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The Effectiveness of Model, Lead, and Test Technique with Real Money Coins to Teach Differentiation and Counting to a 16-Year-Old High School Student with Multiple Disabilities

Brooke Hollowell
T. F. McLaughlin
Department of Special Education
Gonzaga University
and
Kim Hatch
Spokane Public Schools

Author Notes

Brooke Hollowell declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Portions of these data were collected by the first author as part of the course requirements for a Minor in Special Education. In addition, this research is approved under the category of standard classroom practice by the IRB at Gonzaga University.

Requests for reprints should be sent to bhollowell@zagmail.gonzaga.edu or at the Department of Special Education, Gonzaga University, Spokane, WA 99258-0025. *Finally, the study followed the APA and CEC Code of Ethics.*

Abstract

The purpose of this study was to increase correct responses of coin amounts using model, lead, and test (MLT) as a method of intervention. One-ninth grade student, diagnosed with Multiple Disabilities that suffered from specific health impairments including seizures, cerebral palsy right hemiplegia, and schizencephaly participated in our study. Real coins were used for the different quantities presented to the student and the number of correct responses to the coin amounts was the major dependent measure. A multiple baseline across sets was used to implement the MLT with the student. The author of this study conducted the sessions with the student teacher of the classroom providing reliability. The outcomes of the study indicated that the MLT for error correction with real coin money was an effective way of improving the number of correct responses for coin quantity identification. Generalization to the third set was found without the use of MLT error correction.

***Keywords**: Money Counting, Adolescent, Error Correction, Model Lead, and Test, Multiple Baseline Design, High School, Functional Skills*

The Effects of Model, Lead, and Test Error Correction with Real Money Coins to Teach Differentiation and Counting to a 16-Year-Old Adolescent with Multiple Disabilities

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Money counting skills is one of the most important skills students can learn when transitioning into the community involvement. Money skills are viewed as a functional skill for persons with intellectual disabilities (Heward, 2013). All individuals, including those with intellectual disabilities, are constantly dealing with money from simple day-to-day activities such as cashing a paycheck, paying for groceries, or even buying a movie ticket (Denny, 1995). Two primary focus areas on teaching money skills include counting coins or using a pocket calculator. Using coin counting, Lowe and Cuvo (1976) taught four individuals with mild to moderate mental retardation to sum the value of coin combinations using pennies, nickels, dimes, quarters, and half-dollars. A later study, demonstrating the use of pocket calculators (Ford, Nietupski, Loomis, & Brown 1980), taught seven students with moderate to severe disabilities to shop at a supermarket and only to buy the amount of items that their money allowed (Denny, 1995). These have both been successful strategies used to teach money-skills, but a few drawbacks are that pocket calculators are not always readily available and coin counting can be complicated for students with multiple to severe disabilities (Denny, 1995).

The model, lead, and test (MLT) error correction provides students with an evidenced based way to unlearn errors and increase their accuracy. MLT has often been referred to as "I do" "We do" and "You Do. " MLT requires to student to practice items correctly that were originally errors. The model portion of the procedure allows for students to see and hear a complete and correct example of the skill being taught. The lead allows the students to answer without fear of being incorrect and the test allows for teachers to gage student progress and ability/inability to test. For students with learning disabilities and developmental delays, the MLT procedure creates a systematic, repetitive learning system that helps develop important academic skills (Bulkley, McLaughlin, Derby, & Carosella, 2012).

When an error occurs with MLT, the instructor models the correct response, next, both the instructor and student say or write the item correctly together, finally, the student is required to emit the correct response when presented with the same item that was just missed. If the student makes an error, the MLT error correction procedure is repeated. If the student is correct, this item is placed so the student will encounter this item again. When employing DI flashcards with its error correction, the flashcard is placed two or three cards from the top of the stack (Thomas, McLaughlin, & Derby, in press). MLT has been an important component when implementing and teaching skills with explicit instruction in a wide range of academic and social skill areas.

The MLT can be employed with a wide range of academic skills, but across a wide range of behaviors such as social skills (Marchand-Martella, Slocum, & Martella, 2004). Watanabe, McLaughlin, Derby, and Shank, (2013) employed error correction to teach coin counting to a 20-year-old-student with learning disabilities. These results showed an increase in the ability to count money and give the correct amount of change through the use of DI flashcards. Employing very young children, Shouse, Weber, McLaughlin, and Riley (2012) were able to teach a

preschool student with disabilities using the MLT error correction procedure and found that after removal of the procedure, the student performance remained accurate. MLT has been implemented into many settings and subjects for a wide range of students (Anderson et al, 2004).

