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# THE EFFECTS OF DIRECT INSTRUCTION FLASHCARDS AND MATH RACETRACK ON MATH FACTS WITH ONE ELEMENTARY STUDENT*

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## ABSTRACT

*The purpose of the present study was to extend the use of DI Flashcards with a math racetrack employing atypical student enrolled in general education. A second purpose was to replicate and extend the previous research in math with flashcards. The participant was a third-grade male attending a parochial school. His performance in long division was below grade level. When flashcards and the math racetrack were implemented, his performance increased. The participant reached mastery for two of his three sets of division facts by the end of data collection. The efficacy of employing flashcards with a math racetrack was discussed.*

***Keywords:*** *flashcards, math racetrack, long division, general education student, multiple baseline design*

## INTRODUCTION

In the American culture math is typically used every day in many situations, so understanding and being able to strategize is a highly important skill to obtain in order to be a contributing member of society (Cipani, 1988; McClosky & Macaruso, 1995). Learning mathematics takes time and it not just something one can pick up, the comprehension of mathematics demands practice of the subject and grasping the relationships and patterns between numbers (Cruikshank, 1992). Today there are about 5 to 8% of students who have memory or other cognitive deficits that interfere with their ability to acquire, apply or master mathematical concepts and skills; using flash cards will help overcome this challenge (Geary, 2004; Lerner & Johns, 2011).

Once students have the concept of basic operations, the next goal is to teach the student their basic facts, and at the same time, the ability to respond quickly and correctly to various facts (Thornton, 1989). Without such skills, it becomes more and more difficult for students to build upon their basic skills and attain mastery of higher level of math concepts (Erbey, McLaughlin, Derby, & Everson, 2011). Memorization of multiplication facts is the first step towards algebra and geometry, which will be useful for any person. With practice of multiplication facts, a student's fluency and accuracy will only increase, thus leading into skills of division facts.

In today's high-tech and increasingly connected world, it is vital that young children have the confidence and skillsin math. Issues in math can be a major impediment to many facets of lifeand has been associated with to dropping out of school (Lloyd, 1978). For example, low skills in math have been shown to be functionally significant for health numeracy (Donelle, Arocha, & Hoffman-Goetz,

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2008; Nelson Reyna, Fagerlin, Lipkus, & Peters, 2008) constraining informed patient choice and limiting access to available treatments. Moreover, difficulty in math has been negatively linked to full-time employment in adulthood (Rivera-Batiz, 1992).

An effective procedure has been to employ flashcards to teach students specific skills (Van Houten, & Rolider, 1989). Flashcards with and without racetracks have been employed to teach students sight word skills in reading (Cates, Skinner, Watson, Meadows, Weaver, & Jackson, 2003; Green, McLaughlin, Derby, & Less, 2010; Romjue, McLaughlin, & Derby, 2011; Ruwe, McLaughlin, Derby, & Johnson, 2011; Tan, &Nicholson, 1997), math, (Brasch, Williams, & McLaughlin, 2008; Erbey et al., 2011; Hayter, Scott, McLaughlin, & Weber, 2007), and spelling (Arkoosh, Weber, & McLaughlin, 2009). In several of these studies a motivational system or token economy has been in place in the classroom. In the present research, no such token program was employed.

The purpose of the present study was to extend the use of DI Flashcards to improve the skills of an elementary student enrolled in general education. A second purpose was to replicate and extend the previous research in math (Erbey et al., 2011; Hayter et al., 2008; Kaufman et al., 2011; Ruwe et al., 2011) using flashcards and racetrack procedures.

## METHOD

### Participant and Setting

There was one participant in the study. The participant was an eight-year-old male in third grade. He was not identified as having any disabilities. He attended the general education classroom in a local parochial school. The participant's mother and the first author chose the participant for this project. In the early fall, the participant was assessed using the *Woodcock-Johnson Test of Achievement III*, (Woodcock, McGrew, & Mather, 2008). All of his subtests were at grade level; with math his lowest subtest.

The study took place in a small workroom located at a private university located in the Pacific Northwest. Data were taken either in the morning or after 4:00 p.m. Only the first author and the student were present. However at times, there was four author was also present to gather reliability.

### Materials

There were a number of materials utilized in this project. We employed a set of flashcards, three math racetracks, a data collection sheet, a handmade graph, and ballpoint a pen.

### Dependent Variable and Measurement

The dependent variable was the number of correct answers when the participant was presented and prompted to answer a long division fact. A correct response was scored if the participant said the correct quotient with 2s of being presented a flashcard. Any other answer was scored as an error. If the participant incorrectly answered the answer, but self-corrected immediately then the response was counted as correct. The participant had to respond within 2s of the appearance of the card, after 2s the next card was presented. Set 1 consisted of 6 divided by 2, 18 divided by 3, 36 divided by 3, 33 divided by 3, and 21 divided by 3. Set 2 consisted of 3 divided by 3, 15 divided by 3, 30 divided by 3, 27 divided by 3, and 8 divided by 4. Set 3 consisted of 12 divided by 4, 40 divided by 4, 16 divided by 4, 44 divided by 4, and 20 divided by 4. Once the skill sets were determined baseline was completed across all sets. After establishing baseline the math racetrack was used to teach the sets of division facts.

