The Effects of Direct Instruction Flashcards and a Model, Lead, Test Procedure on Letter Recognition for Three Preschool Students with Developmental Disabilities

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Abstract

The purpose of this study was to evaluate the effects of Direct Instruction (DI) flashcards with its model, lead, and test procedure for teaching three preschool students with developmental disabilities to recognize the letters in their names. The study was conducted in a self-contained special education preschool classroom located in the Pacific Northwest. The number of correct letters in a student's name was the dependent variable. The number of letters varied because each participant's first and last name contained differing numbers of letters. During baseline, the frequency of correct letter recognition was low for all three participants. When DI flashcards with model, lead, and test error correction was in effect, letter recognition increased for each participant. One participant (Participant 3) reached mastery with his first name letters quite early in this condition, and then was taught to recognize the letters in his last name. The other two participants demonstrated large increases in letter recognition over the course of the investigation. The procedures employed in this study were easy to implement and cost efficient.

Reading proficiency is a fundamental skill critical to most, if not all, academic learning and success in school (Catts & Kamhi, 2005). Knowing the alphabet is an important early literacy skill. Letter naming fluency, the speed at which students can name a particular letter or group of letters, has been found to be a good predictor of reading achievement (Daly, Chafouleas, & Skinner, 2005). Findings have suggested that rapid naming of letters and words can differentiate good and poor readers at an early age, with weaker readers demonstrating slower letter and word naming speed (Catts & Kamhi, 2005). Letter identification is a crucial pre-skill to reading success. Correct labeling and identification of letters allows children to store the information necessary for reading using long-term memory (Gibson, 1969; Howard, Williams, & Lepper, 2010). Children documented as having delays in the area of cognitive development and communication development, typically benefit greatly from intervention on pre-reading skills. Specifically, research has shown that early reading abilities are a strong predictor of an individual's long-term success in school (Cunningham & Stanovich, 1997).

Direct Instruction (DI) flashcards provide a researched based, systematic, effective form of instruction for increasing student knowledge across many academic areas. Employing

the DI flashcard system provides the systematic instruction that has been shown to be effective for teaching students with disabilities a wide range of skills (Brasch, Williams, & McLaughlin, 2008; Erbey, McLaughlin, Derby, & Everson, 2011; Green, McLaughlin, Derby, & Lee, 2010; Hayter, Scott, McLaughlin & Weber, 2007; Herberg, McLaughlin, Derby, & Gilbert, 2011; McGrath, McLaughlin, Derby, & Bucknell, 2012; Ruwe, McLaughlin, Derby, & Johnson, 2011; Sante, McLaughlin, & Weber, 2001; Treacy, McLaughlin, Derby & Schlettert, 2012). Ruwe and colleagues implemented a flashcard system to improve the sight word skills for three middle school students with intellectual disabilities. They also found some generalization of sight word instruction to help in reducing errors when their participants read in context. Brasch et al. employed DI flash cards and model lead and test to teach math skills to students with severe behavior disorders enrolled in a special day school. They employed a multiple baseline design across three sets of math facts. As part of the DI flashcard procedure instructors are required to employ the model, lead, and test (MLT) error correction procedure. If the student makes an error, that error is corrected using MLT. This mandates the teacher to first model the math fact orally and its correct solution. Second, the teacher and student say the fact and its correct solution in unison. The final step for MLT requires the student to independently state the problem and its answer correctly. If the student makes an error again, this process is repeated until the error is corrected. These error cards are then placed back two or three cards, and the next flash card is presented (Bulkley, McLaughlin, Derby, & Carosella, 2013; Glover, McLaughlin, Derby, & Gower, 2010; Skarr, McLaughlin, Derby, Meade, & Williams, 2012; Skarr, Zelinski, Ruwe, Sharp, Williams, & McLaughlin, 2014). Placing the card two or three back by the instructor increases the opportunity that the student will have adequate practice with his errors so they later become correct responses. Hayter and colleagues employed these same procedures to teach high school students with intellectual disabilities basic math facts. Herberg et al. were able to implement DI flashcards to teach young preschool students with disabilities their colors. Erbey and colleagues (2011) employed DI flashcards and reading racetracks to teach students with learning disabilities sight words, letter sounds, and math facts. A multiple baseline design across problem or word sets was employed. Increases in student performance were found each time, for one or both procedures. Finally, Bulkley and colleagues (2013) employed DI flashcards to teach three elementary school students with learning disabilities letter sounds. They found that all three students were successful in learning their letter sounds.

