

## THE EFFECTS OF DIRECT INSTRUCTION FLASHCARDS AND A COLOR RACETRACK TO SEE BASIC COLORS TO THREE PRESCHOOL STUDENTS: A FAILURE TO REPLICATE FOR TWO PARTICIPANTS

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**Abstract:** *The purpose of this study was to evaluate the effects of a Direct Instruction (DI) flashcard system to teach 10 basic colors to three preschool students, two of them with disabilities and one typically developing. The study was conducted in a private birth to three program in a preschool special education classroom. The preschool was located in a large urban city in the Pacific Northwest. Ten colors were taught to our three participants.. During baseline, performance was low. When DI flashcards and a color racetrack were employed, the two preschool students with disabilities showed little improvement. However, the typically developing preschool student showed mastery for Set 1 colors, and partial mastery for Set 2. Possible reasons for the lack of outcomes for two of our participants were made. The procedures were inexpensive, easy to implement and evaluate, and caused little classroom disruption. Possible reasons for the lack of positive outcomes for the two participants with developmental delays were made.*

**Key Words:** *developmental delays, birth to three intervention program, failure to replicate, single case research design*

### Introduction

Early intervention for preschool age children is a research based and effective practice that is designed to decrease the effects of disabilities of students later in life (Heward, 2012). Knowing the effectiveness of early intervention, preschool students with disabilities are by law entitled to valuable teaching strategies in an early developmental preschool.

It is important for all children to learn the basic colors, because it is an early milestone, which should to be met before advancing to kindergarten (Howard, Williams, & Lepper, 2010). Knowledge of basic colors is a building block for learning letters and recognizing different labels and signs.

An effective academic practice found to help students with disabilities learn specific skills has been to employ Direct Instruction flashcards (DI flashcards). DI flashcards is a drill and practice

procedure that employs rapid presentation of the facts to be learned on flashcards. When a student misses a fact or item, the instructor employs a model, lead, and test error correction procedure. This error correction procedure (Shouse, Weber, & McLaughlin, 2012) requires the teacher models item and the correct answer. Next, the student and teacher correctly state the problem and answer together. Third, and the student is required to correctly state and answer the error flashcard correctly. If the student is correct, this error card is placed two or three back from the top of the stack of flashcards (Brasch, Williams, & McLaughlin, 2008; Glover, McLaughlin, Derby, & Gower, 2010; Hopewell, McLaughlin & Derby, 2010; Hayter, Scott, McLaughlin, & Weber, 2007; Lund, McLaughlin, Neyman, & Everson, 2012; Ruwe, McLaughlin, Derby, & Johnson, 2011). This is done to provide additional practice with flashcards that the student is having difficulty. After the student gets the error card correctly for three consecutive times, it is then placed at the bottom of the stack. The instructor records the data and typically provides a brief amount of time (2 to 5 minutes) in which the performance that session is taken. These data are typically plotted, and feedback and praise provided to the student(s).

Employing DI flashcards have been shown to be effective in teaching different skills such as math facts (Erbey, McLaughlin, Derby, & Everson, 2011; Glover et al., 2010; Hayter et al., 2007), sight word recognition (Green, McLaughlin, Derby, & Lee, 2010; Kaufman et al., 2011; Romjue, McLaughlin, & Derby, 2010; Ruwe et al., 2011) with elementary and middle school students with disabilities. DI flashcards have been proven effective in providing students with an individualized programming in math in a special day school program for high school students with severe behavior disorders (Brasch, Williams, & McLaughlin, 2008). Also, DI flashcards have been effective in improving both math and reading skills for elementary students with learning disabilities (Kaufman et al., 2011; McGrath, McLaughlin, Derby, & Bucknell, 2012) as well as with elementary students enrolled in general education classrooms (Standish, McLaughlin, Neyman, 2012). Finally, DI flashcards have been effective across a wide range of student groups and skills.