### Dependent Variables and Measurement

Data were collected after every session by the first author. The first author would identify either a correct or incorrect response for each flashcard. Corrects were place in one stack while errors were put in a different stack.

### Experimental Design and Conditions

A multiple baseline design (Kazdin, 2010) across three sets of division facts each set consisted of five different cards.

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### *Pre-Testing*

The participant was given numerous pre-tests in order to determine what skills needed to be taught. Overall there were ten pre-tests given, the lowest number being zero and the highest being four. The pretests consisted of 64 division problems, there was no time limit and these tests were not timed.

### *Baseline*

During baseline the first author would hold the deck of flashcards out so the participant could read them. The participant would then read the equation and answer verbally. If the participant correctly responded within 2s or self corrected then a + was tallied. If the subject incorrectly responded or did not respond at all then a – was marked. The number sessions in baseline ranged from 2 to 18.

Direct Instruction Flashcards And Math Racetrack

Three sets of division facts were created for the participant. There was no specific order in which the cards were placed; each set was made up of five division facts the participant incorrectly answered on the pretest.

At the beginning of every session, the first author went through the flashcards with the participant and recorded the outcome on the hand-made graph. The first author then went through the participant's division facts placed on his math racetrack. Each racetrack consisted of 28 division facts that were placed on the track in random order. This was done so the participant could not detect a pattern in the problems and their solutions. Each set of division facts was placed on the track twice. The rest of the division facts were problems the participant knew on the pretests. The first author would time the participant on how fast he could get around the track without any mistakes. Once the participant went around the track three times without any mistakes then the first author would test the participant on those flashcards. If the participant had perfect performance for his five division, the first author would again test the participant on these flashcards. Once the participant correctly answered all five problems on his set twice, the first author would move to the next set.

### *Interobserver Agreement*

Interobserver agreement data was collected on 3 of 3 (100%) sessions for baseline in Set 1. During intervention of Set 1, interobserver agreement was taken in 2 of the 4 (50%) sessions. For baseline in Set 2 interobserver agreement was not collected. During intervention of Set 2, interobserver agreement was conducted on 4 of 12 (33%) sessions. Interobserver agreement was collected on 8 of 17 (47%) sessions for baseline in Set 3. During intervention of Set 3 interobserver agreement was conducted on 1 of 3 (33%) sessions. The participant's mother also collected interobserver agreement data. When taking reliability the participant's mother would stand behind the participant and individually score the session. The participant's mother would tally the correct and incorrect responses on their own sheet of paper. The number of correct and incorrect responses, recorded by either observer on their own individual recording sheet was compared. The smaller number of corrects and errors were divided by the larger and multiplied by 100 for each session. Mean agreement was 100% across all sessions.

## RESULTS

### Baseline

During baseline for Set 1, the participant made no correct responses. For baseline in Set 2 the participant's performance was increasing ($M$ = 2.5; range 1 to 4). In baseline for Set 3, the participant's performance was variable but increasing ($M$ = 2.27; range 0 to 4).

### Math Racetrack

When the math racetrack was employed with flashcards for Set 1, the participant's performance improved ($M$ = 3.5; range 1 to 5). For the last two sessions, mastery was achieved. OnSet 2, his overall mean performance was high ($M$ = 4.25). After 12 sessions of intervention on Set 2, the participant reached mastery. For Set 3, the participant had perfect performance and he reached mastery after only two sessions.

### Maintenance

Maintenance was conducted for Sets 1 and 2. For Set 1, the participant had variable performance after mastery. The number correct ranged from 1 to 5 with a mean of 3.93). Due to the completion of the first author's practicum, no maintenance data were taken for Set 3.

## DISCUSSION

The present research shows that the participant made progress using the intervention of DI flashcards and a math racetrack. The participant enjoyed working with the authors. He was not embarrassed by having his mother (fourth author) as part of the study and appeared to enjoy her assistance.

This procedure was practical and easy to implement. For a classroom teacher this procedure would work tremendously because of the short time the study requires and the cost effectiveness. If a teacher were to use this in a classroom, it would only take 15 to 20 minutes. If student is fast learner than it may take less time. The materials needed for this procedure are available in most classrooms, flashcards, a pen, a racetrack, which can be printed off the Internet, and a data collection sheet.