The purpose of the present investigation was to increase the accuracy of basic letter identification using letters found in each individual student's first and last name. Letter identification is recognized as a pre-reading skill for later academic success. Specifically, preparing the student to transition into kindergarten was one of the goals for each participant's educational program. A final purpose was to extend the use of DI flashcards to teach letter recognition to preschool students with disabilities thereby further replicating and increasing the confidence regarding our recent outcomes teaching preschool students their shapes (Jasny, Chin, Chong, & Vignieri, 2011).

Method

Participants and Setting

Three verbal preschool children served as the participants. The participants were selected because the teacher reported concerns regarding their letter identification knowledge, which is a necessary pre-skill to transition into kindergarten.

Participants 1 and 3 included a three-year-old girl and boy with a developmental disability, and the second participant was a three-year old boy diagnosed with developmental delays. The origin of these delays was unknown. The third participant was a three-year-old boy diagnosed with rickets, developmental delays due to failure to thrive, delayed gastric emptying, cytomegalovirus xanthoma, and liver failure, which is secondary to Alagille syndrome. Their ages ranged from 3 years 3 months to 3 years 7 months. Participants 1 and 2 were viewed as having mild developmental delays while Participant 3 was viewed as having a moderate delay. Each of the participants had an individualized family service plan (IFSP) and a goal

to increase their letter recognition skills. Each participant was Caucasian.

This study was conducted in a self-contained special education preschool classroom. The classroom was located in a large urban public school district in the Pacific Northwest. This research met the guideline of being viewed as standard classroom practice by the Institution Review Board for both the school district and Gonzaga University. Throughout the investigation an average of 11 students were enrolled in the classroom. However, the class membership did vary due to the transitioning of other students in and out of the class. All three of the participants were enrolled in the afternoon preschool class. The first author worked individually with each student for 15–25 minutes per session at a round table located in the back corner of the classroom. This was done to minimize distractions for our participants. Additional support personnel involved in the classroom routine consisted of a speech therapist, an occupational therapist, and two physical therapists. Two instructional assistants and the primary classroom teacher and first author were always present in the classroom. The first author was completing her student teaching in special education throughout the investigation. Sessions occurred once per day. However, on some days data were not gathered due to other scheduling conflicts in the classroom or school building.

Materials

The materials used in this study included 5x7 inch laminated flashcards that contained the upper-case letters found in each individual student's first and last name. A stopwatch was employed to time the number of seconds after the flashcard was first presented. Edible rewards were also employed. The first two participants' rewards consisted of small bite-sized Snickers® bars. The third participant was rewarded with white paper and colored markers for use during extra coloring time. These reinforcers were established using a forced choice preference assessment (Alberto & Troutman, 2012) that was conducted by the first author. A pen and a data collection sheet to record each participant's responses were also employed.

Dependent Variable

Instruction for teaching letter recognition took place each afternoon for all students in the classroom. Each preschool student in the class was instructed using the same wide range of materials. These included picture books, Handwriting without Tears®, and letter recognition games during circle. The number of letters correctly identified by each participant was the dependent variable. A correct response was defined as the participant verbally stating the letter name when shown a flashcard that contained that corresponding letter. If the participant verbalized the incorrect letter name, or did not give a verbal response within 5 seconds, it was scored as an error. Each participant had 5 seconds in which to make a response or an error was scored. For each trial, the order in which each letter was presented to each participant was randomly changed to keep each participant from memorizing the order in which the letters were being presented. The first author recorded a "+" for correct responses and a "-" for an error. These were placed beside each letter on a data collection sheet.

