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The Effects of Direct Instruction Flashcards with Model, Lead, and Test on Counting Money with a High School Student with Autism and Intellectual Delay

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Abstract

The purpose of this study was to increase the fluency and accuracy on counting out money amounts for one 16-year-old student with autism and intellectual delay. The study was conducted in a self-contained special education classroom in a public school in the Pacific Northwest. The behaviors measured were corrects and errors on counting out money amounts in Sets 1-4. The behavior was measure 3-4 times a week. The student was taught using Direct Instruction, which included a Model, Lead, and Test Procedure. The results showed a clear increase of corrects and a decrease in errors for the participant. The benefits of Direct Instruction clearly demonstrated that a 16-year-old student with autism and intellectual delay could be taught to count out money amounts and use a calculator to find the total cost of items.

Keywords

Direct Instruction, Autism, Intellectual Delay, Money, MLT, Functional Skills

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1. Introduction

Functional money skills are an absolutely necessary skill to ensure the success of students, especial students with special needs, in life outside of the classroom and after high school. When considering if the learner will be able to live independently, in a group home or with family, basic functional money skills are an important factor. The learner must be able to manage his bills, create and execute grocery lists, and navigate and pay for transportation (Anderson, Shattuck, Cooper, Roux, & Wagner, 2014; Kao, Kramer, Liljenquist, & Coster, 2015; Wei, Wagner, Hudson, Yu, & Shattuck, 2015). The learner must be able to independently and fluently use money to purchase items and plan shopping lists to ensure future success in a semi-independent living situation.

Direct instruction is a systematic approach to teaching a skill and works for many types of learners (Marchand-Martella, Slocum, & Martella, 2004; Stein & Carnine, 2006). Small group or individualized instruction is common when using Direct Instruction because it allows the instructor to closely monitor student performance and provide immediate feedback and error corrections (Kinder & Carnine, 1991). Direct instruction methods have been shown to be effective for students with intellectual delay and with autism (Erbey, McLaughlin, Derby, & Everson, 2001; Hopewell, McLaughlin, & Derby, 2009; Kaufman, McLaughlin, Derby, & Waco, 2011). Direct instruction has also been shown to be effective when teaching students money counting skills (Watanabe, McLaughlin, Weber, & Shank, 2013) and other

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mathematics program and procedures (Kinder & Carnine, 1991; Marchand-Martella et al., 2004; Stein et al., 2006).

One method of Direct Instruction is a Model, Lead, Test (MLT) procedure. The MLT teaching procedure has been shown to increase performance by number of correct responses in many academic areas for children with disabilities (Bechtolt, McLaughlin, Derby, & Blecher, 2006; Bulkley, McLaughlin, Neyman, & Carosella 2007; Shouse, Weber, McLaughlin, & Riley, 2010). MLT error correction also provides the student with a lot of repetition which will increase the likelihood that the student will maintain the skill (Gerhardt, Garcia, & Foglia, 2014). Through a Model, Lead, Test procedure one can use conditional discrimination training to teach students to discriminate between different coins and types of bill (Keintz, Miguel, Kao, & Finn, 2011).

The purpose of this study was to test the effects of a Direct Instruction MLT Procedure on counting out money amounts up to $10 on a 16-year-old boy with autism and intellectual delay. A second purpose was to extend and replicate the use MLT in a high school setting.

2. Method

2.1. Participant and Setting

The participant was a 16-year-old boy in the 9th grade that attended a high school in the Pacific Northwest. The student was placed in a self-contained special education room. The student came from a middle-class family consisting of a single parent and an older brother who attended the same high school as him but took general education classes. The student qualified for special education services under the category of multiple disabilities. He was diagnosed with autism and intellectual delay. The student's self-contained classroom had students who were at a pre-academic to third grade level. The focus in the student's classroom was on acquiring life skills. His classroom teacher mentioned that he struggled with functional money skills, specifically counting out money amounts up to $10. For this study, the criterion for participant selection was that the student's teacher informed the researcher that he needed extra support in gaining this functional life skill. The participant's current level was not given to the researcher so the researcher assessed the student and determined that the student could identify all coins, knew their value, and could count money amounts under $1 with 50% accuracy.