The MLT technique has been used with a variety of students with disabilities. Peterson, McLaughlin, Weber, and Anderson (2008) examined the effects of the MLT procedure with a 13-year-old boy with autism. Their results showed that the participant was able to maintain the skill of answering "Where are you?" when visual prompts were faded and no longer provided. The MLT procedure for error correction was developed so that when a student missed an item, it was gone over together with the student and the instructor. Error correction continues until the MLT procedure is complete and the student can test correctly on his or her own (Peterson et al, 2008). MLT has been successfully employed and evaluated with preschool students (Albade, Altharwa, Newman, & Rinaldi, 2013; Bechtoldt, McLaughlin, Derby, & Blecher, 2014; Carnes, McLaughlin, Derby, & Clark, 2015; Delong, McLaughlin, Neyman, & Wolf, 2013; Dundon, McLaughlin, Neyman, & Clark, 2013; Mortenson, McLaughlin, Neyman, & Girshick, 2013), elementary school students (Bulkley et al., 2012; Shouse et al., 2012), as well as older students (Peterson et al., 2010). MLT has even been successfully employed by parents to teach their children basic skills in the home (Aldahri et al., 2013). MLT error correction is an important part of DI flashcard procedures (Thomas et al., in press).

From past studies, MLT was shown to be an effective method for students with disabilities and for those without as well (Watanabe et al., 2013). To further the research on MLT, the purpose of this study was to increase the accuracy of coin identification and counting of a 16-year-old girl with multiple disabilities and intervening using MLT procedure with error correction using real money. This would allow for a replication of previous research that has illustrated the effectiveness of MLT. Replication in science allows one to be confident that implementing and employing such a procedure will improve student outcomes (Johnston & Pennypacker, 2009; Sidman, 1988). It remains very important to replicate the document the outcomes of prior research on this or any other topic (e. g. Jasny, Chin, Chong, & Vignieri, 2011; Nosek, Alter, Banks, Borsboom, Bowman, Breckler, ….Yarkoni, 2015). A final purpose was to use MLT with an older student rather than an preschool, elementary, or middle school student.

Method

Participant and Setting

The participant in this study was a 16-year-old adolescent female enrolled in the 9th grade in the Pacific Northwest. She was diagnosed with multiple disabilities and suffered from specific health impairments including seizures, cerebral palsy right hemiplegia, and Schizencephaly. She was placed in a designed instruction (DI) classroom from 8 a.m. to 3 p.m. based off of her IQ of 58, which was established from the *Comprehensive Test of Nonverbal Intelligence-Third Edition* (CTONI-3) (Brown, Sherbenou, & Johnsen, 1997). Learning to count money was included in a section of her IEP goals with math. According to the teacher, this student had a hard time

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applying paper math problems completed in class to actual money when it was placed in front of her.

The setting was a designed instruction (DI) classroom located in a high school in the Pacific Northwest region. The participant completed the tasks involved with the study at a table located in back of the classroom. The classroom contained nine students, three instructional aides, and one certified teacher. The study took place during second period, occurring in the morning while all of the students worked on their individualized math skills. The environment got quite loud depending on the other students' behaviors during the time of the intervention. The student teacher took reliability of the sessions when necessary. All sessions were one on one with the student and first author. Recently, this classroom has been employed in prior research (e. g. Fox-Lopp, McLaughlin, & Hatch, 2015; Harris, Helling, Thompson, Neyman, McLaughlin, Hatch, & Jack, 2015; Steele, Aoyama, Neyman, McLaughlin, & Hatch, 2014), but not with the current participant.

Materials

The materials needed for this study included coins (quarters, dimes, nickels, and pennies) and two recording sheets. The coins were placed in different quantities for the participant to identify. The recording sheets were for the first author and student teacher to collect data on the responses from the student. These can be seen in Appendices A and B.

Dependent Variable

The number of correct oral responses for coin quantities presented to our participant was tallied by the first author. A correct response was defined as the participant verbally expressing the amount of money quantities placed in front of her. Incorrect answers were the wrong responses to the amounts of money, saying the phrase "I don't know", or similar terms.

The second dependent measure was the percent of non-overlapping data points (NDP). The use of this procedure allows one to evaluate the effectiveness of an intervention when implementing a single case design (Scruggs & Mastropieri, 2013; Scruggs, Mastropieri, & Casto, 1987).

Data Collection and Inter-observer Agreement

The measurement system was a multiple-baseline data collection sheet that contained the phases (baseline and MLT for Sets 1, 2, or 3) and numbers in each set so the first author could mark with a check the correct responses or an X for incorrect responses (Appendix A). The quantities in each set varied by the coin combinations (Appendix B).

