques to help the participants predict their shopping performance and potential performance challenges. For example, the

participants were asked to predict total cost, item location, and time needed to locate all listed items. Next, the interventionist facilitated generation of strategies to apply during the shopping activity by providing the participants with cues in order from general to specific (e.g., “Can you think of any strategies that will help you during the shopping activity? Is there anything you can do or use that would help you find the items on the list? Is there anything you can do or use to help you find the cheapest prices?”). When the participants demonstrated difficulty identifying appropriate strategies, the interventionist provided strategy suggestions, such as asking store employees for assistance, using a number line to compare prices, rearranging items on the list into smaller categories, and using a systematic left to right visual scanning approach when searching for shelved items.

Shopping Phase

The shopping phase of each session was held at a local grocery store for 45 min. Halfway through the shopping activity, the interventionist used mediation techniques to encourage self-monitoring of performance (e.g., “Let’s pause and check how you’re doing. How are you doing with time? What else do you need to do or find before you are done? Are the strategies helping?”). The interventionist did not otherwise assist the participants unless they explicitly requested assistance or a safety concern existed. However, the participants were provided with positive reinforcement when they spontaneously used appropriate strategies.

Postshopping Phase

After the shopping activity, the participants reconvened at the day facility for the final 30 min of the session. The participants were encouraged to identify and discuss any challenges that were encountered while shopping. In addition, the participants were asked to compare the actual total cost, location of items, and length of time required to locate items with predictions made during the preshopping phase. To promote generalization and transfer of learning, the interventionist guided the participants to identify how strategies used during the activity could be applied to other situations and/or contexts and to make connections between shopping performance and strategies used during previous sessions. Lastly, the participants were instructed to prepare the selected recipe, clean the kitchen area, and store leftover groceries appropriately.

Interventionist

The intervention was administered by the first author, an occupational therapist with expertise in intellectual and developmental disabilities. The interventionist was not blinded to study purpose.

Data Collection

Data collection was performed by the interventionist (the first author) because of limited resources. She was not blinded to the participants’ intervention performance or study purpose.

Baseline

The first author used the recording sheet to collect baseline data regarding the time, frequency, and level of assistance required by the participants to demonstrate targeted shopping skills. The participants were observed during four 25-min sessions over the course of 2 weeks (i.e., study weeks 1 and 2). Observations occurred at four different grocery stores, each located within five miles of the day facility.

Intervention

Data were collected during individual intervention sessions, which occurred every other week (i.e., study weeks 4, 6, 8, and 10). The first author completed the recording sheet to assess the time,

frequency, and level of assistance required by the participants to demonstrate targeted shopping skills. Observations occurred at the same four locations used for baseline data collection to ensure consistency.

1-Month Probe

The first author collected probe data 1 month after intervention end. Data were collected over a span of 2 weeks (i.e., study weeks 15 and 16). The recording sheet was used to measure the time, frequency, and level of assistance required by the participants to demonstrate targeted shopping skills during four 25-min observations. The observations occurred at the same four locations as baseline and intervention data collection.

Data Analysis

Analysis consisted of two separate methods commonly used in single subject design: (a) visual inspection of graphed data to determine whether changes occurred in targeted skills with regard to level of assistance, time, and frequency (Kazdin, 2011; Kennedy, 2005); and (b) analysis of variance (ANOVA) with post hoc testing to determine whether the participants experienced statistically significant changes in performance from baseline to 1-month follow-up probe (Portney & Watkins, 2015). A Friedman's ANOVA with Wilcoxon signed rank post hoc tests were selected to discern statistical significance between study phases, since data were nonparametric, not normally distributed, and derived from a small sample. Data analysis was performed using SPSS version 26 and statistical significance was set at $p < .025$ to account for a small sample size with multiple data observation points.