Experimental Design and Conditions

The effects of a DI flashcard system and the model, lead, test procedure were evaluated using a multiple baseline design across participants and sets of letters (Kazdin, 2011). First, baseline data were recorded for each individual student using event recording. Next, the DI flashcard system was implemented. For Set 3, the model, lead, test procedure was implemented in a staggered style across all three participants. Thus, each participant served as a form of wait-list control for the previous participant. This experimental documentation rules out threats to internal validity (e.g., passage of time and uncontrolled variables).

Baseline. Baseline conditions consisted of the presentation of a capital letter for each set, which varied depending on the first and last name of each student. Each participant was expected to respond within 5 seconds, or the card was marked as incorrect. The correct and incorrect responses were marked on each participant's data collection sheet, which was unique for each student. No feedback or rewards (praise, food,

etc.) were provided during the baseline phase. For Participant 1, four baseline sessions were completed. Three baseline sessions were completed for Participants 2 and 3.

Direct instruction flashcards + model, lead, test procedure (MLT). Two sets of letters were created for each individual participant. The first set of cards contained the letters in the student's first name and the second set of cards contained the letters common to the first and last name. For example, if the child had two e's, these were defined as common letters. The third set of cards contained the letters only found in each student's last name. Each participant had a different data collection sheet and had different letters to learn depending on their first and last names.

At the beginning of each session, the first author presented each individual participant with a DI flashcard that contained a capital letter from either his/her first or last name. The set was presented twice before data were recorded. The first author presented the participant with a card and would say, "what letter?" and provided the child with five seconds to respond. If the child correctly identified the letter within five seconds or less, a "+" mark was recorded on the data collection sheet, and verbal praise, high fives, and pats on the back were given. If the child did not respond, took longer than the allotted five seconds, or misidentified the letter presented, then a "-" mark was recorded on the data collection sheet. Incorrect responses resulted in the delivery of the model, lead, test correction procedure and the missed flashcard was placed two to three cards back in the pile. This was done until the individual letter was identified correctly by the participant.

Reliability

Inter-observer agreement was completed 38.8% of the time for Participant 1. For Participant 2 and Participant 3, inter-observer agreement was conducted 44.4% of the time. An observer recorded each participant's responses independently from the first author. The observer would sit with the first author during each session, at the other end of the table, and would mark on a separate inter-observer data collection sheet whether a response was correct or incorrect. The letters in each participant's first and last name were listed vertically down the data sheet and both the inter-observer and the first author would mark a "+" or a "-", depending on each participant's response, next to the corresponding letter. Inter-observer agreement was calculated by dividing the number of agreements by the sum of the agreements and disagreements and then by multiplying by 100. Agreement between the first author and the second observer was 100% for all three participants.

Data Analysis

Data Analysis involved the visual inspection of each participant's performance. Data for each set of letters were summed and the average and range by condition and set was calculated.

