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Teaching Personal Finance Mathematical Problem Solving to Individuals With Moderate Intellectual Disability

Jenny Root, PhD, BCBA[1], Alicia Saunders, PhD[2], Fred Spooner, PhD[2], and Chelsi Brosh, MEd, BCBA[2]

Abstract

The ability to solve mathematical problems related to purchasing and personal finance is important in promoting skill generalization and increasing independence for individuals with moderate intellectual disabilities (IDs). Using a multiple probe across participant design, this study investigated the effects of modified schema-based instruction (MSBI) on personal finance problem solving skills, purchasing an item on sale or leaving a tip, and using a calculator or iDevice (i.e., iPhone or iPad) for three middle school students diagnosed with a moderate ID. The results showed a functional relation between MSBI using a calculator on the participant's ability to solve addition and subtraction personal finance word problems and generalize to iDevices. The findings of this study provide several implications for practice and offer suggestions for future research.

Keywords

mathematics, mathematical problem solving, severe disabilities, purchasing, calculator

Managing one's finances is an important milestone toward financial security and responsibility (Bell, Burtless, Gornick, & Smeeding, 2006). In general, the acquisition of academic skills has been found to be significantly related to positive outcomes in adult life (e.g., employment, citizenship, community living, Benz, Lindstrom, & Yovanoff, 2000; McDonnell, & Copeland, 2016; Phelps & Hanley-Maxwell, 1997). Skills in problem solving related to personal finance can increase independence and community integration. Acquiring the skills necessary to purchase goods and services increases the opportunities for individuals with intellectual disability (ID) to establish relationships within the community (Colyer & Collins, 1996), increase the quality of daily life (Cihak & Grim, 2008), gain greater control of their lives (Browder & Grasso, 1999), and live more independently (Morse & Schuster, 1996). Instruction in solving word problems related to purchasing skills is the first step to generalization of personal finance problem solving in current and future environments.

Personal finance, including spending, budgeting, and saving money, can be difficult for individuals with ID because of mathematical skill deficits (Hua, Woods-Groves, Kaldenberg, Lucas, & Therrien, 2015). Although research on teaching mathematics to individuals with moderate and severe disabilities has historically had a strong emphasis on basic skills, such as dollar and coin identification, the instruction was decontextualized and focused on discrete skills outside of their natural use (Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, 2008; Spooner, Root, Browder, & Saunders, 2016). Teaching mathematical computation simply addresses how to solve problems; however, it does not teach individuals when and why to apply the skills (Saunders, 2014).

Alternatively, some research on teaching personal finance skills has shown that students with moderate and severe disabilities can be taught to use a debit card, which replaces the need for instruction on traditional forms of payment (e.g., Scott, Collins, Knight, & Kleinert, 2013; Rowe, Cease-Cook, & Test, 2011). While the use of a debit card is an important skill related to making purchases in the community, it does not account for the mathematical decisions that may need to be made, such as providing a tip or accounting for an item being on sale. Given the difficulties individuals with ID have with generalization (Collins, 2012; Stokes & Baer, 1977), teaching personal finance skills through problem solving may be a more meaningful approach.

[1]Florida State University, Tallahassee, USA
[2]The University of North Carolina at Charlotte, USA

Corresponding Author:
Chelsi Brosh, Department of Special Education and Child Development, The University of North Carolina at Charlotte, 9201 University City Blvd., Charlotte, NC 28223-0001, USA.
Email: crbrosh@uncc.edu

Considering the potential impact of mathematical problem solving skills on an individual's independence and academic achievement, it is important for educators to consider evidence-based approaches for teaching this set of skills (Hua et al., 2015). Schema-based instruction (SBI) is an evidence-based practice for teaching word problem solving to students with mild disabilities and has many instructional features that benefit students with moderate/severe disabilities (Jitendra et al., 2015). SBI uses a conceptual teaching approach that combines mathematical problem solving and reading comprehension strategies (Jitendra & Hoff, 1996). Three essential elements of SBI include (a) identification of the problem structure to determine the problem type, (b) use of visual representations of the structure to determine problem type and to organize information from the problem, and (c) explicit instruction on the schema-based problem solving method (Jitendra et al., 2015). In traditional SBI, students draw their own visual representations illustrating the underlying problem structures of different problem types that represent the relationship of quantities in the word problem. One such problem type is the *change* problem type where the starting quantity is either increased or decreased to result in an ending quantity. Personal finance problems fall into this problem type.