There were limitations to the present research. For example, the first author was only able to meet with the participant once or twice a week. The first author felt that the progress made by the participant would have been greater if the study could have continued for a longer period of time. The variable performance for Set 1 was a function of failing to have problems on Set 2 interspersed with division facts from Set 1. When this was changed on Session 12, his performance improved. The final limitation of the present case report was that data collection and instruction took place outside the school day in a university setting. However, this was when the participant was available.

The present outcomes replicate previous research using flashcards and a racetrack procedure (e. g. Arkoosh et al., 2009; Beveridge, Weber, & McLaughlin, 2006; Kaufman et al., 2011) for math. In addition it extends the applicability of flashcards and racetrack procedures to an area that has received little attention in the literature than reading or sight words. Also, we were able to improve the performance of a student enrolled in a general education setting.

## REFERENCES

Arkoosh, M., Weber, K. P., & McLaughlin, T. F. (2009). The effects of motivational/reward system and a spelling racetrack on spelling performance in general education: A case report. *The Open Education Journal,2,* 17-20. Retrieved from: http://www.benthamscience.com/open/toecij/

Beveridge, B., Weber, K. P., Derby, K. M., & McLaughlin, T. F. (2005). The effects of a math racetrack with two elementary students with learning disabilities. *International Journal of Special Education, 20*(2), 58-65.

Brasch, T. L., Williams, R. L., & McLaughlin, T. F. (2008). The effects of a direct instruction flashcard system on multiplication fact mastery by two high school students with ADHD and ODD . *Child & Family Behavior Therapy, 30*(1), 51-59.

Cates, G. L., Skinner, C. H., Watson, T. S., Meadows, T. J., Weaver, A., & Jackson, B. (2003). Instructional effectiveness and instructional efficiency as considerations for data-based decision making: An evaluation of interspersing procedures. *School Psychology Review, 32*, 601–616.

Cipani, E. (1988). *Transitioning exception children and youth in the community: Research and practice*. New York: Haworth Press.

Cruikshank, D. E. (1992). *Teaching and learning elementary and middle school mathematics* (2nd ed.). New York: Macmillan Publishing Company.

Donelle L., Arocha, J.F., & Hoffman-Goetz, L. (2008). Health literacy and numeracy: Key factors in cancer risk comprehension. *Chronic Disease Canada*, *29*,1-8.

Erbey, R., McLaughlin, T. F., Derby, K. M., & Everson, M. (2011). The effects of using flashcards with reading racetrack to teach letter sounds, sight words, and math facts to elementary students with

learning disabilities. *International Electronic Journal of Elementary Education, 3*(3), 213-226. Retrieved from: http://www.iejee.com/index.html

Geary, D. C. (2004). Mathematics and learning disabilities. *Journal of Learning Disabilities, 37*, 2-4.

Green, C., McLaughlin, T. F., Derby, K. M., & Lee, K. (2010). Using reading racetracks and flashcards to teach sight words to students with disabilities: Effects for acquisition and response maintenance. *Journal of Educational Research: JER, 13*(2), 84-98. Retrieved from: http://www.iub.edu.pk/jer/previous_issue.html

Kaufman, L., McLaughlin, T. F., Derby, K. M., & Waco, T. (2011). Employing reading racetracks and DI flashcards with and without cover, copy, and compare and rewards to teach of sight words to three students with learning disabilities in reading. *Educational Research Quarterly, 34,* 24-44.

Kazdin, A. E. (2010). *Single case research designs: Methods for clinical and applied settings* (2nd Ed). New York: Oxford University Press.

Lerner, J., & Johns, B. (2011) *Learning disabilities and related mild disabilities: Characteristics, teaching strategies, and new directions* (11th Ed).Boston: Houghton Mifflin Co.

Lloyd, D. N. (1978). Prediction of school failure from third grade data. *Educational and Psychological Measurement, 38*, 1193-1200.

Marchand-Martella, N. E., Slocum, T. A., & Martella, R. (Eds.) (2004) *Introduction to direct instruction*. Boston, MA: Pearson Education, Inc.

McClosky, M., & Macaruso, P.(1995).Representing and using numerical information. *American Psychologist, 50*, 351–363.

Nelson, W., Reyna, V.F., Fagerlin, A., Lipkus, I., & Peters, E. (2008). Clinical implications of numeracy: Theory and practice. *Annals of Behavioral Medicine*, *35*, 261-274.

Rivera-Batiz, F.L. (2007). Quantitative literacy and the likelihood of employment among young adults in the United States. *Journal of Human Resources, 27*, 313-328.

Ruwe, K., McLaughlin, T. F., Derby, K. M., & Johnson, K. (2011). The multiple effects of direct instruction flashcards on sight word acquisition, passage reading, and errors for three middle school students with intellectual disabilities. *Journal of Developmental and Physical Disabilities, 23,* 241-255.

