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The Effects of DI Flashcards and Math Racetrack on Multiplication Facts for Two Elementary Students with Learning Disabilities

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The purpose of this study was to evaluate the effects of a Direct Instruction (DI) flashcard system paired with a math racetrack to teach basic multiplication facts to two elementary students diagnosed with learning disabilities. The study was conducted in a resource room which served intermediate aged elementary students. The school was located in an urban school district in the Pacific Northwest. Targeted math facts were chosen based on the students' pretest scores. The effects of the DI flashcard procedure were evaluated using a multiple baseline design across sets of problems. Both participants improved their mastery of multiplication facts. The flash card procedure was inexpensive and easily implemented in a resource room setting.

Keywords: math facts, learning disabilities, flashcards, elementary-school students.

Multiplication facts are a central and essential piece of elementary math curriculum. Basic multiplication facts are imperative for success of students in k-12 education and beyond (Johnson & Layng 1994; Lerner & Johns, 2011; Stein, Kinder, Silbert, & Carnine, 2006). Mathematics is not only important in the school setting, but in everyday life and in the current job market as well (National Mathematics Advisory Panel, 2008). Despite the math requirements that have been placed on students, the students are failing to learn and retain the required math benchmarks for their grade levels (Adelman, 1999; Gersten, Beckmann, Foegen, Marsh, Star, & Witzel, 2009; National Mathematics Advisory Panel, 2008). This issue causes great concern for parents, teachers, and school policy makers (Gersten, Jordan, & Flojo, 2005; Ravich, 2010; Stein et al., 2006). Poor academic outcomes, struggling students, and other educational issues led to the creation of The No Child Left Behind Act of 2001 (United States Congress, 2002). This act affects both students and teachers, making each accountable for performance (Altwerger, Arya, Jordan, & Martens, 2004).

Basic multiplication facts are an incredibly significant part of the math curriculum. Knowing the facts themselves is an important skill, but also being able to use the facts in various types of math as students progress through their schooling. Without mastery of facts, students will struggle throughout their schooling (Gersten et al., 2005, 2009). Students who ultimately struggle with mathematics often react by decreasing effort, having lower self-esteem, or just “shut down”, not wanting to do math (Heward, 2013).

According to the Individuals with Disabilities Improvement Education Act of 2004 (IDEIA, 2004), learning disabilities are a group of disorders manifested by difficulties in listening, thinking, speaking, reading, writing, spelling, or doing mathematical calculations (Lerner & Johns, 2011). Students with learning disabilities are often difficult to distinguish from other low performing students who may be underachievers or just unmotivated (Swanson & Jerman, 2006). Once a student has fallen behind in math, it is difficult for student to catch up without extra small group instruction. Direct Instruction has been found to be the most effective and successful procedure to teach students with disabilities basic math facts (Kroesbergen & Van Luit, 2003).

Direct Instruction (DI) flashcard system is one method proven to be successful to improve a student’s performance with basic math facts and is also one of the three methods suggested and developed by Silbert, Carnine, and Stein (1981). Flashcards can be implemented in almost any setting and teaches specific skills quickly and easily (VanHouten & Rolider, 1989). DI flashcard systems (Brasch, Williams, & McLaughlin, 2008; Erbey, McLaughlin, Derby, & Everson, 2011; Glover, McLaughlin, Derby, & Gower, 2010; Hayter, Scott, McLaughlin, & Weber, 2007; Sante-Delli, McLaughlin, & Weber, 2001; Silbert et al., 1981) have been effective, and have received some attention in the peer-reviewed literature. It has been shown when students are taught using this teaching method, they have performed higher posttest scores than those who were taught using traditional methods in math (Wilson & Sindelar, 1991). The intervention consisted of presenting the student with pre-determined sets of targets basic multiplication math facts in a flashcard format. The student had to state the problem and answer correctly within the two seconds for the fact to be considered mastered.