A growing body of literature supports the use of modified schema-based instruction (MSBI) to teach individuals with moderate to severe disabilities to solve mathematical word problems. MSBI maintains the three essential features of SBI (identification of the problem structure, use of visual representation, explicit instruction) and adds evidence-based practices for teaching students with moderate/severe disabilities, including the use of systematic instruction, a task analysis, and a read-aloud (Spooner, McKissick, & Knight, in press; Spooner et al., 2016). Pre-drawn graphic organizers with additional supports, such as color-coding, visual supports, and an equation prompt, are provided as the visual representations of problem types in MSBI. Several studies have used the MSBI approach in teaching word problem solving to elementary and middle school students with Autism Spectrum Disorder (ASD) and moderate ID (Root, 2016; Root, Browder, Saunders, & Lo, 2016; Saunders, Lo, & Browder, 2016).

While MSBI has emerging literature to support its effectiveness, the existing studies have limited the quantities depicted in the problems to 10 and taught the use of manipulatives to compensate for early numeracy deficits of students with moderate/severe disabilities, such as lack of fact recall. While this is an effective strategy, many real-world mathematical situations, including those related to personal finance, require fluency with quantities greater than 10. In addition, many personal finance situations involve the use of decimals to represent prices. The use of a calculator is one way to overcome this barrier to more complex mathematical problem solving. Calculators can assist students in solving real-world problems, as well as provide students with a more efficient means to use strategies during problem solving (Fielker, 1987; Kellems et al., 2016; Shuard, Walsh, Goodwin, & Worcester, 1991).

Calculators have been successful in assisting students with ID in mathematics. Heinrich, Collins, Knight, and Spriggs (2016) used an embedded simultaneous prompting procedure to teach a high school student with moderate ID student to solve linear equations with one variable using a graphing calculator. Bouck and Bouck (2008) found sixth-grade students with disabilities, including ID, performed significantly better when given access to a calculator during mathematics assessments. In addition, Gulnoza and Bouck (2014) found calculators were effective in increasing accuracy and mathematical performance for fifth-grade students with mild ID. While these studies taught students with ID to solve mathematical equations using a calculator, they did not teach students to solve personal finance word problems or measure generalization to devices that are more commonly used in society and less socially stigmatizing (e.g., calculator on an iDevice).

Recent research has shown students with ID may benefit from calculator use in solving personal finance problems. A study conducted by Hua et al. (2015) investigated the effectiveness of teaching a three-step cognitive strategy (TIP; [a] take a look at the total bill and enter it on the calculator, [b] identify the tip by multiplying the total by 15%, and [c] plus the total and find out how much to pay) on functional mathematical problem solving skills of young adults with ID. Using a pre- and posttest nonequivalent-group design, results indicated a statistically significant effect on the participants' ability to solve word problems to calculate tip and total bill amount. Participants were given the option to use a calculator; however, the use of a calculator was not specifically targeted.

Research on the use of a calculator within word problem solving tasks for students with moderate ID is warranted. Although MSBI is an emerging practice and has been effective for teaching individuals with ASD and ID to solve mathematical word problems, the research is limited in that only whole digit sums to 10 and differences of zero to nine were used in the word problems and intervention packages relied on manipulatives for computation (Root & Browder, 2016; Root et al., 2016; Saunders, Lo, & Browder, 2015). In addition, current studies evaluating MSBI have included participants with ASD. Additional research is needed to investigate the use of MSBI to solve word problems that include two-digit numbers through the use of a calculator for students with moderate ID who do not have ASD. Students may encounter many different forms of calculators, and instruction should include strategies to promote generalization of calculator skills to multiple common devices (Stokes & Baer, 1977). Therefore, the purpose of this study was to evaluate the effectiveness of MSBI with a calculator on solving two-digit personal finance mathematical word problems by students with moderate ID and to measure the degree to which they are able to generalize across forms of calculators. The following research questions were addressed:

Research Question 1: What was the effect of MSBI with a pre-drawn graphic organizer and a calculator on the total number of steps independently solved correctly on a task analysis by students with moderate ID?
Research Question 2: Were students with moderate ID able to generalize the acquired skill of solving mathematical word problems using an iDevice (iPhone, iPad)?