Results

Six participants enrolled in and completed the study. The participants were largely female ($n = 4$, 66.66%; male $n = 2$, 33.33%), White ($n = 4$, 66.66%; Hispanic/Latino $n = 1$, 16.66%; mixed race $n = 1$, 16.66%), and ranged from 21 to 34 years of age ($M = 27.16$, $SD = 5.26$). Five (83.33%) of the participants had a diagnosis of moderate ID and one (16.66%) was diagnosed with mild ID. Five (83.33%) of the participants completed high school, while one (16.66%) completed some college. Four (66.66%) of the participants were unemployed at the time of the study and two (33.33%) were employed part-time. All of the participants were living at home with their parents during the study.

Level of Assistance

A Friedman's ANOVA found that, as a group, the participants demonstrated statistically significant improvements in the level of assistance needed to complete shopping tasks ($\chi^2 = 207.08$, $p < .000$). Post hoc testing using a Wilcoxon signed rank test revealed that statistically significant improvements, with moderate to large effect sizes, occurred from baseline to intervention ($Z = -9.37$, $p < .000$, $d = -1.69$), baseline to 1-month probe ($Z = -9.39$, $p < .000$, $d = -2.44$), and intervention to 1-month probe ($Z = -6.58$, $p < .000$, $d = -0.64$). These findings indicate that participant gains occurred throughout all data collection phases, with the largest improvements observed from baseline to 1-month probe (see Table 1 and Figure 1). The group results mirrored those calculated for individual participant performance (see Table 2 and Figure 2).

Table 1

Participant Mean Group Scores

	Baseline	Intervention	1-Month Probe
Level of Assistance	$M = 2.81$, $SD = .97$	$M = 4.30$, $SD = .78$	$M = 4.73$, $SD = .54$
Time (min)	$M = 6.25$, $SD = 5.05$	$M = 3.39$, $SD = 2.96$	$M = 2.52$, $SD = 2.67$
Frequency	$M = .58$, $SD = 1.13$	$M = 2.62$, $SD = .64$	$M = 2.79$, $SD = .41$