Recently, we have been employing and evaluating DI flashcards with young students attending special education preschool classrooms. We have found that the efficacy of DI flashcards becomes variable when implementing and teaching with DI flashcards with very young children. For example, Herberg, McLaughlin, Derby, & Williams (2011) employed DI flash cards to effectively teach two preschool students to recognize and retain their shapes. They found that employing DI flashcards to be effective for one of the young preschool students enrolled in a private birth to 3 classroom. When the questioning strategy employed with DI flashcards was modified for the second participant, improvements for both recall and recognition were found. For example, Ehlers, McLaughlin, Derby, and Rinaldi (2012) employed DI flashcards and a math racetrack to teach number identification to three preschool students with autism or developmental delays. They reported mixed outcomes with only two of their three participants showing improvement. Also, these improvements were variable across groups of numbers (sets)

and participants. Chandler, McLaughlin, Neyman, and Rinaldi (2012) also found the same differential outcomes between participants and sets of numbers when teaching number identification. Both participants improved their performance with their first set of numbers, but after that, improvements were small or did not occur with a different set of numbers.

In this study, a color racetrack was evaluated and later DI flashcards were implemented with three individual preschool students. This study evaluated the effects of DI flashcards with three preschool students, two of which with developmental delays, and their recognition of colors. A typically developing student was employed to provide a measure of efficacy with a preschool student without disabilities that attended the classroom.

In conjunction with DI flashcards, a color racetrack was also employed to teach mastery of basic colors. This track is an adapted form of reading racetrack, using math facts instead of letters of simple words (Beveridge, Weber, & McLaughlin, 2006). This game-like procedure has received attention in the literature in reading (Anthony, Rinaldi, & McLaughlin, 1997; Rinaldi & McLaughlin, 1996; Rinaldi, Sells, & McLaughlin, 1997; McLaughlin et al., 2009), math (Beveridge et al., 2006; Walker, McLaughlin, & Weber, 2012), and spelling (Arkoosh, Weber, & McLaughlin, 2009; McLaughlin, Weber, Derby, Hyde, .....Barton et al., 2011; Skarr, McLaughlin, Derby, Meade, & Williams, 2012; Verduin, McLaughlin, & Derby, 2012).

Therefore, one purpose of the present research was to implement a color racetrack and DI flashcards to teach preschool students their colors. A second purpose was to employ a rigorous single case design so such a decision could be based on student performance. Third, we wanted to employ to preschool student so a comparison could be made between our two participants with special needs to a student that we typically developing. Fourth, we wanted to determine if the age of our participants or their difficulties that produced differential outcomes noted in our recent research. Fifth, we also wanted to implement DI flashcard with a color racetrack to teach color identification in the same setting as Herberg et al., (2011), but with a different group of students.

## Methodology

### Participants and Setting

Three preschool students served as the participants. Participant 1 was a two-year-old typically developing boy. He was chosen for the study to compare our results with a typically developing preschoolers to children with disabilities. Participant 2 was an adopted two-year-old girl with developmental delays, and severe gross motor delays. Participant 3 was a two-year-old girl with dyspraxia, a chromosome 22q deletion and a hearing impairment.

The preschool class enrolled nine students for the first half, then one student graduated, and there were eight students in the class at the end of data collection. Various support personnel such as

the speech pathologists, occupational therapists, and physical therapists work closely with the classroom teachers, and instructional aide. The classroom also had a speech center, physical therapy area, and occupational therapy area. There was also a free play area, which was where group took place. There was a bathroom and a table between the physical therapy and occupational therapy area and the speech and group area used for snack. In the group area, there were toys, games, dolls, and tables to work at. The area where the intervention took place was in the group area. Each student was seated across from the researcher on a bench (used during circle and for table work). The participant and researchers were seated behind the speech therapy part of the classroom, facing away from the rest of the classroom.

### Materials

The materials used were 10 laminated cards with a different color. The colors, red, blue, yellow, green, orange, purple, pink, black, brown, and white were used. A “math racetrack” (Beveridge et al., 2003) was modified and became a “color racetrack” with each color the individual student was focusing on, in each square. Data were gathered using a data collection forms (See Appendix A, B, and C).

### Experimental Design and Conditions

The effects of a Direct Instruction (DI) flashcard system and color racetrack were evaluated in a combination multiple baseline and reversal design (Kazdin, 2011). Baseline data were taken for each student. Next, a color racetrack was implemented with each participant. Third, a DI flashcard system was implemented in combination with the color track.

**Baseline.** Baseline was taken for each student. Baseline consisted of the presentation of each color of each set (different for each student). The children were expected to respond within 3 seconds, or else the card was counted as incorrect. The correct and incorrect responses were documented on the child’s data sheet. No feedback was given during baseline. For participants 1 and 3 baseline was taken for four sessions, and for participant 2, baseline was taken for three sessions.