Method

Participants

Three middle school students diagnosed with ID participated in this study.

Students were nominated to participate in this study by their mathematics teacher based on meeting the following criteria: (a) participation in a special education program under the eligibility category of moderate ID (IQ of 40–55), (b) participation in alternate assessment aligned with alternate achievement standards (AA-AAS), and (c) ability to identify numerals 1 to 99 when presented randomly in isolation.

Jack was a 14-year-old Caucasian male seventh-grade student with Down syndrome. He had a full IQ score of 47 (*Wechsler Intelligence Scale*, Wechsler, 2008). He received the majority academic instruction in a self-contained classroom for students with moderate disabilities. According to his Individualized Education Program (IEP), Jack was able use a calculator to solve multi-digit addition and subtraction problems and identify the value of coins and dollars; however, he was not able to solve addition and subtraction word problems that involved decimals.

Hudson was a 14-year-old Caucasian male seventh-grade student with Down syndrome. He had a full IQ score of 42 (*Wechsler Intelligence Scale*, Wechsler, 2008). He received the majority academic instruction in a self-contained classroom for students with moderate disabilities. According to his IEP, Hudson was able to use a calculator to solve simple algebraic equations with numbers less than 10; however, he was not able to solve two-digit addition and subtraction word problems.

Max was a 14-year-old Hispanic male seventh-grade student with Down syndrome. He had a full IQ score of 42 (*Wechsler Intelligence Scale*, Wechsler, 2008). Max was an English language learner (ELL) who, according to his IEP, was able to identify numbers, count with one-to-one correspondence, and solve one-digit equations using a graphic organizer. Max inconsistently uses a calculator to solve one-digit math problems and struggled when solving problems that involved decimals. As an ELL, Max was able to consistently respond receptively but had difficulty with expressive language. In the home, his family spoke Spanish as the primary language and Max had difficulty with understanding spoken English language. He also had a visual impairment that required him to wear glasses. Max inconsistently wore his glasses, which caused him to frequently make mistakes on his assignments.

Setting

This study took place in a public middle school in a large metropolitan area in the southeastern United States. Participants received all academic instruction in a self-contained special classroom. Participants were integrated with their typically developing peers for non-academic-related arts courses, during reverse inclusion peer buddy opportunities, and during various schoolwide events. Intervention sessions were conducted one-on-one in a conference room or in the students' classroom during time allocated for mathematical instruction. Sessions lasted approximately 10 to 15 min and took place three to four times per week. The primary interventionist was a special education doctoral student who was a Board Certified Behavior Analyst (BCBA) and former special education teacher. A special education doctoral student and a second observer with a doctoral degree in special education collected interobserver agreement (IOA) and procedural fidelity to ensure reliability.

Materials

Materials and procedures were developed as a part of a multi-year federally funded research grant. This study addressed one of the goals of the project, which was to measure the degree to which students can learn to generalize word problem solving to two-digit numbers using a calculator. Materials, lessons, and word problems were adapted to meet the needs of this study. The intervention package included a student worksheet with word problems and a pre-drawn graphic organizer, a self-monitoring checklist, and a calculator.

Each worksheet displayed a word problem, an equation template, a plus and minus sign with the words "sale" and "tip," and the graphic organizer. While the format of the worksheets remained constant throughout the study, novel word problems were used in each session. The word problems were written using a consistent formula (Neef, Nelles, Iwata, & Page, 2003), easy-to-decode words and common verbs (Stein, Kinder, Silbert, & Carnine, 2006), and used common names from diverse cultures (Xin, Wiles, & Lin, 2008). During each session, the problems presented were from community-based thematic units (e.g., hotel, airport, hardware store, aquarium)

