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Effectiveness of using computer-based video instruction (CBVI) in teaching the location of grocery items to students with intellectual disabilities

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EFFECTIVENESS OF USING COMPUTER-BASED VIDEO INSTRUCTION (CBVI) IN TEACHING THE LOCATION OF GROCERY ITEMS TO STUDENTS WITH INTELLECTUAL DISABILITIES

by

Minkowan Goo

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Teaching and Learning (Special Education)
in the Graduate College of
The University of Iowa

May 2013

Thesis Supervisors: Associate Professor William J. Therrien
Assistant Professor Youjia Hua

The purpose of this study is to examine whether CBVI is an effective method for teaching students with intellectual disabilities the skills of locating grocery items in classroom settings, and whether the skills acquired in classroom settings generalize to actual grocery stores. Four high school students with intellectual disabilities participated in the study. A multiple probe design across students was used to investigate the effectiveness of CBVI. A CBVI program containing video clips, photographs, and text was developed and used for teaching the skills to the students. Seventeen steps in the process of locating grocery items were used as dependent variables across all conditions. Results indicate that CBVI is an effective and efficient means of teaching the skills of locating grocery items to students with intellectual disabilities and helps these students generalize the acquired skills to actual grocery stores. All students acquired the skills during the CBVI intervention condition and generalized the skills to a grocery store depicted in the CBVI program and to a grocery store not depicted in the CBVI program.

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Graduate College
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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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ABSTRACT

The purpose of this study is to examine whether CBVI is an effective method for teaching students with intellectual disabilities the skills of locating grocery items in classroom settings, and whether the skills acquired in classroom settings generalize to actual grocery stores. Four high school students with intellectual disabilities participated in the study. A multiple probe design across students was used to investigate the effectiveness of CBVI. A CBVI program containing video clips, photographs, and text was developed and used for teaching the skills to the students. Seventeen steps in the process of locating grocery items were used as dependent variables across all conditions. Results indicate that CBVI is an effective and efficient means of teaching the skills of locating grocery items to students with intellectual disabilities and helps these students generalize the acquired skills to actual grocery stores. All students acquired the skills during the CBVI intervention condition and generalized the skills to a grocery store depicted in the CBVI program and to a grocery store not depicted in the CBVI program.

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CHAPTER I

INSTRUCTION

The acquisition of life skills is considered one important component of special education (Cronin, 1996; Mechling, Pridgen, & Cronin, 2005) because competence in these skills provides individuals with opportunities (a) to learn other skills required to live in varied community settings (Mechling & Langone, 2000), (b) to independently interact with their communities (Hutcherson, Langone, Ayres, & Clees, 2004), and (c) consequently to experience an improved quality of life (Cronin, 1996; Roessler, Brolin, & Johnson, 1990). For these reasons, researchers and special educators emphasize teaching these skills to students with disabilities (Alwell & Cobb, 2009).

In particular, the acquisition of grocery purchasing skills is often emphasized among the life skills taught to students with disabilities (Morse, Schuster, & Scandknop, 1996; Smith & Hilton, 1994). This is because (a) the acquisition of grocery purchasing skills is necessary in individuals' everyday lives (Ford, Schnorr, Meyer, Davern, Black, & Dempsey, 1989), (b) the acquisition of grocery purchasing skills is closely associated with individuals' self-sufficiency, health, and nutrition (Morse et al., 1996), (c) the acquisition of grocery purchasing skills allows individuals with disabilities to function independently in community settings (Frederick-Dugan, Test, & Varn, 1991; Nietupski, Welch, & Wacker, 1983), and (d) the acquisition of grocery purchasing skills offers individuals with disabilities opportunities to develop other functional skills, such as social skills, money management skills, and motor skills (Morse & Schuster, 2000).

While it is critical for students with intellectual disabilities (ID) to acquire and become competent in these skills as a step toward independent living (Morse et al.1996), it is not easy to teach these skills to students with ID because they generally have deficits among prerequisite skills such counting money, making change, and calculating basic math (Nietupski et., 1983). Therefore, students with ID often need to be systematically taught such skills (Wheeler, Ford, Nietupski, Loomis, & Brown, 1980) unlike students without ID, who acquire grocery purchasing skills without explicit instruction.

Research has suggested several interventions to effectively teach grocery purchasing skills to students with ID: (a) community-based instruction (Ferguson & McDonnell, 1991; Marholin, O'Toole, Touchette, Berger, & Doyle, 1979); (b) classroom simulations (Bates, Cuvo, Miner, & Korabek, 2001; Sandknop, Schuster, Wolery, & Cross, 1992); (c) video technology (Branham, Collins, Schuster, & Kleinert, 1999); (d) concurrent instruction (Cihak, Alberto, Taber-Doughty, & Gama, 2006; Morse & Schuster, 2000); (e) computer-based instruction (CBI) (Langone, Shade, Clees, & Day, 1999; Hutcherson et al., 2004); and (f) computer-based video instruction (CBVI) (Ayres & Langone, 2002; Mechling & Gast, 2003; Hansen & Morgan, 2008; Wissick, Lloyd, & Kinzie, 1992).

Statement of Problem

Even though researchers have indicated that these methods are effective in teaching grocery purchasing skills to students with ID, they have also reported several potential barriers to using these interventions: (a) constraints of resources such as funds, time, and staff (Mechling & Gast, 2003; Wissick, Gardner, & Langone, 1999; Wissick et

al., 1992); (b) insufficient similarity to real world situations (Ayres & Langone, 2002; Hutcherson et al., 2004; Mechling, 2004; Stokes & Baer, 1977); and (c) cumbersome technology (e.g., awkward and time-consuming manual control of DVD/VCR players) (Mechling, 2004) .

For these reasons, more attention has been given to how technology might be used to mitigate some of the barriers encountered in teaching these skills (Mechling, Gast, & Langone, 2002; Van Laarhoven & Van Laarhoven-Myers, 2006; Wehmeyer, Smith, Palmer, & Davies, 2004). In particular, computer-based video instruction (CBVI) has been considered a promising alternative to address the problems in teaching these skills (Mechling et al., 2002; Wissick et al., 1992). The advantages of using CBVI are as follows: (a) using computers can emulate real world situations by incorporating varied materials such as text, photographs, animation, and videos (Hutcherson et al., 2004); (b) the combination of these materials in computers can enhance the probability of skill generalization (Wissick et al., 1992); and (c) interactive components provided by computers can promote the acquisition and generalization of learned skills (Mechling et al., 2002). Even though multiple studies have examined the effectiveness of using technology such as CBVI to teach various life skills to students with ID (Wehmeyer et al., 2004), only a few studies have specifically evaluated the effectiveness of CBVI in teaching grocery purchasing skills to students with ID (Ayres, Langone, Boon, & Norman, 2006; Hansen & Morgan, 2008).

Purpose of the Study

In special education, grocery purchasing skills are recognized and reported as pivotal functional life skills for students with ID (Frederick-Dugan et al, 1991; Morse & Schuster, 2000; Morse et al., 1996). In spite of such awareness, instructional concerns for teaching these complex skills have not been fully addressed (Mechling & Gast, 2003). In particular, there is limited research on the effectiveness of using CBVI to teach these skills. Since 1992, only seven studies have examined this intervention. Although existing research suggests that CBVI is an effective means for teaching grocery purchasing skills, more studies are required for researchers to be confident of its effectiveness in classroom settings (Ayres & Langone, 2002, Ayres et al., 2006). Furthermore, CBVI should be further examined to ensure that it promotes the generalization of acquired skills from classroom to community settings (Hansen & Morgan, 2008).

Therefore, the primary purpose of this study is to determine if CBVI is effective in teaching students with ID to locate grocery items in classroom settings. The secondary purpose of the study is to determine if grocery locating skills, acquired through CBVI in classroom settings, generalizes to actual grocery stores in community settings.

CHAPTER II

LITERATURE REVIEW

This chapter first presents an overview of intellectual disability and the characteristics of students with intellectual disabilities (ID). It also discusses how the proficiency of life skills affects the life outcome of students with ID and presents an overview of interventions for teaching life skills to these students. In particular, the chapter describes the six most prominent approaches recommended for teaching grocery purchasing skills to students with ID. This is followed by a review of the literature on the effectiveness of each type of intervention (See table 1), including accounts of both advantages and disadvantages. Finally, the chapter presents rationale for the current study using CBVI and describes its unique features. Five criteria were used to identify relevant studies for this review. These criteria included: (a) empirical studies, (b) students with intellectual disabilities (ID) as subjects, (c) grocery purchasing skills as skills for teaching, (d) grocery or convenience stores as places for training and/or assessment, and (e) studies conducted from 1991 to 2011. In accordance with the criteria, sixteen empirical studies were identified for review. These studies were classified based on the approaches they employed. Researchers have investigated the effectiveness of six approaches for teaching grocery purchasing skills to students with ID. These include: CBVI (seven studies); CBI (two studies); concurrent instruction (three studies); classroom simulations (two studies); and community-based instruction (two studies). Although no studies have examined whether video technology alone is effective in teaching grocery purchasing skills to

students with ID, it was also included in this review because it is usually combined with other approaches (e.g., community-based instruction).

Definition of ID

Over the past 50 years, the definition of ID has changed along with the terminology. Recently the American Association on Intellectual and Development Disabilities (AAIDD) has defined ID as follows:

> Intellectual disabilities is characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills. This disability originates before age 18. (AAIDD, 2010, p. 1)

The definition of ID includes three key criteria: (a) intellectual abilities; (b) adaptive behavior; and (c) age of onset. Even though the term and definition of ID have changed over the last decades, the definitions have consistently included these key criteria (AAIDD, 2010), which are explained as follows:

Intellectual Abilities

Intellectual abilities entail various abstract abilities such as reasoning, problem solving, planning, and thinking (AAIDD, 2010). Usually, these abilities are measured by standardized intellectual tests, which compare one's score to the average scores of other people. When an individual scores below two standard deviations [approximately below Intellectual Quotient (IQ) 70 to 75] on a standardized intellectual test, the individual meets the criteria of AAIDD to be diagnosed as an individual with ID (Hardman, Drew, & Egan, 2007).

Adaptive Behavior

Adaptive behavior is defined as conceptual, social, and practical skills that individuals need to learn for functioning in their everyday lives (AAIDD, 2010). As with intellectual abilities, standardized tests, often referred to as *adaptive behavior scales*, are used to assess adaptive behavior. These scales use interviews and observations to assess an individual's abilities for conceptual, social and practical skills such as communication and hygiene (Hardman et al., 2007).

Age of Onset

In defining ID, age 18 was considered a cutoff point of onset because ID is categorized as a developmental disability and includes mental and/or physical impairments that are diagnosed at birth or during childhood through adolescent years. Developmental disabilities cause limitations to critical life activity areas such as self-direction, mobility, and language (Hardman et al., 2007).

However, in order to apply this definition, the AAIDD (2010) indicates that it is important to consider the following five assumptions:

> (a) limitations in present functioning must be considered within the context of community environments typical of the individuals' age peers and culture; (b) valid assessment considers cultural and linguistic diversity as well as differences in communication, sensory, motor, and behavioral factors; (c) within an individual, limitations often coexist with strengths; (d) an important purpose of describing limitations is to develop a profile of needed supports; and (e) with appropriate personalized supports over a sustained period, the life functioning of the person with ID generally will improve. (p. 7)

Characteristics of Individuals with ID

Individuals with ID present a wide range of characteristics that affect their lives. These can be categorized as lack of adaptive skills, low academic achievement, speech and language delay, lack of self-regulation, and abnormal physical development.

Lack of Adaptive Skills

Adaptive skills refer to skills required to live in community settings (AAIDD, 2010). Some examples of these skills include taking care of personal needs, interacting with others, and responding to the demands of the environment (Thompson, McGrew & Bruininks, 1999). Students with intellectual disabilities have problems not only with acquiring these skills but also with applying them to their particular situations.

Low Academic Achievement

Roberts and Zubrick (1992) demonstrated that children with ID showed lower achievement in academic areas in general as compared to their counterparts without ID. In particular, this lower achievement affects both reading and math skills. Researchers have reported that the reading fluency of students with ID is below their mental-age level (Kaiser & Grim, 2006) and that they perform poorly on reading comprehension (Drew & Hardman, 2007). Researchers have also indicated that students with ID cannot appropriately utilize cognitive strategies in solving mathematical problems (Butler, Miller, Lee, & Pierce, 2001; Parmar & Cawley, 1991). Additionally, even though students with ID may not have problems with simple computation, they may have difficulty applying math concepts to real-life situations (Beirne-Smith, Patton, & Kim, 2006).

Speech and Language Delay

One of the significant characteristics of students with ID is delayed speech and language development. Although the exact types of these delays are largely associated with the causes of students' disabilities (Abbeduto et al., 2006), the difficulties usually include articulation problems and language comprehension and production problems (Hallahan, Kauffman, & Pullen, 2011).

Lack of Self-Regulation

Self-regulation is a broad concept regarding the ability to control one's own behavior (Shonkoff & Phillips, 2000); this ability is closely linked to metacognition, referring to an individual's awareness of which strategy is needed to solve a problem, how to use the strategy appropriately, and monitoring whether the strategy works well (Sternberg, 2003). Students with ID do not develop and/or efficiently use (e.g., rehearse) such strategies needed in certain situations (Hardman et al., 2007).

Abnormal Physical Development

Even though no significant difference in physical appearance exists between most individuals with and without ID, researchers indicate that there is a relationship between physical abnormalities and the severity of intellectual disabilities (Drew & Hardman, 2007; Horvat, 2000). Hardman et al. (2007) indicated that individuals with profound and severe intellectual disabilities have a significant likelihood of physical differences caused by genetic factors such as Down syndrome and Fetal Alcohol Syndrome (FAS), whereas individuals with mild intellectual disabilities generally do not have significant physical differences because the intellectual problems tend to be related to environmental rather than genetic factors.

Students with ID and Development of Life Skills

Researchers define life skills as those skills that are necessary to live independently in everyday life (Mastropieri & Scruggs, 1994), such as housekeeping, cooking, shopping, and organizing one's own environment (Smith & Luckasson, 1995). This definition highlights the fact that the acquisition of life skills is a pivotal step toward independent adult life for students with ID. Along the same lines, researchers have indicated several concerns about adult outcomes for students with ID who do not acquire adequate life skills (Link, 2008). Some report that students with ID have much more difficulty making the transition from high school to adult life than their peers without disabilities (Affleck, Edgar, Levine, & Kortering, 1990). Others report that students with ID confront unemployment or under-employment, low salaries, temporary rather than permanent jobs, quick job changes, segregation from the community, and difficulty establishing independent living (Halpern, 1993). Link (2008) indicated that these disappointing outcomes are directly connected to the students' proficiency in life skills, and that improving these students' life skills can produce better life outcomes.

In particular, one important life skill that students with ID need to acquire for better life outcomes is grocery purchasing (Morse et al., 1996; Smith & Hilton, 1994). Morse and Schuster (2000) suggested three reasons for why teaching grocery purchasing skills is important for improving the prospects of independent life for students with ID: (a) grocery purchasing skills are required to be taught in school curricula and are included in textbooks and in varied assessments (e.g., Westling & Fox, 1995); (b) acquisition of these skills allows students with ID to learn behaviors which are associated with health, nutrition, and self-sufficiency (Morse et al., 1996); (c) these skills provide various

opportunities for students to acquire many other skills such as social skills, math skills, and motor skills. Additionally, Browder and Grasso (1999) reviewed studies on teaching money management skills to students with ID. They indicated that purchasing skills (e.g., grocery and food) are some of the most important for successful money management and allow students with ID access to items they want to purchase.

However, teaching grocery purchasing skills to these students is especially challenging because of some particular characteristics of people with ID. Spitz (1979) indicates that students with ID are generally not competent in utilizing conceptual strategies such as (a) grouping or restructuring information for solving problems and completing tasks; (b) using their acquired strategies efficiently in certain situations (Beirne-Smith, Ittenbach, & Patton, 1998); (c) transferring acquired skills across novel situations (Langone, Clees, Oxford, Malone, & Ross, 1995); and (d) responding properly to changing situations (Langone et al., 1999). These difficulties are worsened by various distractions within community settings (Morse et al., 1996). Thus, researchers have made efforts to identify effective interventions for teaching these skills to students with ID. Xin and colleagues (2005) conducted a meta-analysis on teaching purchasing skills to individuals with developmental disabilities. The results of this analysis indicated that a range of interventions (e.g., modeling, verbal instruction, prompting system, and in vivo instruction) can be used effectively to teach purchasing skills to this population. In particular, it is essential to use systematic interventions to teach these skills to students with ID (Wheeler et al., 1980).

Core Components of Teaching Life Skills to Students with ID

Competency in life skills promotes the successful transition of students with disabilities into their communities (Hutcherson et al., 2004) and enhances their quality of life (Cronin, 1996; Roessler et al., 1990). Regardless of their importance, teaching these skills has been considered a challenging task to special education teachers due to the previously described characteristics of students with ID (e.g., lack of adaptive skills and lack of self-regulation). Therefore, researchers and teachers need to use specialized methods for this task. In general, these methods include two core components. One is general case instruction and the other is response prompting systems.

In the 1980s, general case instruction emerged as an effective strategy to address special education teachers' concerns about teaching students with ID the life skills they require to function independently in communities (Sandknop et al., 1992). Research followed which focused on teaching particular types of life skills in isolation. For example, using the telephone (Horner, Williams, & Steveley, 1987), performing janitorial and housekeeping tasks (Woolcock, Lyon, & Woolcock, 1987), using fast food restaurants (McDonnell & Ferguson, 1988), and crossing the street (Marchetti, McCartney, Drain, Hooper, & Dix, 1983).

General case instruction is a series of procedures that identifies a wide range of examples for the stimulus and response of tasks which students will encounter. Students are provided with these examples in classroom and community settings to facilitate the acquisition and generalization of the targeted life skill (Domaracki & Lyon, 1992; Horner, Sprague, & Wilcox, 1982). For example, Day and Horner (1986) conducted a study on

the relative effectiveness of single instance and general case instruction on teaching dressing skills to six individuals with severe ID. Two independent studies were conducted using a multiple-baseline across participants design. During the interventions, the single instance instruction, which provided limited examples, was delivered first, followed by the general case instruction, which provided multiple examples. The combined results of these studies indicated that general case instruction is much more effective in teaching dressing skills to students with ID. Although none of the six students was able to fully master dressing skills, after the general case instruction, all six acquired and then maintained these skills. Another study by McDonnell and Ferguson (1988) investigated the relative effectiveness of general case instruction in community settings and general case instruction in the combination of simulation and community settings. They taught six students with ID how to make purchases in fast-food restaurants. The six students were randomly split into two groups for a two level multiple-baseline across participants design. One group was taught through general case instruction in community settings, and the other was taught through general case instruction in the combination of simulation and community settings. The results demonstrated that both are effective in teaching the target skills to students with ID. No significant difference was found in the level of students' improvement in performance and error analysis.

However, with the emergence of technology, the means of providing the stimulus and response for general case instruction has recently changed from using simple flashcards and photographs to using video and computer technologies, and the effectiveness of using these advanced technologies has been proven in teaching life skills to students with ID. For example, Mechling and Cronin (2006) conducted a study in

which they taught how to use augmentative and alternative communication (AAC) devices at fast-food restaurants to three students with moderate to severe ID using a computer-based video instruction (CBVI) program. This program contained photographs and video clips to provide multiple examples for the students. The results of the study indicate that CBVI including multiple examples can be used to teach students with ID how to use AAC devices for ordering at fast-food restaurants. After the intervention, all three students showed improvement in performances on responding to the target behaviors. Moreover, Ayres and Cihak (2010) examined the effectiveness of CBVI in teaching food preparation to three students with ID. Commercial software ("I Can! Daily Living and Community Skills") was used to repetitively provide multiple examples to the students. The results of the study report that CBVI that includes multiple examples is an effective means of teaching life skills (Hutcherson et al., 2004; Tam, Man, Chan, Sze, & Wong, 2005). All students were able to complete tasks after the CBVI intervention.

Response prompting systems are another core component of teaching life skills to students with ID. These systems include various types of prompting procedures, such as a constant time delay (CTD) procedure (Dogoe & Banda, 2009; Browder, Ahlgrin-Delsell, Spooner, Mins, & Baker, 2009), progressive time delay (Collines, Stinson, & Land, 1993), the system of least-to-most prompting (Taber, Alberto, Seltzer, & Hughes, 2003; Wolery, Ault, & Doyle, 1992), and the system of least prompts. Particularly, the CTD procedure has been considered one of the most effective prompting procedures. During the CTD procedure, first students receive an instructor's cue to perform a target behavior, and then a specified time interval (e.g., 0, 3, or 5s) is given to the students in which to perform the target behavior. If a student does not initiate responding or responds

incorrectly, a controlling prompt is given to the student (Dogoe & Banda, 2009). The time interval is maintained constantly throughout all trials until the student meets the criterion (Schuster, Morse, Ault, Doyle, & Crawford, 1998).

A wide variety of empirical data have proven that the CTD procedure can be used efficiently to teach various skills (e.g., life and academic skills) to students with ID (Browder et al., 2009; Dogoe & Banda, 2009). For example, Graves, Collins, Schuster, and Kleinert (2005) examined whether using the CTD procedure with video prompting was effective in teaching three cooking skills to three secondary students with ID. The researchers used video prompting along with a 0s and 5s CTD procedure. During the intervention, 0s and 5s CTD procedures were delivered by videotape instead of by the researchers. For example, in the 5s CTD procedure, the videotape started with a cue for the students to perform target behaviors, and then nothing was presented on the screen for 5 seconds. If the students initiated responding, the 5-second controlling prompt was skipped, but if the students did not initiate responding or responded incorrectly within 5 seconds, the 5-second controlling prompt was presented. After the video prompts for each step were seen, the students performed each step of the skills within 20 seconds. The results of the study indicate that the CTD procedure with video prompting is effective in teaching students with ID food preparation skills. Although the researchers could not complete this study due to time constraints resulting from the ending of the school year, all of the students in the study mastered two of the target skills, and one of the two skills was maintained. Mechling and O'Brien (2010) conducted another study to examine the effectiveness of CBVI and the CTD procedure in teaching students how to use public transportation. The researchers used CBVI and the CTD procedure to teach three young

students with moderate ID how to reach a target destination by recognizing three landmarks. During the intervention, a 0s time delay was used with a CBVI program. When the students reached the criterion for the 0s time delay session, a 3s time delay was used with the CBVI program. The results of this study indicated that the CTD procedure can be used effectively with CBVI to teach students how to use public transportation. All students acquired and maintained these skills.

Overview of Interventions for Teaching Grocery Purchasing Skills to Students with ID

Although there is little empirical data indicating which life skill is the most important for students to learn (Gaule, Nietupski, & Certo, 1985), it is clear that grocery purchasing skills are one of the most important for students with ID (Frederick-Dugan, Test, & Varn, 1991; Morse & Schuster, 2000; Morse et al., 1996). Unfortunately, grocery purchasing is also one of the most challenging skill sets for such students to acquire because it encompasses so many component skills, such as using reading to locate items, math to calculate payment, and communication with other people. Additionally, students with ID may have deficits in these and other basic skills (e.g., self-regulation) that prevent them from efficiently acquiring and generalizing the steps of grocery purchasing skills.

Thus, various interventions have been used to teach these skills to students with ID, such as community-based instruction, classroom simulations, video technology, concurrent instruction, and computer technology. Research has shown positive effects can be achieved with all of these interventions, alone or in combination (Alberto, Cihak,

& Gama, 2005; Bates et al., 2001; Gardill & Browder, 1995; Morse & Schuster, 2000; Mechling & O'Brien, 2010; Wissick et al., 1992).

