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THE DIFFERENTIAL EFFECTS OF DIRECT INSTRUCTION FLASHCARDS WITH AND WITHOUT A SHORTER MATH RACETRACK TO TEACH NUMERAL IDENTIFICATION TO PRESCHOOLERS: A FAILURE TO REPLICATE

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ABSTRACT

The purpose of this study was to evaluate the effects of a Direct Instruction (DI) flashcard system and math racetrack system to teach the numerals 1-9 to two preschool students. Both were young children with disabilities. The study was conducted in a self-contained Special Education preschool classroom. Nine numerals were presented to the participants to be learned. During baseline each did not know their numerals. Both students showed mastery across Set 1 but not across any other sets. When DI flashcards were added to the math racetrack system, student performance improved. Overall the procedures were an easy intervention to implement. The reasons for the failure to replicate our previous research were presented.

Keywords: preschool students with disabilities, numeral identification, flashcards, math racetracks, failure to replicate math racetracks

INTRODUCTION

Early intervention for children birth to 6 is a research based and effective practice that is designed to decrease the effects of disabilities of students later in life (Heward, 2010). Knowing the effectiveness of early intervention, preschool students with disabilities are by law entitled to valuable teaching strategies in an early, developmental preschool (Howard, Williams, &Lepper, 2010).

There are several effective practices proven to help students with disabilities, especially in early intervention programs (Heward, 2013). Direct Instruction (DI) flashcards are known to be effective in teaching different skills such as math facts (Glover, McLaughlin, Derby, & Gower, 2010; Hayter, Scott, Weber, & McLaughlin, 2007), sight word recognition (Kaufman, McLaughlin, Derby, & Waco, 2011; Romjue, McLaughlin, & Derby, 2011; Ruwe, McLaughlin, Derby, & Johnson, 2011; Shahtout, McLaughlin, Derby, &Arenez, in press; Travis, McLaughlin, Derby, &Carosella, 2012) to elementary and middle school students with disabilities. Recently, DI flashcards have been proven effective in assisting students at the elementary and high school level with severe behavior disorders in math (Brasch, Williams, & McLaughlin, 2008; Hopewell, McLaughlin, & Derby, 2010; Treacy, McLaughlin, Derby, &Schlettert, 2012). Finally, we were recently able to extend the use if DI flashcard procedures with a non-disabled elementary student enrolled in a private parochial school (Standish, McLaughlin, &Neyman, in press). In the present study, a color racetrack was gaged and later DI flashcards were implemented with individual preschool students. This study evaluated the effects of DI flashcards with two preschool students, two of which were diagnosed with developmental delays, and their recognition of colors.

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Recently, studies have been conducted involving a racetrack system with flashcards. This game-like procedure has received attention in the literature in both reading (Anthony, Rinaldi, & McLaughlin, 1997; Rinaldi& McLaughlin, 1996; Rinaldi, Sells, & McLaughlin, 1997; McLaughlin et al., 2009), math (Beveridge et al., 2006), spelling (Arkoosh, Weber, & McLaughlin, 2009; McLaughlin, Weber, Derby, Hyde, Barton, et al., 2009, 2011), and handwriting (McBride, Pelto, McLaughlin, Barretto, Mortensen, & Robison, 2008).

Mathematics and numeral identification will be an integral part of kindergarten and in every year of schooling. It is an extremely important skill to be able to identify numerals for making change, making purchases, and paying taxes.

In the present research we implemented a math racetrack procedure without flashcards. However, due to student performance, flashcards were added to the intervention.

METHOD

Participants and Setting

The participants were two preschool aged boys who attended a South Spokane elementary school. Both students were enrolled in a self-contained special education preschool classroom. Both students demonstrated deficiencies in cognitive functioning. Participant 1 also qualified in the area of Emotional/Behavioral Disorder. Participant 2 qualified in the areas of speech and language impairment and cognitive impairment. Both students had significant areas of delay in numeral identification.

Participant 1 was a 5-year-old boy who had a diagnosis of Developmental Delay. He has been in this same preschool classroom since he was issued his IEP. His IEP goals were under the Pre-academic Area and the Adaptive Area. Participant 1 could not identify any numerals at the start of the study. This participant was taking medication for ADHD and Anxiety during the study. These medications were not consistent. This student also had prescription glasses, but did not always have them during the study sessions.