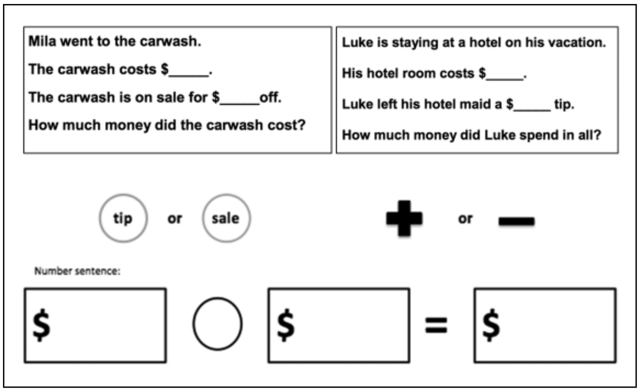

Figure 1. Example of change-addition (tip) and change-subtraction (sale) word problems and the worksheet template.

to set the real-world context for the word problems. A total of 60 word problems were used in the study. The problems were randomly presented by theme for each participant. By randomly presenting the word problems, the order of operation (addition or subtraction) was not predictable. Themes were presented to each student by perceived interest or experience. For example, the airport and hotel thematic units were presented to a student after he returned back from a trip. Figure 1 is an example of a change-addition and change-subtraction word problem. An expert in elementary mathematics instruction reviewed all word problems for consistency and content validity (see Figure 1).

The graphic organizer developed for this study was approved by experts in the field of SBI and elementary mathematics for content validity. The graphic organizer depicted a large circle to represent the starting amount (e.g., initial price of item). A plus sign above the starting amount circle represented adding to the starting amount (e.g., tip) and a trash can below the starting amount circle represented subtracting from the starting amount (e.g., sale).

Students were presented with a self-instruction sheet that allowed for self-monitoring. The self-instruction sheet displayed 10 steps, with each step pairing a picture with text to provide additional support to emerging readers. These steps are found in Table 1.

Participants used a simple, handheld electronic calculator throughout all phases except generalization. The interventionist received a Texas Instrument TI-15 Explorer Calculator from the classroom teacher to use during the study. This device is commonly used in middle school settings and is available during statewide assessments. During generalization probes, iDevices (e.g., iPads, iPhones) were used.

Experimental Design

A multiple probe across participants design was used (Horner & Baer, 1978). All three participants entered baseline together and were continuously probed. After collecting 5 data points for all three participants during baseline, a stable trend was observed and the first participant entered intervention. During this time, the remaining participants continued in baseline with intermittent baseline probes administered at a minimum every eight sessions. After the first participant showed a stable upward trend in the number of steps completed independently on the task analysis, the second participant entered intervention after three consecutive baseline probes were administered. This systematic process continued until all participants entered intervention (Kratochwill et al., 2013).

This study consisted of four conditions: (a) baseline, (b) intervention, (c) generalization, and (d) maintenance. There were three phases in intervention, including change addition, change subtraction, and change-mixed. In the baseline condition, participants were given four word problems, two change-addition and two change-subtraction word problems. Data were recorded on the first addition and first subtraction problem presented to the student. During change addition and change subtraction, participants were given two word problems per session of the targeted problem type (i.e., change addition or change subtraction). During change-mixed and maintenance, participants were given two word problems per session, one change-addition and one change-subtraction problem.

Dependent variables. Two dependent variables were measured. The first and primary dependent variable was mathematical problem solving, measured by the total number of points a participant received by independently performing the steps of the task analysis (see Table 1). Steps 1 to 9 were worth 1 point each. Step 10 was worth a total of 3 points for three distinct behaviors: (a) writing the answer in the correct location on the number sentence (i.e., final position), (b) putting the decimal point in the correct location, and (c) stating the answer aloud correctly (e.g., three dollars and five cents vs. three dollars and fifty cents). Thus, each problem could receive a total of 12 points resulting in a total of 24 points available in each session across the two word problems. Criterion for mastery and changing intervention phases was achieving a score of at least 10 out of 12 points, which had to include independent correct responses on Steps 4, 6, 9, and 10 for at least two consecutive sessions. These steps were deemed "critical" for demonstrating mastery of both conceptual and procedural components of solving personal finance problems (Test & Spooner, 1996).