One widely used intervention is community-based instruction (Alberto et al., 2005; Bates et al., 2001; Berg, Wacker, Ebbers, Wiggings, Fowler, & Wilkes, 1995). This method involves directly visiting real community settings (e.g., grocery stores) and requires students to enact target behaviors in these settings (e.g., shopping for grocery items). Some researchers have indicated that this is the most desirable method for teaching these students because training occurs in real community settings where students must actually learn to conduct their lives (Wissick et al., 1992).

Classroom simulations have also been introduced as an effective means of teaching grocery purchasing skills to students with ID (Gardill & Browder, 1995; Mores & Schuster, 2000). In classroom simulations, students mimic making grocery purchases with items that are found in actual grocery stores by using various materials, such as item photographs, price flash cards, or money pictures. Then the students perform, in actual grocery stores, the same steps of learned skills taught in the classroom (Aeschleman & Schladenhauffen, 1984).

Video technology (video modeling and video prompting) is another intervention considered a useful medium for teaching grocery purchasing skills to with ID (Haring, Breen, Weiner, Kennedy, & Bendersh, 1995; Alberto et al., 2005). This intervention allows students to model shopping tasks by illustrating the actual steps of the tasks through videos (Morgan & Salzberg, 1992); afterward, the students perform the target behaviors in actual grocery stores.

As a fourth type of intervention, researchers have also recommended the use of concurrent instruction, which is defined as instruction that takes place in a school setting using simulated instruction (e.g., classroom simulations and video technology) and then subsequently takes place in community settings with a short time interval (Brown, Nisbet, Ford, Sweet, Shiraga, York, et al., 1983). Classroom simulations followed by community-based instruction (Bates et al., 2001) or video modeling followed by community-based instruction (Alberto et al., 2005; Cihak et al., 2006) can be examples of this type of intervention.

As using computers in education has become more widespread in classrooms (Wehmeyer et al., 2004), one intervention in particular that has attracted attention over the past decade is computer-based instruction(CBI), which is a method that simulates real-life environments using the varied functionalities of computers, such as pictures, photographs, sounds, and animation (although it usually does not include videos). Additionally, it provides interactive components to facilitate the acquisition and generalization of functional skills (Mechling, 2004; Wissick et al., 1992).

Another computer technology that has been used as an intervention in special education is computer-based video instruction (CBVI), which provides several advantages in teaching grocery purchasing skills to students with ID (Wissick et al., 1992). CBVI is an intervention that uses a computer program containing videos, photographs, and animation to simulate real-life environments, and provides multiple examples and immediate feedback (Hutcherson et al., 2004). Particularly, the video components in CBVI allow students to easily imitate targeted skills they need to learn (Mechling, 2005).

Interventions for Teaching

Grocery Purchasing Skills to Students with ID

Community-Based Instruction

Community-based instruction is suggested for teaching grocery purchasing skills to students with ID (Bates et al., 2001; Ferguson & McMonnell, 1991) because this instructional method provides students with opportunities for practice in the real-life situations that they are most likely to encounter (Wissick et al., 1992). Kluth (2000) indicated that the strength of community-based instruction is that it uses community settings as classrooms, thus allowing students to practice meaningful skills. This may decrease gaps between what they learn and what they need to know in order to function in their communities. A total of two studies examined community-based instruction. Ferguson and McMonnell (1991) examined the relative effectiveness of two community-based instructions on teaching the location of grocery items to students with ID. The researchers compared community-based instruction that used a serial sequencing strategy with a community-based instruction that used a concurrent sequencing strategy. They randomly assigned six high school students with severe ID to two groups for a two-level multiple-baseline across subjects design (Barlow & Hersen, 1984). Then they took the students to three different grocery stores for training. In the community-based instruction combined with the serial sequencing strategy, the training for one store was given to the student until they reached the completion criteria. They were then introduced to the next store. In the community-based instruction combined with the concurrent sequencing strategy, the training for all three stores was given simultaneously without the completion of the performance criteria for each store. The percent of correct location of target items,

frequency of errors during the generalization condition, and correct selection of the target items were collected as the dependent variables during this training condition. The results of the study indicate that both types of community-based instruction are effective in teaching the location of grocery items to students with ID; however, the concurrent sequencing strategy is more effective than the serial sequencing strategy. The average correct location of items in the concurrent sequencing strategy was 17% higher than in the serial sequencing strategy.

Another study by Bates et al. (2001) compared two instructional conditions (community-based instruction only and classroom simulations plus community-based instruction). Grocery purchasing skills and three other skills were taught to 20 students with mild ID and 20 students with moderate ID. The students were assigned to two different groups based on the severity of disability (i.e., mild ID group and moderate ID group). A mixed factorial design was employed for the comparisons. Each instructional condition was alternately given to each group. For example, the researchers taught one group these skills with community-based instruction only, while teaching the other group the skills with classroom simulations (a pictorial board) and community-based instruction. Two dependent variables were used: (a) the percentage of the selection of correct photographs associated with grocery purchasing skills during the classroom simulations condition, and (b) the percentage of correct steps associated with grocery purchasing skills during the generalization condition. The findings of the study demonstrate that both instructional conditions are effective in teaching grocery purchasing skills with no significant statistical difference, and students with mild ID performed significantly better under both conditions. The researchers thus stated that the effectiveness of community-

based instruction alone is just as strong as the effects of the combination of community-based instruction and classroom simulations.

Even though a range of studies on community-based instruction have validated that this intervention is effective and efficient, some issues remain to be addressed in order for practitioners to use it practically (e.g., funds, staff, and time, as well as safety concerns) (Mechling & Gast, 2003; Wissick et al., 1999). Researchers have also suggested that more studies are needed to examine the effectiveness of combinations of community-based instruction and various classroom simulations (Bates et al., 2001).

Classroom Simulations

Another intervention for teaching grocery purchasing skills is classroom simulations (Bates et al., 2001; Colyer & Collins, 1996; Sandknop et al., 1992). Although this intervention does not provide students with actual situations in community settings, it simulates these situations in the classroom using various materials (e.g., photographs, flash cards, and picture prompt money cards). This provides several advantages for teachers and students, such as allowing for sufficient repetition to practice, saving cost, reducing safety concerns, and causing less disruption for instruction (Bates et al., 2001). The intervention also promotes the generalization of grocery purchasing skills acquired in the classroom to actual grocery stores (Matson & Long, 1986).

A total of two studies examined classroom simulations. Sandknop and colleagues (1992) conducted a study to teach the selection of lower-priced grocery items to four adolescents with moderate ID in the classroom. A multiple-baseline across participants design was used in the study. The students were taught using an adaptive number line (Kleinert, Guiltinan, & Sims, 1988) to select lower-priced grocery items. Eighty index

cards including grocery item prices (forty cards with two-digit prices and forty cards with three-digit prices) were developed for classroom simulations. During the baseline and intervention conditions, seven pairs of price index cards (e.g., $1.79 and $2.94, $2.45 and $2.29, and $0.54 and $0.59) were presented to the students twice (14 trials), and the students selected the lower-price cards using the adaptive number line. The CTD strategy was used throughout the training sessions. Pre- and post-test sessions occurred in the classroom with actual grocery items ("Which item is cheaper?") and generalization sessions occurred at a grocery store with novel items that had not been presented in the training sessions. The mean percentage of correct responses in selecting lower prices was used as the dependent variable. The results of the study demonstrated that classroom simulations can be used successfully to teach students with ID how to utilize the adaptive number line for the selection of cheaper grocery items. All students showed an improvement in these skills during the training sessions, and their performances were maintained.

Colyer and Collins (1996) also conducted a study examining the effectiveness of classroom simulations. They taught the *Next Dollar* strategy, which is used to teach students how to pay correct dollar amounts, to four students with mild and moderate ID. A multiple probe across participants design was used in the study. Flash cards containing grocery item prices were used for simulations. During the intervention condition, the flash cards were presented to the students for training on the *Next Dollar* strategy while the system of least prompts provided them with hierarchical prompts (i.e., least to most prompts). Five levels of prompts were used for the procedure: (a) verbal prompts only; (b) flash card presentations plus verbal prompts; (c) flash card presentations plus extra verbal

prompts; (d) flash card presentations plus extra verbal prompts and directions; and (e) modeling plus extra verbal descriptions. The level of prompts increased until the students responded correctly. During the generalization condition, the students went to actual stores for assessing the generalization of the acquired skills through classroom simulations. The dependent variable was the percent of correct responses for the correct amount of dollar bills. The results of this study indicated that classroom simulations used with the system of least prompts is an effective method for teaching the *Next Dollar* strategy to students with ID. Three of the four students acquired the *Next Dollar* strategy and generalized the acquired skills to novel stores.

However, some researchers have reported that even though the quality of similarities between simulated and natural environments increases the possibility of the generalization of acquired skills (Bates et al., 2001; Colyer & Collins, 1996; Langone et al., 1999), classroom simulations are not sufficient in providing such similarities (Ayres & Langone, 2002; Hutcherson et al., 2004; Mechling, 2004). Moreover, it is recommended that more research be conducted to compare the effectiveness of different response prompting strategies (e.g., the CTD procedure and the system of least prompts) used in classroom simulations (Colyer & Collins, 1996).

Video Technology

Haring et al. (1995) indicated that using video technology as an intervention creates realistic world situations in classrooms and more closely replicates real world situations than any other intervention. It also allows students to model behaviors that need to be acquired and generalized to actual shopping situations (Morgan & Salzberg, 1992). In the videos, students view behaviors that they will perform and environments

that they will experience in grocery stores. Based on the advantages of video technology (Mechling, 2005), this intervention can be used for training on grocery purchasing skills by providing repetitive trials, immediate feedback, and decreased cost.

However, there exist no studies that examine the effectiveness of video technology in isolation for teaching grocery purchasing skills to students with ID; instead, researchers have combined this technology with other instructional methods, such as community-based instruction, classroom simulations, and computer technology. Researchers have indicated that these combinations can help students with ID to acquire and generalize grocery purchasing skills (Alberto et al., 2005; Bates et al., 2001; Cihak et al., 2006; Colyer & Collins, 1996; Morse & Schuster, 2000).

Concurrent Instruction

Although community-based instruction, classroom simulations, and video technology have been proven effective in teaching grocery purchasing skills to students with ID, some researchers have suggested that when simulated instruction (e.g., classroom simulations and video technology) and community-based instruction occur sequentially within a short interval (e.g., a day), students can acquire and generalize grocery purchasing skills more effectively (Cihak et al., 2006; Morse & Schuster, 2000; Alberto et al., 2005). This is because although simulated instruction does not present actual situations, students have the opportunity to become familiar with these situations through simulated instruction, and then this familiarity facilitates their ability to easily acquire and generalize grocery purchasing skills when they receive community-based instruction.

A total of three studies examined concurrent instruction. A study by Morse and Schuster (2000) examined the effectiveness of using a pictorial storyboard combined with community-based instruction in teaching grocery purchasing skills to ten elementary school students with moderate ID. A multiple probe across participants design was used in the study. During the baseline condition, the researchers took the students to a grocery store and had them independently shop for two grocery items. During the classroom simulations condition, a pictorial storyboard activity was used to teach the students the critical steps of grocery shopping. This storyboard contained thirteen color photographs regarding the critical shopping steps accompanied by the teacher's descriptions. Following the classroom simulations, community-based instruction was provided at a grocery store along with the CTD procedure. The researchers measured thirteen critical steps of grocery purchasing skills as the dependent variables across the conditions. The study reported that concurrent instruction (i.e., using a pictorial board and community-based instruction) is an effective means of teaching grocery purchasing skills to students with moderate ID. Six of the students reached the mastery level of grocery purchasing skills and successfully performed the critical steps in the maintenance condition. Due to time constraints resulting from the ending of the school year, even though two students did not complete the training, they demonstrated improvement in the skills. The remaining two students did not begin the training.

Alberto et al. (2005) also investigated the differences between two instructional conditions (i.e., video modeling combined with community-based instruction and picture prompts combined with community-based instruction). They taught eight secondary level students with ID two tasks [i.e., withdrawing money ($20) from an automatic teller

machine (ATM) and purchasing two grocery items using a debit card] using a one-on-one format. The researchers used an alternative treatment design to examine the relative effects of these two conditions. During the baseline condition, the students were asked to perform the tasks without any instruction. During the classroom instruction condition, the eight students were split into two groups. One group was given video modeling instruction while the other group was given picture prompting instruction. Then each group received the alternate type of instruction. After the classroom instruction had occurred, each student received community-based instruction. The percent of correct responses, number of errors, and number of sessions in using a debit card to withdraw cash and to shop for two grocery items were used as the dependent variables. The results demonstrated that both types of concurrent instruction are an effective means of teaching grocery purchasing skills to students with ID. The students' performance improved in both conditions. Although there were minor differences in performance among students between the two conditions, no functional difference between using picture prompts combined with community-based instruction and using video modeling combined with community-based instruction was verified.

In 2006, a similar study was conducted by Cihak et al. (2006). The researchers taught six middle school students with moderate ID two tasks [i.e., withdrawing money ($20) from an ATM and purchasing two grocery items using a debit card]. However, unlike Alberto et al. (2005), the researchers used a group format in teaching these skills. An alternative treatment design was used to compare the two conditions (i.e., video modeling combined with community-based instruction and picture prompts combined with community-based instruction). During the baseline condition, no instruction was

delivered while the students performed the tasks. During the classroom instruction condition, each student was assigned to one of two groups. While one group was instructed through video modeling, the other group was instructed through picture prompts. Then each group received the alternate instruction type. Community-based instruction followed the classroom instruction condition. The dependent variables were the same as in Alberto et al.'s (2005) study (i.e., the percent of correct responses, number of errors, and number of sessions in using a debit card to withdraw cash and to shop for two grocery items). The results of this study indicate that both instructional combinations are an effective and efficient means of teaching community skills such as grocery purchasing skills to students with moderate ID. The students' performance improved in both conditions. Even though minor differences were found in performance among students between the two conditions, significant differences between the instructional combinations were not observed. These results are consistent with the findings of Alberto et al. (2005).

Even though concurrent instruction is an effectual method of teaching grocery purchasing skills to students with ID, it may have the same barriers as community-based instruction (Mechling & Gast, 2003) or classroom simulations (Ayres & Langone, 2002; Collins, Stinson, & Land, 1993; Hutcherson et al., 2004; Langone et al., 1999; Mechling, 2004) reported previously. Therefore, Wissick et al. (1992) indicated that researchers should continue to explore instructional arrangements to address these barriers, and Alberto et al. (2005) suggested that various types of incorporation of simulated instruction and community-based instruction should be investigated.

Computer-Based Instruction (CBI)

The increasingly widespread use of computer technology in education has offered another possible intervention for teaching grocery purchasing skills to students with ID. One way this has manifested is in the technology of CBI, which is an instructional intervention that simulates real-world situations by using multimedia materials. Computer technology is a tool that simulates natural environments by incorporating various components such as text, photographs, animation, and videos (Hutcherson et al., 2004). Using this technology provides interactive components that promote the acquisition and generalization of acquired skills (Mechling et al., 2002) and may increase the likelihood of the generalization of acquired skills by providing multiple examples students will encounter in the real world (Mechling & Langone, 2000).

A total of two studies investigated CBI. Langone et al. (1999) investigated the effectiveness of CBI in teaching the discrimination of target grocery items (cereals) to three middle-school students with moderate ID. A CBI program, containing possible cereal photographs to simulate an actual grocery store, was used to teach these skills. The researchers employed a multiple probe across participants design in the study. The CBI program provided a wealth of opportunities to discriminate the target grocery items among various distractors during the intervention condition. Then the skills learned through the CBI program were assessed to ensure that these skills were generalized to actual grocery stores. Two dependent variables were used: (a) time to locate correct items, and (b) percent of correct item selections across the conditions. The researchers indicated that CBI alone may be as effective as community-based instruction for helping students with ID acquire and generalize grocery purchasing skills. Furthermore, the researchers

suggested that this intervention may be cost-effective and could be used across different levels of ID. All students' correct responses improved and time for location of the target items decreased.

Another study examining the effectiveness of CBI was conducted by Hutcherson et al. (2004). The researchers used a CBI program called *Project Shop* (Langone, Clees, Rieber, & Matzko, 2003) to deliver instruction on discrimination tasks for shopping to four students with moderate to severe ID. This CBI program included various photograph stimuli (i.e., 33 cereals, 22 canned soups, 21 frozen pizzas, and a shopping cart). A multiple probe across target behaviors (the selection of grocery items) design was replicated across participants. The CBI provided the students with video models for finding target items and with opportunities for training on finding target items. The percentages of correct responses during the computer intervention condition and the percentages of the correct location of target items during the grocery store condition were measured as the dependent variables. The results indicate that overall CBI is an effective means of teaching grocery purchasing skills to students with ID. The number of correct responses during the computer intervention condition increased for all students, and all students' performances in locating the target items correctly improved during the grocery store condition.

Because of the positive effects of CBI, Langone et al. (1999) recommended that researchers examine whether it is effective in teaching skills to students with more severe disabilities. Furthermore, because current studies on using computer technology have investigated only discrete segments of grocery purchasing skills (e.g., locating or paying

for grocery items), Hutcherson et al. (2004) have suggested that the effectiveness of using CBI to teach complete grocery purchasing skills should be explored.

Computer-Based Video Instruction (CBVI)

Researchers have recommended using CBVI to overcome the barriers mentioned in the previous sections (e.g., time and inconvenience) (Ayres & Langone, 2002; Ayres et al., 2006; Mechling, 2004; Mechling & Gast, 2003; Wissick et al., 1992). This intervention includes and intermixes various advantages of the other interventions. It provides students with realistic environments (e.g., videos and photographs) (Mechling, 2004; Mechling et al., 2002), video modeling (e.g., video clips) (Ayres et al., 2006; Mechling et al., 2002), and interactive activity (e.g., clicking) (Mechling, 2004; Mechling et al., 2002; Wissick et al., 1992). The combination of these components can help students with ID to acquire and generalize grocery purchasing skills (Ayres et al., 2006; Mechling et al., 2002).

A total of seven studies have investigated CBVI. In the early 1990s, the first attempts to examine the effectiveness of CBVI in teaching grocery purchasing skills to students with moderate ID began with a study by Wissick et al. (1992). Three secondary-level students with mild to moderate ID participated in the study. A multiple baseline across subjects design was used. The researchers used a computer program (i.e., video-disc simulation) including video footage and photographs to teach the students how to locate and purchase items at convenience and grocery stores. The program also provided the students with interactive components to promote their learning (e.g., touching buttons on the computer screen). Two types of dependent variables were collected (the number of extra actions and assistance needed, and the correct steps of grocery purchasing skills) in

two different settings (simulated classroom and community-based settings). The results indicate that overall CBVI is effective in teaching grocery purchasing skills to students with moderate ID. All participants demonstrated a decrease in extra actions and assistance needed and an increase in correct purchasing steps after the CBVI intervention.

Another study by Mechling et al. (2002) yielded additional meaningful findings on CBVI. The researchers taught grocery purchasing skills to four students with moderate ID using a CBVI program. In particular, they taught the students how to match the words for specific grocery items with category words on aisle signs and how to locate grocery items at actual grocery stores. A multiple probe across three grocery item sets design was replicated across the four participants. The CBVI program created by the researchers was used along with a least prompt procedure to teach these skills. Four grocery stores were used in the study. Three of them were videotaped and embedded into the CBVI program for the training and were used to assess the generalization of the acquired skills to trained settings. The remaining grocery store was not videotaped and was used to assess the generalization of the acquired skills to untrained settings. The program presented aisle sign and grocery items words for training on entering target aisles and locating target items using photographs and video recordings. Two critical steps (i.e., entering correct aisles and locating correct items) for target items were used as the dependent variables. The results indicate that CBVI is an effective means of teaching grocery purchasing skills to students with ID. All students performed better at entering the target aisles and locating the target items in both the CBVI and generalization conditions. Furthermore, the researchers report that CBVI alone is an effective method of teaching grocery purchasing skills and generalizing those skills to actual grocery stores.

Ayres and Langone (2002) examined whether or not CBVI alone was effective in teaching a *Dollar Plus* strategy to students. Three elementary school students with ID participated in the study, in which a multiple probe across participants design was replicated across five sets of grocery item prices. The researchers used a CBVI program, called *Dollar Plus*, along with CTD to teach the *Dollar Plus* strategy and a national chain grocery store for the pre- and post- generalization conditions. The program included subjective viewpoint video clips to provide five sets of dollar amounts in order: (a) set 1: amount to the whole dollar, (b) set 2: amounts between $1.01 and $2.99, (c) set 3: amounts between $3.01 and $5.99, (d) set 4: amounts between $6.01 and $8.99, and (e) set 5: amounts less than ten dollar. The correct responses (i.e., paying one dollar more than the dollar amounts of the totals) were used as the dependent variables. The results of the study demonstrate that although CBVI alone is somewhat sufficient in teaching the *Dollar Plus* strategy, it was not completely sufficient. None of the students mastered all five sets of dollar amounts, and the skills acquired through CBVI were not generalized to the grocery store. Two students mastered set 1 and showed progress in set 2; however, the other participant did not even master set 1, although he demonstrated slight progress in paying for up to one dollar for items.

Another study investigated the effectiveness of CBVI in teaching the location of grocery items. Mechling and Gast (2003) demonstrated how to match grocery aisle sign words with grocery items associated with the words, as well as the location of grocery items associated with the words. They employed three students with mild to moderate ID for the study. A multiple probe design across three sets of grocery word pairs, replicated across participants, was used. In order to teach these skills, the researchers created a

CBVI program containing text, photographs, and video clips which was used along with the CTD strategy during the intervention condition. Two actual grocery stores were used for generalization sessions. Locating the target items and removing items from the shelves correctly were measured as the dependent variables. The results of the study report that using CBVI facilitates the acquisition and generalization of locating and removing grocery items. All participants demonstrated better performance in locating the target grocery items during the CBVI training and post-generalization conditions. However, the researchers argued that although CBVI alone is an effective method for acquiring and generalizing grocery-purchasing skills, when CBVI is combined with community-based instruction, the acquisition and generalization of these skills would be promoted more effectively (Wissick et al., 1992).

Mechling (2004) continued the research on CBVI with a study evaluating its impact on increasing shopping fluency. In the study, three students with moderate ID were taught how to shop at a grocery store. These students had prior experience with participating in Mechling's (2003) study on locating grocery items. A multiple probe across participants design was used in the study. Training was provided on shopping for twelve grocery items (i.e., six grocery items whose names were directly presented on aisle signs and six grocery items whose names were not directly presented on aisle signs) using a CBVI program along with the CTD strategy. The program contained multi-media components (e.g., videos and photographs) and interactive components (e.g., clicking). The researcher measured the correct responses and the amount of time required to complete 10 steps for locating and obtaining the target items. The results indicate that overall, using CBVI alone is an effective strategy for teaching shopping skills to students

with ID. All participants showed progress in the location and selection of grocery items, and the acquired skills were generalized to the real grocery store. Also, the amount of time each student required to locate and select the target grocery items decreased.

Ayres et al. (2006) yielded additional meaningful findings on CBVI. They taught four middle-school students with ID *Dollar Plus*, which is a strategy for paying the appropriate dollar amount for purchases. In order to investigate effectiveness, a multiple probe across participants design was used in the study. The researchers used a portion of the *Project Shop* software package, containing photographs and videos, to teach the *Dollar Plus* strategy. During the CBVI intervention condition, this program provided the students with video models of how to pay with money and training on paying the appropriate dollar amount ($.01-$9.99) corresponding with the price of grocery items. During the intervention, the CTD procedure was used along with the CBVI program. Following the CBVI intervention condition, the generalization condition occurred in a grocery store. Two types of dependent variables were measured across the condition. One was the number of correct responses during the CBVI intervention condition (i.e., selecting the correct dollar amount), and the other was the number of correct responses during the generalization condition (i.e., paying the correct dollar amount). The findings of the study indicate that CBVI is effective in teaching the *Dollar Plus* strategy to students with ID. Three of the students exhibited progress in paying the total amounts correctly during the CBVI intervention condition and exhibited the generalization of the acquired skills during the generalization condition.