The study was conducted in the participant's self-contained designed instruction (DI) classroom at a private table. Typically there were few distractions beyond the normal noise level of the classroom. The sessions usually took place three days a week. Each session lasted approximately 20 to 30 minutes and only one sessions was conducted per day during the student's normal math class time.

2.2. Materials

Throughout the course of the project a variety of materials were implemented. First, an assortment of coins including quarters, dimes, nickels, and pennies were used. Bills including dollar bills and five dollar bills were used. A piece of white paper with an equal sign drawn on it was used to show equivalency between money amounts (Ex. A quarter = two dimes and a nickel). A price sheets, containing the prices of department store items, was used so the student could practicing finding item prices and paying that amount. A calculator was used so the student could add the prices of more than one item together to find the total amount.

2.3. Response Definitions and Data Collection

The dependent variable was correct responses to questions in Sets 1-4 that were presented verbally after instruction in each session. Responses were correct if they used the correct bills and coins to display each money amount in simplest form. Responses were incorrect if they did not display the money amount, or if they were not in simplest form. For example, an answer would not be in simplest form if the student used 25 pennies to show 25 cents instead of a quarter.

The recording system used during assessment was frequency recording that measured how many times the student provided correct responses to the in Sets 1-4. The primary recorder (the person directing the intervention) immediately checked the answers visually to see if the money amount displayed the price the student was supposed to count out. During baseline and intervention, data was collected on a data sheet to keep track of correct answers for each quiz. If the student correctly counting out the money amount, the first author left the question blank. If the student incorrectly counted out the money amount, the researcher placed an "X" through the question. The percent correct was determined at the end of each assessment. (See data sheets in Appendix)

2.4. Experimental Design and Conditions

This experiment used a single-subject multiple-probe design. For Set 1, baseline took place for two sessions. The trend was low and stable so the researcher moved into intervention for Set 1. Intervention occurred for five sessions. When the student reached 100% accuracy for two sessions the researcher began intervention on Set Two. Intervention occurred for three sessions in Set 2. When the student reached 100% accuracy for two sessions the first author began intervention on Set Three. Intervention occurred for three sessions in Set Three. When our participant reached

100% accuracy for two sessions that first author began intervention on Set Four. Intervention occurred for three sessions in Set Four. When the student reached 100% accuracy for two sessions the researcher considered the skill mastered.

2.4.1. Baseline

During baseline, the student was asked to complete questions in Sets 1-4 independently (See Appendix). Baseline was conducted for at least two sessions before beginning intervention on a set.

2.4.2. DI Flashcards + MLT

The learning objective for Set 1 was given 5 problems (Set One, Appendix), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions. The learner was taught to use simplest form to count out money amounts under $1 by using a Model, Lead, and Test Procedure. When the student made an error, the researcher would say "My turn," and model the correct way, then ask the student to count with the researcher and finally have the student count out the money amount by himself. This Model, Lead, and Test Procedure was done continuously until the student was able to independently complete the problem. When the student met the learning objective the research began intervention on Set 2.

The learning objective for Set 2 was given 5 problems (Set Two, Appendix), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions. The learner was taught the $1 bill, and to count out money amounts under $5 by using a Model, Lead, and Test Procedure. When the student made an error, the researcher would say "My turn," and model the correct way, then ask the student to count with the researcher and finally have the student count out the money amount by himself. This MLT error correction procedure was carried out continuously until the student was able to independently complete the problem. When the student met the learning objective the research began intervention on Set 3.

The learning objective for Set 3 was given 5 problems (Set Three, Figure 1), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions. The learner was taught to add items prices using a calculator and then use the skills learned in Sets 1 and 2 to complete practice problems and the questions in Set 3. When the student made an error counting out money amounts or using the calculator, the researcher would say "My turn," and model the correct way, then ask the student to count with the researcher and finally have the student complete the problem independently. This Model, Lead, and Test Procedure were done continuously until the student was able to independently complete the problems. When the student met the learning objective the research began intervention on Set 4.