Generalization to an iDevice was the second dependent variable and was measured by the number of points received by independently performing the steps of the task analysis and correctly solving and writing the answer during generalization probes. Generalization probes followed mastery in each of the intervention phases.

IOA and procedural fidelity. To ensure reliability and fidelity, a second observer was trained to observe sessions and record both IOA and procedural fidelity. Sessions were recorded

Table 1. Expected Student Response for Each Step on the Self-Instruction Sheet.

Step		Expected student response
1.	Read the problem	Read the word problem or ask for the problem to be read aloud
2.	Underline the starting amount	Underline the initial dollar amount
3.	Circle the second amount	Circle the second amount, or the change amount (i.e., the amount that we are adding, or taking away from the starting amount)
4.	Circle "sale" or "tip"	Find the key word in the word problem; when something is on sale the price decreases; when we leave a tip, the cost increases
5.	Use rule	State the rule for the change problem type ("One thing, money, we add to tip, or take away for sale, and change")
6.	Plus or minus?	Circle the correct symbol (plus or minus) on worksheet
7.	Label graphic organizer	Write numbers in the correct place on the graphic organizer
8.	Fill in number sentence	Complete the number sentence with the numbers used in the word problem
9.	Solve with calculator	Correctly transfer the equation to the calculator
10.	Write answer	Write the answer with correct (a) placement of the decimal place on the calculator, (b) amount for multiples of 10 (i.e., write US$15.20 not US$15.2), and (c) state amount back to interventionist correctly (e.g., fifteen dollars and twenty cents)

Note. Steps 1 to 9 were each worth 1 point. Step 10 was worth 3 points, 1 for each distinct behavior.

using a GoPro device, and both in vivo and video observations were used. IOA measured the reliability of the dependent variables. IOA was conducted for at least 30% of baseline and intervention sessions for each participant. IOA for Jack was taken for 60% of baseline sessions with a mean agreement of 99.6%, for 40% of intervention with a mean agreement of 99.6%, and for 33% of generalization sessions with a mean agreement of 100%. IOA for Hudson was taken for 75% of baseline sessions with a mean agreement of 100%, for 50% of intervention sessions with a mean agreement of 99.6%, and for 100% of generalization sessions with a mean agreement of 100%. IOA for Max was taken for 60% of baseline sessions with a mean agreement of 100%, for 40% of intervention sessions with a mean agreement of 98.6%, and for 33% of generalization sessions with a mean agreement of 100%.

Procedural fidelity was calculated for a minimum 30% of the baseline, intervention, and generalization sessions. Fidelity for Jack was taken for 60% of baseline sessions with a mean agreement of 100%, for 40% of intervention with a mean agreement of 98%, and for 33% of generalization sessions with a mean agreement of 100%. Fidelity for Hudson was taken for 75% of baseline sessions with a mean agreement of 100%, for 50% of intervention sessions with a mean agreement of 99%, and for 33% of generalization sessions with a mean agreement of 100%. Fidelity for Max was taken for 60% of baseline sessions with a mean agreement of 100%, for 40% of intervention sessions with a mean agreement of 98%, and for 33% of generalization sessions with a mean agreement of 100%.

Due to time constraints and the academic year ending, only two participants entered into the maintenance phase. IOA and fidelity for Jack were collected for 33% of maintenance sessions with a mean agreement of 100%. IOA and fidelity for Hudson were collected for 50% of maintenance sessions with a mean agreement of 100%.

Procedures

Baseline. At the start of each baseline session, participants were given a writing utensil, a calculator, and worksheets. In each baseline session they completed four worksheets: two worksheets had word problems depicting a real-world application of giving a tip (addition) and two had word problems related to real-world applications of items being on sale (subtraction). The order of the four worksheets was randomized each session. The interventionist presented the verbal prompt, "Show me how to solve this problem," to the participant. The interventionist read the problem aloud if a participant requested. No prompting, feedback, or error correction was provided during baseline.