Most recently, Hansen and Morgan (2008) investigated the efficiency of using CBVI for helping students with ID to acquire and generalize grocery purchasing skills.

Three high school students with ID participated in the study. A multiple baseline across participants design was used, and the *Project Shop* software from Ayres et al.'s (2006) study was employed to teach the five steps of grocery purchasing skills. The instruction was delivered in the participants' school computer lab through a CBVI program, and four different grocery stores were used for the assessment of the generalization of the acquired skills. After several CBVI intervention sessions (4-5 times), assessments for computer performance mastery were conducted at the end of each week. Then weekly generalization sessions were conducted at an actual grocery store. Five steps of grocery purchasing skills were measured as dependent variables during the CBVI intervention and generalization conditions: (a) choosing a checkout stand; (b) placing three items on the checkout stand; (c) paying the correct amount using the *Dollar Plus* strategy; (d) responding to a cashier's question; and (e) obtaining change, receipt, and the purchased items. The researchers report that CBVI is an effective means of teaching grocery purchasing skills to students with ID. A significant increase in correct responses was observed during the intervention conditions for all participants, and all participants attained 100% correct responses during the generalization conditions (i.e., actual grocery stores).

Although CBVI has been proven as an effective and efficient intervention in teaching grocery purchasing skills to students with ID, more evidence is needed on the effectiveness of using CBVI (Ayres et al., 2006; Mechling et al., 2002; Wissick et al., 1992) in teaching these skills, and researchers recommend that the effects of the combination of CBVI and community-based instruction should be investigated as well (Bates et al., 2001; Mechling et al., 2002; Mechling & Gast, 2003).

Pros and Cons to the Interventions

There are both pros and cons to the current interventions in use for teaching grocery purchasing skills to students with ID (See Figure 1). For instance, even though community-based instruction might be one of the most advisable interventions for teaching life skills because it provides students with opportunities to train in the exact situations they will confront in communities (Wissick et al., 1992), researchers have indicated that the intervention is limited by the constraints of instructional resources such as funds, staff, and time. In addition, taking students out of the relatively protected environment of the school raises safety concerns (Mechling & Gast, 2003; Wissick et al., 1999).

Fortunately, there exists another intervention that can efficiently be used for teaching these skills. Classroom simulations can promote the generalization of acquired skills by providing multiple examples for instruction and practice (Browder, Snell, & Wildonger, 1988; Neef, Lensbower, Hockersmith, DePalma, & Gray, 1990) and are a relatively cost-efficient means of providing instruction and training on life skills (Hutcherson et al., 2004). However, even though the use of simulations in classroom settings is helpful for students to acquire target skills (McDonnell & Horner, 1985; Langone et al., 1999), classroom simulations may not provide stimuli that sufficiently approximate real-life situations in order to teach life skills (Collins et al., 1993; Langone et al., 1999; McDonnell & Ferguson, 1988; McDonnell & Horner, 1985) because they are limited in their ability to create real-world situations; that is, money pictures are not real money (Hutcherson et al., 2004; Mechling, 2004; Stokes & Baer, 1977).

Given the potential limitations of classroom simulations, another alternative method to community-based instruction is the intervention of video technology. Branham et al. (1999) have quantified the advantages of video technology: (a) immediate feedback and repetition of instructional trials as an effective strategy for instruction; (b) the reinforcement quality of video technology contributing to its positive effects; and (c) a cost-efficient format for delivering instruction. In spite of quite a few advantages, Mechling (2004) indicates that video technology poses technological inconveniences such as manual control of DVD/videotape players. While using this intervention, an instructor frequently needs to manipulate these DVD/videotape players to play, review, and pause.

Therefore, some researchers have recommended the use of concurrent instruction, which simultaneously provides opportunities for simulated instruction and practice in classroom settings and for instruction and practice in the natural environments of community settings (Cihak et al., 2006) to increase the possibility of acquisition and generalization of skills. However, this type of instruction may encounter the same problems of community-based instruction, classroom simulations, and/or video technology such as lack of funds and time, insufficiency of similarity to actual situations, and cumbersome technology.

Finally, CBI has also been considered an effective and efficient means of teaching life skills to students with ID. Using CBI facilitates the acquisition and generalization of skills by providing multiple examples, including various scenarios students may confront in community settings (Hutcherson et al., 2004; Mechling & Langone, 2000; Langone et al., 1999). Moreover, CBI allows students to repetitively practice the same tasks

(Hutcherson et al., 2004; Langone et al., 1999); however, this intervention does not include the advantages of using video technology, which allows students to imitate behaviors they are required to actually perform in community settings.

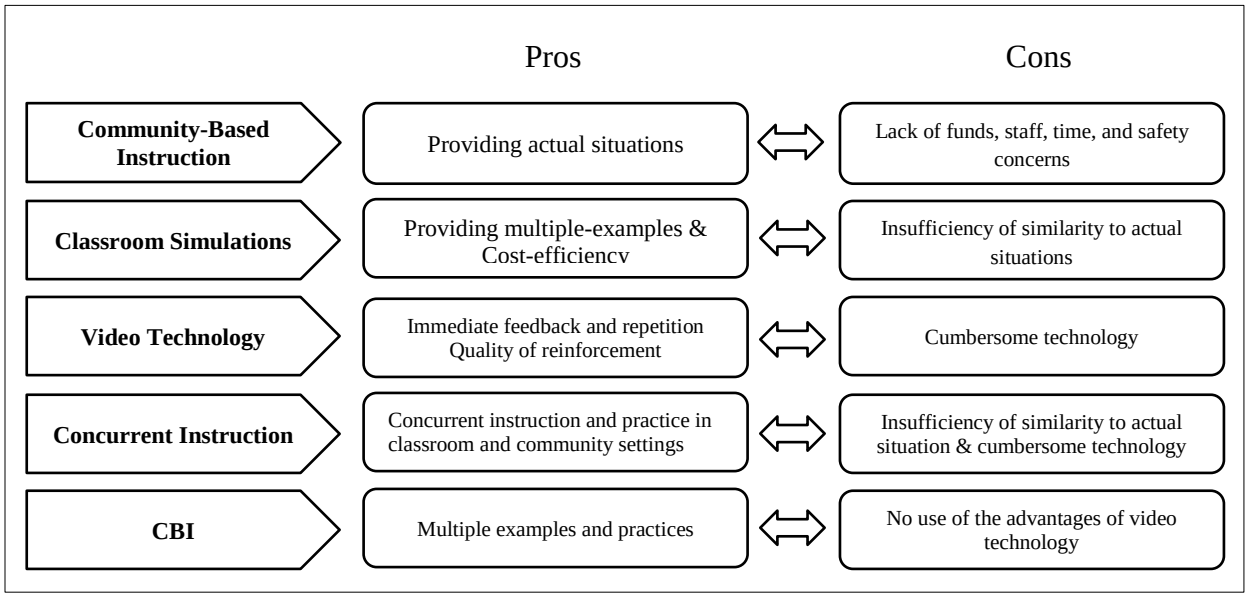

Figure 1. Pros and Cons of the Interventions to Teach Grocery Purchasing Skills

Considering these pros and cons, it is clear that enhancing CBI with video capacity overcomes some of these limitations and thus makes CBVI a promising new approach for teaching grocery purchasing skills to students with ID.

CBVI Intervention in this Study

As previously described, CBVI has several advantages in teaching life skills to students with disabilities, and thus a CBVI program was developed for the intervention in this study. During the development of this program, I made efforts to include the advantages of CBVI reported in the previous literature to maximize its effectiveness in

teaching grocery purchasing skills. Therefore, the program includes: (a) multiple examples (Branham et al., 1999; Mechling et al., 2002); (b) video technology (i.e., video modeling) (Ayres et al., 2006; Mechling et al., 2002); (c) interactive activity (Mechling, 2004); (d) repetitive practice (Mechling et al., 2002); and (e) cues for real-life situations (Wissick et al., 1992).

Since the 1980s, the literature on teaching life skills, such as grocery purchasing skills, to students with ID has repeatedly emphasized one key factor: the importance of providing a wide range of examples that students will encounter in actual environments. Even though it is clear that there may not always be a best choice of intervention for teaching grocery purchasing skills, when we consider all of the pros and cons of the interventions described above, CBVI could be one of the best options because it can repetitively provide a variety of examples using photographs and videos that represent a higher similarity to real world situations than any other materials. The use of CBVI for classroom training may also reduce the number of trials for traveling to actual community settings needed to acquire and generalize these skills.

Therefore, this study has two purposes. The primary purpose is to determine if CBVI is effective in teaching students with ID to locate grocery items in classroom settings. The secondary purpose is to determine if the skills acquired through CBVI in classroom settings generalize to actual grocery stores in community settings. This study adds to the current literature arguing that CBVI alone is effective and efficient in teaching grocery purchasing skills to students with ID (Mechling et al., 2002; Mechling, 2004) when using a CBVI program containing various components. Some previous studies have used CBVI along with instructional strategies, such as the CTD procedure (Ayres et al.,

2006; Mechling, 2004). This means that these studies changed two variables during the interventions, which may have impacted why researchers concluded that CBVI combined with other factors (e.g., the CTD strategy) is more effective than using CBVI alone. However, this study used only CBVI to determine whether CBVI is effective in teaching grocery purchasing skills to students with ID.

Table 1. *Overview of Studies on the Intervention of Teaching Grocery Purchasing Skills to Students with ID*

Reference (Intervention)	Participants	Teaching Materials	Design	Dependent Variables	Results
Ferguson & McDonnell (1991) (Community-based instruction)	6 students with mild ID [a] (CA [b] = 16.0 – 18.0 yrs.[c])	Grocery stores	Two-level multiple-baseline across participants	The percentage of the correct location of target items, the frequency of errors, and the correct selection of the target items during the generalization condition	Both methods of instruction are effective; however, the concurrent sequencing strategy is slightly more effective than the serial sequencing strategy
Wissick, Lloyd, & Kinzie (1992) (CBVI)	8 students with mild to moderate ID (CA = 12.0 – 17.0 yrs.)	CBVI program	Multiple-baseline across participants	The average number of extra actions and teacher assistance to locate and determine grocery items	All 3 students decreased the number of extra actions and assistance required in the location of the target grocery items
Sandknop, Schuster, Wolery, & Cross (1992) (Classroom simulations)	4 students with moderate to severe ID (CA = 14.0 – 19.0 yrs.)	Adaptive number line; index cards	Multiple-baseline across participants	The mean percentage of correct responses in selecting lower prices	All 4 students showed an improvement in these skills during the training sessions, and their performances were maintained

Table 1 (continued)

Reference (Intervention)	Participants	Teaching Materials	Design	Dependent Variables	Results
Colyer & Collins (1996) (Classroom simulations)	4 students with mild to moderate ID (CA = 12.0-14.0 yrs.)	Flash cards	Multiple probe across participants	The percent of correct responses for the correct amount of dollar bills	3 of 4 students acquired and generalized the skills to novel stores; one student was not able to finish the study due to ending the school year
Langone, Shade, & Clees (1999) (CBI)	3 students with moderate to severe ID (CA = 13.0-15.0 yrs.)	CBI program	Multiple probe across participants	Time to locate correct items; percent of correct item selections	All 3 students' correct responses improved and time for location of the target items decreased
Morse & Schuster (2000) (Concurrent instruction)	10 students with moderate ID (CA = 6.0 – 12.0 yrs.)	Pictorial storyboard; grocery store	Multiple probe across participants	13 critical steps of grocery purchasing skills	6 of the students reached the mastery level; maintained and generalized the skills
Bates, Cuvo, Miner, & Korabek (2001) (Community-based instruction)	20 young adults with mild ID (mean CA = 16.9); 20 young adults with moderate ID (mean CA = 17.4)	Classroom (pictorial board); grocery stores; restaurants; restrooms	Mixed factorial	The percentage of the selection of correct photographs during the classroom simulations condition; the percentage of correct steps during the generalization condition	Both instructional conditions are effective in teaching grocery purchasing skills with no significant statistical difference

Table 1 (continued)

Reference (Intervention)	Participants	Teaching Materials	Design	Dependent Variables	Results
Mechling, Gast, & Langone (2002) (CBVI)	4 students with moderate ID (CA = 9.0-17.0 yrs.)	CBVI program	Multiple probe across 3 sets of words design replicated across participants	Entering the target aisles and obtaining the target items	All 4 students improved on entering the target aisles and obtaining the location of the target grocery items
Ayres & Langone (2002) (CBVI)	3 students with mild to moderate ID (CA = 6.9-10.6 yrs.)	CBVI program (Dollar Plus software)	Multiple probe across 2 training sets design replicated across participants	The correct number of trials performed paying the exact dollar amount required	2 of 3 students mastered set 1 and showed progress in set 2 and the remaining student did not master set 1; all students did not generalize the acquired skills to actual grocery stores; however, all students showed improvement in the payment pattern
Mechling & Gast (2003) (CBVI)	3 students with mild to moderate ID (CA = 11.8-18.7 yrs.)	CBVI program	Multiple probe across 3 sets of associated word pairs design replicated across participants	Correct performance on locating items	While all 3 students improved entering the target aisles and locating the target grocery items and generalized the skills, a lack of generalization for some items

Table 1 (continued)

Reference (Intervention)	Participants	Teaching Materials	Design	Dependent Variables	Results
Hutcherson, Langone, Ayres, & Clees (2004) (CBI)	4 students with moderate to severe ID (CA = 14.3-16.0 yrs.)	CBI program	Multiple probe across target behaviors design replicated across participants	The percentages of correct responses during CBI condition; the percentages of the correct location of target items during generalization condition	All 4 students' performances during CBI and generalization conditions improved
Mechling (2004) (CBVI)	3 students with mild to moderate ID (CA = 13.0-19.11 yrs.)	CBVI program	Multiple probe across participants	Correct performance on reading target aisle signs and locating target grocery items	All 3 students mastered grocery purchasing skills in the generalized setting and improved shopping fluency
Alberto, Cihak, & Gama (2005) (Concurrent instruction)	8 students with moderate ID (CA = 11.0 – 15.0 yrs.)	Picture prompts & videotape; 3 ATMs & grocery stores	Alternative treatment	The percent of correct responses, number of errors, and number of sessions in using a debit card and shopping for two grocery items	No functional difference between picture prompts and video modeling combined with community-based instruction was verified
Cihak, Alberto, Taber-Doughty, & Gama (2006) (Concurrent instruction)	6 students with moderate ID (CA = 11.0 – 15.0 yrs.)	Picture prompts & videotape; 3 ATMs & grocery stores	Alternative treatment	The percent of correct responses, number of errors, and number of sessions in using a debit card and shopping for two grocery items	No functional difference between picture prompts and video modeling combined with community-based instruction was verified

Table 1 (continued)

Reference (Intervention)	Participants	Teaching Materials	Design	Dependent Variables	Results
Ayres, Langone, Boon, & Norman (2006) (CBVI)	4 students with mild to moderate ID (CA = 14 yrs.)	CBVI program (*Project SHOP*)	Multiple probe across participants	Obtaining target grocery items and correct payment	3 of 4 students acquired the Next Dollar strategy and generalized the strategy at a grocery store
Hansen & Morgan (2008) (CBVI)	3 students with ID; CA = 16.0-17.0 yrs.; moderate ID	CBVI program (*Project SHOP*)	Multiple baseline across participants	Obtaining target grocery items and using a five-step sequence to pay	Significant increase in correct responses for all 3 students at grocery stores; 100% correct responses at new grocery stores

[a] Intellectual disabilities.

[b] Chronological age.

[c] Years.

CHAPTER III

METHODS

Participants

Based on the nomination of their special education classroom teacher, four high school students with mild intellectual disabilities who had difficulty with grocery purchasing skills participated in this study. All students attended in a resource room for academic skills (e.g., reading and mathematics), living skills (e.g., grocery purchasing and food preparation skills), and job skills (e.g., assembling simple electric parts, packing simple items, and barista) in a large urban district in South Korea. All students had past experience with learning grocery purchasing skills; however, those experiences were not successful. All students also had experience working on computers in the school and at home. None of the students had any physical problems that affected their movements.

Al was a 17-year-old Korean male whose IQ was 44 (Korea Institute for Special Education-Korea Intelligence Test for Children: KISE-KIT). Academically he was able to read first grade level textbooks and calculate simple addition and subtraction questions. Socially he was very friendly and liked to play with other students.

Mig was an 18-year-old Korean male whose IQ was 55 (Korea-Wechsler Intelligence Scale for Children III: K-WISC III). He was able to read second grade level textbooks and perform simple addition and subtraction with regrouping. He had mild articulation difficulties occasionally resulting in communication problems. Socially, he liked to be alone and avoided eye contact.

Mar was an 18-year-old Korean male whose IQ was 47 (K-WISC III). He was able to read basic sight words and write simple spelling words. Also, he could perform simple two digit addition and subtraction. He enjoyed activities related to computers. He had low self-confidence resulting in tension in unfamiliar activities or situations.

Hoz was an 18-year-old Korean male whose IQ was 55 (K-WISC III). Academically he could read second grade level textbooks and calculate simple two-digit addition and subtraction. He exhibited a mild range of autistic behaviors (e.g., repeating phrases, getting upset by minor changes). Socially, he had difficulty initiating conversations with other people.

Prior to this study, several prerequisite skills were assessed to determine whether or not the students would be included. To identify the students, four skills were assessed: (a) purchasing skills, (b) reading skills, (c) matching skills, and (d) computer skills.

Pre-test of Grocery Purchasing Skills

Prior to the baseline conditions, I assessed the students' present purchasing skills at a national chain grocery store. In accordance with the current classroom curriculum, the special education classroom teacher chose three specific grocery items (e.g., Richam—a different brand of canned meat) from different aisles to be used in the study. The students had not been previously taught how to shop for these grocery items. No part of the grocery items' names was presented on the aisle signs (Mechling & Gast, 2003). I developed a shopping list (See Appendix P) with these three grocery items and quantities required for each (e.g., Richam – 1 can). The items on the shopping list were sequentially presented according to the layout of the grocery store . During the pre-test of purchasing skills, I took the students to the grocery store to assess their current levels of purchasing

skills. At the grocery store, I gave the students a pencil and the shopping list, which was held on a clipboard, and had them independently shop for the three items. These procedures were individually conducted with each student. Concurrently, the special education classroom teacher and I measured each student's shopping performance using a checklist (See Appendix A; Mechling, 1999) which had been slightly modified from the checklist used by Mechling (1999). I followed approximately two feet behind each student with a timer to measure responses, and the teacher followed approximately four feet behind each student with a timer for inter-observer reliability.

Mechling et al.'s (2002) seven steps of grocery purchasing skills were adopted and modified for this study. The seven steps were as follows: (1) obtaining a shopping cart, (2) entering the correct aisle, (3) obtaining the target grocery item on the shopping list, (4) putting the obtained grocery item in the shopping cart, (5) crossing out the obtained grocery item on the shopping list, (6) returning to the entrance of the aisle (either side), and (7) reaching a checkout counter. Some of the seven steps were repeated three times (i.e., steps 2-6) because the students were required to purchase three grocery items. Step 1 ("obtaining a shopping cart") and step 7 ("reaching a checkout counter"), however, occurred just once because once a shopping cart had been obtained it was used throughout the assessment; similarly, reaching a checkout counter was required only once for each shopping trip. Therefore, the sequence of the entire shopping steps was (1)-(2)-(3)-(4)-(5)-(6)-(2)-(3)-(4)-(5)-(6)-(2)-(3)-(4)-(5)-(6)-(7).

The completion of these 17 steps was measured during the pre-test condition. A *correct response* was defined as a correct performance of a step within the allotted time (See Table 2). An *incorrect response* was defined as an incorrect performance of a step within

the allotted time or a correct performance of a step outside of the allotted time. If a student performed a step incorrectly, I physically prompted the student using procedures similar to those proposed by Mechling and Gast (2003). For example, if a student entered an incorrect aisle for a target item, I physically guided the student to the entrance of the aisle and said “Keep looking”; if a student passed a target aisle, I physically guided the student back to the target aisle; if a student missed the target item or obtained the wrong item in the target aisle, I had the student get the correct item on the list associated with the aisle and asked “What is next?” The correct completion of a step after these verbal and physical prompts was considered an incorrect response. After completion of the shopping, I put the items back.

Each step was worth one point, and the total possible was 17 points. Students who scored five points (i.e., 29.4%), or below in the assessment were included in the study. Furthermore, I measured the total amount of time each student used to shop. In order to determine the time limit for these shopping tasks, I previously shopped for three grocery items at the grocery store and measured the amount of time required. Based on the results, I determined 10 minutes as the time limit for completing shopping. The shopping started at the entrance of the grocery store and finished at a checkout counter. The timing started once I gave a student a direction to shop (i.e., “Can you begin shopping for these three items?”), and stopped once the student reached a checkout counter. Reaching a checkout counter was defined as placing the cart in front of a waiting line or cashier. If a student did not score five points or below in the assessment, or the completion of the shopping tasks took over 10 minutes, the student was included in the study.

Table 2. *Definition of Correct Responses for Dependent Variables*

	Actual Grocery Store
Dependent Variables	Definitions of Correct Responses
Step 1 - Obtaining a shopping cart	Completion of getting a shopping cart and starting to push the cart toward the aisles within 20s after the researcher's direction to start shopping
Step 2 - Entering the first correct aisle	Completion of passing under the correct overhead aisle sign with the shopping cart within 120s after the completion of Step 1
Step 3 - Obtaining the first grocery item on the shopping list	Completion of holding and lifting the target item within 40s after the completion of Step 2
Step 4 - Putting the obtained grocery item in the shopping cart	Completion of putting down the obtained item in the shopping cart within 15s after the completion of Step 3
Step 5 - Crossing out the obtained grocery item on the shopping list	Completion of crossing out the obtained item on the shopping list with a pencil within 15s after the completion of Step 4
Step 6 - Returning to the entrance of the aisle	Completion of placing the cart at the end of the aisle (either side) within 20s after the completion of Step 5
Step 7 - Entering the second correct aisle	Completion of passing under the correct overhead aisle sign with the shopping cart within 40s after the completion of Step 6
Step 8 - Obtaining the second grocery item on the shopping list	Completion of holding and lifting the target item within 40s after the completion of Step 7
Step 9 - Putting the obtained grocery item in the shopping cart	Completion of putting down the obtained item in the shopping cart within 15s after the completion of Step 8

Table 2 (continued)

	Actual Grocery Store
Dependent Variables	Definitions of Correct Responses
Step 10 - Crossing out the obtained grocery item on the shopping list	Completion of crossing out the obtained item on the shopping list with a pencil within 15s after the completion of Step 9
Step 11 - Returning to the entrance of the aisle	Completion of placing the cart at the end of the aisle (either side) within 20s after the completion of Step 10
Step 12 - Entering the third correct aisle	Completion of passing under the correct overhead aisle sign with the shopping cart within 40s after the completion of Step 11
Step 13 - Obtaining the third grocery item on the shopping list	Completion of holding and lifting the target item within 40s after the completion of Step 12
Step 14 - Putting the obtained grocery item in the shopping cart	Completion of putting down the obtained item in the shopping cart within 15s after the completion of Step 13
Step 15 - Crossing out the obtained grocery item on the shopping list	Completion of crossing out the obtained item on the shopping list with a pencil within 15s after the completion of Step 14
Step 16 - Returning to the entrance of the aisle	Completion of placing the cart at the end of the aisle (either side) within 20s after the completion of Step 15
Step 17 - Reaching a checkout counter	Completion of placing the cart in a line or in front of a cashier within 80s after the completion of Step 16

Assessment of Reading Skills

I assessed the students' reading skills for aisle sign words associated with the grocery items (e.g., "Fruit Juice") and for the three grocery item words because they needed to read these words during the study (Mechling & Gast, 2003). For example, the students were asked to read aisle signs and grocery item words in the CBVI and computer-based assessment program, and to find the aisle signs and grocery items at the grocery store by reading these words. To assess these skills, I presented each aisle sign and grocery item word on flashcards, and asked the students to read each word (e.g., "Can you read this word?"). A *correct response* was defined as correctly reading the aisle sign or grocery item word within five seconds after the presentation of each flashcard. An *incorrect response* was defined as incorrectly reading or not reading the word. A correct response was worth one point, and an incorrect response was worth zero points. Therefore, the total possible for this assessment was six points (three points for reading three aisle sign words and three points for reading three grocery item words). Students who scored six points (i.e., 80 %) in the assessment were included in the study.