In conjunction with DI flashcards, a math racetrack was also used for developing mastery of basic multiplication math facts. A math racetrack (McLaughlin, Weber, Derby, Hyde, Violette, Barton, et al., 2011) is an adapted form of reading racetrack, using math facts instead of letters of simple words. Math racetrack intervention has been shown to be very effective in accuracy and fluency that is evident in classroom performance and during the “game” (Arkoosh, Weber, & McLaughlin, 2009; Beveridge, Weber, & McLaughlin, 2006; McLaughlin et al., 2011).

The purpose of this study was to increase the accuracy and fluency on basic multiplication facts for two elementary school students who are at risk in mathematics. Intervention using math racetrack and DI flashcards was carried out to teach those math facts. One of the participants was an 11-year-old female; the other participant was an 11-year-old male. The results indicated employing a math racetrack and DI flashcards were successful increasing the math skills for both the participants in math.

Method

Participants and Setting

There were two participants in this study. Sammy was an-11-year-old female in the sixth grade that spent part of her day in the special education resource room. “Royal” was an 11-year-old male in the sixth grade that spent part of his day in the resource room. Both were diagnosed with learning disabilities and had Individualized Education Plans (IEP). Both the students demonstrated deficits in accuracy and fluency for basic multiplication facts. The resource room teacher felt these two students needed extra help in mathematics to reach their math IEP goals.

The study was conducted in the resource room of an elementary school in a lower socioeconomic area in the Pacific Northwest. The school is a LAP school with 62% of the students qualifying for free or reduced lunch. A LAP school is just below the criterion for free or reduced lunch for a Title 1 school. The classroom had a diverse population of students (i.e. ages, grade levels, and learning disabilities). “Sammi” and “Royal” spent time between the resource room and their general education classrooms. The special education classroom setting was managed by three adults; a certified special education teacher, a student teacher from a local private university, and an instructional assistant. Most the students enrolled in the resource room were at least behind on one or more academic areas (math, reading, or written language) and needed individualized instruction. There were several different tables throughout the room used to create a small group atmosphere and were used for small group instruction. The study was conducted in the resource room at a separate table from any other students. The room was usually quiet when the first author was working with the students. The study took place over eight weeks on various days of the week depending on the availability of the participants. The first author worked independently with each student.

Materials

The materials used were 3 by 5 index cards with all multiplication facts 0-12 for both students (one set for each student). The multiplication facts were written horizontally with an equal sign. The first author also used various math racetrack worksheets (Arkoosh et al., 2009; Beveridge et al., 2006), a timer, and data collection forms (copies can be obtained from the 2nd author) to record the results.

Dependent Variables and Measurement

The target response was fluency and accuracy while answering basic multiplication facts (0-12) for two sixth grade students. The dependent variable was performance for three sets of multiplication facts. The first author determined the 18 facts not mastered for each student from the pretest taken by the participants. The students were encouraged to do their best but no feedback or help was given during the test.

The targeted math facts were then divided into three sets of six facts per set and were randomly presented to the students at the end of each session. All participants were required to verbally state the entire problem and answer (i.e. three times six equals eighteen”) for each presented card to be awarded a correct response. The first author modeled the desired behavior and the participants orally stated the entire problem and answer within 5s. An error was defined as giving the wrong answer or by verbally delaying for more than 5s. When an error was made a minus sign (-) was recorded in the corresponding box on the data collection form. A correct response was defined as correctly stating the problem and answer within 5s (Brasch et al., 2007). When a correct response occurred, a plus (+) sign was recorded in the corresponding box on the data collection form.

For the time to completion measure, the first author timed each student to determine how many minutes and seconds it required the participants to complete the math racetrack at the end of each session. There data were only gathered during the DI flashcard and math racetrack sessions.

Data Collection and Interobserver Agreement

The first author employed event recording. The flashcard was presented and once the student made a response to the card, or time passed the first author placed the card on the table and put either a plus or minus in the corresponding box on the data collection sheet.