Results

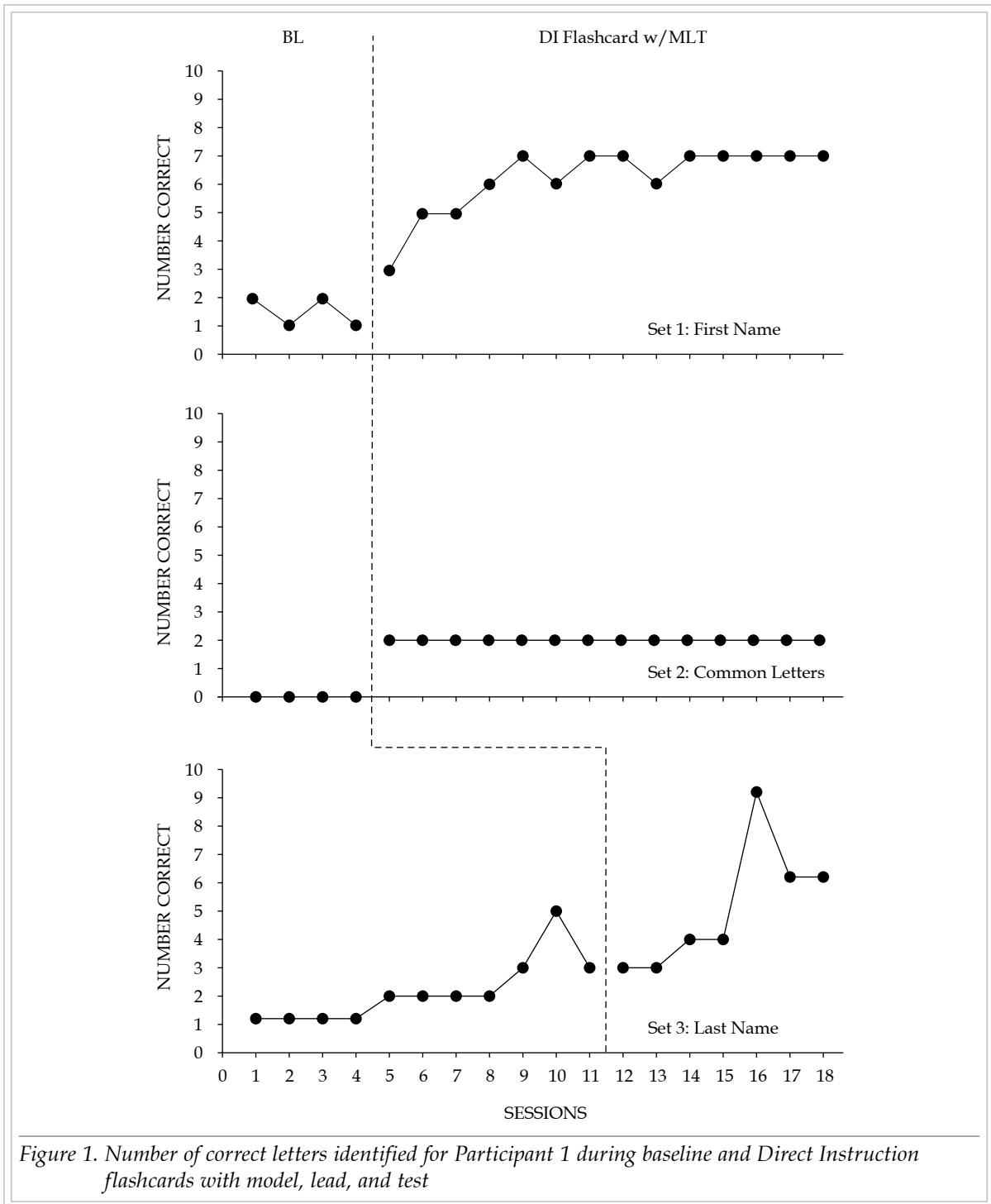Results for Participants 1, 2, and 3 are shown in Figures 1, 2, and 3, respectively

Baseline

As shown (see Figures), letter identification performance during baseline for Participants 1, 2 and 3, was low. Participant 1 correctly identified an average of 1.5 letters out of 7 (range 1–2) for Set 1. For Set 2, none of the letters were correctly identified, and for Set 3, the participant identified an average of 2.3 letters out of 9 (range 1–4).

Participant 2 correctly identified an average of 1.3 letters out of 5 (range 1–2) for Set 1, and an average of 0.33 letters out of 3 (range 0–1) for Set 2. For Set 3, an average of 3.6 letters out of 7 (range 0–5) were correctly identified.