Assessment of Matching Skills

I asked the students to match the grocery item words (flashcards) with photographs of the grocery items and with actual grocery items (Mechling & Gast, 2003) because matching skills were required during the study. For example, the students were asked to choose the photographs of the grocery items during the CBVI intervention and to find the grocery items at the grocery store. The words for the three grocery items used in the pre-test were used for the assessment. During the assessment, I presented photographs of each grocery item directly to each student. Then, I showed each grocery

item word to the student and asked the student to choose a photograph that represented the word presented (e.g., “Show me the picture of this word.”). After this, the student was asked to match each grocery word with the correct actual grocery item. A *correct response* was defined as choosing a correct photograph or actual grocery item within five seconds after the presentation of each word. An *incorrect response* was defined as choosing an incorrect photograph or actual grocery item or not choosing a photograph or actual grocery item. A correct response was worth one point, and an incorrect response was worth zero points. Therefore, the total possible for this assessment was six points (three points for matching the grocery item words with the grocery photographs and three points for matching the grocery item words with actual grocery items). Students who scored six points (i.e., 80%) in the assessment were included in the study.

Assessment of Computer Skills

I assessed the computer skill of using a computer mouse (i.e., clicking) because the CBVI and computer-based assessment programs used in this study required the students to use a mouse. In order to assess these skills, I developed a program that adopted and slightly modified the procedures used by Wissick et al. (1992) (See Appendix C and D). The procedures were as follows: (a) when a circle button (0.5 inch × 0.5 inch) was presented, the students clicked on the circle and (b) when an arrow button (1 inch × 0.5 inch) was presented, the students clicked on the arrow. The circle and arrow buttons were randomly placed on the screen. When a student clicked on the circle or arrow buttons, the click led the student to the next question. Even if the student did not correctly click on the circle or arrow buttons, each click led the student to the next question; however, these occasions were considered incorrect responses. The circle and

arrow buttons were presented five times each. A *correct response* was defined as clicking on a circle or arrow button on the screen within 10 seconds. An *incorrect response* was defined as incorrectly clicking or not clicking on a circle or arrow button on the screen. If the student did not click on anything within 10 seconds, the program automatically advanced to the next question, and the response was considered incorrect. The students' responses were automatically scored by the program. A correct response was worth one point, and an incorrect response was worth zero points. Therefore, the total possible for this assessment was10 points (five points for clicking on the circle buttons and five points for clicking on the arrow buttons). Students who scored eight points (i.e., 80%), or above in the assessment were included in the study.

Settings

This study took place in two settings. The first was the students' high school special education classroom, which was used for the baseline and CBVI conditions. The classroom measured approximately 35 ft by 25 ft. A laptop for the intervention and dependent measures was positioned on a desk near the corner of the classroom. The second was two national chain grocery stores. One grocery store was depicted to the students through the CBVI program during the intervention and was also used for the pre- and post-test conditions. This store was located approximately 20 minutes by car from the students' school. The other grocery store was not depicted to the students during the intervention and was also used for generalization store condition. This store was located approximately 30 minutes by car from the students' school. Each grocery store used different aisle sign words for the same grocery items. For example, one store used "meat

canned food" as an aisle word for the third target item, but the other store used only "canned food" as the aisle word for the third target item. The first grocery store was chosen because the students frequently visited this store to shop for grocery items and to practice grocery purchasing skills, and the other store was chosen to determine if the acquired skills were generalized to an unfamiliar grocery store.

Materials

Equipment

An *HP Pavilion g series* laptop was used to run the CBVI and computer-based assessment programs. A *CANNON EOS 5D Mark III* digital camera was used to photograph the aisle signs and grocery items and to make the video recordings required to develop the CBVI program. *Adobe* Photoshop CS5 software was used to edit the photographs, and *SONY* Vegas pro 11.0 software was used to make the video clips for the CBVI program. *Adobe* Flash Professional CS5 software was used to develop the CBVI and computer-based assessment programs including the photographs and video clips.

Checklist

A checklist for the purchasing skills (Appendix A) was adopted and modified to collect data for the pre- and post-test, and generalization conditions. It included student name, data, location, observer, session, score, start time, end time, duration, and the steps of purchasing skills (i.e., 17 steps).

Video Clips

I made 17 short video clips to teach the steps of purchasing skills (See Appendix E). Each video clip lasted approximately 10-20 seconds. I hired an actor and developed a

script (See Appendix F) for the actor, who behaved like a shopper to present the sequence of steps as seen in the 17 clips. Additionally, a close-up technique was used to present some key factors in the video clips. For example, a clip could present a lot of detail about the location of a target grocery item by using the close-up technique (See Appendix G and Appendix H).

Experimental Design

In order to investigate the effectiveness of CBVI on acquisition and generalization of purchasing skills, this study used a multi-probe multiple baseline across subjects design (Kazdin, 1982). This design allowed the researcher to examine the effects of the intervention on the acquisition of purchasing skills which were not reversible. During the study, I collected baseline data across the four students. After the first student reached stable data I began his intervention, while continuing to collect baseline data intermittently with the remainder of the students. In comparison to continuous baseline data collection, collecting baseline data intermittently minimized the effects of testing and maturation on the students (Ayres & Langone, 2002). Once the first student reached the skill acquisition criterion, I implemented the intervention with the second student. I then repeated this procedure with the remainder of the students. Delayed and sequential implementation of the intervention allowed the researcher to demonstrate and replicate the effects of intervention across students, thus strengthening the internal validity of the study (Barlow, Nock, & Hersen, 2008).

Procedure

Baseline Condition

The baseline condition took place following the pre-test condition. I conducted the procedure with each student. The baseline sessions occurred 1-2 times per day, and each session lasted approximately 5 minutes. The computer-based assessment program was used to assess the students' knowledge of each step of purchasing skills. The first student sat in front of the laptop in the classroom, and I sat next to the student. In each session, the multiple choice questions associated with the steps of grocery purchasing skills were given to the student through the computer-based assessment program. The three grocery items used for the pre-test were used to develop these questions. The first screen of the computer-based assessment program included the title of the program and a "*Start*" button (See Appendix I). At the beginning of each session, I directed the student to click on the "*Start*" button (i.e., "If you are ready to start this computer program, click on the "Start" button in the middle of the screen."). In the second screen (See Appendix K), a virtual shopping list was presented with a voice recording (i.e., "This is the shopping list for today."), and the student clicked on an arrow button in the bottom right hand corner of the screen to advance to the questions. Also, a smaller virtual shopping list with the three grocery items was displayed in the top right hand corner of the screen to allow the student to continuously view the shopping list during the assessment. The sequence of the grocery items in the virtual shopping list was the same as the sequence of the grocery items in the shopping list used for the pre-test condition. The student was asked to choose responses that represented the correct steps of purchasing the grocery items in sequence (e.g., "Using the aisle signs, what aisle would you go to in order to get

the first item on your shopping list?"). The computer-based assessment program gave the students 17 written multiple-choice questions to assess the purchasing skills: (a) one multiple choice question for the first step (i.e., step 1), (b) 15 multiple choice questions for the five middle steps (i.e., repetition of steps 2-6), and (c) one multiple choice question for the last step (i.e., step 7). Each question contained four text or photograph options. Text options were used in steps 1, 4, 5, 6, and 7, and photograph options were used in steps 2 and 3. For example, an option for step 1 was "b. Get a shopping cart," and an option for step 3 was "b. A photograph of a grocery item" (See Appendix L). Each question included one correct option and three incorrect options. The sequence of these options was randomly presented in each question. When a question and its options were presented, the question was provided with a voice recording. After the completion of the voice recording, the options were presented, and the program started a 10-second timer (See Appendix M).

A *correct response* was defined as choosing a correct option within 10 seconds after the presentation of each question. After choosing one option, the student advanced to the next question by clicking on an arrow button on the bottom right hand corner of the screen. An *incorrect response* was defined as choosing an incorrect option, or not choosing any options within 10 seconds. If the student did not respond to a question within 10 seconds, the computer-based assessment program automatically advanced to the next question, and this occurrence was considered an incorrect response. The student's responses were automatically scored by the program. A correct response was worth 1 point, and an incorrect response was worth 0 points. Therefore, the total possible was 17 points for each session. The final score was expressed as a percentage, and I

recorded the percentage on the score sheet (Appendix N). Regardless of the student's responses, the computer-based assessment program did not give any prompts or feedback. Once the student completed the assessment, the computer program visually provided neutral praise (e.g., "Good job") on the middle of the screen, and I also provided verbal and physical praise (e.g., "Good job" or clapping). After the first student demonstrated the stability of at least three consecutive data points during the baseline condition, that student began the CBVI intervention. The same procedures were repeated across the remaining students. While a student was involved in the baseline and CBVI conditions, the remaining students to whom the intervention had not yet been delivered were intermittently measured for the baseline data with the same procedures used for the first student. This intermittent data collection occurred 1-2 times per week.

CBVI Condition

The CBVI condition took place following the baseline condition. I conducted these procedures with each student. The intervention sessions occurred 1-2 times per day, and each session lasted approximately 15 minutes. Each intervention session included (a) instruction on grocery purchasing skills using the CBVI program which I developed (See Table 3 and Appendix B) and (b) assessment of the student's acquisition of purchasing skills using the computer-based assessment program. In order to develop the CBVI program, I used and slightly modified a framework of the CBVI program developed by Mechling (2004). The CBVI program delivered instructions regarding the 17 steps of grocery purchasing skills at the grocery store. It looked like individualized tutorial courseware, providing instructional video clips and interactive components (e.g.,

clicking). Aside from the title, the first two screens of the program (See Appendix J and K) were the same as the first two screens of the computer-based assessment. The same

Table 3. *Components of the CBVI Program*

Step	Content	Video	Question
Step 1	Obtaining a shopping cart	1	1
Step 2	Entering the first correct aisle	1	1
Step 3	Obtaining the first grocery item on the shopping list	1	1
Step 4	Putting the obtained grocery item in the shopping cart	1	1
Step 5	Crossing out the obtained grocery item on the shopping list	1	1
Step 6	Returning to the entrance of the aisle	1	1
Step 7	Entering the second correct aisle	1	1
Step 8	Obtaining the second grocery item on the shopping list	1	1
Step 9	Putting the obtained grocery item in the shopping cart	1	1
Step 10	Crossing out the obtained grocery item on the shopping list	1	1
Step 11	Returning to the entrance of the aisle	1	1
Step 12	Entering the third correct aisle	1	1
Step 13	Obtaining the third grocery item on the shopping list	1	1
Step 14	Putting the obtained grocery item in the shopping cart	1	1
Step 15	Crossing out the obtained grocery item on the shopping list	1	1
Step 16	Returning to the entrance of the aisle	1	1
Step 17	Reaching a checkout counter	1	1

Note. *Step* refers to the entire sequence of purchasing skill steps for three target items; the *question* is a multiple choice question related to each step.

direction used in the baseline condition was given to the first student to begin the intervention (i.e., “If you are ready to start this computer program, click on the “Start” button in the middle of the screen.”). After the student began the program, each step of

purchasing skills was illustrated by 17 short instructional video clips in which an actor presented and delivered the instruction required. The CBVI program's sequence of video clips was the same as the 17 steps of shopping for the three grocery items. Following each video clip, the student was asked the same questions used for the computer-based assessment program. However, each question was presented simultaneously with its four options. During the intervention condition, if the student responded correctly, auditory praise (e.g., "Good job") was given while visual praise (e.g., "Good job") was presented at the bottom middle of the screen. If the student responded incorrectly, an auditory prompt (e.g., "Try again") was given while a visual prompt (e.g., "Try again") was presented at the bottom middle of the screen. If a student did not begin to respond to the questions within the allotted time (10s), the CBVI program automatically provided auditory prompts (e.g., "What is the correct answer?"), and if the student again did not respond to the questions within the new allotted time (10s), a small red dot showed up in the bottom left hand corner of the screen. At this time, I gave the student the correct response (e.g., "The correct answer is _____"); had the student click on the correct response with gesture prompts (e.g., pointing out the correct responses); and prompted the student to move to the next question (e.g., "Can you click the arrow button?"). The student's responses were automatically scored by the program. A correct response was worth one point, and an incorrect response was worth zero points. Therefore, the total possible was 17 points for each session. The final score was expressed as a percentage, and I recorded the percentage on the score sheet. These scores were not considered as dependent measures, but as referential data for discussion.

Following the CBVI intervention, I assessed the progress of the students' acquisition of purchasing skills. The same procedures and computer-based assessment program used in the baseline condition were used for these measures. The criterion of task completion for each session was a score of 14 points (i.e., 82.4%) or above. Once the first student reached the criterion for three consecutive sessions, the intervention was stopped for that student, and then a subsequent student began the baseline condition. These procedures were repeated across the remaining student.

Dependent Variables

Two types of dependent variables were collected during different conditions and in different ways. The first type was correct responses during the computer-based assessment condition, and the second type was correct performances during the two generalization conditions.

Computer-Based Assessment Condition

During the baseline and CBVI conditions, I used the computer-based assessment to measure the dependent variables. This assessment automatically scored the students' responses. The total possible was 17 points for each session. The final score was expressed as a percentage, and I recorded the percentage on the score sheet (Appendix N). For this, I divided the gained point(s) by the total points, and then multiplied the results by one hundred (e.g., [3/17] × 100).

Pre- and Post-test, and Generalization Conditions

The special education classroom teacher, a graduate student in the special education program, and I measured the data for the completion of the 17 steps of

purchasing skills at the grocery store for the pre- and post-test, and generalization conditions. The same procedures as used in the pre-test were used to collect data during the post-test and generalization conditions. After each student reached the criterion of task completion in the CBVI condition, the post-test and generalization conditions occurred to ensure that the purchasing skills acquired through the CBVI program were generalized to the actual grocery stores. The generalization condition individually occurred for each student regardless of the progress of the remaining students' acquisition of these skills. Two sessions occurred for each student at the grocery store depicted in the CBVI program. After all students finished the post-test condition, the generalization condition individually occurred for each student at the grocery store not depicted in the CBVI program. The same method used for the computer-based assessment condition was used to calculate a percentage of the final score for each condition.

Inter-Observer Reliability

The resource room teacher and graduate student collected data for inter-observer reliability at the grocery stores. Before the pre-test, I trained the teacher to score the students' responses during the pre-test and generalization conditions. During the training, I first explained the procedures of data collection. Then, another staff member (i.e., a paraprofessional) pretended to shop for the three grocery items at the grocery store for the generalization condition, and the teacher and I collected the data for the 17 steps of purchasing skills in the classroom. After this classroom training, we went to the first grocery store and conducted training for collecting the data. After 100% agreement on data collection for the two raters occurred for three consecutive training sessions, the

training was stopped. The teacher collected the data in the pre-test condition and in the first session of the first student's generalization condition. However, after this the teacher stopped collecting data because of health problems. Therefore, the graduate student started collecting the data for the generalization conditions after that student received the same training for two grocery stores.

This data collection occurred in all sessions of the pre- and post-test, and generalization conditions. I used a point-by-point agreement method (Kennedy, 2005) to calculate inter-observer agreement by (a) dividing the number of agreements by (b) the number of agreements plus disagreements and then (c) multiplying by one hundred. During the CBVI condition, the computer-based assessment program collected all data; therefore, inter-observer reliability was not necessary. I converted the point scores collected by the computer-based assessment program during the baseline and CBVI conditions to percentage scores. The results were as follows: the mean inter-observer agreement was 98.9% (range = 94.1%-100%) across all students during the three conditions (100% for the pre-test condition, 97.8% for the post-test condition, and 100% for the generalization condition).

Procedural Fidelity

Procedural fidelity was established by using a procedural fidelity checklist (See Appendix O). Before the CBVI condition for the first student, I trained the teacher and graduate student to observe the steps of implementation. For this training, I pretended to implement the intervention to a paraprofessional, and then the teacher observed and scored the accuracy of implementations with the checklist. During the CBVI condition,

the teacher and graduate student observed and scored the procedures of the intervention. The teacher made the first three observations, and the graduate student made the last five due to the teacher's health problems. The procedural fidelity checklist included seven steps related to the implementation of the CBVI intervention, and the data of procedural fidelity were collected during 50% of CBVI sessions across the students. To compute the procedure fidelity, the total number of correct procedural performances was divided by the total number of procedural performances, and the results were multiplied by one hundred. Mean procedural fidelity was 100% across all students.

CHAPTER IV

RESULTS

The results of this study investigating the effectiveness of CBVI in teaching the location of grocery items to students with intellectual disabilities are presented in this chapter. Findings are summarized briefly in accordance with the research questions.

Experimental Criteria

In visual analysis, four criteria were used: (a) the magnitude of changes, (b) the immediacy of effects, (c) the trend of changes, and (d) the consistency of data patterns (Horner et al., 2005). In accordance with these criteria, a combination of data from the multiple measurements and comparisons in this study was used to determine whether a functional relationship exists between the effectiveness of teaching the location of grocery items to students with intellectual disabilities and the use of CBVI.

Magnitude of Changes

The magnitude of changes refers to shifts in students' performance averages across conditions. Consistent changes in the average frequency of desired behaviors provide a basis to determine if data meet the criteria of study designs (Horner et al., 2005; Kazdin, 1982; Tawney & Gast, 1984).

Immediacy of Effects

The immediacy of effects refers to level changes between the last three data points in one condition and the first three data points in the next condition (Kratochwill et al., 2010). Immediate changes may yield more convincing inferences about the effectiveness of CBVI

Trend of Changes

The trend of changes refers to the tendency in the slope of the data points to present systematic increases or decreases across conditions. The implementation of the intervention can present an accelerating slope or a decelerating slope of data points on behavior changes (Barlow, Nock, & Hersen, 2008).

Consistency of Data Pattern

The consistency of data pattern refers to inspection of data within the same or similar conditions and also to the extent to which data patterns are consistent across conditions (Horner et al., 2005; Hersen & Barlow, 1976; Kennedy, 2005).

Acquisition and Generalization of Grocery Locating Skills

Figure 2 presents the percentage of correct responses in the students' performances on the acquisition of the skills of grocery locating skills in the classroom and on the generalization of the acquired skills at the grocery stores.

Individual Results

Al

During the pre-test condition, Al completed 11.8% of the steps of grocery shopping independently. During the baseline condition, he answered a mean of 49.0% of the questions related to the steps of grocery shopping correctly (range 47.1% - 52.9%). When he started receiving intervention using CBVI, he immediately improved his knowledge of the steps with an upward trend and reached the criterion (82.4%) of task completion in three consecutive sessions (range 88.2% - 100%). He answered a mean of 94.1% of the steps correctly. He also generalized the procedural knowledge he learned through the

CBVI program to the grocery store used for the pre-test condition. During the post-test condition, he completed a mean of 79.4% of the steps independently (range 70.6% - 88.2%), a 67.6% increase as compared to the pre-test condition. During the generalization condition (new grocery store), he completed 52.9% of the steps independently.

Mig

During the pre-test condition, Mig completed 17.6% of the steps of grocery shopping independently. During the baseline condition, he answered a mean of 42.6% of the questions related to the steps of grocery shopping correctly (range 35.3% - 52.9%). After he began receiving the intervention, he immediately improved his knowledge of the steps and reached the criterion of task completion in three consecutive sessions (range 100%). He also generalized the procedural knowledge he learned through the CBVI program to the grocery store used for the pre-test condition. During the post-test condition, he completed a mean of 94.1% of the steps independently (range 94.1%), a 76.5% increase as compared to the pre-test condition. During the generalization condition, he completed 58.8% of the steps independently.

Mar

During the pre-test condition, Mar completed 0% of the steps of grocery shopping independently. During the baseline condition, he answered a mean of 25.9% of the questions related to the steps of grocery shopping correctly (range 17.6% - 29.4%). When he started receiving the intervention, he gradually improved his knowledge of the steps and reached the criterion of task completion in six sessions (range 17.6% - 100%). He answered a mean of 73.5% of the steps correctly. He also generalized the procedural knowledge he learned through the CBVI program to the grocery store used for the pre-

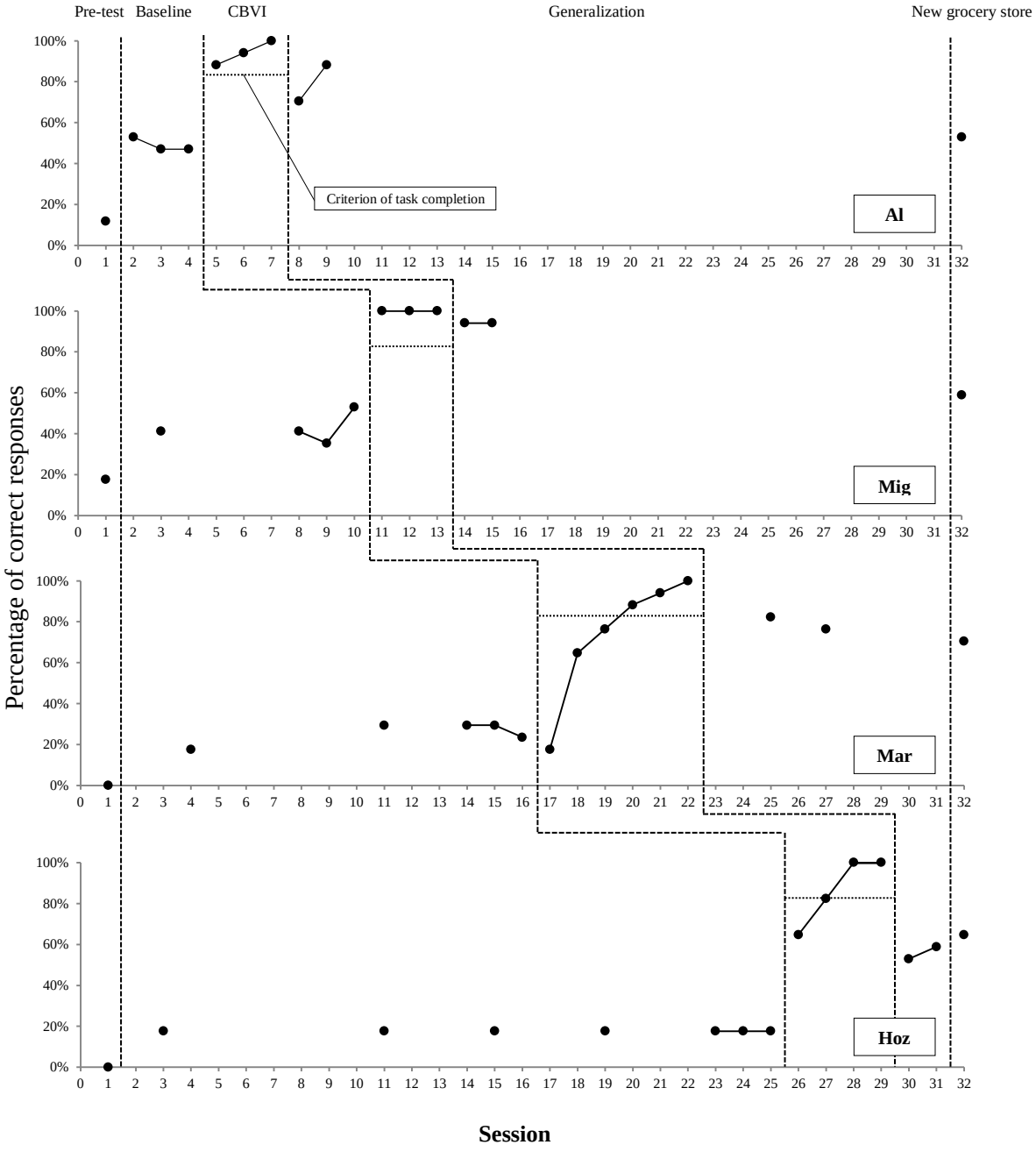

Figure 2. Percentage of Correct Responses in the Students' Performances on the Acquisition of Grocery Locating skills in the Classroom and Generalization of the Skills to the Actual Grocery Stores

test condition. During the post-test condition, he completed a mean of 76.5% of the steps independently (range 70.6% - 82.4%), a 76.5% increase as compared to the pre-test condition. During the generalization condition, he completed 70.6% of the steps independently.