Inter-observer agreement data were collected by the student teacher observing and independently taking data. These two observers gathered these data at the same time. The student teacher sat on the opposite side of the table to take independent recording marks. The marks were compared to constitute agreement. Agreement included consistent and matching marks for incorrect (X) and corrects (check marks). Agreements over the agreements plus disagreements were divided and then multiplied by 100%. This was the formula used to calculate interobserver agreement data. Data were collected 1 of the 3 sessions for baseline (33%) with 100% agreement) and 11 of the 13 sessions (84.6%) for intervention through Sets 1

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and 2. Mean agreement for MLT was 100%. Set 3 IOA was 100% with no intervention implemented.

Experimental Design and Conditions

A multiple baseline across three sets (Kazdin, 2011, McLaughlin, 1983) was employed to evaluate the efficacy of teaching money skills. The design was implemented starting with baseline of all three sets. Set 1 contained five different coin quantities, including quarters and dimes only. Set 2 contained five different quantities as well but included quarters, dimes and nickels. The third set had three different quantities and all the coins (quarters, dimes, nickels and pennies) were involved. Once baseline was shown to be low and stable, the intervention was implemented across set one while baseline continued for set two and three. When the student had three or more consecutive sessions of 100% mastery, the next set was implemented into treatment and the third set remained in baseline. Once the second set showed 100% mastery for three consecutive sessions, the third set was implemented with MLT. Maintenance of the skill was implemented for all three sets to see if the participant had retained the procedure from treatment.

Baseline. During baseline, the participant was presented with all three sets and was given no help when identifying the quantities given. The student was prompted to identify the "what amount of money is this in front of you" during the sessions with the first author during the class period. If the participant correctly identified the amount presented, praise such as, "Great job! That was correct!" or similar expressions, was given before moving onto the next quantity. If the answer was incorrect, the first author moved onto the next amount with no feedback.

Model, Lead, Test (MLT). The first author implemented a MLT treatment within each set for error correction. With the multiple baseline design across sets, the first author asked the participant what the amount of money was in front of her and recorded the responses for each set. Correct responses did not receive the MLT procedure but praise was given to the participant by the first author. For incorrect responses, the first author would first model the correct coin identification and demonstrate how to add up the coins for the appropriate total amount. The student had already learned touch point money counting by fives in the classroom during regular instruction. Therefore, the first author just corrected her counting to show the how to get to the appropriate amount. The first author would then lead the student in saying the coin identification and quantity amount added together. Then the first author would again test the student on the quantity presented to her. Each quantity for every set was done in this manner for her responses. Once mastery was accomplished, maintenance for the quantities continued and MLT was implemented for the errors even though intervention had moved onto the next set.

Results

The number of correct coin amount identifications of the participant is shown in Figure 1. The mean for baseline across all sets was .96. For MLT the mean for corrects in Set 1 was 4.07 (range; 2 correct to 5 correct). The mean for Set 2 was 4.8 (range: 4 correct to 5 correct). Set 3 did not implement MLT and mean score was 1 (range from 1 correct to 3). Figure 1 shows

acceleration of correct responses in Set 1 up to mastery of the quantities. Set 2 had an average of 1.7 throughout baseline, but increased rapidly once MLT was implemented. Set 3 remained very low for correct responses until MLT was implemented for Set 2 and then the number or correct responses increased quickly even though intervention was not implemented at all in Set 3.

The percent of non-overlapping data points for Set 1 was 92.3%. This indicates that MLT was a highly effective intervention. The percent of non-overlapping data points for Set 2 was 75%. This means that MLT was somewhat effective. Since intervention did not occur with Set 3, no data could be calculated. Pooling the data for both Sets 1 and 2, the percent of non-overlapping data points was 89% and this is judged to be moderately effective.

Discussion

In evaluating the effects of MLT with identification of correct coin quantities, this study found the system to be highly effective. Utilization of the system generated marked improvement of complete mastery across three sets of coin quantities for one participant. The participant quickly developed an understanding of coin identification after MLT was implemented and carried that knowledge across the sets to where MLT was not implemented into the third set. Other research has shown that carry over effects from the intervention can be seen across sets (Bechtolt et al 2014) and that mastery is possible through the learned skill. The present outcomes replicate much of our previous research employing MLT (Albade et al., 2013;Bechtoldt et al., 2014; Bulkley et al., 2012; Shouse et al., 2012)

The procedure was practical and effective. MLT was implemented in a clear and straight-forward way that most care providers or teachers should be able to implement this strategy. There were few materials required, making it easy to access them in almost every setting. Money counting for this participant also generalized to her other activities in class that involved counting because she started to take her time with the materials and not rush through the assignments. The study took a minimal amount of time, half of one period, and was easy to incorporate within the lesson plans of the teacher.