Participant 2 was a 3-year-old boy who had a diagnosis of Developmental Delay. It was his first year in preschool. His IEP goals were under pre-academics as well as speech and language. Participant 2 could not identify any numerals at the start of the study. This participant was not taking any medications during the study.

The study took place at an elementary school in the Pacific Northwest. The school enrolled approximately 360 students. Of those students 61% qualified for free or reduced lunch. The researcher used two different locations to conduct the study. The first area that was used was the corner of the classroom away from the students at a table with two small chairs and a table. The second area that was used was the instructional room down the hallway. This room had a few tables and chairs and was relatively quiet. Very few students would enter the room and was therefore very quiet. The study took place over 6 weeks.

The preschool classroom had nine students enrolled for the majority of the study. Towards the end of the study, one child moved away. Various support personnel such as the speech pathologists, occupational therapists, and physical therapists work closely with the classroom teacher and instructional aides.

Materials

The materials used were 9 cardstock cards with the numerals 1-9 written on them. Three separate “math racetracks” (Beveridge et al., 2003) were used as the vehicle for data. Data were gathered using a data collection forms.

Experimental Design and Conditions

The effects of our two separate and combined interventions (math racetracks, DI flashcard system) were evaluated in a combination ABC and multiple probe single case design (Kazdin, 2010) across two participants. Baseline data were taken for each student. Next, a DI flashcard system was implemented as well as a math racetrack system.

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Baseline

Baseline data were gathered for each student at the beginning of the study. Baseline involved the demonstration of the numbers 1-10 on a page. The children were asked, "What number?" in random order. The children were expected to respond within 3 seconds, or else the answer was not counted as correct. The correct and incorrect responses were documented on the baseline sheet. No feedback was given during baseline. Both participants were unable to successfully identify any numerals. Participant 1 identified the number "7", but gave this same answer for multiple numerals, so it is unlikely he knew the numeral's name. Baseline was only taken for 1 session for both participants.

Direct instruction flashcards + math racetrack

The researcher used both the DI flashcard system as well as the Math Racetrack system for the entire study. Each participant had a different data sheet. When the researcher presented the DI flashcard and said "what number?" the child had 3 seconds to respond. If the child correctly identified the number within 3 seconds, the card was put in the back of the deck. If the child did not respond, took longer than 3 seconds, or misidentified the number presented, the card was put 2 back. This procedure lasted until each participant was able to correctly identify all three of the cards. After this procedure, the Math Racetrack was given to the child. The researcher would say, "On your mark, get set, GO!" and start pointing to the first space. If the participant correctly identified the numeral, nothing was marked on the data sheet. If the participant did not respond, took longer than 3 seconds, or misidentified the number presented, a tally mark was written in the "Incorrect" box on the data recording sheet. The child would go all the way around the track and the time would be recorded. A formula was used to calculate the numerals per minute. It was the number correct, divided by the amount of time it took to go around the whole track, multiplied by 60.

Short math racetrack + DI flashcards

The math racetrack was shortened and had 14 spaces, and in each one, there was a different numeral written depending on which set was being intervened on. This racetrack was presented after baseline and the DI flashcard method with a model, lead and test procedure. The researcher would present the racetrack and tell each student to say the name of each number before moving to the next space. The researcher would point to each space with her finger. Each racetrack was testing three different numerals at a time. After set 1 was mastered, the new racetrack would have Set 2 numerals randomly ordered in the spaces. Some Set 1 numerals were placed on the Set 2 track as well. The student was required to identify the numeral within 3s. If the student did not identify the numeral within 3s, or said the incorrect answer, or no answer at all, the researcher would say "this is a ____" and the Participant would have to repeat the numeral, and then move on, while the timer was still running. The participants were timed using the second hand on the classroom clock.

Reliability

Interobserver agreement was taken 10% of the time for Participant 1 and 50% of the time for Participant 2. An observer recorded the Participants' responses separately from the researcher. The other observer used a separate data collection sheet and recorded the incorrect answers just as the researcher did. 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%.