The learning objective for Set 4 was given 5 problems (Set Four, Appendix), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions. The learner was taught the $5 bill, to discriminate between the $1 and $5, to add item prices together using the calculator, and to count out money amounts under $10 by using a Model, Lead, and Test Procedure. When the student made an error the researcher would say "My turn," and model the correct way, then ask the student to work with the researcher and finally have the student complete the problem independently. This Model, Lead, and Test Procedure was done continuously until the student was able to independently complete the problems. When the student met the learning objective for Set 4 the study was considered complete.

2.5. Reliability of Measurement and Interobserver Agreement

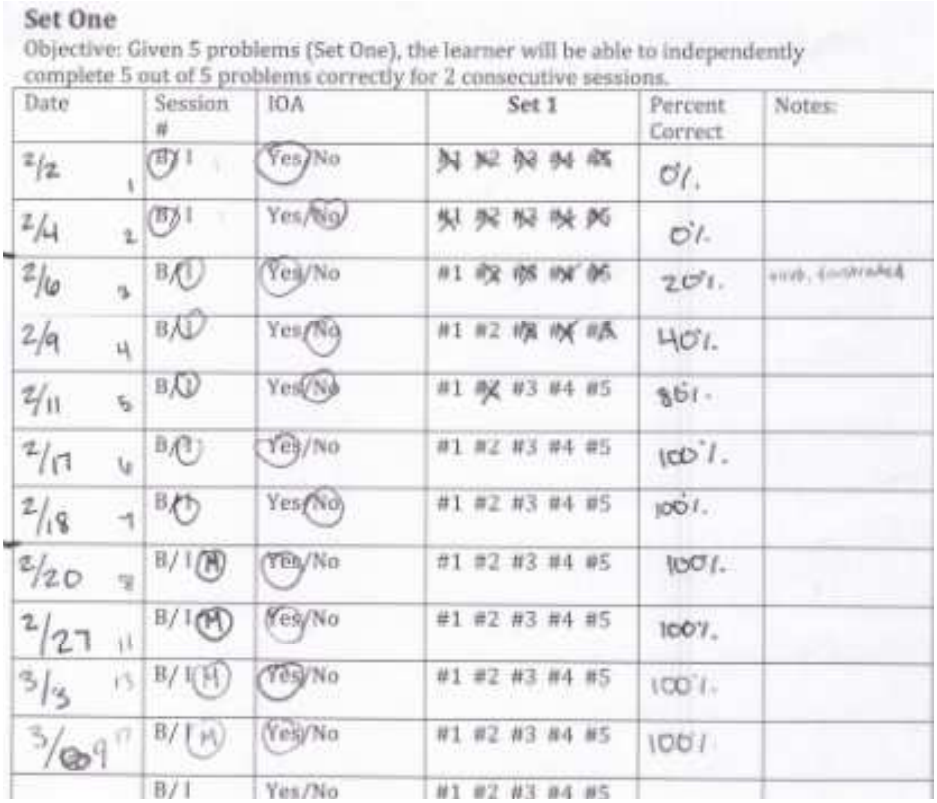
Inter-observer agreement (IOA) was collected in the same way across all phases. Videos of sessions were used by the reliability data collector to check the student's answers. Two data sheets were used, one was for the primary and one was for reliability. The reliability data collector would not mark the question if the student correctly counting out the money amount. If the student incorrectly counted out the money amount, the reliability data collector placed an "X" through the question. Data were taken independently between the primary and reliability data collectors.