Participant 3 correctly identified an average of 0.33 letters out of 10 (range 0–1) for Set 1, and none for Set 2. For Set 3, an average of 2.8 letters out of 5 (range 2–4) were correctly identified.

DI Flashcards with MLT

As shown in Figure 1, when DI flashcards and the model, lead, and test procedure was initiated, Participant 1 was able to recognize an average of 6.3 letters out of 7. For Set 2, this student was able to recognize an average of 1 letter out

Figure 1. Number of correct letters identified for Participant 1 during baseline and Direct Instruction flashcards with model, lead, and test

of 2, suggesting that mastery was not accomplished. For Set 3, an average of 5 letters out of 10 were identified.

As seen in Figure 2, Participant 2 was able to recognize an average of 4.1 letters out of 5. For Set 2, he was able to recognize an average of 2.9 letters out of 3 and mastery was obtained after 4

sessions during intervention for Set 2. For Set 3, Participant 2 was able to recognize an average of 6.8 letters out of 7 and mastery occurred after 3 sessions of intervention for Set 3.

As shown in Figure 3, Participant 3 was able to recognize an average of 5.6 letters out of 9 and for Set 2 was able to recognize an average of
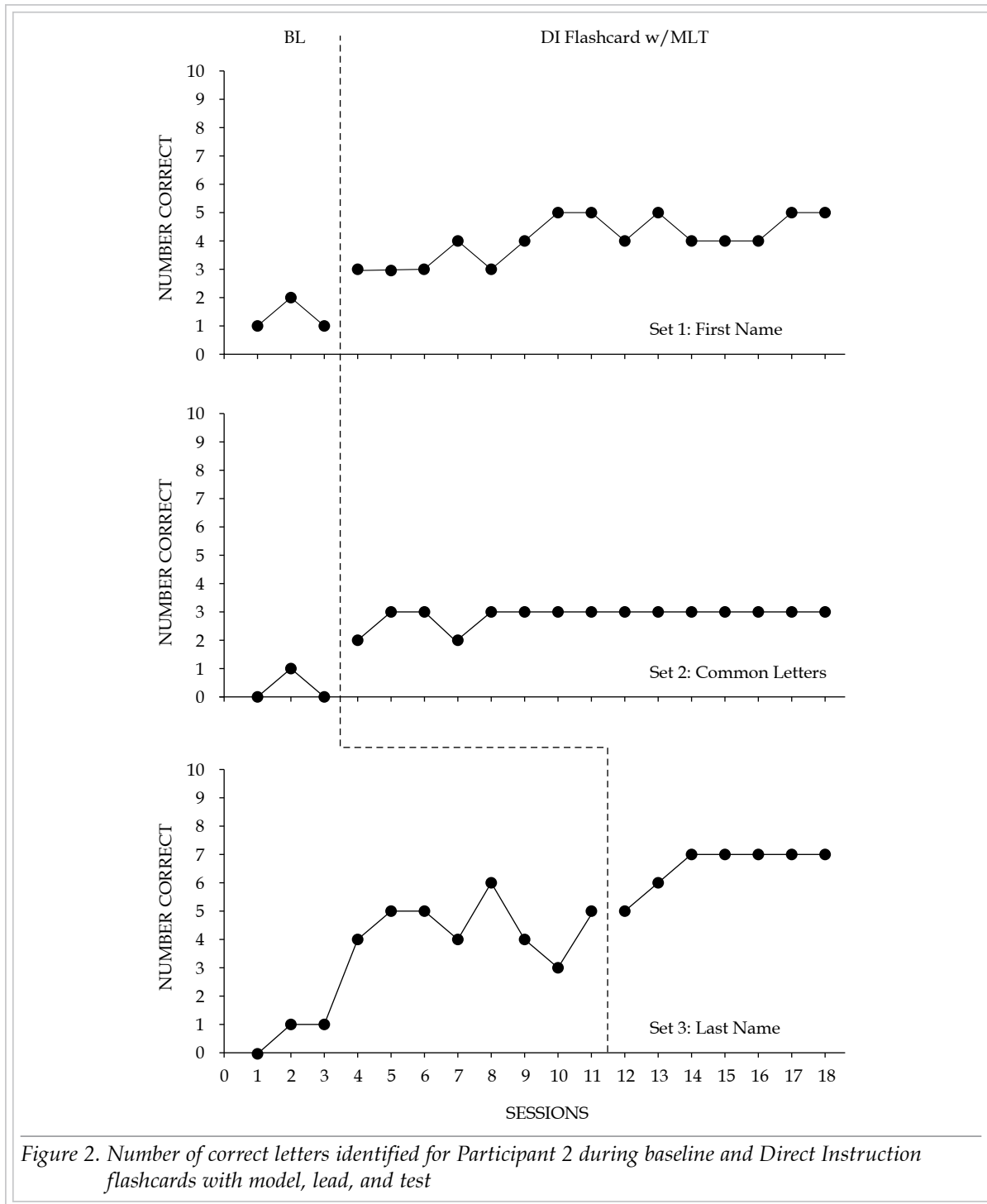
Figure 2. Number of correct letters identified for Participant 2 during baseline and Direct Instruction flashcards with model, lead, and test