**Color racetrack.** The color racetrack had 28 spaces, each filled in with a different color from the set being practiced (McLaughlin et al., 2011). This racetrack was presented after baseline and the DI flashcards. The researcher would present the racetrack and tell each student to say the name of each color before moving to the next space. There were three different colors being tested, and repeated in a random order throughout the racetrack. The student was required to name the color within 3s. If the student did not name the color within 3s, or said the incorrect answer, or no answer at all, the researcher would say “that color is \_\_\_\_” and the participant would have to repeat the color statement, and then move on, while the timer was still running. The participants were timed using the second hand on the classroom clock.

**Direct instruction flashcards + color racetrack.** Based on the results of the color racetrack, the researcher added a DI flashcards system. Each participant had a different data sheet, and different color goals. When the researcher presented the DI flashcard and said “what color?” the child had 3s to respond. If the child correctly identified the color within 3s or less a (+) mark was marked on his/her data collection sheet. If the child did not respond, took longer than 3 seconds, or misidentified the color presented, then a (-) mark was recorded. Then, the color racetrack would be shown. After two sessions it became clear that the racetrack was not motivating nor effective for our participants, so the first author continued to only employ the DI flashcard system.

### **Reliability**

Interobserver agreement was taken 44% of the time for Participant 3, 37.5% of the time for participant 2, and 40% of the time for Participant 1. An observer recorded the participants’ responses separately from the researcher. The researcher put the colors in different piles, based on correct and incorrect, and the other observer used the scratch part of the data collection sheet. The data sheet was a scratch piece of paper used throughout the entire stud. Interobserver agreement was calculated by dividing the number of agreements by the sum of the agreements and disagreements and multiplying by 100. Agreement between the researcher and second observer was 100%.

### **Findings**

The number of correct color flashcards during baseline and during the DI flashcard system across two sets of colors are presented in Figures 1 through 3.

#### **Participant 1**

For baseline, participant one scored from 0 to 2 correct. The mean for baseline was .75 correct colors. When DI flashcards were implemented, Participant one had an increase in scores. The scores increased to three correct over three sessions.

After mastery of Set 1, Participant one was moved to set two. Baseline for set two showed scores from 0 to 3 correct with a mean of 1.5 correct. When DI flashcards were implemented for Set 2, his scores remained stable. He had 3 correct, over two sessions, with the mean of 1.5 correct for Set 2.

#### **Participant 2**

For baseline, participant two scored 0 correct on all three sessions. The range was 0 and the mean correct was 0. When DI flashcards were implemented, participant two’s performance increased. Her mean was 1.2 correct, and her range was 0 to 3 colors. A return to baseline resulted in a small reduction in performance. Her mean in the return to baseline was 1.0. A

return back to DI flashcards did not result in an increase in performance. Her mean was .75, and the range was 0 to 1. Participant 2 never mastered set one, so Set 2 remained in baseline. The mean for this extended baseline was .75 correct colors, and a range of 1 to 0.

**Participant 3**

For baseline, participant three scored from 0 to 1 correct. The mean for baseline was .5 correct colors. When DI flashcards were implemented, participant three’s performance increased. Her mean was 1.55 correct colors. The range was from 1 to 2. A return to baseline did not result in a reduction in performance. The mean was 2, with a range from 1 to 3. A replication DI flashcards also did not increase her performance ( $M = 1.25$ ; range 1 to 2). Since Participant 3 never met our criteria for mastery with Set 2, Set 3 remained in baseline. The mean for baseline was just .13 and the range of scores was 0 to 1.