Figure 1
Participant Mean Group Scores

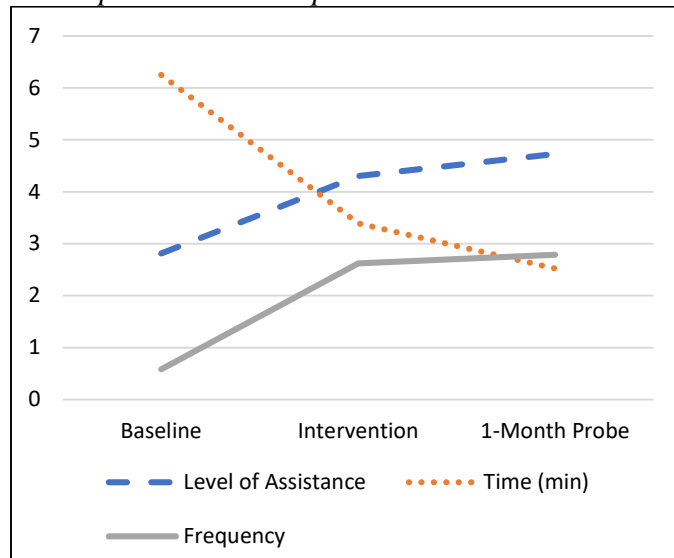


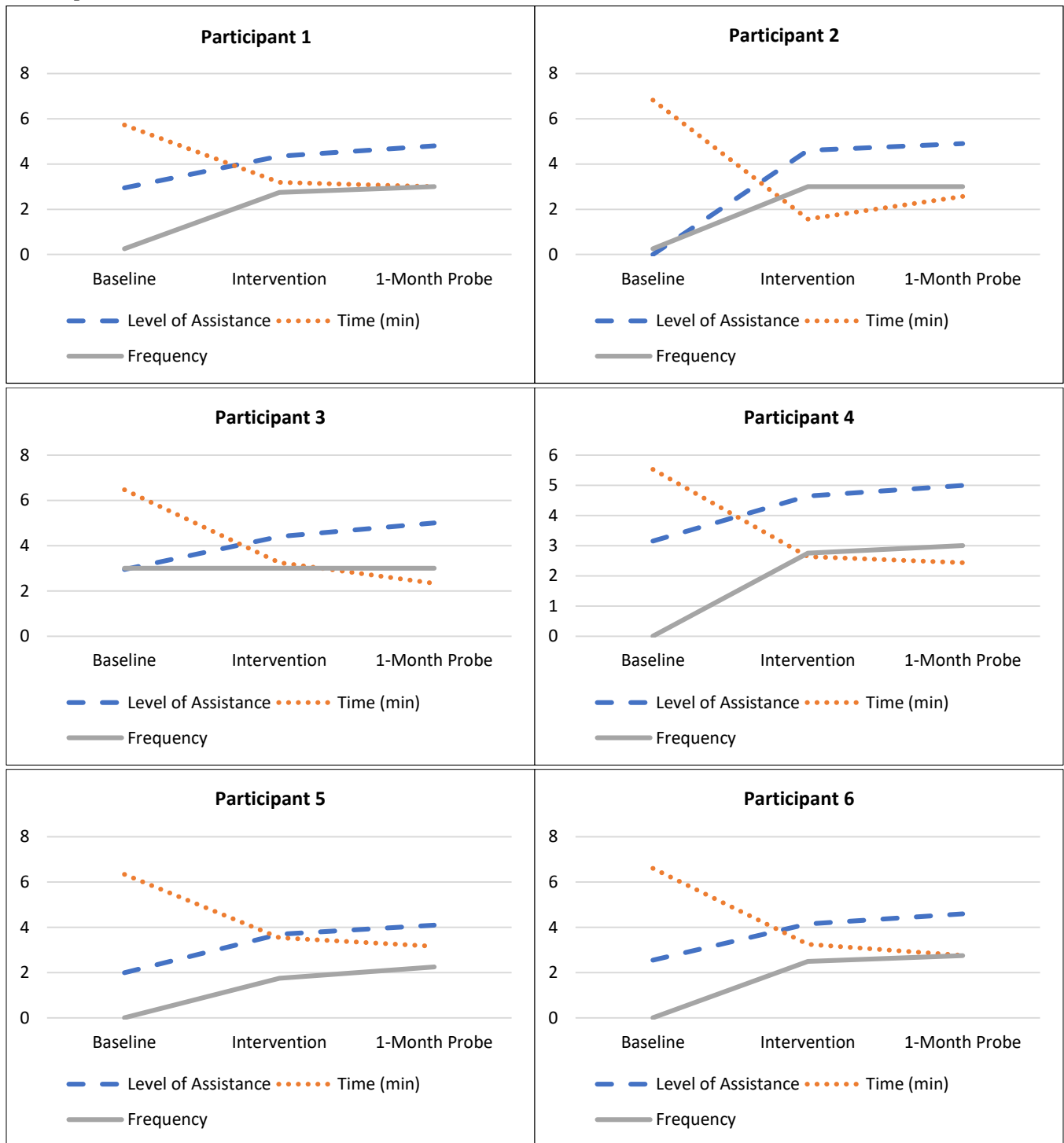
Table 2
Individual Participant Scores

	Baseline	Intervention	1-Month Probe	Friedman's ANOVA	Wilcoxon Signed Rank
Participant 1					
Level of Assistance	$M = 2.95$ $SD = 1.05$	$M = 4.35$ $SD = .74$	$M = 4.80$ $SD = .41$	$\chi^2 = 31.60,$ $p < .000$	Baseline & Intervention: $Z = -3.71, p < .000, d = -1.54$ Baseline & 1-Month Probe: $Z = -3.78, p < .000, d = -1.54$ Intervention & 1-Month Probe: $Z = -3.00, p < .003, d = -0.75$
Time (min)	$M = 5.73$ $SD = 4.24$	$M = 3.19$ $SD = 2.90$	$M = 3.00$ $SD = 3.01$	$\chi^2 = 25.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 0.70$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 0.743$ Intervention & 1-Month Probe: $Z = 2.09, p < .036, d = 0.70$
Frequency	$M = .25$ $SD = .50$	$M = 2.75$ $SD = .50$	$M = 3.00$ $SD = .00$	*	*
Participant 2					
Level of Assistance	$M = 3.3$ $SD = .92$	$M = 4.60$ $SD = .50$	$M = 4.90$ $SD = .30$	$\chi^2 = 33.60,$ $p < .000$	Baseline & Intervention: $Z = -3.83, p < .000, d = -1.75$ Baseline & 1-Month Probe: $Z = -3.78, p < .000, d = -2.33$ Intervention & 1-Month Probe: $Z = -2.44, p < .014, d = -0.72$
Time (min)	$M = 6.82$ $SD = 5.40$	$M = 1.57$ $SD = .89$	$M = 2.57$ $SD = 2.64$	$\chi^2 = 24.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 1.35$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 1.00$ Intervention & 1-Month Probe: $Z = -.72, p < .469, d = -0.50$
Frequency	$M = .25$ $SD = .50$	$M = 3.00$ $SD = .00$	$M = 3.0$ $SD = .00$	*	*

Participant 3						
Level of Assistance	$M = 2.95$ $SD = .60$	$M = 4.40$ $SD = .68$	$M = 5.00$ $= .00$	SD	$\chi^2 = 37.14,$ $p < .000$	Baseline & Intervention: $Z = -4.04, p < .000, d = -2.26$ Baseline & 1-Month Probe: $Z = -4.05, p < .000, d = -4.05$ Intervention & 1-Month Probe: $Z = -2.97, p < .003, d = 1.05$
Time (min)	$M = 6.47$ $SD = 5.88$	$M = 3.25$ $SD = 3.40$	$M = 2.34$ $= 3.28$	SD	$\chi^2 = 27.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 0.67$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 0.86$ Intervention & 1-Month Probe: $Z = -3.05, p < .002, d = 0.27$