For interobserver agreement (IOA), the first author and the IA of the classroom scored data simultaneously but independently. Interobserver agreement was taken in 36% of the sessions for "Sammi" and in 44% of the sessions for "Royal". Interobserver agreement was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. The percent of interobserver agreement was 100%.

Experimental Design and Conditions

This study used a multiple baseline design (Barlow, Nock, & Hersen, 2008; Kazdin, 2010) across three sets of multiplication facts.

Pretesting. The first author presented both participants every multiplication fact from 0 to 12 (169 total). This were presented on a flashcard and asked the student to state the problem and answer within 5s. The first author recorded whether the participants got each flashcard correct or incorrect and chose the 18 facts the students had the most errors for each student. The first author then divided the 18 facts into three sets of 6 cards each.

Baseline. Three sets of multiplication facts were established for each participant base on their performance on the pretest. Baseline data were taken using all the flashcards for Sets 1 through 3. Next the first author slowly and silently counted to five when each card was presented to each participant. If the participants were able to state the problem and the correct answer within five seconds, the first author marked the fact correct by marking a plus sign (+) in the corresponding box on the data collection sheet. If the flashcard was skipped, the participants responded incorrectly, or required more than five seconds to respond, it was placed on the data sheet as incorrect using a minus sign (-). Baseline data were gathered for 2 to 5 sessions.

Direct instruction flashcards and math racetrack. For each session during the intervention, the set currently being intervened and one of the two other sets was presented. For each session, the cards in the various sets were randomly presented to avoid the students simply learning the order of the flashcards. Participants were instructed to verbally state the entire problem and answer. If the participant gave the wrong answer or delayed for more than five seconds, the card would be reviewed with a model, lead, test procedure (Marchand-Martella, Slocum, & Martella, 2004; Peterson, McLaughlin, Weber, Derby, & Anderson, 2008) and placed back two cards in pile. Therefore, the participants were provided an additional opportunity to make the correct response after two other flashcards had been presented. This process was repeated for each set until the participants could correctly state and answer each previously unknown fact for three sessions in a row. Once the participants reached mastery for Set 1, the flashcard system for Set 2 was implemented, until all three sets were taught.

The other procedure used to improve mastery of the facts was a math racetrack. The math racetrack was a game board track shaped like a racetrack with 28 spaces for math facts. The first author filled twelve of the spaces were filled with six target facts (twice each) and the other 16 spaces were filled with previously mastered multiplication facts. At the beginning of each turn, the first author had the student use a cube or pencil to follow and point at each square as they go. The participants got to push “start” on a timer when they wished to start. The participants were required to read the problem and state the answer as quickly as possible before they went on to the next square containing the next fact. The first author provided praise and feedback while the participant tried to complete the track as fast as possible.

The first author timed the track sequence and recorded each of the participants’ progress on a data collection sheet, so their progress can be followed to check for fluency. An example of the correct response was the participant starting at their chosen starting point, pushing start and then stating the first fact. The participant read the fact, for example 3 x 4 = 12 and then proceeded to the next box. If the participant responded with an incorrect answer such as: 3 x 4 = 15, then the first author stated 3 x 4=12 and prompted the student to try again before advancing to the next box. The first author periodically gave feedback and praise during the session. Each session lasted from 5 to 10 minutes.

After going over the racetrack, the first author showed the student the flashcards set he or she was currently working and asked the students to state the fact and its answer. As the student answered, the first author marked the fact correct or incorrect on the corresponding box on the data collection sheet. Then, the first author showed the student the flashcards from one of the other sets (baseline on the other two sets was alternated due to time constraints in the school day) and marked the card correct or incorrect on the data collection sheet.

All the session ended by the first author giving positive feedback to the participant about the progress made each day. The first author showed excitement when the progress showed improvement by completing the track in “record time”, faster than the time before. The first author shared the student’s daily progress with the classroom teacher and gave positive feedback about the participants.

Post-testing. Again, the first author showed both participants every multiplication fact 0 to 12 (169 total) on a flashcard and asked the student to state the problem and answer within 5s. The first author recorded whether the participants got each flashcard correct or incorrect.