1.26 letters out of 2. For Set 3, this student was able to recognize an average of 4.9 letters out of 5 and mastery was achieved after 2 sessions.

In summary, Participant 1, never achieved mastery during Set 3, but mastered all but one of the letters contained in both Sets 1 and 2. Participant 2 achieved mastery in both Sets 1 and 2 and was performing at a consistent trend of 5 out of 5 letters during Set 1. Participant 3 achieved mastery for Sets 2 and 3 and was performing at a positive, increasing trend during Set 1.
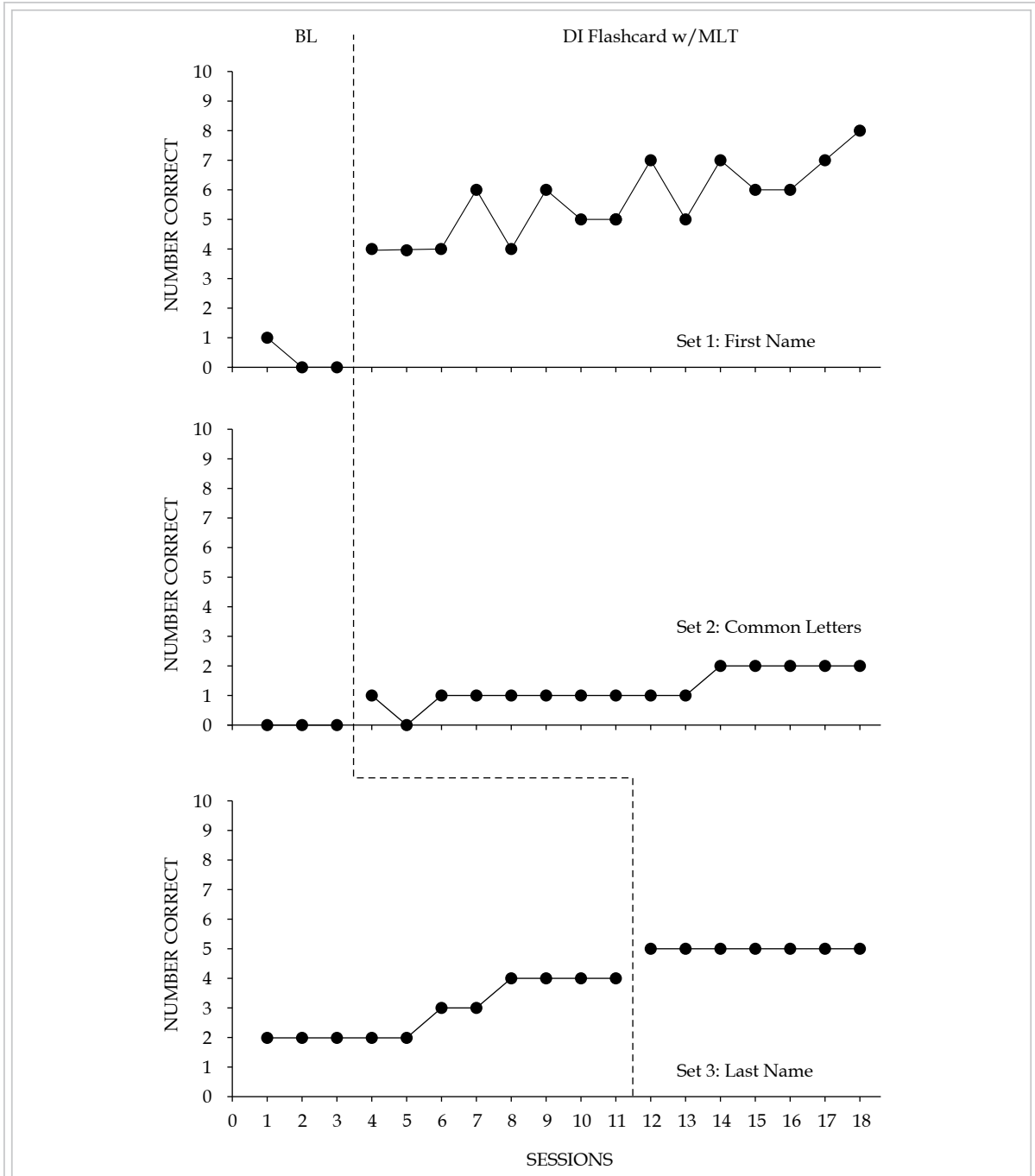
Figure 3. Number of correct letters identified for Participant 3 during baseline and Direct Instruction flashcards with model, lead, and test.