Specific criteria were used for agreement and disagreement between the primary and reliability data. Each session's score was compared. A session was considered in agreement if the sessions' percentage score for the quiz matched exactly on both primary and reliability data. A session was considered in disagreement if the sessions' percentage score for the assessment did not match exactly on both primary and reliability data. Reliability was taken for 44% of sessions. The percentage of inter-observer agreement (IOA) was calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying it by one hundred. For Baseline Set 1 IOA was 100%; Intervention Set 1 IOA was 100%; Baseline Set 2 IOA was_100%; Intervention Set 2 IOA was 100%; Baseline Set 3 IOA was 100%; Intervention Set 3 IOA was 100%; Baseline Set 4 IOA was_100%; Intervention Set 4 IOA was 100%; which made the overall IOA of the study 100%.

3. Results

The percent of correct answers in Sets 1-4 is shown in Figure 1. For baseline in Set 1, the student's mean percentage of

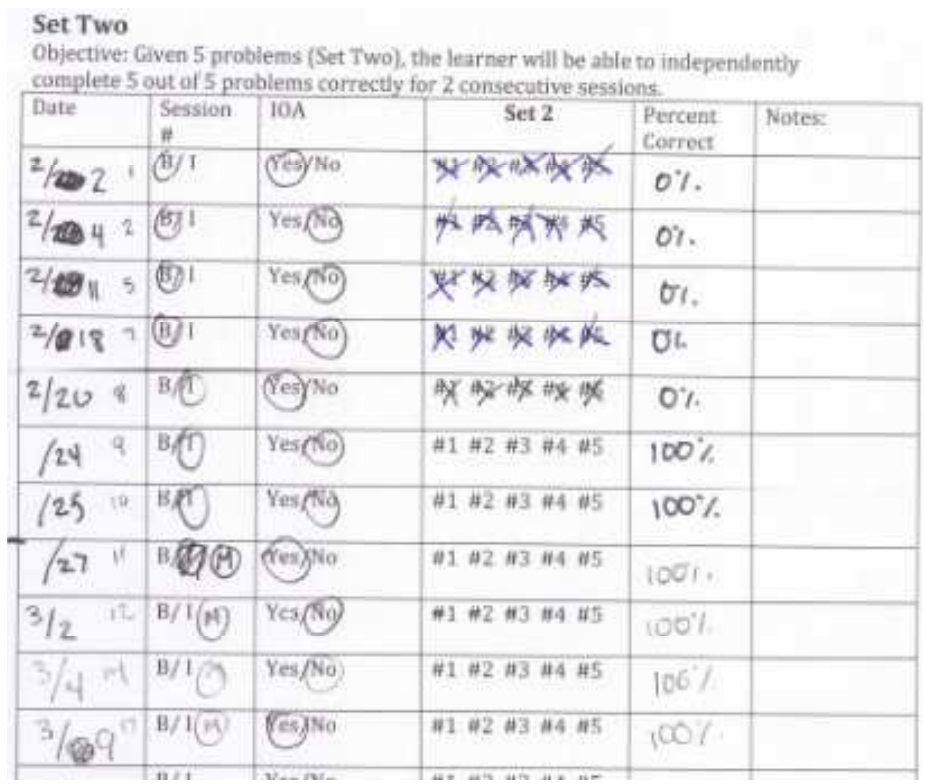
correct answers was 0%. For Set 1 MLT the student's mean percentage of correct answers was 82.2% (range 20-100%). For Baseline in Set 2, the student's mean percentage of correct answers was 0%. For Set 2 MLT, the student's mean percentage of correct answers was 85.7% (range 0-100%). For baseline in Set 3, the student's mean percentage of correct answers was 0%. For Set 3 Intervention, the student's mean percentage of correct answers was 92% (range 60-100%). For baseline in Set 4, the student's mean percentage of correct answers was 0%. For Set 4 Intervention, the student's mean percentage of correct answers was 96% (range 80-100%).



Set One

Objective: Given 5 problems (Set One), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions.