Results

Sammi

Her pretest score was 115 out of 169 multiplication facts correct. The number of multiplication facts stated correctly during baseline and during the DI Flashcards and math racetrack intervention across three sets of flashcards can be seen in Figure 1. The mean number correct for Set 1 during Baseline was 2 out of 6 possible (range 1 to 3). Accuracy for this set increased to a mean of 6 during the DI flashcards and math racetracks. The student showed a trend of

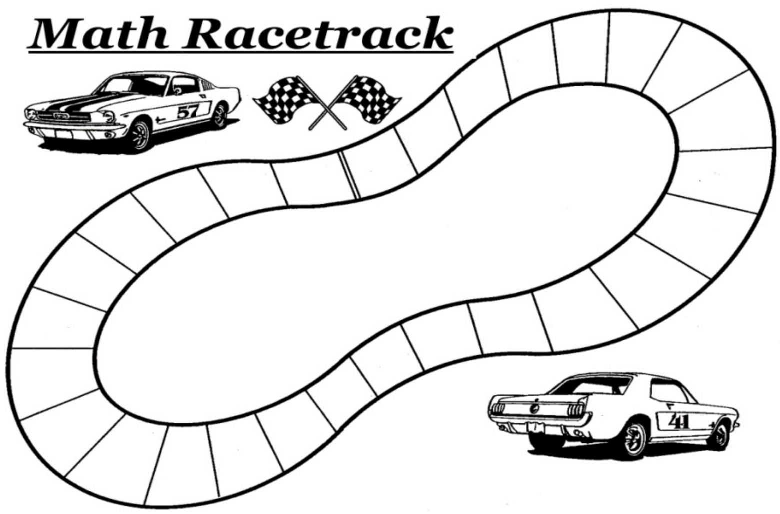
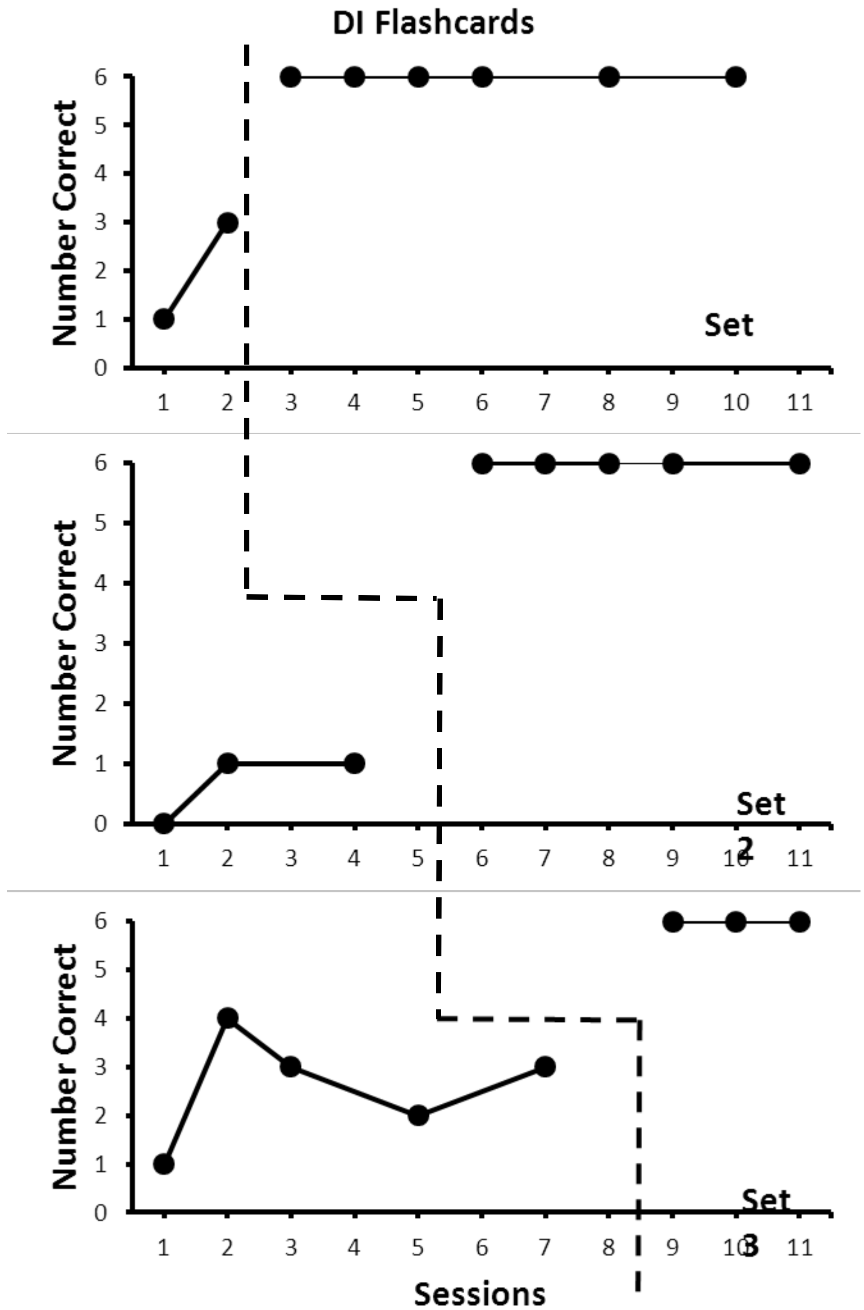