Hoz

During the pre-test condition, Hoz completed 0% of the steps of grocery shopping independently. During the baseline condition, he answered a mean of 17.6% of the questions related to the steps of grocery shopping correctly (range 17.6%). When he began to receive intervention using CBVI, he immediately improved his knowledge of the steps and reached the criterion of task completion in four sessions (range 64.7% - 100%). He answered a mean of 86.8% of the steps correctly. He also generalized the procedural knowledge he learned through the CBVI program to the grocery store used for the pre-test condition. During the post-test condition, he completed a mean of 55.9% of the steps independently (range 52.9% - 58.8%), a 55.9% increase as compared to the pre-test condition. During the generalization condition, he completed 64.7% of the steps independently.

Analysis of Grocery Items

Located Correctly and the Completion of the Last Step

In order to closely examine the effectiveness of CBVI in teaching grocery purchasing skills, I also analyzed data on the number of grocery items located correctly and the completion of the last step during grocery store conditions (i.e., pre- and post-test, and generalization conditions).

Individual Results

Al

Table 4 presents the number of items Al located correctly and the completion of the last step during grocery store conditions. During the pre-test condition, he located one target item correctly and could not complete the last step (i.e., reaching a checkout stand). In session 1 of the post-test condition, his performance improved; he located three target items correctly and completed the last step. In session 2 of the post-test condition, he located two target items and completed the last step. However, during the generalization condition, his performance decreased. He located one target item and could not complete the last step.

Table 4. *Al's Number of Items Located Correctly and the Completion of the Last Step*

Condition	The number of items located correctly	Completion of the last step
Pre-test	1	No
Post-test (session 1)	3	Yes
Post-test (session 2)	2	Yes
Generalization	1	No

Mig

Table 5 presents the number of items Mig located correctly and the completion of the last step during grocery store conditions. During the pre-test condition, he located two target items correctly and could not complete the last step. In session 1 of the post-test condition, his performance improved; he located three target items correctly and completed the last step. In session 2 of the post-test condition he maintained this

Table 5. *Mig's Number of Items Located Correctly and the Completion of the Last Step*

Condition	The number of items located correctly	Completion of the last step
Pre-test	2	No
Post-test (session 1)	3	Yes
Post-test (session 2)	3	Yes
Generalization	1	Yes

performance, locating three target items and completed the last step. However, during the generalization condition his performance decreased. He located one target item and completed the last step.

Mar

Table 6 presents the number of items Mar located correctly and the completion of the last step during grocery store conditions. During the pre-test condition, he located zero target items correctly and could not complete the last step. In session 1 of the post-test condition, his performance improved in locating the target items, but his performance

Table 6. *Mar's Number of Items Located Correctly and the Completion of the Last Step*

Condition	The number of items located correctly	Completion of the last step
Pre-test	0	No
Post-test (session 1)	3	No
Post-test (session 2)	1	No
Generalization	1	Yes

in purchasing the target items did not change. He located three target items correctly but could not complete the last step. In session 2 of the post-test condition, Mar's performance decreased. He located one target item and could not complete the last step. During the generalization condition, his performance continued at this low level; he located one target item and completed the last step.

Hoz

Table 7 presents the number of items Hoz located correctly and the completion of the last step during grocery store conditions. During the pre-test condition, he located zero target items correctly and could not complete the last step. In session 1 of the

Table 7. *Hoz's Number of Items Located Correctly and the Completion of the Last Step*

Condition	The number of items located correctly	Completion of the last step
Pre-test	0	No
Post-test (session 1)	2	No
Post-test (session 2)	2	No
Generalization	2	No

post-test condition, Hoz's performance somewhat improved in locating the target items, but his performance in purchasing these items did not change. He located two target items correctly but could not complete the last step. In session 2 of the post-test condition he maintained his performance, locating two target items and could not complete the last step. During the generalization condition, his performance continued at the same level. He located two target items and could not complete the last step.

Procedural Error Analysis of Baseline and Intervention Conditions

I analyzed procedural errors to measure efficiency during baseline and intervention conditions for each student.

Individual Results

Al

Figure 3 presents the number of errors Al made in the steps of locating grocery items during the baseline and intervention conditions. During the baseline condition, he did not respond correctly to steps 1, 2, 9, 11, and 15 at all; he responded somewhat correctly to steps 4, 5, 6, 10, 12, 14, and 16; and he reached a mean of 100% correct of steps 3, 7, 8, 13, and 17. However, he reached 100% correct of all steps in the final session of the intervention condition.

Mig

Figure 4 presents the number of errors Mig made in the steps of locating grocery items during the baseline and intervention conditions. During the baseline condition, he did not respond correctly to steps 2, 6, 10, 11, 14, and 15 at all; he responded somewhat correctly to steps 1, 4, 5, 7, 8, 9, 12, 13, and 16; and he reached a mean of 100% correct of steps 3 and 17. However, he reached 100% correct of all steps in the final session of the intervention condition.

Mar

Figure 5 presents the number of errors Mar made in the steps of locating grocery items during the baseline and intervention conditions. During the baseline condition, he did not respond correctly to steps 1, 2, 7, 11, and 14 at all; he responded somewhat

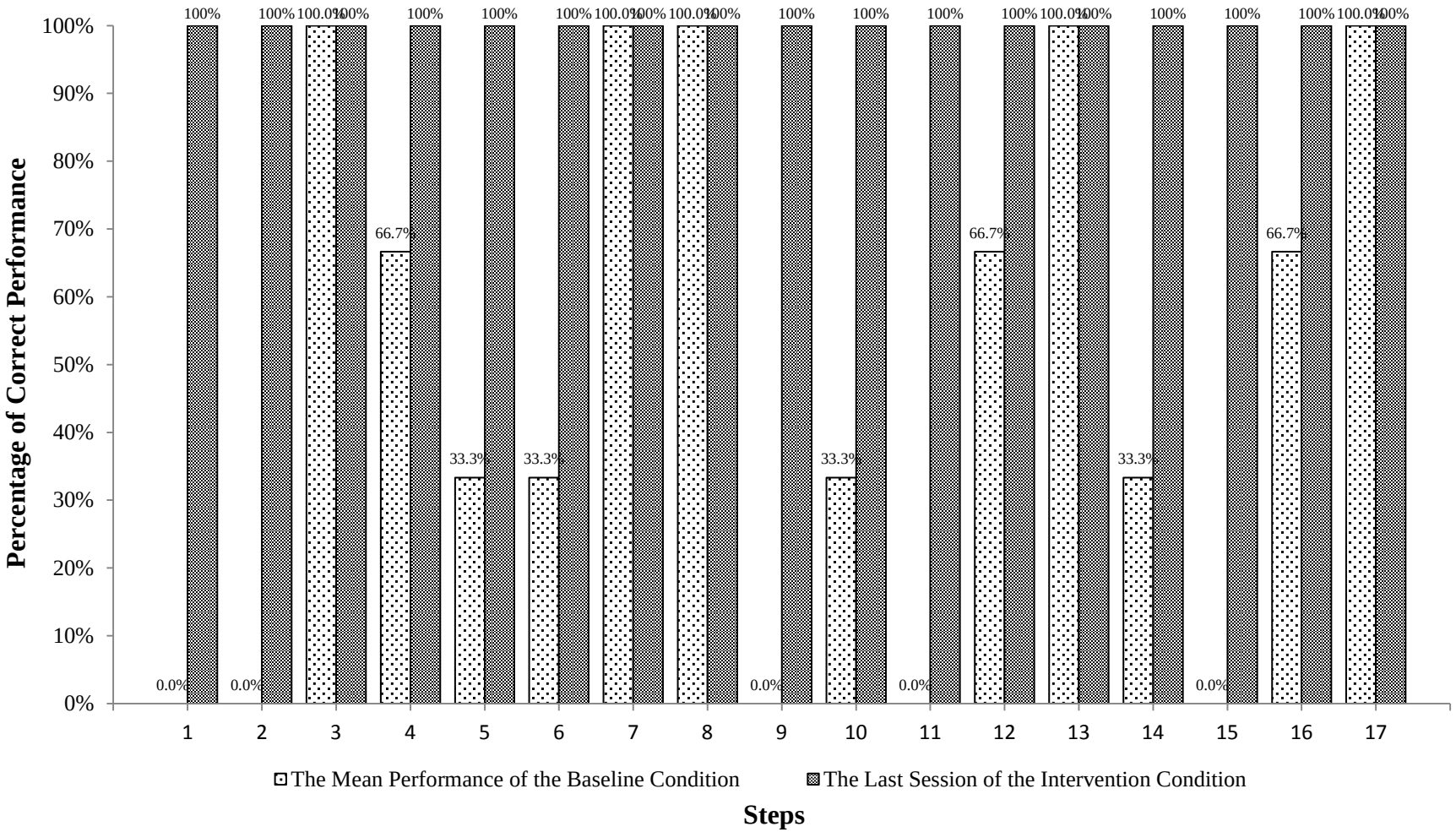

Figure 3. Al's Mean Performance of Each Step in the Baseline Condition and Performance of Each Step in the Final Session of the Intervention Condition

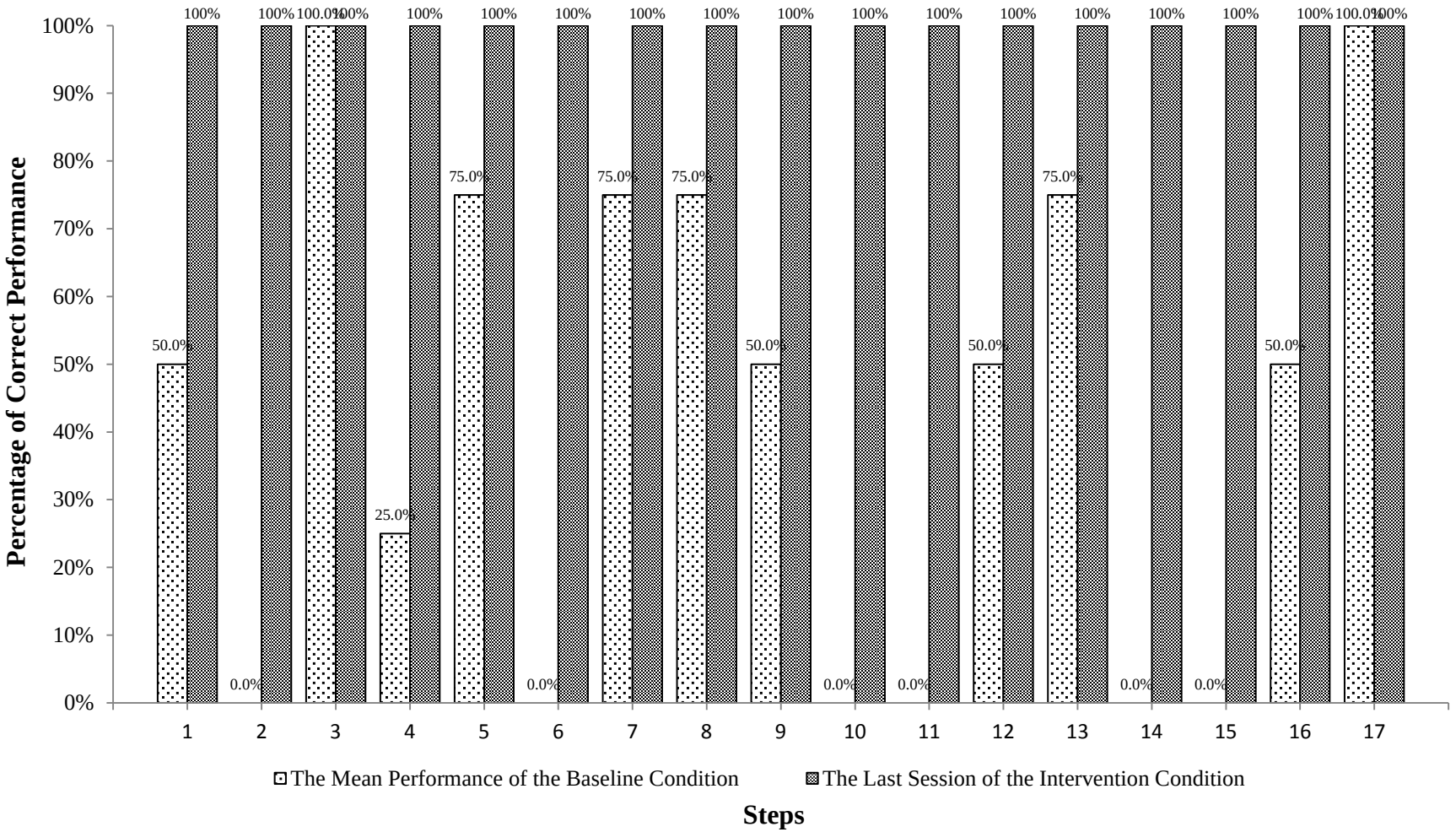

Figure 4. Mig's Mean Performance of Each Step in the Baseline Condition and Performance of Each Step in the Final Session of the Intervention Condition

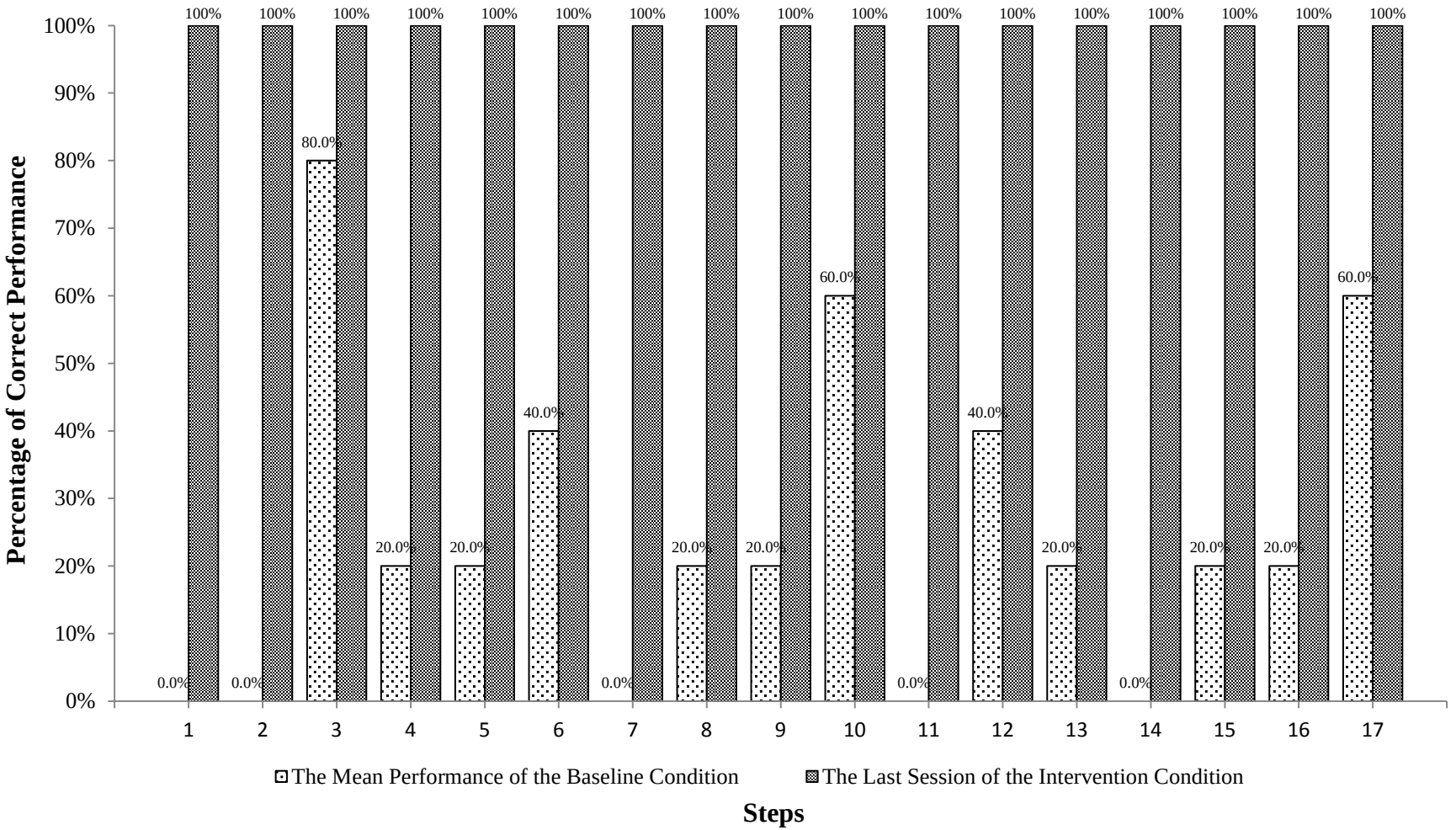

Figure 5. Mar's Mean Performance of Each Step in the Baseline Condition and Performance of Each Step in the Final Session of the Intervention Condition

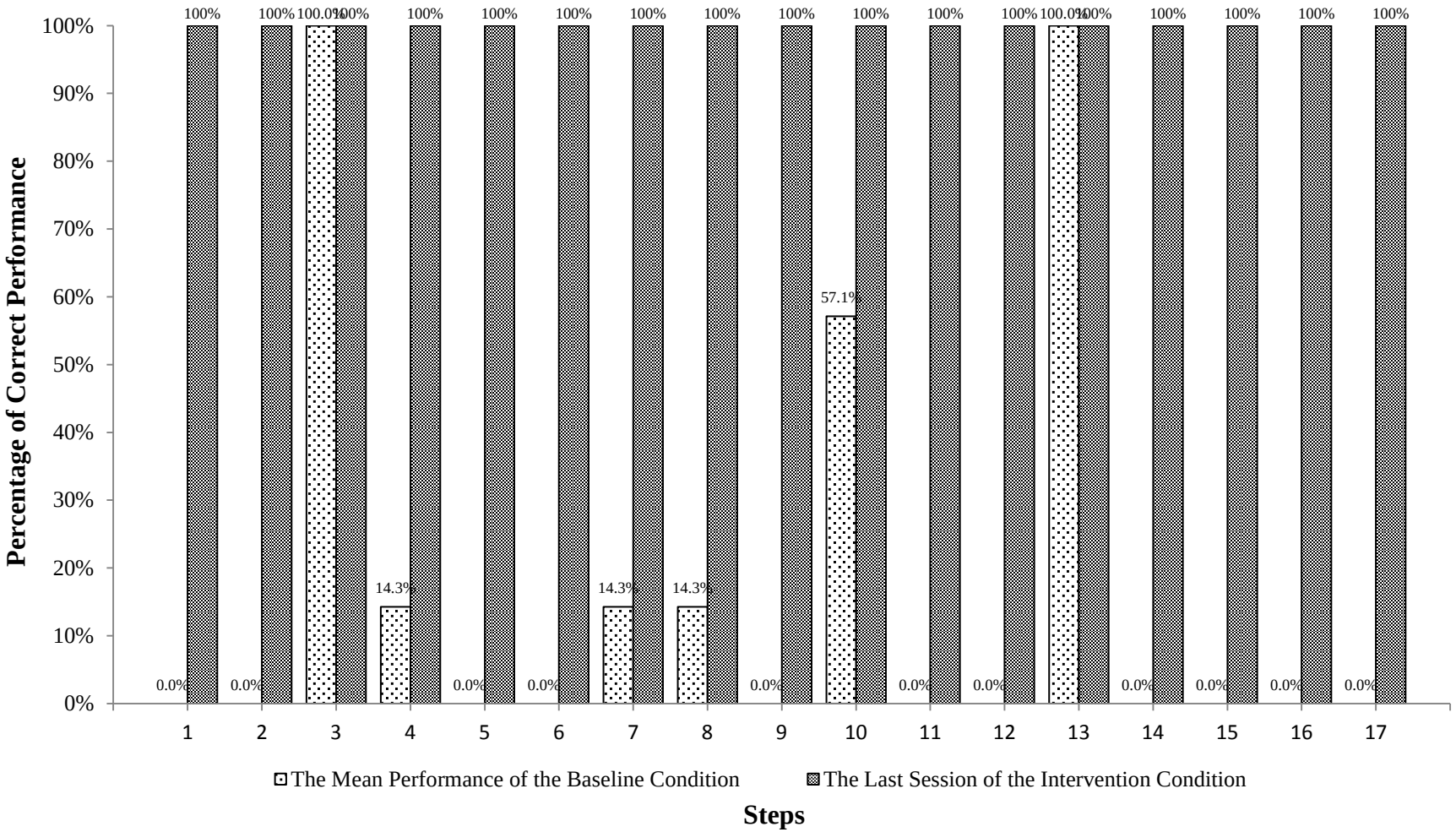

Figure 6. Hoz's Mean Performance of Each Step in the Baseline Condition and Performance of Each Step in the Final Session of the Intervention Condition

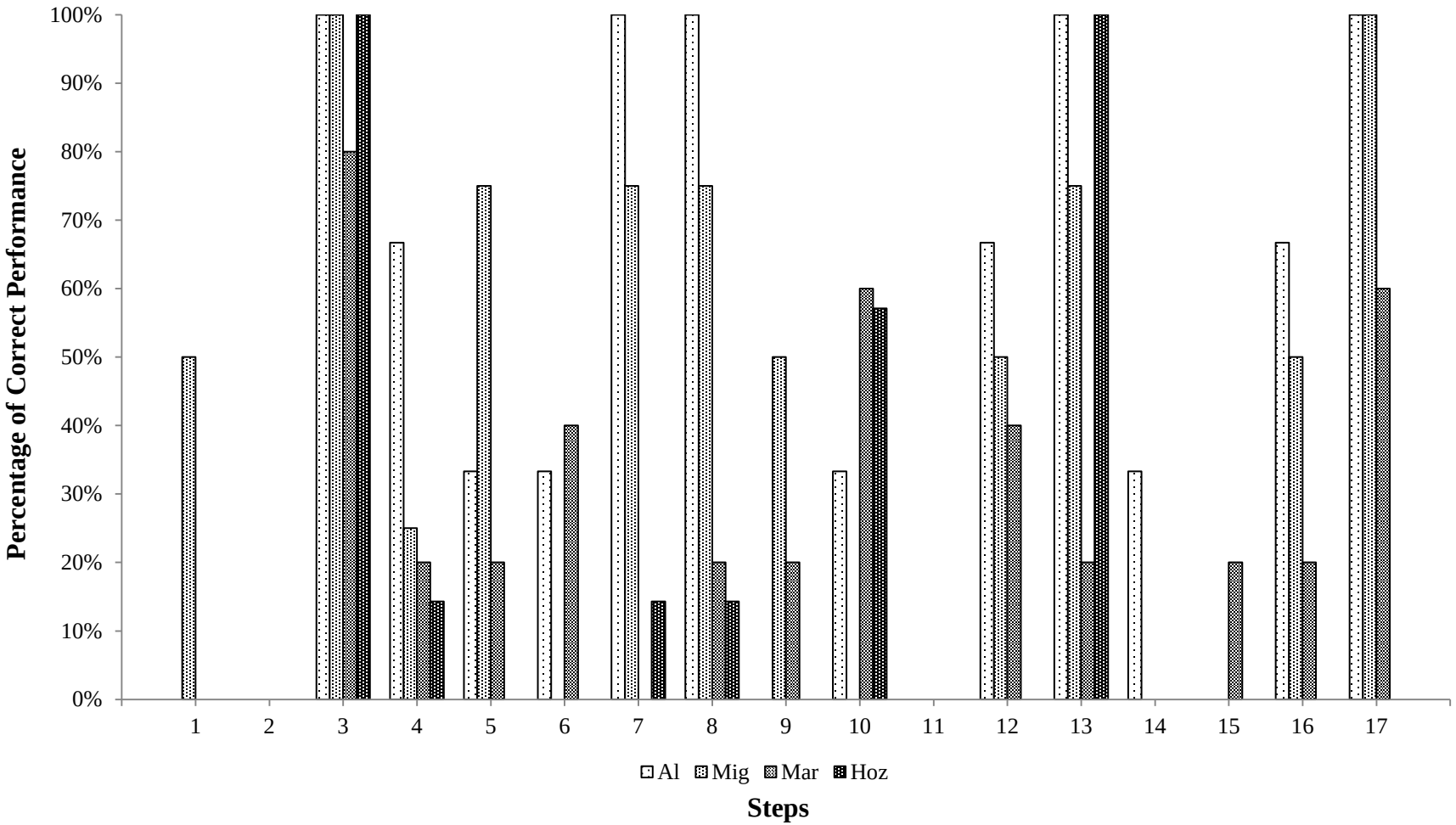

Figure 7. Students' Mean Performances of Each Step in the Baseline Condition

correctly to steps 3, 4, 5, 6, 8, 9, 10, 12, 13, 15, 16, and 17; and he did not reach a mean of 100% correct for any steps. However, he reached 100% correct of all steps in the final session of the intervention condition.