Pre-unit. A unit to build fluency with early numeracy skills, the expressive and receptive identification of written amounts using decimals, identification of sale and tip as vocabulary words, and calculator use was introduced prior to intervention. The goal of this unit was to provide participants with explicit instruction to build fluency on critical components on the intervention. The interventionist administered the pre-unit to each participant individually after all of their baseline sessions were completed but before intervention began. Participants were required to independently perform each skill for three consecutive correct responses across two consecutive sessions before beginning intervention.

Intervention. For the first 2 days of a new intervention phase, the interventionist modeled each step of the student self-instruction sheet with active participation using a model-test format. Modeling sessions were completed prior to beginning the change-addition, change-subtraction, and change-mixed phases. During modeling, no student data were collected because the student was guided through each step of the problem solving method. The student was not asked to respond independently during modeling. Table 1 lists expected participant responses for each step of the task analysis.

Following the 2 days of modeling, the interventionist gave participants the opportunity to attempt each step on the student checklist using a system of least prompts. The interventionist provided the participant with a self-monitoring checklist, worksheet, writing instrument, and a calculator and gave the cue, "Show me how to solve the problem." Two participants who were emergent readers attempted to read each problem, however, following the participants attempt the interventionist read the problem aloud for each student. The third participant was a non-reader who would attempt to read and filled in each number in the question. Following his attempt, the interventionist read the question aloud for the participant. If the participant did not respond to a specific step on the task analysis within 10 s of the instructional cue, the interventionist followed a system of least intrusive prompts by providing the participant with a verbal prompt, followed by a specific verbal prompt, then a model of the correct response.

Generalization. Generalization probes measured the participants' ability to generalize word problem solving to different electronic touch-based devices, specifically iDevices (iPads and iPhones). Generalization sessions took place following mastery in each instructional phase. After the first intervention phase, each participant was able to generalize Steps 1 to 4 and 8 to 10 from the student checklist to subsequent problems. Steps 5 to 7 were specific to the addition or subtraction operation and often required additional prompting. In each generalization probe, participants were given the same instructional materials from that phase, with an iDevice substituted for the calculator. Each participant was given a choice whether to use the iPhone or iPad during generalization phases, however, it was recommended that Participant 3 use the iPad to account for his visual impairment. Instructional procedures remained the same during generalization probes; prompting and feedback were provided.

Maintenance. After participants met mastery criteria in the change-mixed phase and completed the generalization probes, they moved into maintenance. Maintenance probes were conducted every five sessions that represented approximately 5 academic days. In maintenance probes, participants were given four word problems, two of each operation, to solve with a calculator. Data were collected on the first two problems presented to the participant. While problems were presented in random order, addition and subtraction