Figure 1. An Example of the Board Game for Math Racetrack.

mastery for facts taught in Set 1 over 6 sessions. For Set 2, the mean number correct during Baseline was 0.7 out of 6 possible (range 0 to 1). Correct math facts increased to a mean of 6 during the DI flashcards and math racetrack intervention. Over five sessions, this participant showed mastery for the math facts taught in Set 2. For Set 3, the mean number correct during baseline was 2.6 out of 6 possible (range 1 to 4). This increased to a mean of 6 for the DI flashcard and math racetrack intervention. The student showed a trend of mastery for facts taught in Set 3 over three sessions. Sammi decreased the amount of time to complete a lap around the math track. "Sammi" increased her performance on the posttest to163 out of 169 multiplication facts. This was a 28% increase from the pretest.

Royal

Royal scored 111 out of 169 multiplication facts correct on her pretest. The number of multiplication facts stated correctly during Baseline and during the DI flashcards and math racetrack Intervention across three sets of flashcards is shown in Figure 2. The mean number correct for Set 1 during Baseline was 1 out of 6 possible. This score increased to a mean of 5 (range 4 to 6) during the DI flashcards and math racetrack. This participant showed a trend of mastery for words taught in Set 1 over 6 sessions. For Set 2 the mean number correct during baseline was 2.0 (range 1 to 2). His performance increased to a mean of 5 (range 4 to 6) during the DI flashcards and math racetrack intervention. For Set 3, the mean number correct during baseline was 1.2 (range 1 to 2 problems). The number of minutes and seconds required to complete the math track can be seen in Figure 5. "Royal's" time to completion decreased over each session for each set. No intervention was implemented with Set 3 flashcards and her performance "Royal" increased his performance on the posttest to 153 out of 169 multiplication facts correct. This was an increase of 25% over his performance on the pretest.


DI Flashcards
Number Correct
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11
Set
Number Correct
Set
2
Number Correct
Set
3
Sessions