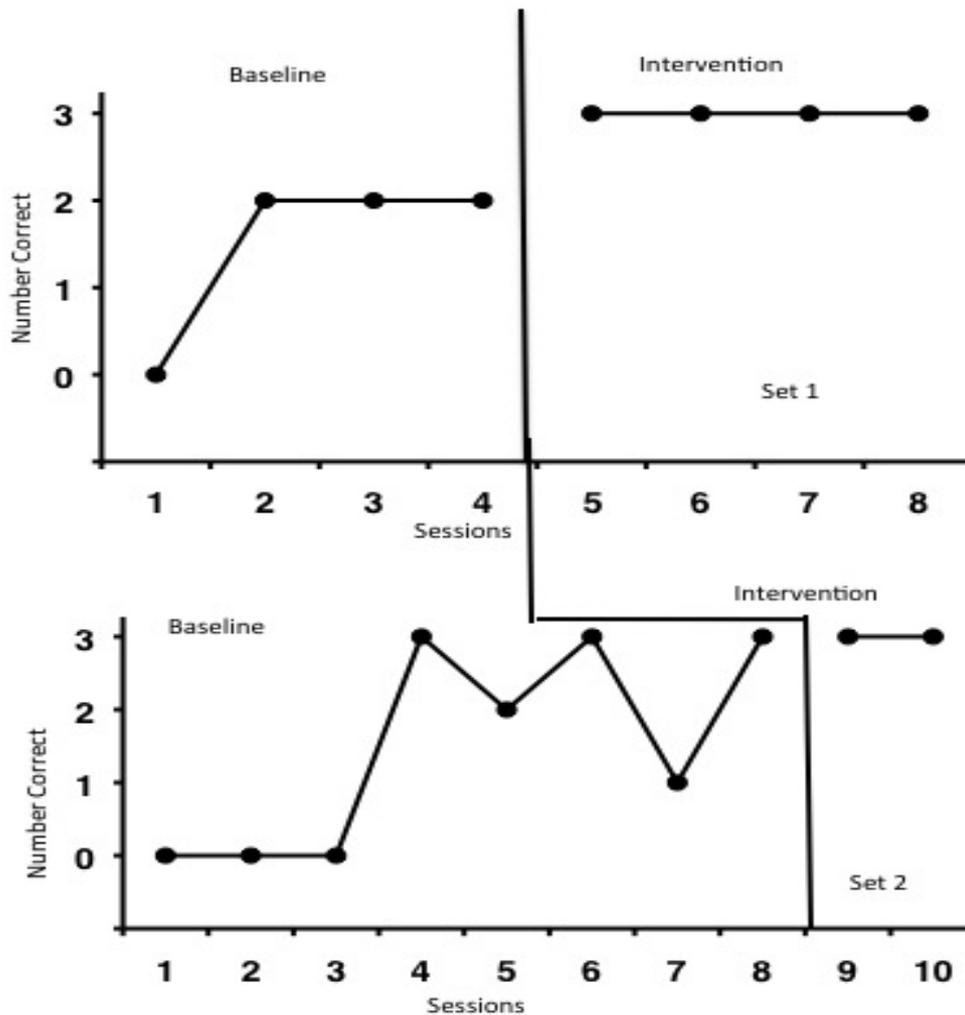