Hoz

Figure 6 presents the number of errors Hoz made in the steps of locating grocery items during the baseline and intervention conditions. During the baseline condition, he did not respond correctly to steps 1, 2, 5, 6, 9, 11, 12, 14, 15, 16, and 17 at all; he responded somewhat correctly to steps 4, 7, 8, and 10; and he reached a mean of 100% correct of steps 3 and 13. However, he reached 100% correct of all steps in the final session of the intervention condition.

Procedural Error Analysis of Grocery Store Conditions

I also analyzed procedural errors to measure efficiency during the pre- and post-test, and generalization conditions for each student.

Individual Results

Al

Figure 8 presents the number of errors Al made in the steps of locating grocery items during the grocery store conditions. During the pre-test condition, Al responded correctly to steps 3 and 7. During the post-test condition, his number of correct responses increased as compared to the pre-test condition. He responded correctly to steps 2, 3, 4, 6, 7, 8, 9, 11, 13, 15, 16, and 17 in session 1 and steps 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, and 17 in session 2. During the generalization condition, his number of correct

responses somewhat decreased as compared to the post-test condition. He responded correctly to steps 4, 6, 7, 8, 9, 11, 12, 14, and 16.

Mig

Figure 9 presents the number of errors Mig made in the steps of locating grocery items during the grocery store conditions. During the pre-test condition, he responded correctly to steps 8, 12, and 13. During the post-test condition, his number of correct responses increased as compared to the pre-test condition. He responded correctly to steps 2-17 in session 1 and in session 2. During the generalization condition, his number of correct responses somewhat decreased as compared to the post-test condition. He responded correctly to steps 1, 4, 6, 9, 11, 12, 13, 14, 16, and 17.

Mar

Figure 10 presents the number of errors Mar made in the steps of locating grocery items during the grocery store conditions. During the pre-test condition, he did not respond correctly to any steps. During the post-test condition, his number of correct responses increased as compared to the pre-test condition. He responded correctly to steps 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, and 16 in session 1 and steps 1, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, and 16 in session 2. During the generalization condition, his number of correct responses somewhat decreased as compared to the post-test condition. He responded correctly to steps 1, 4, 5, 6, 8, 9, 10, 11, 14, 15, 16, and 17.

Hoz

Figure 11 presents the number of errors Hoz made in the steps of locating grocery items during the grocery store conditions. During the pre-test condition, Hoz did not respond correctly to any steps. During the post-test condition, his number of correct

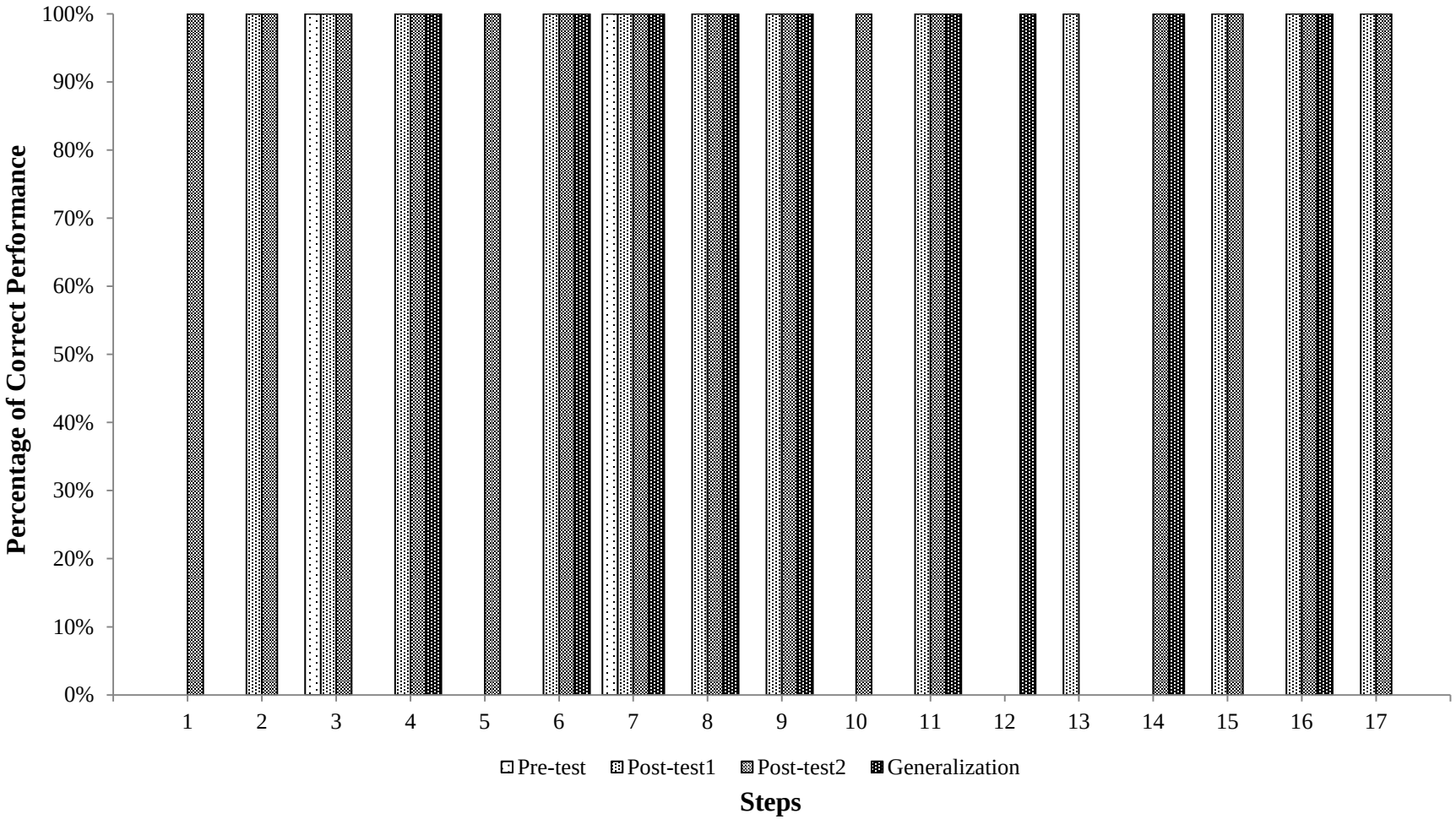

Figure 8. Al's Performance of Each Step during the Pre- and Post-test, and Generalization Conditions

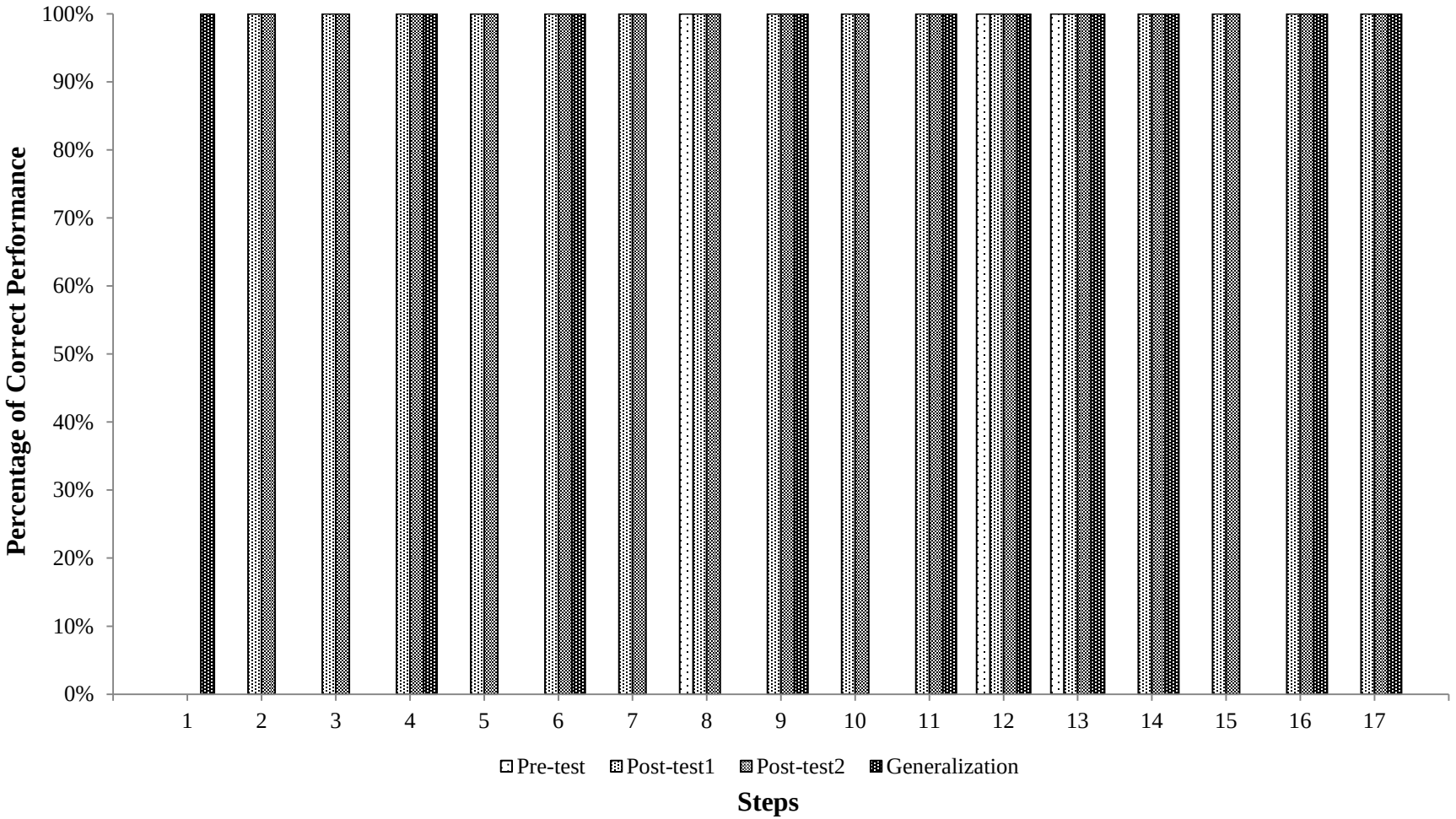

Figure 9. Mig's Performance of Each Step during the Pre- and Post-test, and Generalization Conditions

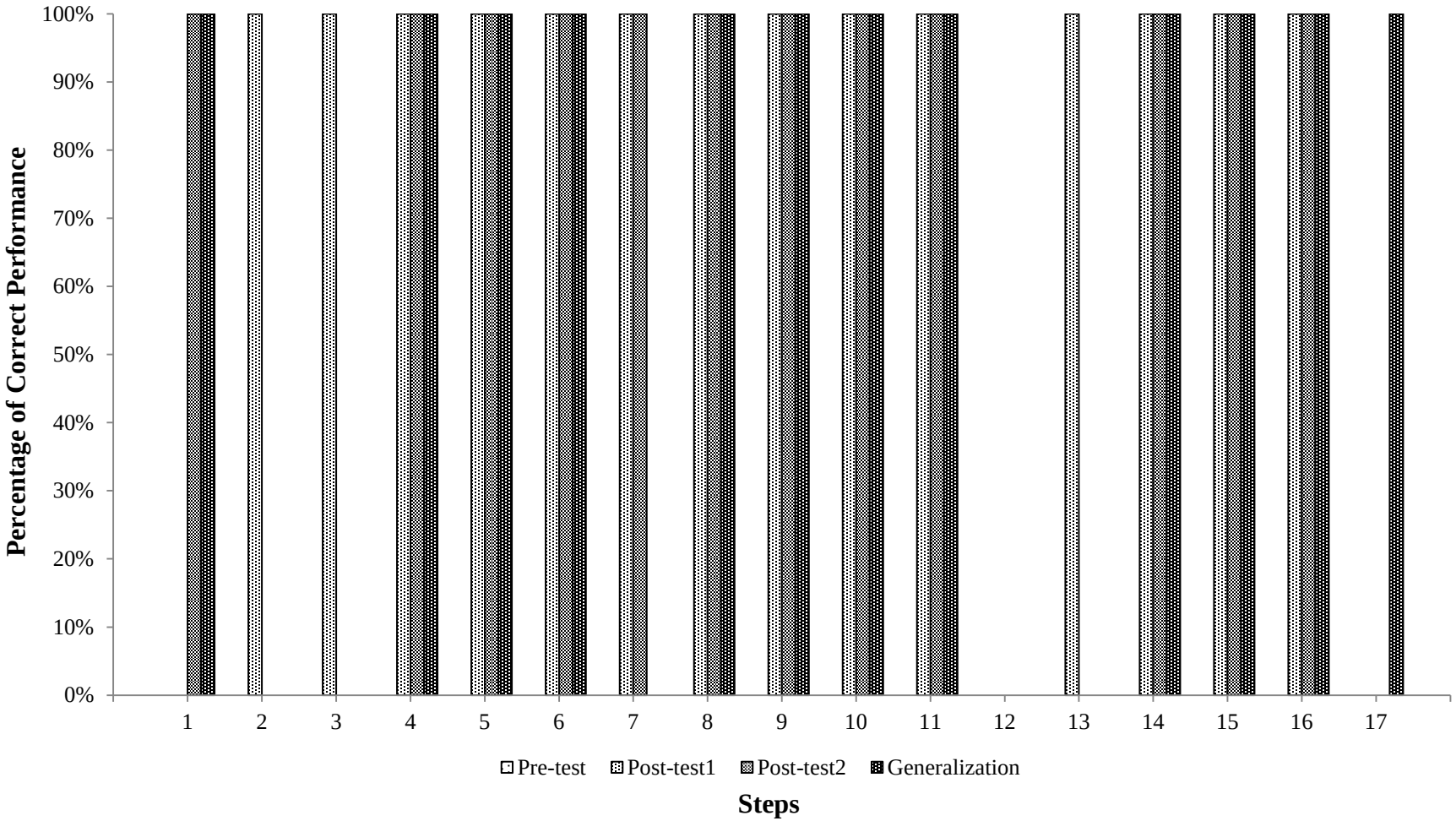

Figure 10. Mar's Performance of Each Step during the Pre- and Post-test, and Generalization Conditions

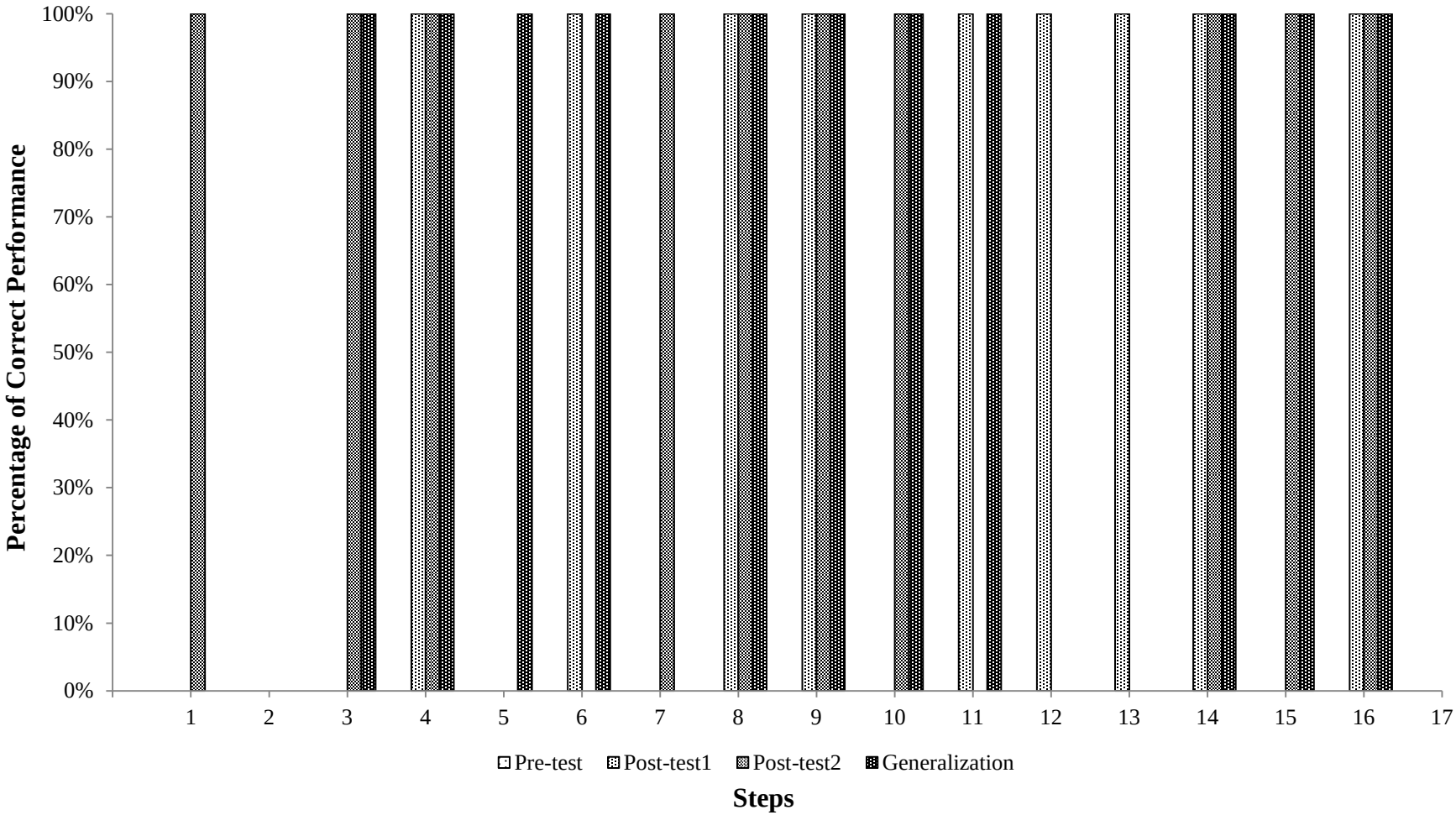

Figure 11. Hoz's Performance of Each Step during the Pre- and Post-test, and Generalization Conditions

responses increased as compared to the pre-test condition. He responded correctly to steps 4, 6, 8, 9, 11, 12, 13, 14, and 16 in session 1 and steps 1, 3, 4, 7, 8, 9, 10, 14, 15, and 16 in session 2. During the generalization condition, unlike other students, the number of his correct responses somewhat increased as compared to the post-test condition. He acquired through CBVI were generalized to the actual grocery store depicted in the CBVI program, but were less generalized to the actual grocery store which was not depicted in responded correctly to steps 3, 4, 5, 6, 8, 9, 10, 11, 14, 15, and 16.

Summary of Results

The results of this study indicate that during the CBVI intervention condition, all students acquired the skills for locating grocery items in the classroom. During the generalization condition, these skills the CBVI program.

All students' performances in locating the target items improved in the post-test condition as compared to the pre-test condition; however, all students' performances in purchasing the target items during the post-test condition did not improve as compared to the pre-test condition. In the generalization condition, all students' performances in locating and purchasing items correctly did not improve as much as during the post-test condition.

Finally, the errors that the students made during the baseline condition varied across all steps; however, once the CBVI intervention began, their errors immediately decreased, and they made no errors in the final session. During the pre-test condition, the students made errors across most steps. During the post-test and generalization conditions,

however, the number of errors made by all students substantially decreased across all steps as compared to the pre-test condition.

CHAPTER V

DISCUSSION

This chapter examines the functional relationship between the use of computer-based video instruction (CBVI) and the acquisition and generalization of grocery locating skills, which is part of grocery purchasing skills. This chapter also examines study limitations that might have affected the outcomes. Further suggestions for future research and implications for practice are discussed, and finally, conclusions are drawn from the analyses.

Overview

This study addressed two research questions. The first was whether CBVI is effective in teaching students with intellectual disabilities (ID) to locate grocery items in classroom settings. The second was whether grocery locating skills acquired through CBVI in the classroom can be generalized to actual grocery stores in community settings. Overall study results are consistent with previous findings that CBVI is an effective intervention for teaching grocery locating skills to students with ID and for promoting the generalization of these skills to actual grocery store settings (Mechling, 2004; Mechling & Gast, 2003; Mechling et al., 2002; Wissick et al., 1992).

Effects of Using CBVI in the Acquisition and Generalization of Grocery Locating Skills

Overall results of the study are consistent with previous studies' findings that CBVI is effective for teaching grocery locating skills in classroom settings to students with ID and for facilitating the generalization of the acquired skills to actual grocery stores (Mechling et al., 2002; Mechling, 2004; Wissick et al., 1992). In terms of the acquisition of the skills, during the baseline condition, questions associated with the steps of locating grocery items were given to each student without instruction to measure their performance (i.e., present knowledge of the skills). Students' mean performance level was 32.1% during this condition. Notably, during the intervention condition all students' performances improved; they reached the criterion of task completion (82.4%) relatively quickly, and in the final session, all students performed all steps 100% correctly. The students' mean performance level was 83.3% during this condition.

