

**THE DIFFERENTIAL EFFECTS OF A COLOR RACETRACK AND COLOR FLASHCARDS ON THE ACQUISITION OF BASIC COLOR FACTS FOR A PRESCHOOL STUDENT WITH BEHAVIOR DISORDERS**

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***Abstract:** The purpose of this study was to evaluate the effects of a color racetrack on the acquisition of basic color facts by a student in preschool getting ready for kindergarten. A color racetrack is a practice procedure where known and unknown facts were placed around an oval track with the objective being to finish the race correctly and as quickly as possible. The effectiveness using color racetracks was evaluated with a multiple baseline experimental design across one set of color facts; with variation in the ratio of mastered to unmastered colored facts around the racetrack. The results indicated that the color racetrack was affective in increasing the accuracy and retention of the basic color facts by the participant. This experiment was based on the racetrack procedure that has been effectively used to teach reading and math, yet stretches beyond its initial purpose to include basic color facts as well. This procedure was cost effective and required little training to implement; it was an overall success.*

***Key Words:** color racetrack, flashcards, preschool student, single case design, colors*

## **Introduction**

Every student should be given the opportunity to excel in his or her own classroom environment. There are many students that miss out on this opportunity because of poor learning chances and because they are not given the chance that they truly deserve (Marchand-Martella, Slocum, & Martella, 2004).

One of the most important milestones for a preschool student is the knowledge of basic colors. This includes, but is not limited to: red, yellow, blue, green, orange, pink, brown, purple, and black (Howard, Williams, & Lepper, 2010). The basic colors are one of the building blocks for kindergarten. Recognizing colors may also be a good step in details of reading and recognition of other classroom activities.

## Review of Literature

There is a growing body of literature on the use of employing racetrack like procedures to improve the fluency and skills for students with disabilities (McLaughlin, Weber, Derby, Hyde, Violette, Barton, et al., 2009; Rinaldi & McLaughlin, 1996; Rinaldi, Sells, & McLaughlin, 1997). Reading racetracks were first developed to teach students sight words (Rinaldi & McLaughlin, 1996). A racetrack is constructed to mimic a racetrack with 28 cells or squares placed in an oval shape. Words to be learned or math problems are placed in these cells. Care is taken to make sure that the order to words or problems that are placed on the racetrack do not permit a student to memorize the orders of various words or problems. We have constructed racetracks for 8.5 by 11 inch copy paper, and constructed tracks out of craft materials that can be placed on 4' by 8' sheets of plywood in the classroom (Printz, McLaughlin, & Band, 2005). After instruction by the teacher or instructional assistant, the student is timed saying or writing the various words or answers. For example, Rinaldi, Sells, and McLaughlin (1997) found that employing such procedures improved both sight word recognition and comprehension with general education and special education students. In several studies (Crowley, McLaughlin, & Kahn, 2013; Falk, McLaughlin, & Band, 2003; Printz et al., 2006; Skarr, Zielinski, Ruwe, Sharp, Williams, & McLaughlin, in press), we have added a flashcards to a racetrack intervention to improve the sight word recognition of elementary students with learning disabilities. Finally, we have expanded the use of racetrack like procedures to such academic areas math (Beveridge, Weber, Derby, & McLaughlin, 2005) and spelling (Arkoosh, Weber, & McLaughlin, 2009) at the elementary school level.

## Methodology

### Participant and Setting

The participant was a five-year-old male student with behavioral disorders. The participant attended a Special Education Preschool classroom. The researcher chose to work with this particular student because they are attending kindergarten next year and were struggling with basic color facts. He was also highly motivated when he came to school and does well with one-on-one attention.

The setting of this study was within the participant's classroom; a preschool classroom. During the session the participant and the researcher would work at the table that was the furthest away from the other children in the classroom. The sessions would be in the beginning of the day right as the participant came in the classroom while the other children were doing "Free Play" as to not take away the participant from learning times. The sessions would take about 10 to 15 minutes each time. The researcher would test the participant with the racetrack at the beginning of each session and then the researcher would move in to flashcards and then a final test of the racetrack. The noise level in the room was typical, and louder than if the researcher and the

participant were to move to another room, as there were many distractions, but he mostly stayed focused throughout the sessions.

## Materials

The items employed were a set of flashcards, a racetrack, and a data collection sheet. The color racetrack can be seen in Figure 1 and the data collection sheet can be viewed in Figure 2. The color racetrack was photocopied and the different colors for each session were then colored onto the squares in the racetrack. The flashcards were constructed carefully by placing the color on the front of the note card and writing the color on the back of a 3 by 5 note card. The data collection sheet, see Figure 2, was created electronically in a spreadsheet format.

## Response Definitions and Observation Procedures

The first measures were corrects and errors. A correct was defined as saying appropriate color when it was presented. This had to take place within 3s after it was presented. If the student skipped a color or answered with the wrong color name, it was scored as an error.