Frequency	$M = 3.00$ $SD = .00$	$M = 3.00$ $SD = .00$	$M = 3.00$ $SD = .00$		*	*
Participant 4						
Level of Assistance	$M = 3.15$ $SD = .81$	$M = 4.65$ $SD = .58$	$M = 5.00$ $= .00$	SD	$\chi^2 = 34.48,$ $p < .000$	Baseline & Intervention: $Z = -3.80, p < .000, d = -2.12$ Baseline & 1-Month Probe: $Z = -3.90, p < .000, d = -3.22$ Intervention & 1-Month Probe: $Z = -2.33, p < .020, d = -0.85$
Time (min)	$M = 5.53$ $SD = 5.00$	$M = 2.64$ $SD = 2.64$	$M = 2.44$ $= 2.71$	SD	$\chi^2 = 25.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 0.72$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 0.76$ Intervention & 1-Month Probe: $Z = -1.73, p < .083, d = 0.74$
Frequency	$M = .00$ $SD = .00$	$M = 2.75$ $SD = .50$	$M = 3.00$ $= 3.00$		*	*
Participant 5						
Level of Assistance	$M = 2.00$ $SD = .97$	$M = 3.70$ $SD = .97$	$M = 4.1$ $SD = .71$		$\chi^2 = 37.17,$ $p < .000$	Baseline & Intervention: $Z = -4.00, p < .000, d = -1.75$ Baseline & 1-Month Probe: $Z = -4.03, p < .000, d = -2.47$ Intervention & 1-Month Probe: $Z = -$ $2.82, p < .005, d = -0.47$
Time (min)	$M = 6.34$ $SD = 4.83$	$M = 3.54$ $SD = 3.03$	$M = 3.16$ $= 2.93$	SD	$\chi^2 = 25.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 0.69$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 0.79$ Intervention & 1-Month Probe: $Z = -1.99, p < .046, d = 0.12$
Frequency	$M = .00$ $SD = .00$	$M = 1.75$ $SD = .95$	$M = 2.25$ $= .50$		*	*
Participant 6						
Level of Assistance	$M = 2.55$ $SD = .88$	$M = 4.15$ $SD = .81$	$M = 4.60$ $= .68$	SD	$\chi^2 = 33.47,$ $p < .000$	Baseline & Intervention: $Z = -3.78, p < .000, d = -1.89$ Baseline & 1-Month Probe: $Z = -3.79, p < .000, d = -2.60$ Intervention & 1-Month Probe: $Z = -2.46, p < .014, d = -0.60$
Time (min)	$M = 6.61$ $SD = 5.49$	$M = 3.25$ $SD = 2.93$	$M = 2.76$ $= 2.58$	SD	$\chi^2 = 25.12,$ $p < .000$	Baseline & Intervention: $Z = -3.51, p < .000, d = 0.76$ Baseline & 1-Month Probe: $Z = -3.51, p < .000, d = 0.89$ Intervention & 1-Month Probe: $Z = -1.99, p < .046, d = 0.17$
Frequency	$M = .00$ $SD = .00$	$M = 2.50$ $SD = .57$	$M = 2.75$ $= .50$		*	*