RESULTS

The number of correctly identified numerals during baseline and the DI flashcard system/Math Racetrack are shown across 3 sets of numerals in the graphs for each participant.

Participant 1

For baseline, Participant 1 scored 0 correct. The mean for baseline was 0% correct. When Di flashcards and math racetracks were implemented, Participant 1 had an increase in scores. The scores increased to 29.7 numerals/min after the first session of intervention.

Mastery of Set 1 took 8 sessions, but the participant was unable to prove mastery two sessions in a row. On session 16, Participant 1 was moved to Set 2 because mastery had occurred for two sessions

in a row. When DI flashcards and Math Racetrack were implemented for Set 2, his scores had an uptrend. His scores for set 2 had a mean of 14.6 numerals correct/min. A probe was taken on the 19th session for Set 1 and the Participant had a score of 19.9 numerals correct/min.

Participant 2

For baseline, Participant 2 scored 0 correct. The mean for baseline was 0% correct. When Di flashcards and math racetracks were implemented, Participant 2 had an increase in correct numerals. The scores increased to 14.8 numerals/min after the first session of intervention.

Master of set 1 took 10 sessions. Participant 2's mastery level was 22 correct numerals/min. Set 2 was then intervened on. Participant 2's mean for set 2 was 4.3 numerals correct/min. A probe was taken on the 13th session for Set 1 and Participant 2 had a score of 10.8 correct numerals/min.

DISCUSSION

The purpose of this study was to teach the participants to correctly identify the numerals 1-9 using a DI flashcard system as well as the math racetracks. Improvements were made for both participants in the study. The failure to replicate our previous outcomes proved to be of concern (Jasny, Chin, Chong &Vignieri, 2011; Kazdin, 2010). The failure to generate powerful affects needs further analysis. There may well have been a number of factors are thought to have affected the results of the study for both participants.

Participant 1 specifically had several environmental factors that most likely contributed to the results of the study. Participant 1 had several days during the study in which he was not taking his medications. This was unknown to the parent, but when the researcher asked the child, he said that he had hid them for the past few days. The parent was quickly notified. Later in the study, this child was put on Adderall to see if it would benefit the child. Participant 1 became very anxious and angry. He was not able to focus on any task, even if it was a preferred task. The parent took Participant 1 off Adderall 4 days later. These medication adjustments had a negative affect on the child's ability to attend and therefore some data points are not a true measure of the child's ability.

Preschool sessions are 2.5 hours a day, 4 days per week. The participants were taken out of the "Free Play" time. This time frame was chosen because it is the only part of the day when explicit teaching is not being conducted. This made it very difficult to keep consistent sessions. There were also attendance issues throughout the study. Both participants missed a number of days during the study.

The racetrack procedure appeared to be not very reinforcing for both participants. It is quite possible that our participants were not old enough to understand the time concept of the track. Either they went too fast and didn't think about correctly identifying the numerals, or they did not understand the reason to go fast. The DI flashcard method was more effective for both boys. However, due to age, it would have been more beneficial to teach 2 numerals at a time, as 3 seemed to prove too difficult. Also, each session took at least 10 or 15 minutes if not more. This was not time-effective for our participants but had a negative effect on their ability to attend to our procedures. It may well have been that the effects of the severity of their disabilities could have had a negative effect on our outcomes. In our earlier research with tutoring, higher functioning preschool students benefited more from that intervention (Tabachek, McLaughlin, & Howard, 1994) than preschoolers who had more severe disabilities (Balenzano, Howard, & McLaughlin, 1992). These differences included the ability to implement the procedures of Class Wide Peer Tutoring (CWPT) as well as the outcomes by the tutee. Travis et al., (2012) were able to improve letter saying skills of two first grade students using a modified racetrack with DI flashcards. Herberg et al. (2012) were able to increase the color recognition of preschool students with disabilities by only using the DI flashcard procedures. In the Travis et al study, the participants were older and in the Herberg et al research, the participants were a bit older and only the DI flashcard procedures were employed. Clearly, the present outcomes warrant future research with preschool students with disabilities as well as with preschoolers enrolled in general education preschool classroom.

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