The first author coded whether the participant had answered the color correctly by either placing a plus, a dot, for no answer or skip; and a minus, for an incorrect answer. At the end of each session, the participant was presented with the racetrack to determine how many seconds it would take for the student to go around the track. These data were gathered by timing the student as he went around the racetrack at the end of each session. All data for each measure was placed on a data sheet for each session, and then transferred to an electronic spreadsheet.

## Experimental Design and Conditions

An ABC single case design (Kazdin, 2011, McLaughlin, 1983) was employed. A baseline was conducted in four sessions. Next, the color racetrack was then implemented for four sessions. Finally, the color racetrack and flashcards were combined for a total of 12 sessions.

**Baseline.** In baseline the participant was presented with a series of flashcards with the basic color facts, green, yellow, red, and blue. No corrective feedback was given during baseline. The participant was asked to do his best and told that he could say “skip” and the first author would move on to the next flashcard. If the correct color was not given in three seconds the card was marked as incorrect. At the end of each session he was timed for a single time around a color racetrack.

**Color racetrack.** During the color racetrack intervention at the beginning of each session the racetrack was presented. The participant would see how fast he could go around the track. There were 25 squares in the racetrack with 9 different colors and a green every fifth space because he knew the color green. This was done to allow him to answer at least one color correctly. If he did not know a color after three seconds, the first author would give him the correct color so

that he could continue around the racetrack. The colors were placed in each square on the racetrack. This allowed for the lines that separated these squares were for the students to move from one color to the next. This also provided participant extra practice in the visual motion of viewing things from left to right; an important skill that is necessary for proper tracking during reading. The participant was timed with a stopwatch. This condition was in effect for four sessions.

**Colored flashcards + racetrack.** The colored flashcards were added because the racetrack only was not improving his performance on any of the measures. He would begin each session with the color racetrack and then move to 18 flashcards with 9 different colors: red, yellow, blue, green, orange, pink, brown, purple, and black. The first author would present the flashcards to the participant. He was allowed 3s to say the correct color. If he did not respond within 3s, he was given the correct answer by the first author and required to repeat the answer to the flashcard again. When a flashcard that was skipped or answered in error, it was place back three cards in the flashcard pile. This was done to provide additional opportunities for practice and error correction. If the color was said correctly, it was placed in a separate pile. This was done so that the participant could see which and how many colors he answered correctly. After all the flashcards had been presented, he was given the color racetrack to determine how many seconds it required for him to say the various colors around the track. After each session the participant was a given a piece of red licorice for remaining seated and attending to the first author. This was a common practice in this classroom for both small group as well as individual

## FINDINGS

### Baseline

For baseline he was given four colors from which to respond. In Sessions 1 and 3 he only had 1 correct. For Sessions 2 and 4 he had only 2 corrects. The amount of time in seconds that was required for our participant to complete a single racetrack ranged from 119 to 115 seconds with an overall mean of 114 seconds.

### Color Racetrack

During the color racetrack, the number of colors he could identify remained low ( $M = 2.75$ ; range 2 to 4). He errors were high with a mean of 15.25 (range 14 to 16. The number of seconds that was required for him to complete his color racetrack decreased ( $M = 88.5$  seconds; range 79 to 100 seconds).

### Color Racetrack + Flashcards

During this intervention attaching colored flashcards to the color racetrack, improvements for both corrects and errors were affected. There was gradual improvement, but after session 15,

large gains in corrects were noted. His overall mean for corrects was 9.62 with a range of 5 to 17 corrects. For errors, a similar decrease was noted ( $M = 7.7$ ; range 2 to 13 errors). By the end of data collection, the participant could name 17 out of the 18 colors that were presented on the racetrack and with only 1 error.

### Statistical Comparisons

Using a Friedman Nonparametric analysis-of-variance (Siegel, 1956), the differences between conditions was statistically significant for both corrects and errors ( $\chi^2 = 15.4$ ;  $p = .004$ ). Follow tests using a Wilcoxon Matched Pairs Signed Ranks Test found significant differences between baseline and two intervention phases for errors ( $Z = -2.371$ ;  $p = .018$ ) and only between baseline and color racetracks + flashcards for corrects ( $Z = 2.123$ ;  $p = .032$ ). A similar outcome was found for the number of seconds to complete one time around the color racetrack. ( $\chi^2 = 13.4$ ;  $p = .014$ ). Follow-up tests were significant between each condition ( $Z = 2.032$ ;  $p = .0422$ ).

Figure 1. The color track employed.