*Note. Individual participant analysis of frequency data was not performed because of the small number of observation points.

Figure 2
Participant Individual Mean Scores



Time

A Friedman’s ANOVA found that, as a group, the participants demonstrated statistically significant reductions in time needed to complete shopping tasks ($\chi^2 = 144.25, p < .000$). Post hoc testing using a Wilcoxon signed rank test revealed that statistically significant improvements, with small to large effect sizes, occurred from baseline to intervention ($Z = -7.37, p < .000, d = 0.69$), baseline to 1-

month probe ($Z = -8.50, p < .000, d = 0.92$), and intervention to 1-month probe ($Z = -5.82, p < .000, d = -0.30$). These findings indicate that reduction in time needed to complete shopping tasks occurred throughout all data collection phases, with the largest improvements observed from baseline to 1-month probe (see Table 1 and Figure 1). The results calculated for individual participant performance were similar to those calculated for the entire group (see Table 2 and Figure 2).

Frequency

As a group, the participants experienced a statistically significant improvement in the frequency with which they used store aisle signage to locate needed items ($\chi^2 = 38.00, p < .000$). Post hoc testing using a Wilcoxon signed rank test revealed that statistically significant improvements, with small to large effect sizes, occurred from baseline to intervention ($Z = -4.01, p < .000, d = -2.22$), baseline to 1-month probe ($Z = -4.07, p < .000, d = -2.60$), and intervention to 1-month probe ($Z = -2.00, p < .046, d = -0.31$). These findings indicate that, as a group, the participants made improvements throughout all data collection phases, with the largest gains observed from baseline to 1-month probe (see Table 1 and Figure 1). Frequency data were calculated only for group scores because the nine observation data points collected to measure the individual participants' frequency performance could have resulted in a Type II error if analyzed alone.

Discussion

This study sought to investigate the effectiveness of an 8-week metacognitive strategy-training intervention to improve shopping performance in adults with ID secondary to DS. Data analysis revealed that all six participants experienced statistically significant improvements in time, frequency, and level of assistance required to demonstrate six targeted shopping skills observed in the community. Notably, the largest improvements occurred from baseline to 1-month probe, indicating that the participants continued to make gains 1 month after intervention end.

Several intervention elements likely influenced the results of this study. For example, the focus on shopping may have been highly motivating for the participants because it is an adult role that promotes both self-determination and autonomy (Wilton et al., 2018). In addition, the use of a group format every other week likely enhanced the participants' learning because socially oriented learning tends to be more successful for individuals with ID secondary to DS (Grieco et al., 2015). By complementing group sessions with individual sessions, the interventionist was also able to provide one-to-one customized intervention based on each participant's learning needs.