Discussion

The purpose of this current investigation was to teach three participants to recognize and say the letters contained in their first and last names using a DI flashcard system in conjunction with its model, lead and test error correc-

tion procedure. Large improvements occurred among the participants and there seemed to be a correlation between the intervention and the results of the participants' performance. All three participants mastered two of the three sets and demonstrated an increasing trend in performance for word sets that had not been

mastered. This outcome merits further analysis and research.

The present outcomes extend the use of DI flashcards with its a model, lead, and test component to a preschool population. These outcomes also replicate the work of Herberg and colleagues (2011) who taught preschool children colour identification. Our results add to the growing body of literature documenting the efficacy of DI flashcards (Becker et al., 2008; Brasch et al., 2008; Erbey et al., 2011; Glover et al., 2010; Hopewell, McLaughlin, & Derby, 2010; Kaufman et al., 2011; Ruwe et al., 2011; Skarr et al., 2012; Skarr et al., in press). Finally, additional research needs to be carried out to address the generalization of academic skills as well as replicating these procedures with different authors in other settings (Jasny et al., 2011; Kazdin, 2011). This would allow one to have more confidence in the use of DI flashcard procedures with a wide range of children and youth.

The model, lead, and test component employed with DI flashcards can also be employed to teach a wider range of skills (Marchand-Martella, Slocum, & Martella, 2004). Model, lead, and test appears to be a crucial component in many social skills training programs as well as teaching students other functional skills.

Participant 1 responded well to the intervention. He showed a large improvement in letter recognition and appeared to be motivated to learn throughout the study. In the beginning of this study, Participant 1 was being rewarded with small bites of snickers, but seemed to prefer extra drawing time over the chocolate treat. Once the reward had been altered, Participant 1 was always very excited to transition from the activity taking place before working with the first author. For Set 3, although mastery was not achieved, Participant 1 demonstrated improvement by the fifth session. This improvement may have been due to a change in the reward from a piece of snickers to a jellybean. However, by the sixth and seventh session, his performance decreased again using a jellybean as a reward.