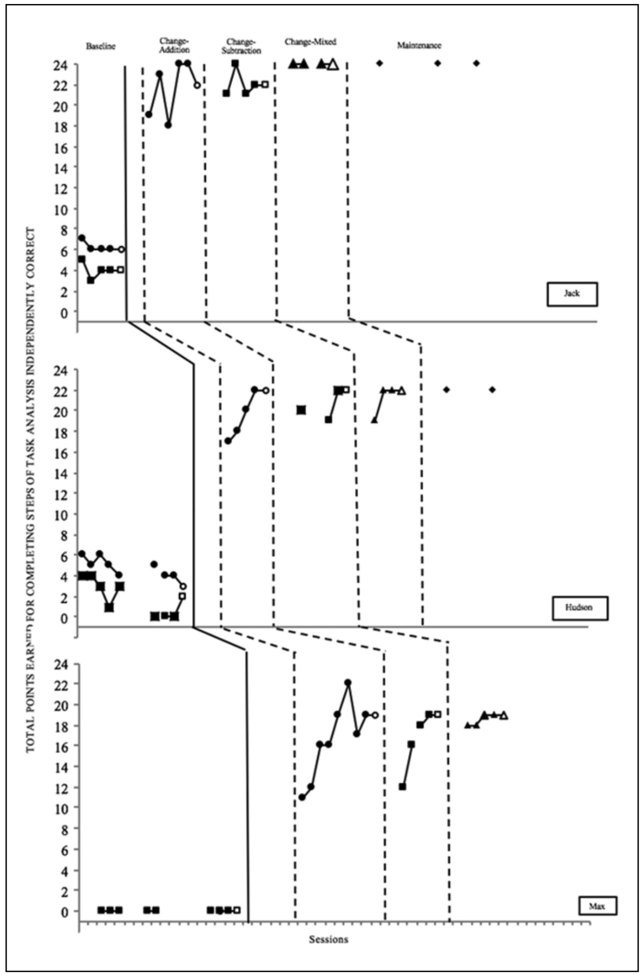

Figure 2. Total number of points received for completing steps of task analysis independently correct.
Note. There was a pre-unit conducted after the last baseline data point and prior to entering intervention to solidify prerequisite skills. Circles represent the change-addition probes, squares represent change-subtraction probes, triangles represent change-mixed probes, and diamonds represent maintenance probes. Open circles, squares, and triangles indicate generalization probes using an iDevice.

problems were presented systematically to ensure that addition or subtraction problems were not presented back-to-back. No prompting or feedback was provided to participants during maintenance probes.

Results

Figure 2 represents the number of points received for independent correct steps on the task analysis for solving mathematical word problems for Jack, Hudson, and Max. Sessions are represented on the x-axis and the number of independent correct responses (12 points per problem for a total of 24 possible correct responses per problem type) during each session is represented on the y-axis. There was an immediacy of effect demonstrated by a jump in level for each participant after the MSBI intervention began using the system of least prompts.

During baseline, Jack scored an average of 6.2 points for independent correct responses on change-addition problems and an average of 4 points for change-subtraction problems. Jack was able to reach mastery of change-addition problems in five sessions, change-subtraction problems in three sessions, and was able to discriminate between addition and subtraction in the change-mixed phase in three sessions. In addition, Jack was able to maintain his performance after four, eight, and 12 sessions.

During baseline, Hudson scored an average of 5.2 points for independent correct responses on change-addition problems and an average of 2.1 points for change-subtraction problems. Hudson was able to reach mastery of change-addition problems in three sessions, change-subtraction problems in three sessions, and was able to discriminate between addition and subtraction in three sessions. In addition, Hudson was able to maintain his performance after four and eight sessions.

During baseline, Max scored an average of 0 points for independent correct responses on change-addition problems and an average of 0 points for change-subtraction problems. Max was able to reach mastery of change-addition problems in five sessions, change-subtraction problems in three sessions, and was able to discriminate between addition and subtraction in three sessions. Due to time constraints with the school year ending, maintenance probes were not presented to Max.

Social validity. After completing the intervention, social validity was collected by directly interviewing each participant. Each participant reported that he or she enjoyed the intervention, wanted to continue solving word problems, and was more confident solving addition and subtraction word problems using a calculator. In addition, participants reported that they wanted to learn to solve more mathematical word problems related to personal finance.

Discussion

The purpose of this study was to evaluate the effectiveness of MSBI with a calculator on solving two-digit personal finance mathematical word problems with decimals by students with moderate ID. Given the potential impact of personal finance skills on community relationships, autonomy, and independence (Browder & Grasso, 1999; Cihak & Grim, 2008; Colyer & Collins, 1996), it is crucial to adequately teach this skill to individuals with ID. The importance of using evidence-based practices is well established (Browder & Spooner, 2011; Spooner et al., in press), but problem solving for students with moderate/severe disabilities is an emerging area of research. In the absence of an established evidence-based practice, Whalon, Al Otaiba, and Delano (2009) suggested looking to other disability groups when designing instruction for students with moderate/severe disabilities and determining what supports can be added. SBI is an evidence-based practice for students with learning disabilities (Jitendra et al., 2015). The MSBI in this study provided strategy instruction as well as instructional supports including systematic instruction, visual supports, and a task analysis, that are evidence-based for students with moderate/severe disabilities (Spooner et al., in press). The graphic organizer with visual supports helped students translate information presented in the word problems and solve. In addition, the calculator supported the students' lack of fast recall and fluency, and helped students successfully solve arithmetic word problems with decimals.