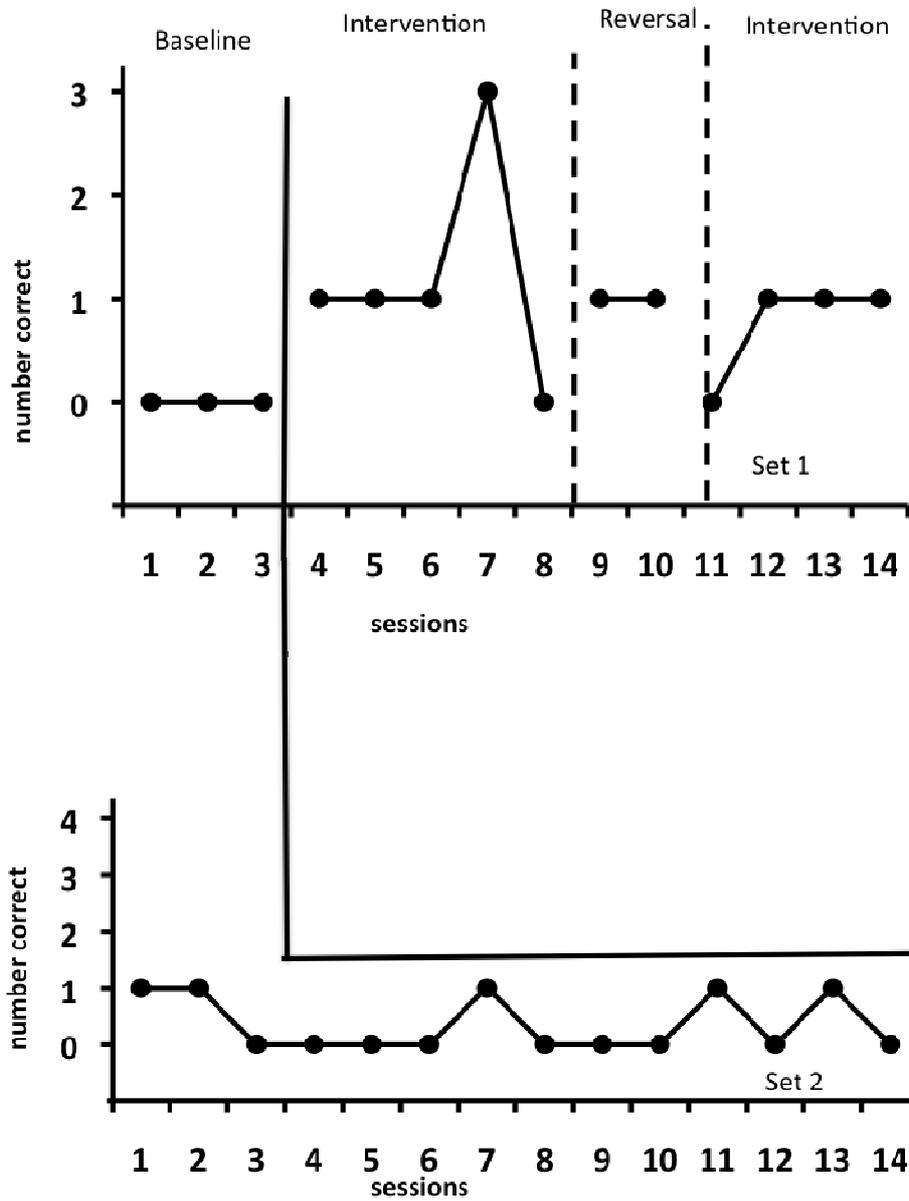