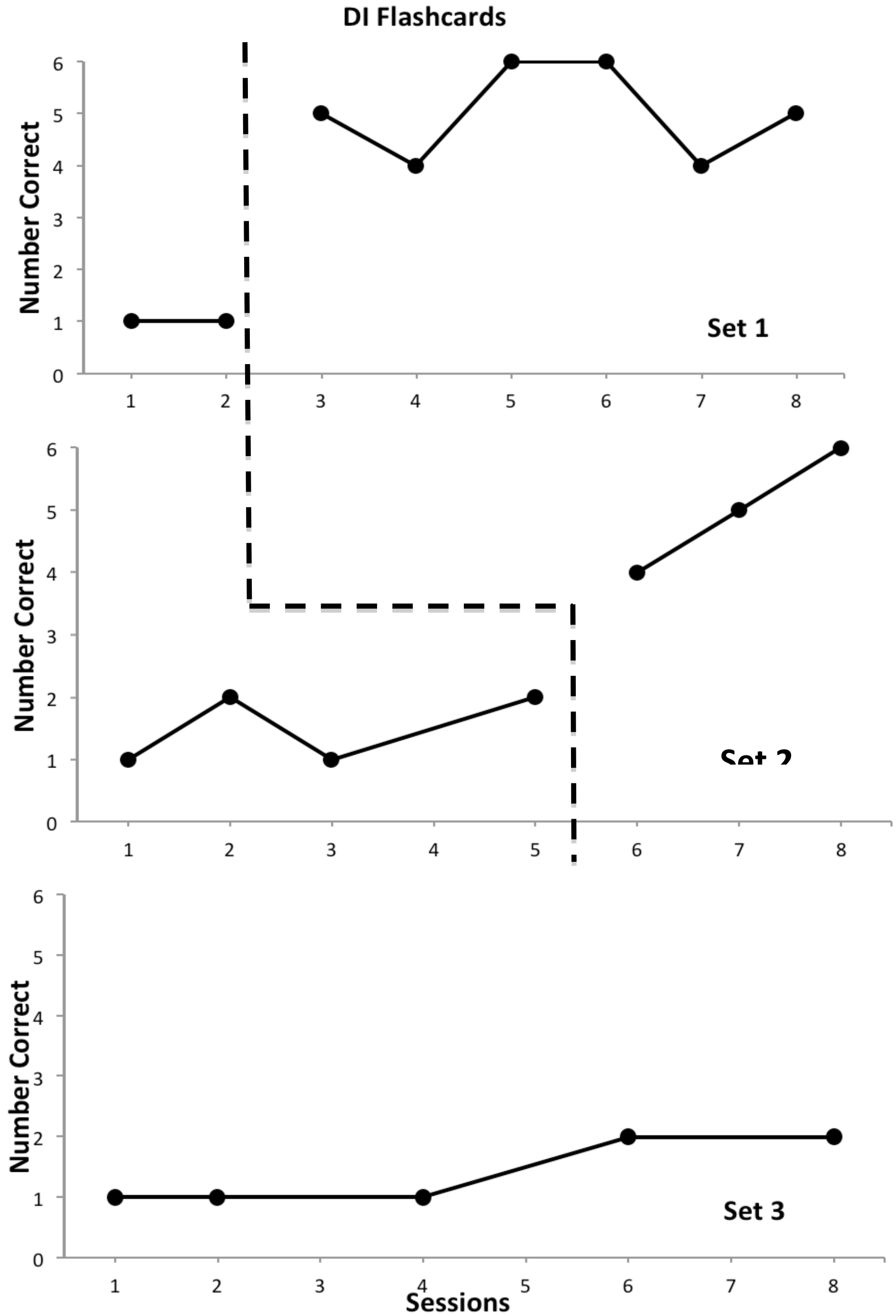


Figure 2. The Number of Basic Multiplication Facts Mastered (Sammi top panel and Royal bottom panels)