Participant 2 also responded well to the intervention. She appeared to prefer getting individual attention from the first author and the snickers reward at the end of each session.

Participant 2 enjoyed the snickers reward at the end of each session so much, that on occasion, she would try and negotiate with the first author to try and get more pieces of candy. Participant 2 achieved mastery for both Sets 2 and 3. She was demonstrating proficiency for Set 1, and intervention should have taken place over additional sessions to demonstrate this mastery; however, due to time limitations, the first author was unable to continue the intervention with Set 1.

Participant 3 demonstrated improvement with the intervention. He mastered Sets 2 and 3. For Set 1, Participant 3 was showing an increasing trend of letter identification. Intervention should have taken place for more sessions for Set 1, to see if mastery could be obtained; however, time constraints became an issue and the first author was unable to extend the intervention for Set 1. Anecdotally, as the intervention was continued, Participant 3 began to demonstrate generalization of his letter knowledge. Specifically, Participant 3 would point to letters he saw around the classroom and would correctly identify the letters. He also looked at the first author's nametag one day, and began pointing out letters he recognized from the work he had done with the first author. He was very excited each day to work with the first author and transitioned easily from a previous activity to come and work with the first author.

There were limitations in the present research. First, it would have been more effective to have taken follow up data to determine if DI flashcards led to maintenance of treatment effects over time. This will have to be carried out in future research. Another limitation was that one of our participants did not reach mastery with Set 3. Perhaps implementing a different consequence or providing longer teaching sessions would have been helpful for this participant.

The baseline data for each of our participants in Set 3 was variable. Each participant displayed a trend toward improvement and this would provide some evidence against our intervention working. However, each were able to identify most of the letters in their names.

The training required to implement and evaluate DI flashcards was minimal. Our university students begin learning about DI flashcards

in their freshman year and typically collaborate with a peer in employing DI flashcards to teach sight words, math facts, or correct spelling (McLaughlin, Williams, Williams, Howard, & Marchand-Martella, 1993; McLaughlin, Williams, Williams, Peck, Derby, et al., 1999; Skarr et al., 2014). Two and three years later our college students often employ these procedures in their classroom management or precision teaching course sequence (Bulkley, McLaughlin, Neyman, & Carosella, 2012; Herberg et al., 2011; Shouse, Weber & McLaughlin, 2012; Skarr et al., 2012). Many of our university students employ DI flashcards as part of their demonstration of their skills in assessment and intervention in their student teaching semester (McLaughlin et al., 1999; McLaughlin, Weber, Derby, Hyde, Violette, Barton, et al., 2011). It appears that determining the form and type of teacher training to successfully implement DI flashcards is needed. A one-day workshop that was employed by Rafdal, McMaster, McConnell, Fuchs and Fuchs (2011) to teach Kindergarten Peer-Assisted Literacy Strategies (K-PALS) would be a step in the right direction. The present intervention was easy and practical to employ in a preschool classroom. Each session took between 10–15 minutes to complete, and was not time consuming and was cost efficient. The intervention procedure was also easy to employ and could be administered by anyone such as an instructional assistant, teacher or parent. Overall, the results of this study and intervention strategy were successful and was subsequently adopted by the classroom teacher of the participating preschool, and may eventually also be used by others in the school.

Key Messages From This Article

Persons with disabilities: Very young children in preschool can learn to recognize letters.

Professionals: There are research-based interventions such as Direct Instruction Flashcards that can be used to teach skills to young children. Also, these same procedures can be used to teach both elementary as well as secondary students such skills. Classroom personnel should be trained to employ and implement such procedures in their respective classrooms.

Policymakers: There are research based academic interventions that should be taught in the schools. These procedures can be either research based as well as evidence-based. A wide range of academic interventions including, cover, copy, compare, Direct Instruction flashcards, classwide peer tutoring, early and intensive intervention, etc. Such interventions could be mandated in teacher training programs.

Acknowledgements

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