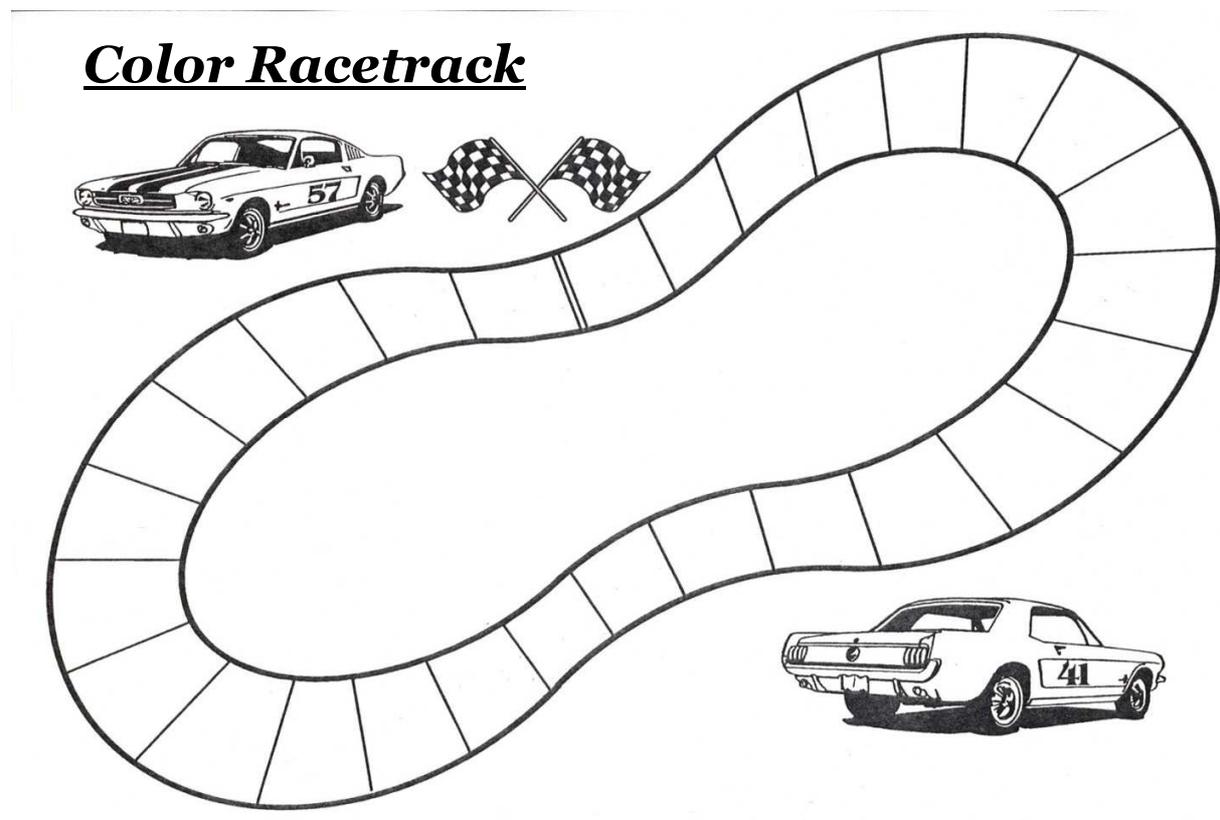


Figure 2. The data recording sheet.

Colors	Recognition	No Recognition
Red		
Blue		
Green		
Yellow		
Black		
Orange		
Pink		
Brown		
Purple		
Red		
Blue		
Green		
Yellow		
Black		
Orange		
Pink		
Brown		
Purple		

Figure 3. The number of corrects and errors for each condition. Baseline was the first four sessions. Color racetrack was the next four sessions. The final condition was the color flashcard phase which lasted for 13 sessions.

Corrects	Errors
Baseline 1	3
2	2
1	3
2	2
Color Racetracks 4	14
2	16
2	16
3	15
Color Racetracks + Flashcards 5	7
6	8
7	9
5	13
6	12
4	14
8	10
9	9
12	6
14	4
16	3
16	3