Figure 2: Number of correct colors: Participant 2



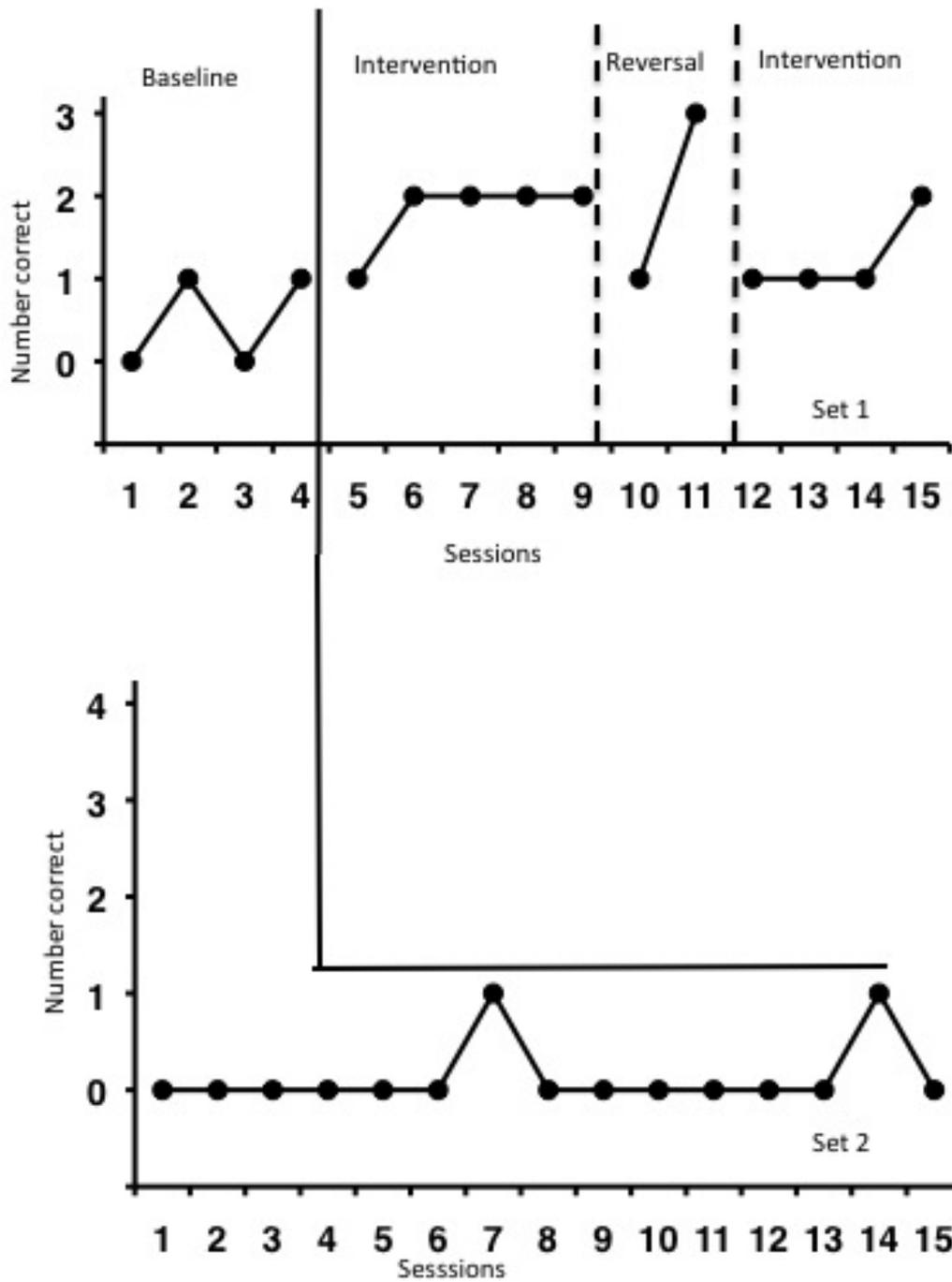


Figure 3: Number of correct colors: Participant 3

## Conclusion

The purpose of this study was to teach the participants basic colors including: red, yellow, orange, green, blue, purple, pink, black, brown, and white using a Direct Instruction flashcard system. Improvements were found for some of the preschool students in the study, but there did not appear to be a functional relationship between employing the DI flashcards and student performance. This differential finding replicates the differential effects note in our recent research employing DI flashcards with young preschool students (Chandler et al., 2012; Ehlers et al., 2012; Higgins, McLaughlin, Derby, & Long, 2012). This also fails to replicate an earlier report (Herberg et al., 2011) that found a more positive set of outcomes in the same school setting

There may have been several reasons for the present outcomes. First, the school was a medical model school, so physical therapists, occupational therapists, and speech language pathologists, and nurses work directly with the students and their families; as well as the special education teacher. Because of the many people working with the students, there was limited time to collect data during preschool, which is only two hours, three days a week. Often, students would be in therapy for their entire day at preschool, and would have a very limited amount of time for group work. Also, our differential results may have been an outcome of the inconsistency in the amount of time for DI flashcards were to be implemented and in which sets.

Participant 3, the child who had a hearing impairment, and 22q Deletion Syndrome had an affected soft pallet of her mouth, making her verbalizations difficult to understand and score. The combination of having to recognize and say or sign the color proved to be a challenge for her.

An adapted color racetrack (McLaughlin et al., 2011) was implemented at the beginning of the first DI flashcard intervention. However, it was soon removed as an intervention tool. The racetrack proved to be neither effective nor motivating for our participants. It was hypothesized that the students did not understand the goal or concept of labeling every color in a row. The racetrack was timed, and it is thought that students that young did not understand the significance of the time, so the goal to finish the racetrack with fluency and accuracy was seemingly not motivational and insignificant to them. The students would attempt label two to three colors on the track, but then stop and change the direction of their attention to something else, negatively affecting the fluency and accuracy of the intervention. After a few sessions, the researcher dropped the intervention tool all together, and focused on the DI flashcards, because it was a more concrete intervention.

Strengths of the study include the low cost of implementation and evaluation of the procedures. Construction paper was used for the flashcards and the data sheet was made from

low cost materials for each student. Each session lasted between 3 and 7 minutes, which was time-effective according to the classroom staff.

### Suggestions and Recommendations

It just may well be, that DI flashcards are not appropriate for young children with developmental delays. In the present research, we found some evidence that DI flashcards were somewhat effective with a typically developing peer (Participant 1), especially with the colors inset 1. When DI flashcards were implemented in Set 2, the variability in her performance was reduced, but the level of change was an issue. This then begs the question, should only DI flashcards be employed with older children and youth (Crowley, McLaughlin, & Kahn, in press). Our outcomes clearly provide a set of questions and issues that should be considered in new and/or future research.

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