We employed another measure of intervention effectiveness involves the use of the percent non-overlapping data points (Scruggs & Mastropieri, 2013; Scruggs, Mastropieri, & Casto, 1987). An examination of Figure 1 illustrates that only 89 percent of the data points were non-overlapping. This measure would indicate a moderate effect size. In addition, the only overlapping data points for Sets 1 and 2 were on the first session of MLT.

The strengths of this study were the MLT itself, the consistency of the sessions and the one-on-one attention that the participant received with this procedure. The participant enjoyed the individualized attention and was very willing to work for the praise presented by the first author. In normal lessons, the students don't receive the continuous attention that MLT provides but this study showed the effectiveness of that individualization and praise. The participant

would continuously ask if the first author and her were going to work together at own station whenever the opportunity arose. The participant was able to generalize across Set 3 after MLT was applied for Set 2 and intervention was not necessary for Set 3. Other strengths included the convenience of taking the student away during the time the first author did the study because that was the period of the school day that the other students did math during, therefore it kept the subject relevant to the teacher's schedule. The student teacher of the classroom was another strength because she could easily record IOA during this period. The classroom teacher was very positive with the participant and wanted him to improve his performance when he worked with the first author.

The generalization of the data from Sets 1 and 2 to Set 3 was an interesting finding. Clearly, as Stokes and Baer (1977, 2003) have indicated, the reasons for this finding need to be determined. However, the items in Set 3 were also found in both Sets 1 and 2. Sharing common stimuli has been suggested as a way to obtain generalization (Stokes & Baer, 1977).

A weakness of the study was the small number of students assessed. The study would have been stronger had additional students been taught coin identification using the MLT procedure. Another weakness of the study was that the participant would get distracted fairly easily from the other students in the classroom at times and would not focus on the coin quantities presented to her. The first author had to constantly remind her to focus and try to identify the correct amount of money in front of her. Other weaknesses include the number of quantities in each set. Set 1 and 2 had 5 different quantities but Set 3 only had 3 different quantities because of the difficult time the participant had getting through just the 13 amounts. By the end of Set 3 when all quantities had been presented, the first author had a difficult time going back to the incorrect responses to apply MLT to those amounts while still keeping the focus of the participant. The teacher did have to maintain the lesson plans; so on certain days, only a specific amount of time was given to the first author to work with the participant due to other activities that the participant had to be a part of. The present outcomes of this study adds further confidence that MLT correction procedure for coin identification of money amounts is a successful treatment.

Further research for the use of MLT should be focused on larger quantities of money, more items in each set, and being able to generalize to more students in the classroom versus just focusing on a single participant. By implementing the intervention with several students, research could ensure that the MLT teaching approach would be an effective procedure in their classrooms (Bulkley et al., 2012). However, for a single participant we were able to replicate the efficacy of MLT and therefore adding to the confidence that MLT is an effective intervention to teach money skills. Also, we were able to replicate and extend MLT to another student in an additional classroom. Being able to replicate and repeat findings is a cornerstone of single case research (Johnston & Pennypacker, 2009; Kazdin, 2011).

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Appendix A: The measurement system used to record the responses contained and the different was employed.

Date	Session	IOA	Condition	Set 1	Set 2	Set 3
	1	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	2	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	3	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	4	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	5	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	6	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3
	7	Y/N	BL IN-set 1 IN-set 2 IN-set 3	#1 #2 #3 #4 #5	#1 #2 #3 #4 #5	#1 #2 #3

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Appendix B: Coin quantities presented in each set and number amount of each coin that was to be represented in that amount.

Set 1 (Quarters and Dimes)		Set 2 (Quarters, Dimes, Nickels)		Set 3 (Quarters, Dimes, Nickels, Pennies)	
#1 $1.05	3 Q, 3 D	#1 $1.10	3 Q, 3 D, 1 N	#1 $1.11	3 Q, 3 D, 1 N, 1 P
#2 $1.25	3 Q, 5 D	#2 $1.35	3 Q, 5 D, 2 N	#2 $1.37	3 Q, 5 D, 2 N, 2 P
#3 $.85	1 Q, 6 D	#3 $.90	1 Q, 6 D, 1 N		
#4 $1.45	3 Q, 7 D	#4 $1.50	3 Q, 7 D, 1 N	#3 $.93	1 Q, 6 D, 1 N, 3 P
#5 $1.65	5 Q, 4 D	#5 $1.70	5 Q, 4 D, 1 N		

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Figure 1: Number of correct oral responses for money amount identification using MLT across three sets of coin combinations.