Date	Session #	IOA	Set 1	Percent Correct	Notes:
2/2 1	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/4 2	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/6 3	B/I	Yes/No	#1 #2 #3 #4 #5	20%	
2/9 4	B/I	Yes/No	#1 #2 #3 #4 #5	40%	
2/11 5	B/I	Yes/No	#1 #2 #3 #4 #5	80%	
2/17 6	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
2/18 7	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
2/20 8	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
2/27 11	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/3 13	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/9 17	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
	B/I	Yes/No	#1 #2 #3 #4 #5		



Set Two

Objective: Given 5 problems (Set Two), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions.

Date	Session #	IOA	Set 2	Percent Correct	Notes:
2/2 1	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/4 2	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/11 5	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/18 7	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
2/20 8	B/I	Yes/No	#1 #2 #3 #4 #5	0%	
/24 9	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
/25 10	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
/27 11	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/2 12	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/4 14	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
3/9 17	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
	B/I	Yes/No	#1 #2 #3 #4 #5		

Set Three

Objective: Given 5 problems (Set Three), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions.

Date	Session #	IOA	Set 3	Percent Correct	Notes:
2/2 1	B/I	Yes/No		0%	
2/4 2	B/I	Yes/No		0%	
2/18 7	B/I	Yes/No		0%	
2/24 9	B/I	Yes/No		0%	
2/27 11	B/I	Yes/No	#1 #2 #3 #4 #5	60%	
3/2 12	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
3/3 13	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
3/4 14	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/9 17	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
	B/I	Yes/No	#1 #2 #3 #4 #5		

Set Four

Objective: Given 5 problems (Set Four), the learner will be able to independently complete 5 out of 5 problems correctly for 2 consecutive sessions.

Date	Session #	IOA	Set 4	Percent Correct	Notes:
2/2 1	B/I	Yes/No		0%	
2/4 2	B/I	Yes/No		0%	
2/18 7	B/I	Yes/No		0%	
2/27 11	B/I	Yes/No		0%	
3/4 14	B/I	Yes/No	#1 #2 #3 #4 #5	80%	
3/5 15	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
3/6 16	B/I	Yes/No	#1 #2 #3 #4 #5	100%	
3/9 17	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
3/10 18	B/I (M)	Yes/No	#1 #2 #3 #4 #5	100%	
	B/I	Yes/No	#1 #2 #3 #4 #5		

Figure 1. Raw data and scoring sheets for Sets 1, 2, 3.and 4.