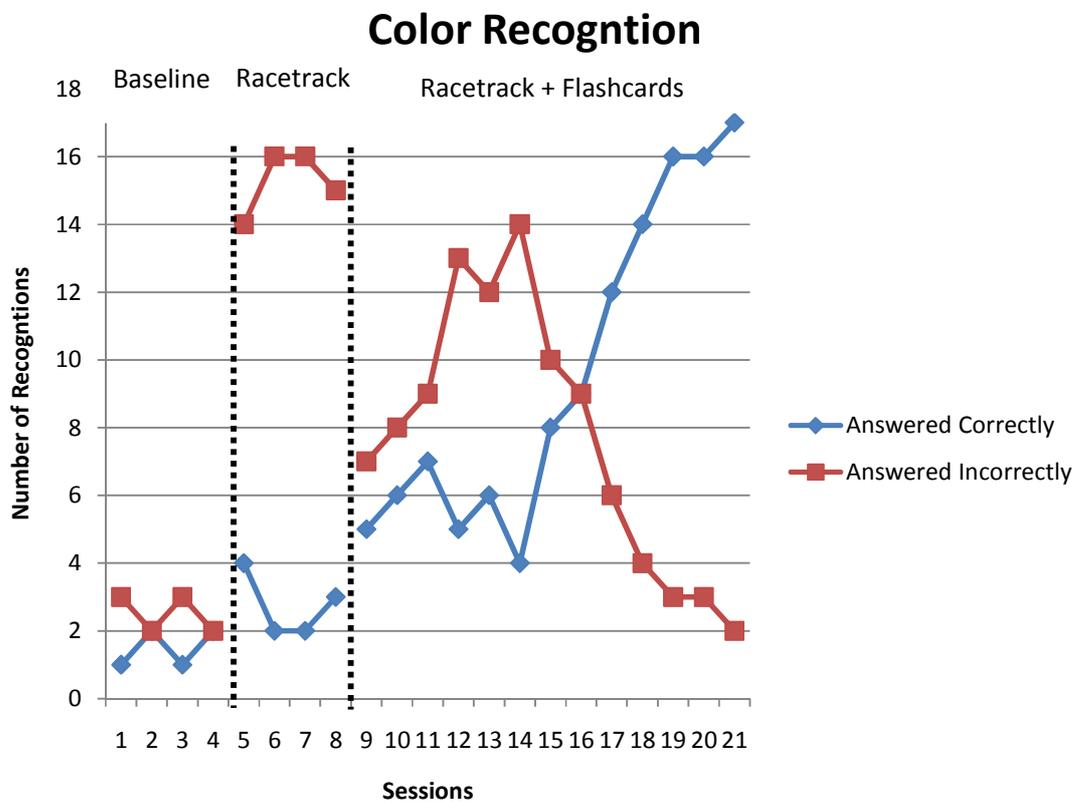
17	2
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Figure 4. The number of minutes and seconds to complete the racetrack.

Session Number	Racetrack Timing
Baseline 1	1:56
2	1:55
3	1:49
Color Racetracks 4	1:58
5	1:40
6	1:29
7	1:26
8	1:19
Color Racetracks + Flashcards 9	1:19
10	1:20
11	1:22
12	1:10
13	0:54
14	0:37
15	0:51
16	0:41
17	0:30

18	0:32
19	0:30
20	0:41
21	0:35

Figure 5. The number of corrects (blue diamonds) and errors (red squares) during each condition.



### Conclusion

As the participant improved his skills in color identification, the time that it took the participant to traverse the color track decreased. As the intervention continued, the participant became faster and faster identifying the various colors.

The participant appeared to be reinforced by the opportunity to work individually with the researcher. The racetrack and the car that he was able to use to show a progression around the

track also reinforced the participant. He felt as though it was a race and the more he understood the colors he realized the faster he could go around the track. He would work really hard during the flashcard time to learn the colors because he wanted to improve his time each session. At the end of the procedure the participant was allowed to keep the car as a reward for doing a great job with the project. Both specific and general praise were used during the racetrack procedure, which may have added even more motivation to the participant. All of these may have been potential reinforcers, which could have added to the participant's success in the study. However, no formal evaluation of these factors was conducted.

### **Suggestions and Recommendations**

The present outcomes provide the first demonstration of employing a racetrack like procedure with flashcards to teach a preschool student his colors. Employing both the racetrack with flashcards replicates our previous work in reading (Anthony et al., 1998; Falk et al., 2003; Mangundayao, McLaughlin, Williams, & Toone, 2013; Printz et al., 2006; Rinaldi & McLaughlin, 1996; Rinaldi et al., 1997) and math (Beveridge et al., 2005). Finally, racetrack like procedures have been effective across a wide range of student populations ranging from learning disabilities (Rinaldi et al., 1997) autism (Petersen, McLaughlin, Derby, & Higgins, 2008), to elementary students with developmental disabilities (Green, McLaughlin, Derby, & Lee, 2008). However, in the present case a single preschool student was employed and color naming rather than sight words or math facts were employed.

There were a number of limitations in the present case report. First a return to baseline after a few sessions when the color racetrack and flashcards were combined did not take place. Also, increasing the number of cards from 4 to 18 would have allowed a stronger comparison between baseline and the other two phases. The data collection period was short and ended when the first author completed her student teaching in the four author's classroom. It would have added to the strength of the case report if data collection would have last for a long period of time.

It is our view that continuing this procedure will be beneficial. Also, more students in the class could take part and instruction could occur in small groups rather than on a one-to-one basis. Finally, other colors could be taught using flashcards with the color racetrack. Also, making it a center activity for the whole class may be an important step in having other teachers employ racetracks and flashcards in their academic instruction.

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