The modifications, or enhancements, provided in this study addressed the barriers students with ID face in solving mathematics word problems as evidenced by the functional relation between MSBI with a calculator and points received for steps of the task analysis completed independently as shown in Figure 2. The problems were considered "solved" if the participant was able to correctly determine if the problem depicted a "sale" or "tip" scenario and choose the correct corresponding operation (i.e., addition for tip and subtraction for sale), solve the problem using a calculator, and correctly write and verbalize the answer. These steps were considered "critical" (Test & Spooner, 1996). Results of the study also show participants were able to generalize skills from the classroom calculator to an iDevice as shown in Figure 2. As the use of iDevices become more commonplace over the use of a standard classroom calculator for solving personal finance problems, generalization to these devices are important. Individuals are more likely to have access to an iDevice than a standard classroom calculator when faced with authentic personal finance tasks, such as determining sale and tip prices, in the community. The participants' ability to use the iDevice to calculate personal finance mathematical problems is an important finding.

Max showed a slower acquisition of mathematical problem solving. As an ELL, he had difficulty with language comprehension and required additional instruction during the pre-unit. Another factor that could have contributed to his performance was his eyesight. While he wore glasses to correct his vision impairment, he preferred not to wear his glasses and struggled to keep his glasses on during intervention. This could have contributed to his mistakes when transferring information from the graphic organizer to the calculator and vice versa. While Max was able to master the change-addition, change-subtraction, and change-discrimination phases of the intervention, maintenance data were unable to be collected due to the academic school year ending.

The findings of this investigation contribute to literature on teaching problem solving, specifically related to personal finance, to students with moderate ID. The realistic quantities depicted in the word problems and instruction on calculator use expands the boundaries on generalization established by prior MSBI studies (Root & Browder, 2016; Root et al., 2016; Saunders, Lo, & Browder, 2016). Specifically, this study adds to the mathematical content, instructional supports, as well as targeted population of empirical studies of MSBI.

Limitations and Future Research

Although the results of this study are promising, there are several limitations. First, the intervention took place outside of the participants' classroom in a one-on-one format with an interventionist who was a doctoral student and BCBA. This is not the typical setting or intervention agent for mathematics instruction for these students. Future research should investigate the effects of MSBI in the natural instructional setting with natural intervention agents, such as teachers, peers, or paraeducators.

A second limitation is related to boundaries on generalization. The format of the word problems was purposefully formulaic and did not account for sales tax. To apply the intervention in the community setting, this would be an important consideration. Real-world applications of sales and tip come from viewing a final bill or seeing a price tag on an item. Future research on the generality of this intervention to real-world settings is warranted.

Finally, although participants in this study were able to solve personal finance mathematical word problems using MSBI and a calculator, further investigation should focus on the generalization of skills in community-based settings. Due to budgetary constraints and rules by the school district, researchers were not able to set up or go on community-based outings to measure the generalizability to real-world settings. While these are common constraints for researchers and teachers, future studies could include simulated generalization measures, perhaps through videos. For example, participants could see videos that depict scenarios in the community of giving a tip or items being on sale and use their calculators to solve. At this time, it is not known if solving word problems related to personal finance questions has an impact on an individual's ability to calculate total cost when making purchases in the community.

Implications for Practice

Practitioners should use treatment packages that include evidence-based practices to support the learning of diverse populations. MSBI is a promising method for integrating core content and functional skills to promote real-world problem solving. Practitioners could use MSBI to pre-teach skills needed for community-based trips and employment opportunities. The results of this study show that calculator use in personal finance tasks is one way to provide access to higher level mathematics and realistic quantities for students who may not have mastered the procedures for calculating sums or differences involving decimals and multiple digit numbers. In addition, the use of portable technology (i.e., iDevices) provides opportunity to practice skills in multiple environments with naturalistic supports.

Conclusion

Ability to manage personal finance is a step toward independence and fiscal security. Personal finance, budgeting, and saving money can be difficult for individuals with moderate ID because of deficits in mathematical skills. In this study, three students with moderate ID were able to learn to solve real-world mathematical problems with the use of a calculator and generalize that skill to an iDevice. Investigations along these lines continue to extend what we know about teaching mathematical problem solving to this population and add one more piece of knowledge to the foundation of increasing the likelihood of quality of life and enhanced independence.

Authors' Note

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