Another key element of the intervention that may have contributed to the improvements seen in the participants' shopping performance was the use of a metacognitive strategy-training approach. Specifically, reductions in time required to demonstrate targeted shopping skills likely resulted from the participants' increased use of metacognitive strategies. At baseline, the participants were observed to be inefficient during shopping performance (e.g., searched for items in inappropriate areas, missed items because of haphazard visual scanning approach, and located items in the order they were listed). The application of strategies, such as using store aisle signage to locate items, visually scanning from left to right, and grouping items by store location, allowed the participants to optimize their use of time while shopping (Brown et al., 2009; Toglia, 2011).

The participant gains may have been maintained 1 month after intervention end because of the emphasis on self-generated strategies since self-generated strategies are more likely to be remembered than strategies provided by others (Goverover et al., 2010; Toglia, 2011). In addition, the maintenance of significant improvements at 1-month probe suggests that the length of the intervention was sufficient. It

is, however, possible that a greater number of intervention sessions could have resulted in greater improvements; it also was not determined whether the participants' gains were lasting beyond 1-month probe.

Limitations

It is important to note that the findings of this study cannot be generalized to the larger population of adults with ID because of the small sample size, which was recruited from a convenience sample of participants attending a day facility for individuals with developmental disabilities. Furthermore, because metacognitive strategy-training was the only intervention studied, it is not possible to determine whether this intervention is more effective than traditional response-prompting interventions designed to improve shopping performance.

Data collection methods also presented a limitation of this study. Although follow-up data collection was performed 1 month after intervention end, an additional probe at 6 months would provide greater understanding regarding maintenance of the participants' gains. Moreover, the interventionist also performed data collection and was not blinded to study purpose or participant performance, which could have biased the results.

A final limitation of this study is related to the outcome measure that was used to collect data during the baseline, intervention, and 1-month probe phases. While the recording sheet developed for this study appears to have high ecological validity because it is based on real-life observations of shopping performance in community settings, the psychometric properties of this outcome measure have not been formally evaluated.

Future Research

Future studies should include larger sample sizes with more rigorous study designs. For example, a comparative effectiveness study that evaluated metacognitive strategy-training and transitional response-prompting interventions would provide additional information regarding which intervention most effectively improves shopping performance in this population. In addition, the use of independent interventionists and data collectors who are blinded to both study purpose and participant performance would decrease the risk of bias. To better assess the extent to which the participant gains are maintained, it is recommended to include follow-up probes at both 1 and 6 months. Lastly, future studies should incorporate ecologically valid outcome measures with established psychometric properties.

Conclusion

This pilot study provides preliminary evidence regarding the effectiveness of a community-based metacognitive strategy-training intervention targeting shopping performance in a small sample of adults with ID secondary to DS. The participants experienced statistically significant improvements in time, frequency, and level of assistance required to demonstrate shopping skills with maintenance of gains observed at 1-month probe. Although the findings of this single subject design study across six adult participants with ID secondary to DS appear promising, the results cannot be generalized to the larger population of adults with ID. The positive results of this study, however, warrant further research with larger sample sizes and more rigorous study designs.

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Appendix
Shopping Skills Recording Sheet

Observable Shopping Skill	Time (min)	Level of Assistance	Frequency	Additional Observations
Composes shopping list				
Retrieves shopping cart/basket				
Locates correct items on shopping list				
Compares prices to select lowest price				
Purchases groceries with sufficient funds				
Uses store aisle signage to locate needed items				

Level of Assistance	
(5) Independent	The participant performs the task completely without cueing or assistance
(4) Indirect cueing	The therapist provides general information regarding performance, without explicitly stating what is to be done
(3) Direct cueing	The therapist provides specific instructions or feedback about performance
(2) Partial assistance	The participant performs part, but not all, of the task
(1) Full assistance	The therapist completes the task for the participant in its entirety