Tan, A.,& Nicholson, T. (1997). Flashcards revisited: Training poor readers to read words faster improves their comprehension of text. *Journal of Educational Psychology, 89*, 276–288.

Van Houten, R., & Rolider, A. (1989). An analysis of several variables influencing the efficacy of flashcard instruction. *Journal of Applied Behavior Analysis, 22*, 111-118.

Thornton, C. (1989). *Basic number facts--strategies for teaching and learning. Book i: addition and subtraction. An activity based program*. Washington DC: Document available from Educational Resources Information Center (ED316425).

Woodcock, R. W., McGrew, W. S., & Mather, N. (2008) *Woodcock Johnson Tests of Achievement (WJ- III).* Rolling Meadows, IL: Riverside Publishing Company.

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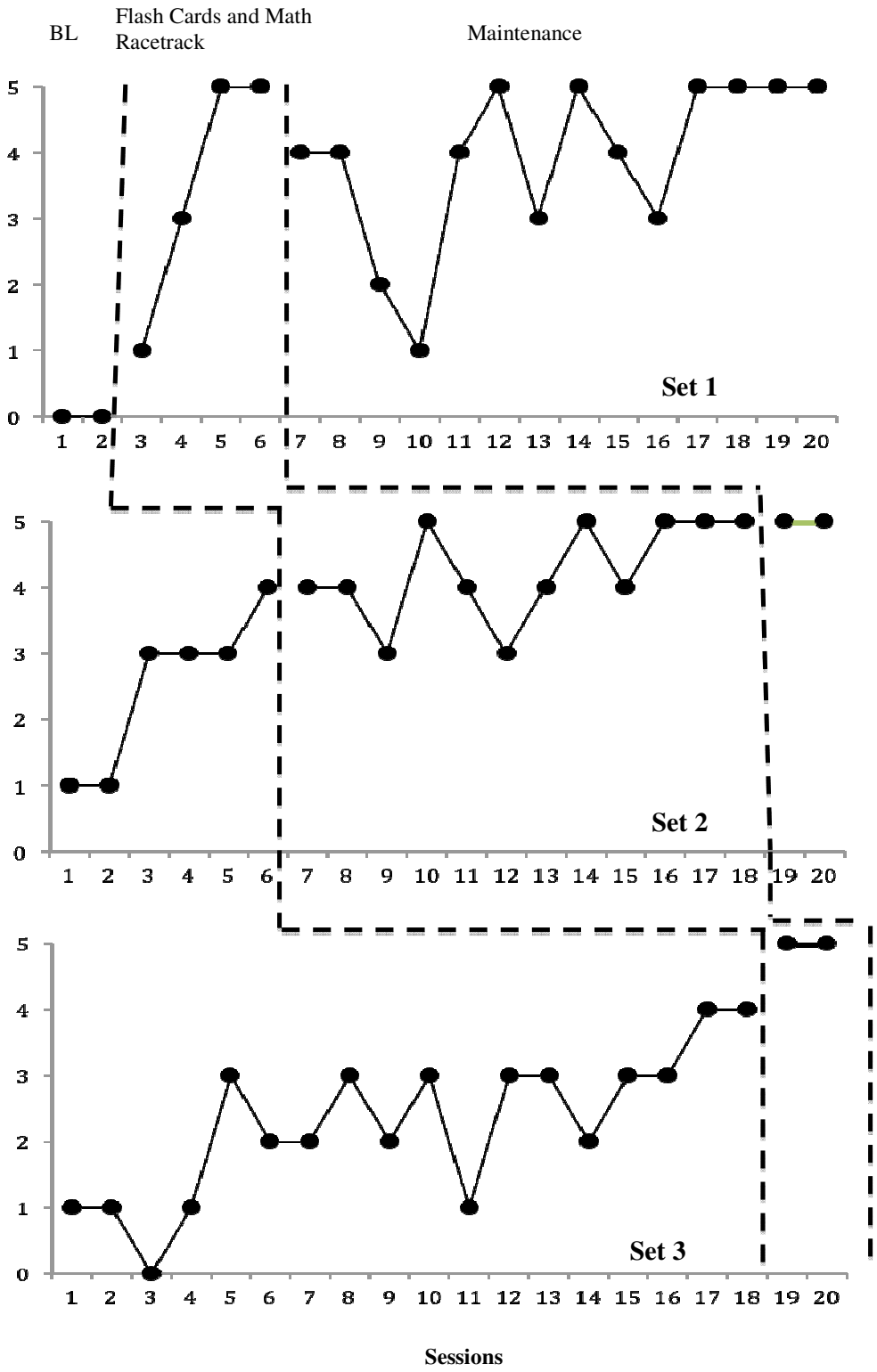


*Figure 1.* The number of correct long division facts for our participant during baseline, flashcards and math racetrack, and maintenance.