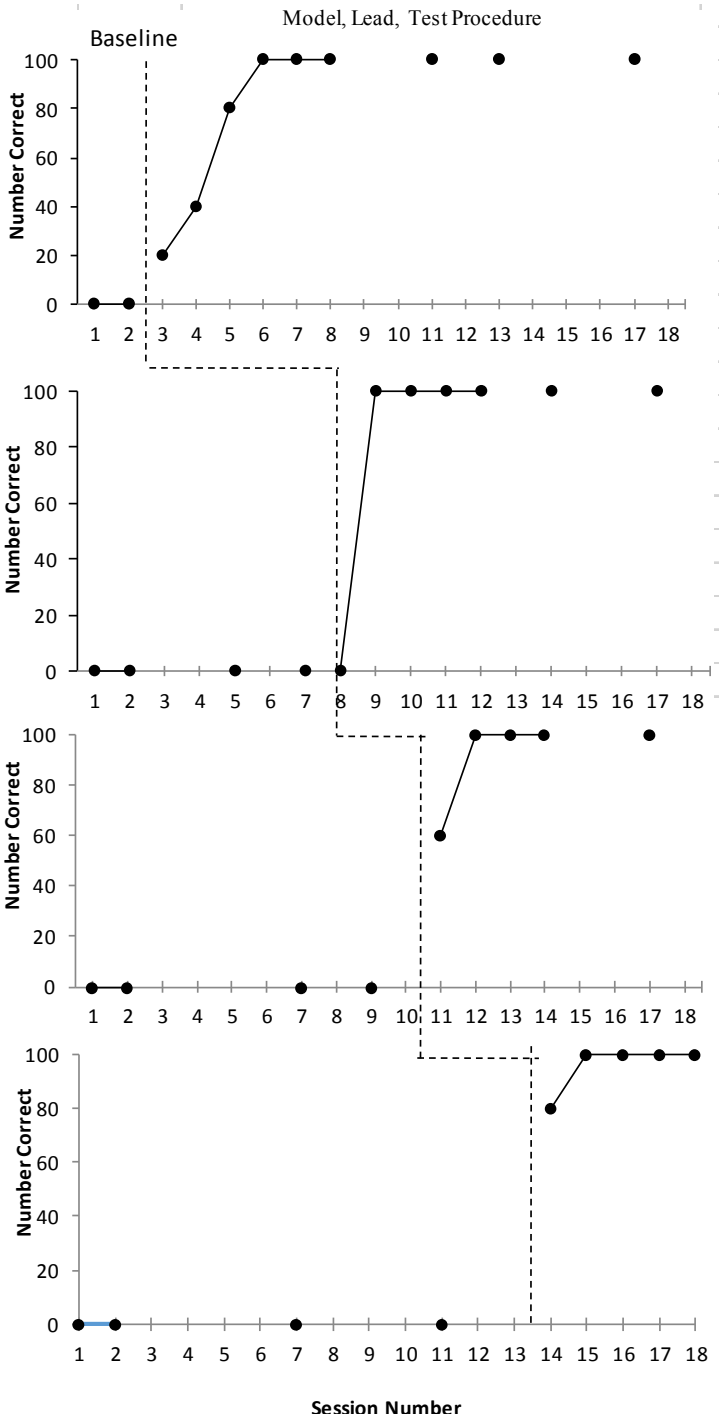


Figure 2. The number of correct responses for Sets 1 through 4.

4. Discussion

The results of this study indicate an increase in accuracy of counting money amounts as a result of a MLT procedure for a 16-year-old boy with autism and intellectual delay. Throughout the course of the study the participant demonstrated fast and steady improvement in scores for all four Sets in the study. The participant quickly became accustomed to the MLT procedure and began noticing his own improvement. This study supports the outcomes of previous studies related to the effectiveness of a MLT procedure on increasing student accuracy (Bechtolt et al., 2012; Brushwein et al., 2014; Bulkley, et al., 2012; Hopewell et al., 2011; Kaufman et al., 2011; Shouse et al., 2012; Watanabe et al., 2013). This information is crucial in order to support the continued implementation of a Model, Lead, and Test procedure for students with low functional money skills.

During all four Sets one can see that the participant's scores increased steadily until he reached mastery. Even for the

problems marked incorrect the student did count out the correct amount of change, the instructor only marked these problems incorrect when he did not use simplest form.

The MLT procedure was very practical. The sessions on average took less than 30-minutes so the intervention could easily continue to be implemented by the classroom teacher or an instructional assistant. The procedure was also very inexpressive. The research was able to print all of the price cards and price sheets needed for free. The calculator was borrowed from the classroom materials. The money the student used to complete the problems was also part of the instructional materials used in the classroom. Another strength of this intervention was that the participant was taught a practical, functional skill that he can use throughout the rest of his life. The student's father commented that he was very happy with his son's quick improvement and maintenance of the skill.

This study also had some weaknesses. If this study were to be replicated in the future it may be beneficial to increase the length of the study. It may also be beneficial to provide a generalization component where the student counts the money amounts out to other adults in the classroom and then finally makes real life purchases in the community. If this study was to be replicated it may be beneficial to replicate the sessions in a more quiet setting. The self-contained classroom where the participant worked was often loud and full of distractions. Another limitation of this study is that it only increased one participant. Having several participants would have increased the reliability of the results. The study also did not implement procedural integrity measures. Even though these weaknesses exist, the procedure was still successful.

A MLT procedure can be an effective intervention for some children with low functional money handling skills. These findings allow for future research to be conducted to test the effectiveness of this procedure on different groups and in different settings. Future research could test the effect of a MLT procedure for children of different age groups and with different disabilities such as ADHD, Down's syndrome, or learning disabilities.

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