Unlike the other students, Mar had one unusual data point in the first session of the intervention condition. In this session, his performance level was 17.6%, even lower than his mean performance (23.5%) in the baseline condition. Potentially his low performance in this session can be explained by the novel appearance of a graduate student who came to collect treatment fidelity data. Mar looked very nervous and sweated abnormally during this session. The combination of the intervention and the presence of an unfamiliar graduate student likely affected his performance. However, from the second intervention session on, he did not exhibit nervousness and sweating, and his performance level improved immediately.

In order to determine whether the skills students acquired in the classroom generalized to actual grocery stores, the steps of locating three grocery items were measured for each student both before and after the intervention. The initial mean level of students' skill at the grocery was 7.4%. However, after the CBVI intervention, students' performance at the grocery store presented in the CBVI program improved by an average of 72.8%. Furthermore, students' mean performance at the grocery store not presented in the CBVI program improved by a mean of 61.8% during the generalization condition.

The increase in students' performance levels was reflected in the number of grocery items they were able to locate correctly. During the pre-test condition students were able to locate a mean of 0.8 items out of a total of 3 items. After the intervention condition, the number of items students correctly located increased. They correctly located a mean of 2.4 items during the post-test condition and a mean of 1.3 items during the generalization condition.

Students' completion of the last step (i.e., reaching the checkout stand) also reflected their ability to correctly purchase grocery items. During the pre-test condition all students were unable to complete the last step. After the intervention condition, Al and Mig were able to complete the last step during the post-test condition and Mig and Mar were able to complete the last step during the generalization condition.

Although students showed improvements in their performances during both post-test and generalization conditions, the level of improvement during the generalization condition somewhat decreased as compared to the pre-test condition. This decrease may be explained by three possible reasons. First, the grocery stores in both the post-test and generalization conditions were large national chains and therefore contained numerous

differences in layout. Second, these stores used different aisle sign words for the same items (e.g., “canned food” vs. “Meat canned food”). Third, the stores used different packaging for the same items (e.g., a package that included two cans of Richam, which is a brand of canned meat, vs. a package including four cans of Richam). These differences might have contributed to the difficulty students had in generalizing the acquired skills to the new grocery store.

Error Analysis

According to the error analysis of the steps of locating target grocery items, during the baseline condition students made similar errors in the following steps (See figure 7): (a) obtaining a shopping cart (step 1); (b) entering the first correct aisle (step 2); (c) returning to the entrance of the aisle after obtaining the second item (step 11); (d) putting the third item in the cart (step 14); and (e) crossing out the third grocery item on the shopping list (step 15). However, during the intervention condition all students mastered all steps of the skills. Although no previous studies have conducted an error analysis of the steps for the intervention conditions, based on the visual analyses of previous studies using CBVI, all students reached a 100% performance level by the final session of the intervention (Mechling, 2004; Mechling & Gast, 2003; Mechling et al., 2002). This may support that CBVI is an effective method for helping students with ID to acquire grocery locating skills in classroom settings.

The error analysis of the steps of locating target grocery items during the pre-test condition also revealed that all students made similar errors across all steps. During the post-test and generalization conditions, the number of errors substantially decreased for

all students across all steps. However, despite this decrease, students continued making errors in locating the third item (Richam) during the post-test condition, and made errors in locating all three items during the generalization condition. Students could not discriminate the target items from similar items (e.g., they were confused by different packaging of the target item, or found Spam instead of Richam). Mechling and Gast (2003) reported similar results and indicated that these errors could be caused by a lack of multiple examples during the intervention condition (Horner, Dunlap, & Koegel, 1988). Students' difficulties might also be attributed to the different layout and aisle signs in the grocery stores for the same items presented in the CBVI program.

Effects of CBVI as a Combination of Multi-Media Technologies

Study results are also congruent with a previous finding that combinations of multi-media components facilitate the acquisition and generalization of grocery purchasing skills among students with ID (Hutcherson et al., 2004; Langone et al., 1999; Mechling, 2002; Wissick et al., 1992). Even though it is impossible to identify which individual component (e.g., video clips, photographs, or audio prompts) of the CBVI program used in the study affected improvements, it is obvious that the combination of all components contributed to the positive results in the acquisition and generalization of skills. During the intervention condition, the CBVI program presented aisle sign and grocery item photographs as well as video clips containing actual aisle signs that the students needed to identify in order to enter the correct aisles and find the actual grocery items they were asked to obtain. This combination of photographs and video clips may

have enhanced the likelihood of acquiring and generalizing the skills to actual grocery stores by providing high quality representations of actual situations (Langone et al., 1999).

Effects of CBVI as a Method Providing Multiple Examples

Furthermore, study results support previous findings that providing multiple instructional examples may assist students with ID in acquiring and generalizing grocery purchasing skills (Mechling et al., 2002). The CBVI program provided students with multiple, repeated examples of correct and incorrect responses (e.g., target grocery items and non-target grocery items). Providing multiple examples might enhance skill acquisition and retention. The results also confirmed previous researchers' findings that offering a wide range of stimuli and responses for an array of possible situations facilitates the acquisition of life skills (Domaracki & Lyon, 1992; Horner, Sprague, & Wilcox, 1982).

Effects of CBVI as a Tool Providing Interactive Components

Results of this study are consistent with previous findings that the use of a CBVI program, including interactive components, promotes the acquirement and generalization of grocery purchasing skills (Mechling et al., 2002; Wissick et al., 1992). During the intervention, students answered questions by clicking options. If they clicked the correct options, the program gave them praise ("Good job"). If the students clicked incorrect answers, the program gave them visual and auditory prompts for the correct answers

("Try again"). Students also clicked to advance to video clips and questions. Mechling and Gast (2003) indicated that CBVI programs more effectively produce positive learning outcomes when students actively interacted with the program than when they only passively watched video clips.

Effects of CBVI as a Type of Video Modeling

Study results partially support previous studies' conclusions that video technology (i.e., video prompts) facilitates the acquisition and generalization of grocery purchasing skills among students with ID (Ayres et al., 2002; Haring et al., 1995; Mechling et al., 2002; Morgan & Salzberg, 1992). A wide range of studies on video technology have proven that this method is an effective means of helping students with disabilities to acquire various skills and generalize them to real-world situations (Mechling, 2005). During the intervention, the video clips in the CBVI program presented the tasks that the students would perform and allowed them to model each step of the tasks at the grocery store. The program also provided natural cues of the actual environments that students would encounter at the grocery store (e.g., actual aisles). The results of this study suggest that these components of video technologies might facilitate students' generalization of the skills.

Differences from Previous Studies

Unlike previous studies (Ayres et al., 2006; Mechling, 2004; Mechling & Gast, 2003), this study did not use any response prompting strategies [e.g., the system of most-to-least prompts or constant-time delay (CTD)] along with the CBVI program. Although

such strategies may constitute an effective method for teaching these skills to students with ID, this study suggests that CBVI alone may be sufficient to teach grocery locating skills.

Limitations

Before drawing conclusions from this study, it is important to acknowledge four limitations that could have affected the results. First, in the study design, a limited number of measurements were taken during the grocery store conditions (Mechling, 2004). Only one session in the pre-test condition, two sessions in the post-test condition, and one session in the generalization condition were collected. This might have limited the accuracy of the measurements of students' performance at the grocery stores before and after the CBVI intervention. In particular, during the generalization condition, there were many distractions (e.g., other shoppers) because this measurement occurred during busy times. It is possible that conducting only one or two sessions during the grocery store conditions was insufficient to determine whether CBVI is effective in helping students generalize the skills to actual grocery stores.

Second, this study did not measure students' continued performances to determine whether the skills would be maintained over time. In general, researchers recommend that follow-up measures are needed in single-subject design for ensuring that interventions are effective by evaluating the maintenance of target behaviors over time. However, due to the ending of the school year, it was not possible to conduct follow-up measures at the grocery stores.

Third, although this study adds to the present literature on the effects of using CBVI in teaching grocery purchasing skills, it was limited to three specific grocery items recommended by the students' special education teacher. Using such a small number of grocery items may have limited the possibility of generalizing the skills because there were many variations within and across these items in the actual grocery stores. For example, the third item (Richam) used in the study was available in several different flavors, each with almost the same wrapper. The only difference among these wrappers was the name of the product flavor (e.g., green tea vs. traditional). As a result of the large number of possible variations in items, three items may not be sufficient stimuli for training students to adapt to shopping in actual grocery stores.

Fourth, there might have been an instrumental effect that affected students' performances during the baseline condition. Although no instruction was given to the students during the baseline condition, each student's performance level increased considerably as compared to the pre-test condition. This might have been caused by the CBVI program that provided the students with cues to respond correctly. For instance, the program presented a limited number of grocery items (4 items) and aisle signs (4 aisle signs) from which the students were required to choose; however, there were many more variations in grocery items and aisle signs at the actual grocery stores.

Suggestions for Future Research

Study results support the claim that CBVI can be effectively used to help students with ID acquire grocery locating skills in classroom settings and to generalize those skills

to actual grocery store settings. However, further research is required to address several questions.

First, analysis of the data indicated that although CBVI alone is an efficacious means of promoting the acquisition and generalization of grocery purchasing skills, the students had difficulty generalizing the skills to the new grocery store. Their difficulties may have been caused by variations within grocery items and between the target items and similar items of different brands. Also, there were several distractions (e.g., display change of a target item and store personnel) that certainly interfered with their performances when students were being assessed at the grocery stores. Both Mar and Hoz suffered as a result of such distractions. For example, a change in the display of the last target item occurred in Mar's second session of the post-test condition and affected Hoz's two sessions in the post-test condition. Also, the work of store personnel (e.g., arranging grocery items on the shelves) distracted Hoz during the first session of the post-test. These distractions might have influenced student performance. Therefore, researchers should investigate the effectiveness of CBVI in combination with community-based instruction in order to enhance the likelihood of generalization (Ayres et al., 2002). Additionally, although there have been some efforts to determine the best combination of methods (e.g., classroom simulations, video technologies, and community-based instruction) to teach grocery purchasing skills (Mechling, 2004; Morse & Schuster, 2000), no study to date has determined which method is best used in combination with CBVI. Thus, researchers should conduct additional studies to examine this issue.

Second, further research is needed to examine ways to develop CBVI programs that can efficiently deliver multiple examples (i.e., programs that can be efficiently

modified and produced). The CBVI used in the study took an extensive amount of time to develop and modify (e.g., making new video clips for new grocery items). During the intervention condition, the CBVI program provided students with multiple examples of the target grocery items; however, it was limited to only three grocery items due to the time necessary for developing and modifying the program. Researchers have emphasized that in order to enhance the possibility of the acquisition and generalization of grocery purchasing skills, it is critical to carefully develop CBVI programs to provide students with real world stimuli, including multiple examples (Hansen & Morgan, 2008). However, no studies to date have investigated how to efficiently develop CBVI programs which do this, and therefore more research is necessary that specifically addresses this issue.

Third, it is also necessary for researchers to examine the effectiveness of using mobile devices such as tablet computers (I-pads) and smart phones to teach grocery purchasing skills to students with ID. These days the use of mobile devices is prevalent among practitioners in special education to teach various skills to their students with ID; however, there is no study that investigates the effectiveness of using mobile devices in teaching students with ID life skills such as grocery purchasing skills. With the perspective of evidence-based practice, it is important for researchers to investigate the effectiveness of such newly emerging devices.

Practical Implications

Study results suggest several practical implications for educators. First, although community-based instruction is an ideal way to teach life skills (e.g., grocery purchasing

skills) to students with ID, this instructional method may not be easy to implement due to cost, transportation, and scheduling conflicts (Wissick et al., 1992). Using CBVI offers an alternative that addresses these problems by simulating real-world situations within a classroom setting. By using CBVI, educators may decrease time/cost and reduce potential concerns about student safety in travel to and within community settings.

Second, due to the cognitive characteristics of students with ID, repetition is one of the most important factors by which students learn skills. However, teaching the same skills to the same students repetitively is sometimes challenging. Study results indicate that CBVI programs can perform this function by enabling educators to easily teach skills that require repeated practice. CBVI also may motivate students by allowing them to interact with multi-media technologies.

Conclusions

Findings from this study support and extend previous literature on the effects of using CBVI in the acquisition and generalization of grocery purchasing skills for students with ID. First, the study's results confirm that using CBVI is an effective intervention in teaching grocery locating skills to students with ID in classroom settings and of generalizing those skills to actual grocery stores. Second, the results indicate that a combination of multi-media technologies is an effective medium for teaching grocery purchasing skills to students with ID and for facilitating the generalization of these skills. Third, this study adds to the previous literature concluding that interactive components in CBVI help students with ID to acquire and generalize grocery purchasing skills to actual grocery stores. Fourth, results confirm previous findings that providing multiple

examples in the classroom assists students with ID in acquiring and generalizing grocery purchasing skills. Finally, this investigation extends literature on the effectiveness of video technology in teaching grocery purchasing skills to students with ID and helping them to generalize those skills.

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APPENDIX A
GROCERY PURCHASING SKILLS CHECKLIST

Grocery Purchasing Skills Checklist

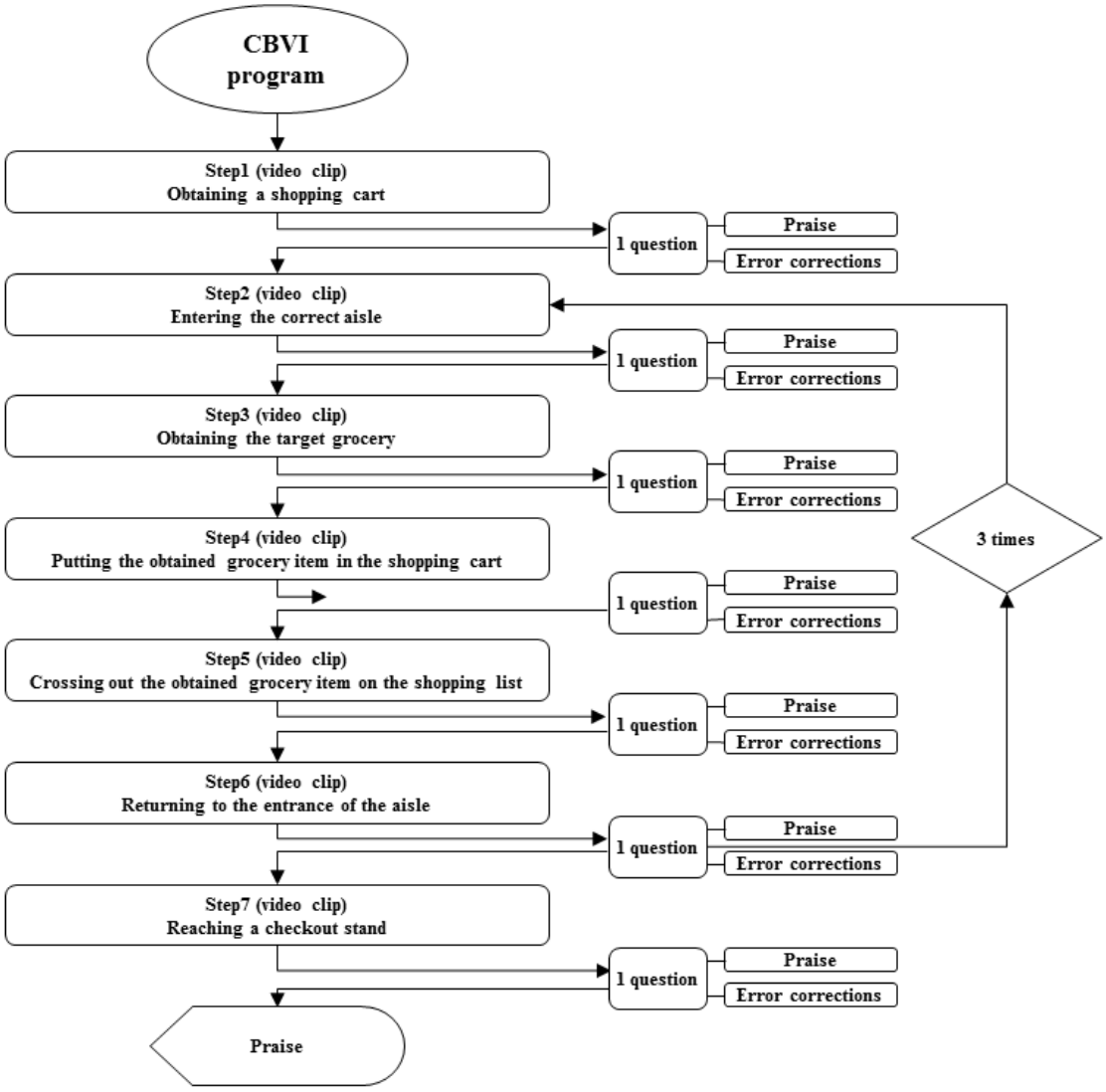
Participant _____ Date _____ Location _____

Observer _____ Session _____ Score _____

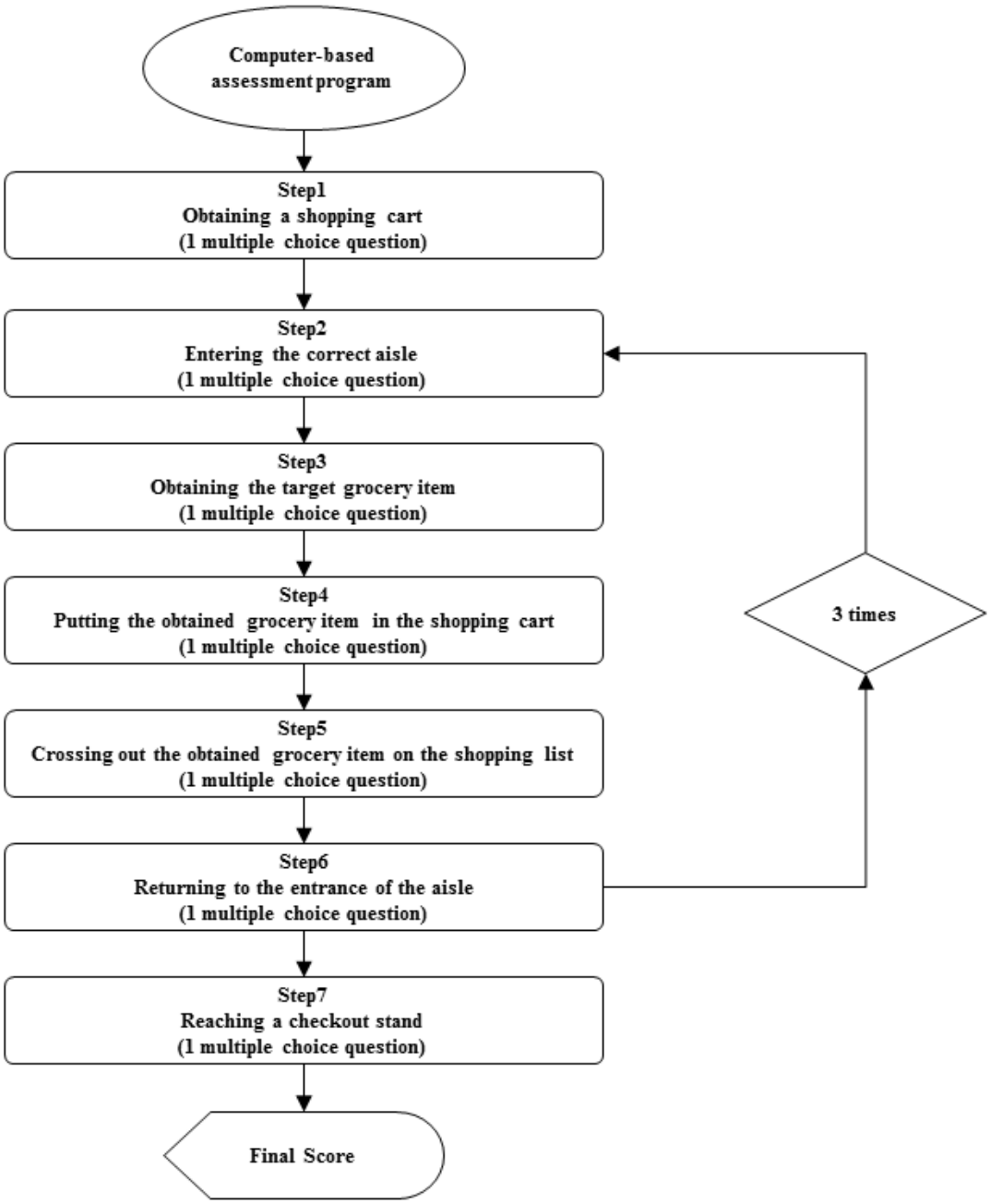
Start Time _____ End Time _____ Duration _____

Steps	Allotted	Time
Step 1 - Obtaining a shopping cart	20s	
Step 2 - Entering the first correct aisle	120s	
Step 3 - Obtaining the first grocery item on the shopping list	40s	
Step 4 - Putting the obtained grocery item in the shopping cart	15s	
Step 5 - Crossing out the obtained grocery item on the shopping list	15s	
Step 6 - Returning to the entrance of the aisle	20s	
Step 7 - Entering the second correct aisle	40s	
Step 8 - Obtaining the second grocery item on the shopping list	40s	
Step 9 - Putting the obtained grocery item in the shopping cart	15s	
Step 10 - Crossing out the obtained grocery item on the shopping list	15s	
Step 11 - Returning to the entrance of the aisle	20s	
Step 12 - Entering the third correct aisle	40s	
Step 13 - Obtaining the third grocery item on the shopping list	40s	
Step 14 - Putting the obtained grocery item in the shopping cart	15s	
Step 15 - Crossing out the obtained grocery item on the shopping list	15s	
Step 16 - Returning to the entrance of the aisle	20s	
Step 17 - Reaching a checkout counter	80s	

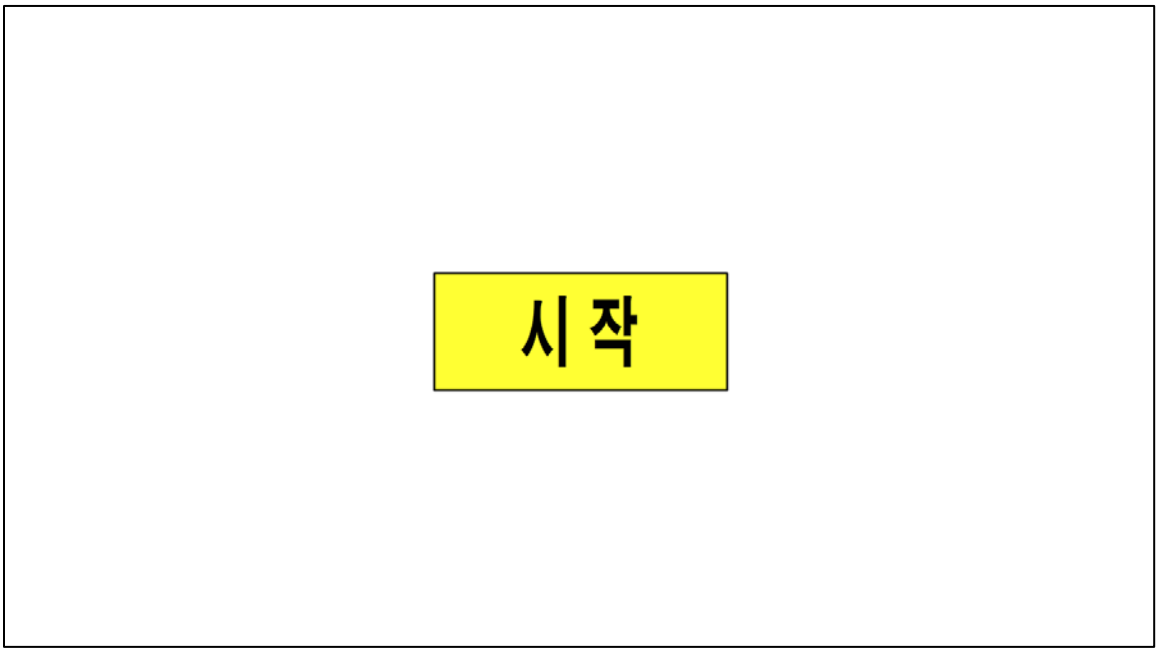
APPENDIX B
FLOW CHART OF THE CBVI PROGRAM

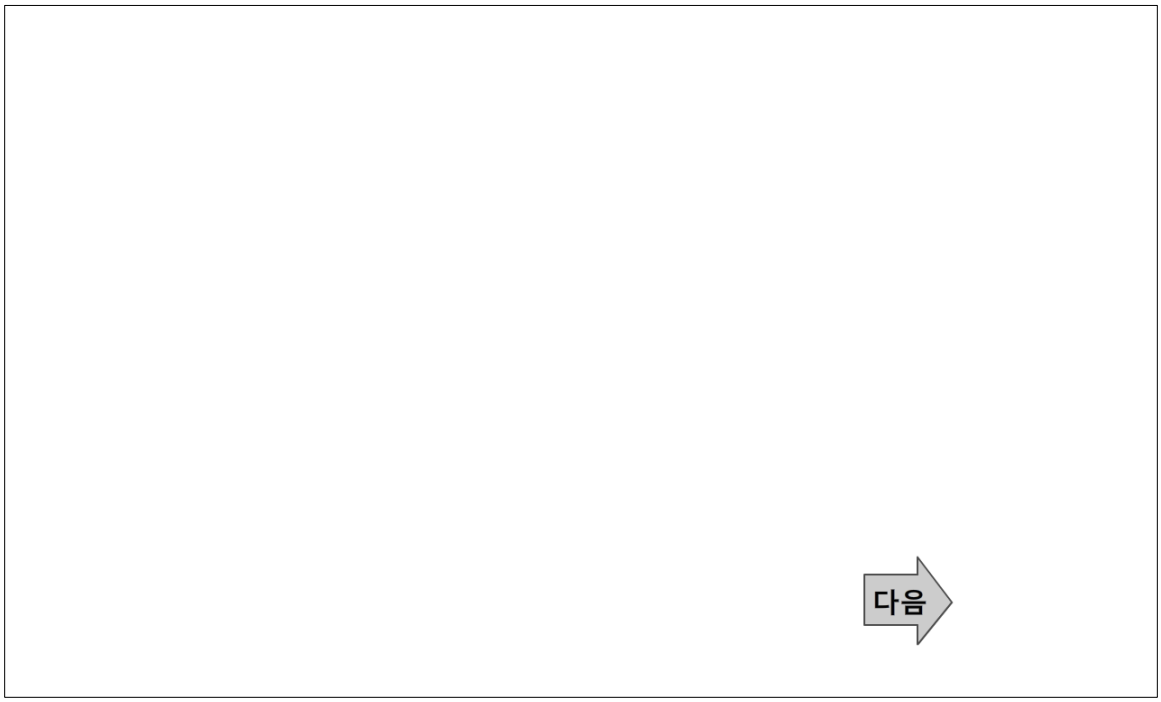


APPENDIX C
FLOW CHART OF THE COMPUTER-BASED ASSESSMENT PROGRAM



APPENDIX D
PROGRAM FOR THE ASSESSMENT OF COMPUTER SKILLS





APPENDIX E
DESCRIPTIONS OF THE VIDEO CLIPS

- Video clip 1: An actor gets a shopping cart at the entrance of the grocery store and starts pushing the shopping cart to the aisles.
- Video clip 2: A close-up technique is used to present the overhead aisle sign associated with the first item on the shopping list, and the actor will reach the aisle and enter the aisle for the first item.
- Video clip 3: The actor searches for, finds, and grasps the first item.
- Video clip 4: The actor puts the first item in the shopping cart.
- Video clip 5: The actor crosses out the first item on the shopping list.
- Video clip 6: The actor returns to the entrance of the aisle.
- Video clips 7 - 11: The same procedures seen in video clips 2 through 6 are repeated with the second item on the shopping list.
- Video clips 12 - 16: The same procedures seen in video clips 2 through 6 are repeated with the third item on the shopping list.
- Video clip 17: The actor reaches a checkout counter.

APPENDIX F
SCRIPTS

Step1
[Shopping cart only]
"The first thing you should do is get a shopping cart. Let's get a shopping cart."
Step2
The next step is finding the aisle for the first item. The first item is "_____" [Showing the shopping list – close-up], so you should find aisle _ including "_____". Let's go and find aisle _ [Walking to aisle _]. Here we go [Aisle _– close-up].
Step3
The next step is finding the first item. The first item is "_____" [Close-up shopping list]. [Walking and looking for the item slowly]. Here we go. This is "_____" [Grasping the item – close-up].
Step4
The next step is putting this item in the shopping cart [Showing the item – close-up & Putting the item in the shopping cart – close-up].
Step5
The next step is crossing out the first item's name on your shopping list with the pencil [Crossing out – close-up].
Step6
The next step is returning to the entrance of this aisle. Let's go this way [Walking to the entrance].
Step7
The next step is finding the aisle for the second item. The second item is "_____" [Showing the shopping list – close-up], so you should find aisle _ including "_____". Let's go and find aisle _ [Walking to aisle _]. Here we go [Aisle _– close-up].
Step8
The next step is finding the second item. The second item is "_____" [Close-up shopping list]. [Walking and looking for the item slowly]. Here we go. This is "_____" [Grasping the item – close-up].
Step9
The next step is putting this item in the shopping cart [Showing the item – close-up & Putting the item in the shopping cart – close-up].
Step10
The next step is crossing out the second item's name on your shopping list with the pencil [Crossing out – close-up].
Step11
The next step is returning to the entrance of this aisle. Let's go this way [Walking to the entrance].

Step12

The next step is finding the aisle for the third item. The third item is "_____" [Showing the shopping list – close-up], so you should find aisle _ including "_____". Let's go and find aisle _ [Walking to aisle _]. Here we go [Aisle _– close-up].

Step13

The next step is finding the third item. The third item is "_____" [Close-up shopping list]. [Walking and looking for the item slowly]. Here we go. This is "_____" [Grasping the item – close-up].

Step14

The next step is putting this item in the shopping cart [Showing the item -- close-up & Putting the item in the shopping cart – close-up].

Step15

The next step is crossing out the last item's name on your shopping list with the pencil [Crossing out – close-up].

Step16

The next step is returning to the entrance of this aisle. Let's go this way [Walking to the entrance].

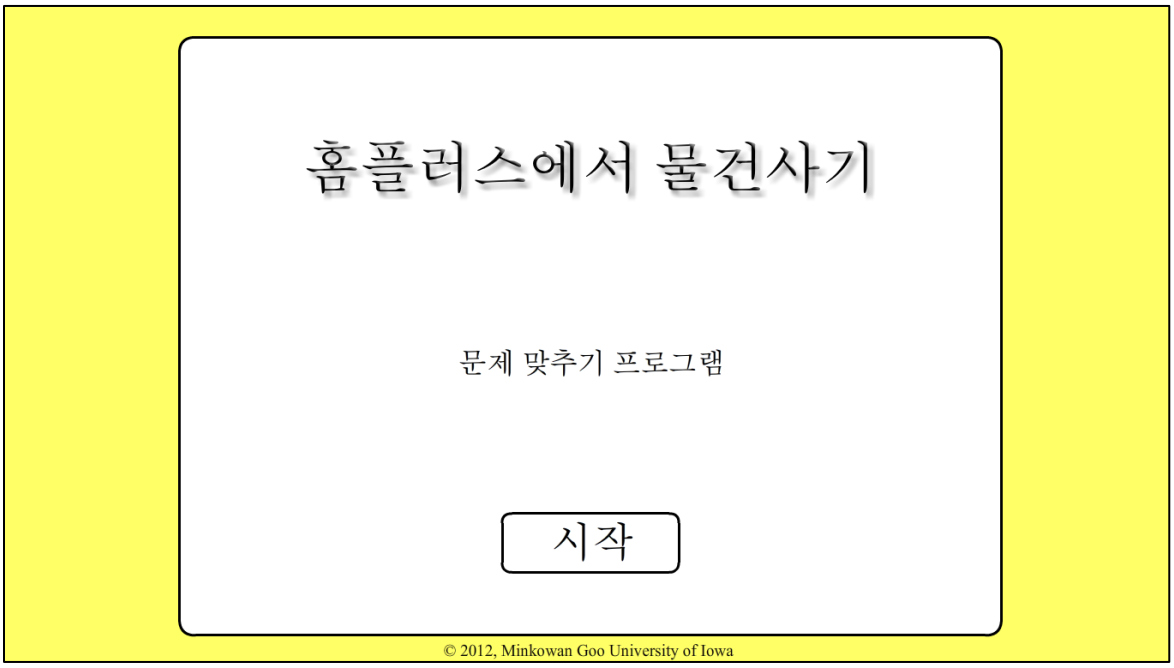
Step17

The last step is getting to any checkout counter. Find which checkout is available. Here we go [Walking to an available checkout counter].

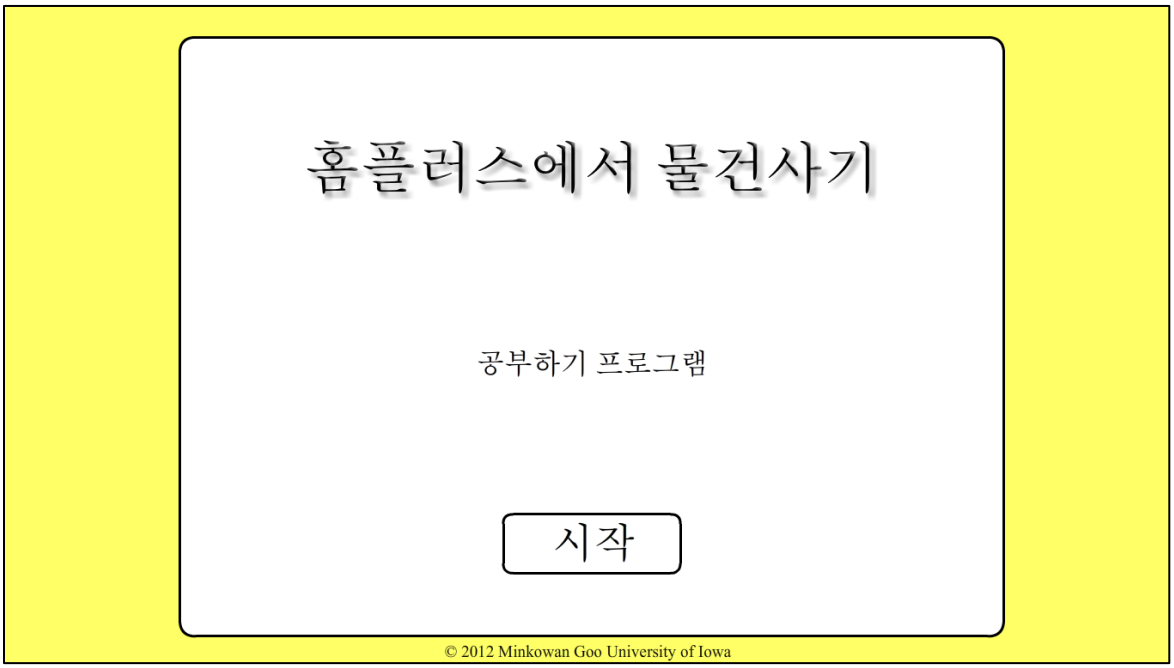
APPENDIX G
CLOSE-UP TECHNIQUE IN THE CBVI PROGRAM

APPENDIX H
VIDEO CLIPS IN THE CBVI PROGRAM

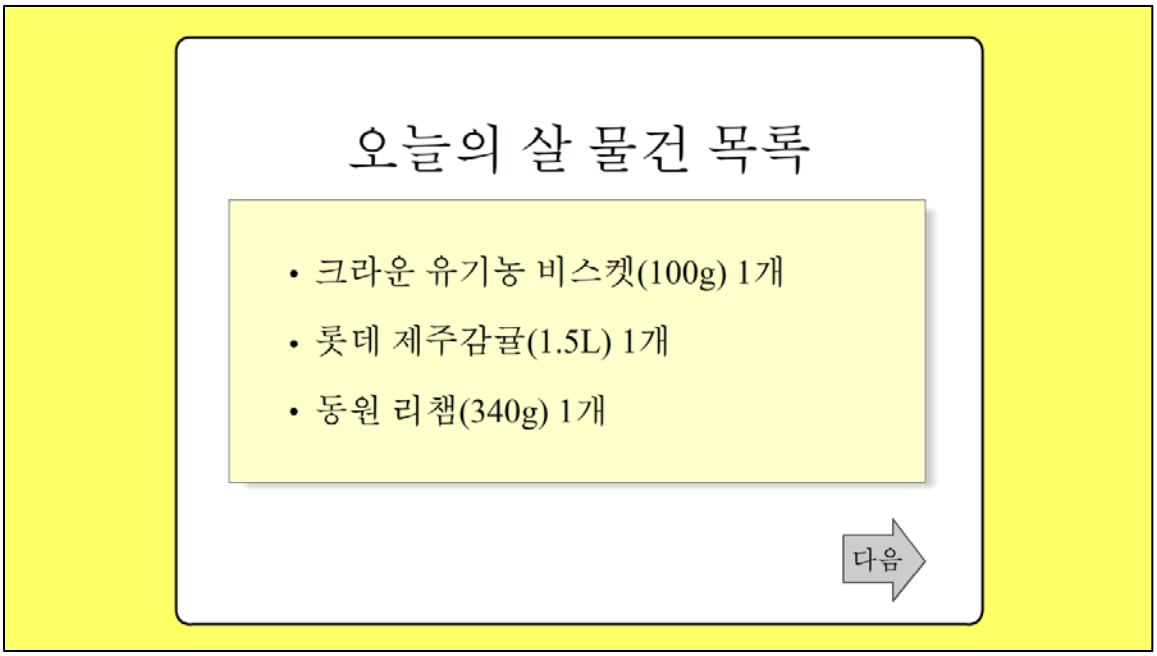
APPENDIX I
FIRST SCREEN OF THE COMPUTER-BASED ASSESSMENT PROGRAM



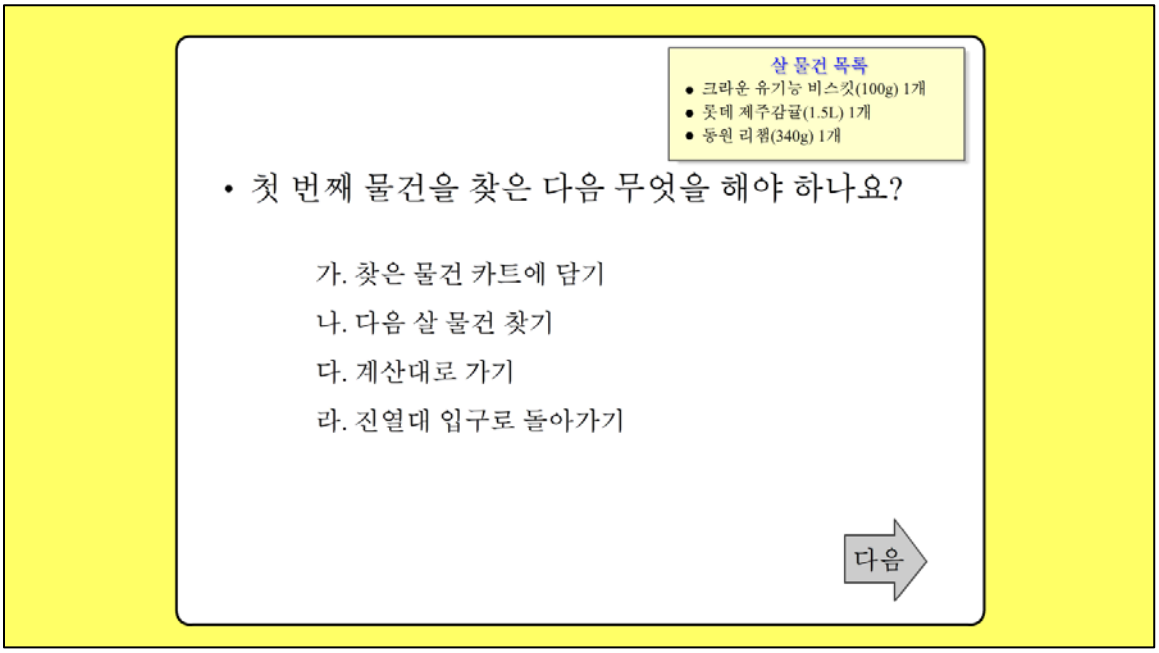
APPENDIX J
FIRST SCREEN OF THE CBVI PROGRAM



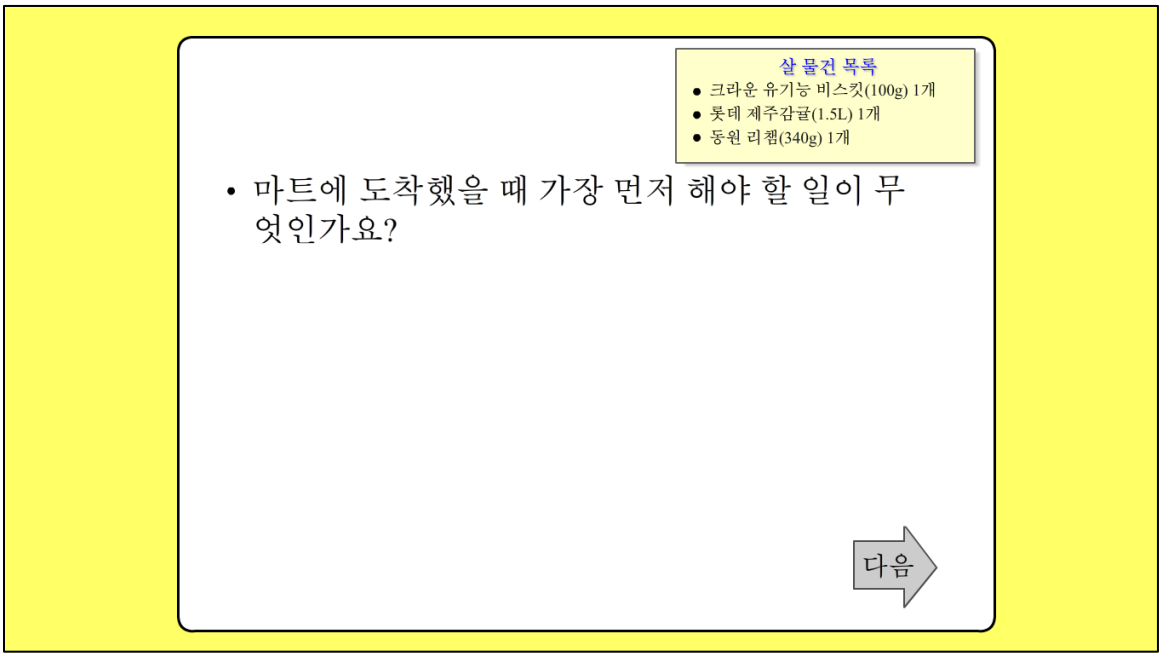
APPENDIX K
SECOND SCREEN OF THE COMPUTER-BASED ASSESSMENT PROGRAM

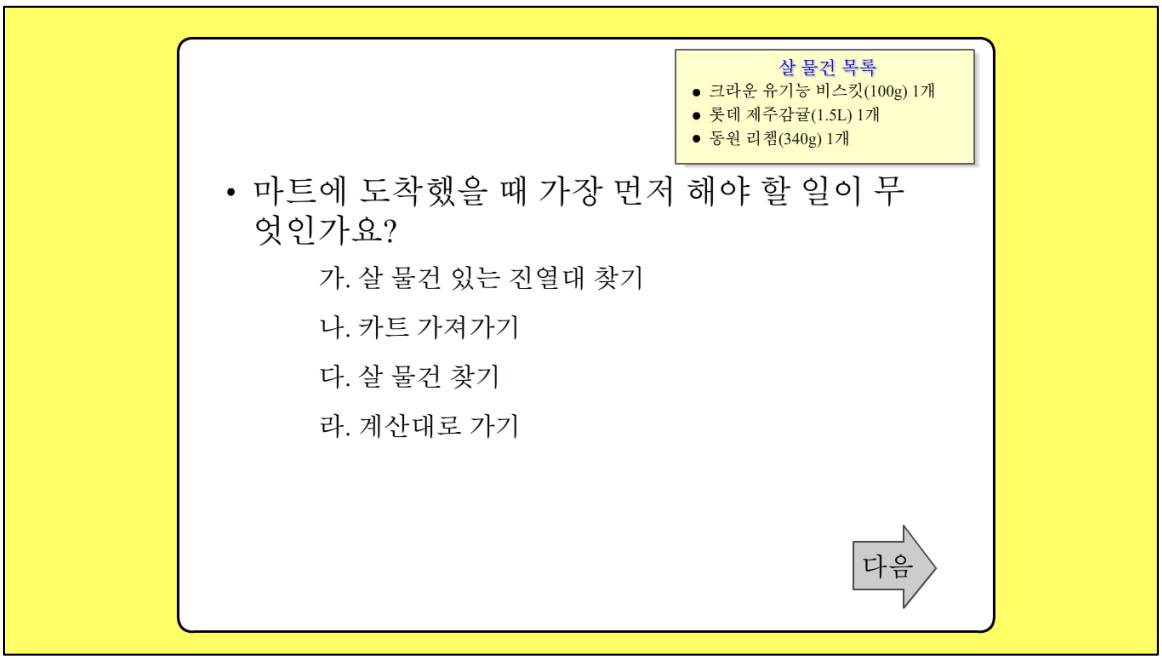


APPENDIX L
TEXT AND PHOTOGRAPH OPTIONS OF THE COMPUTER-BASED ASSESSMENT AND CBVI PROGRAMS



APPENDIX M
COMPUTER-BASED ASSESSMENT PROGRAM





APPENDIX N
SCORE SHEET

Score Sheet

Participant _____ Date _____ Session _____

Steps	A	B	C	D	Note
Step 1					
Step 2					
Step 3					
Step 4					
Step 5					
Step 6					
Step 7					
Step 8					
Step 9					
Step 10					
Step 11					
Step 12					
Step 13					
Step 14					
Step 15					
Step 16					
Step 17					
				Total _____	

APPENDIX O
PROCEDURAL FIDELITY CHECKLIST

Intervention Steps Was the step/procedure implemented? Circle Yes or No.	
1. Turn on the laptop.	Yes or No
2. Run the CBVI program.	Yes or No
3. Give appropriate directions for students to start the program. ***"You will learn shopping skills through this computer program. Pay attention to the video clips and try to memorize what you should do during grocery shopping. If you get stuck, I will tell you what you should do. If you are ready to start this computer program, click on the "Start" button in the middle of the screen."***	Yes or No
4. Give students verbal error corrections when they cannot correctly answer questions within the allotted time, or have problems with moving to the next question. ***"The correct answer is _____. Can you click on the correct answer?"***	Yes or No
5. (If needed) Give students gesture error corrections (pointing to the correct responses) when they cannot correctly answer questions within the allotted time, or have problems with moving to the next question. ***"The correct answer is _____ (pointing to the correct answer). Can you click on the correct answer?"***	Yes or No
6. Give students verbal directions when they have problems advancing to the next question. ***"You can click on the arrow button on the bottom right hand corner of the screen to move to the next question."***	Yes or No
7. Give students appropriate neutral praise after the intervention. "***Good job! Thank you for working so hard."***	Yes or No

APPENDIX P
SHOPPING LIST

크라운 유기농 비스킷(100g) 1개

롯데 제주감귤(1.5L) 1개

동원 리챔(340g) 1개