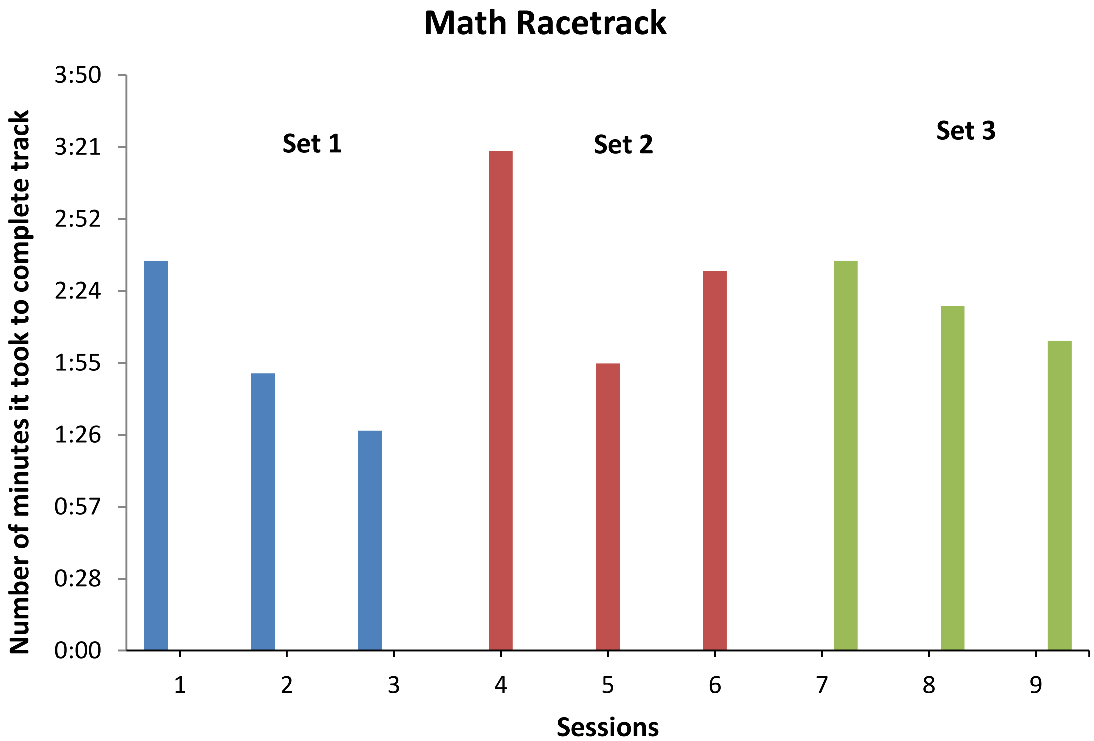


Figure 3. The Amount of Minutes/Seconds to Complete the Math Racetrack for "Sammi" Over Time.

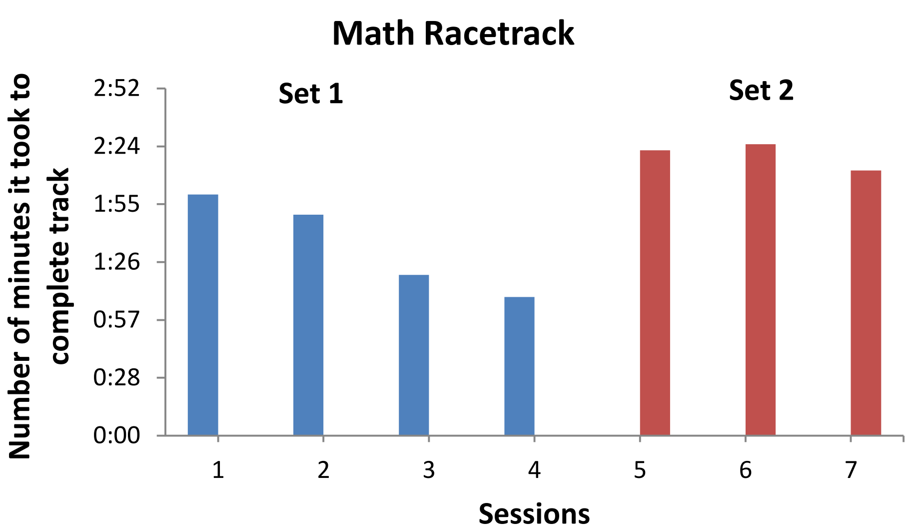


Figure 5. The Number of Minutes and Seconds Required to Complete the Math Racetrack for "Royal" Over Time.

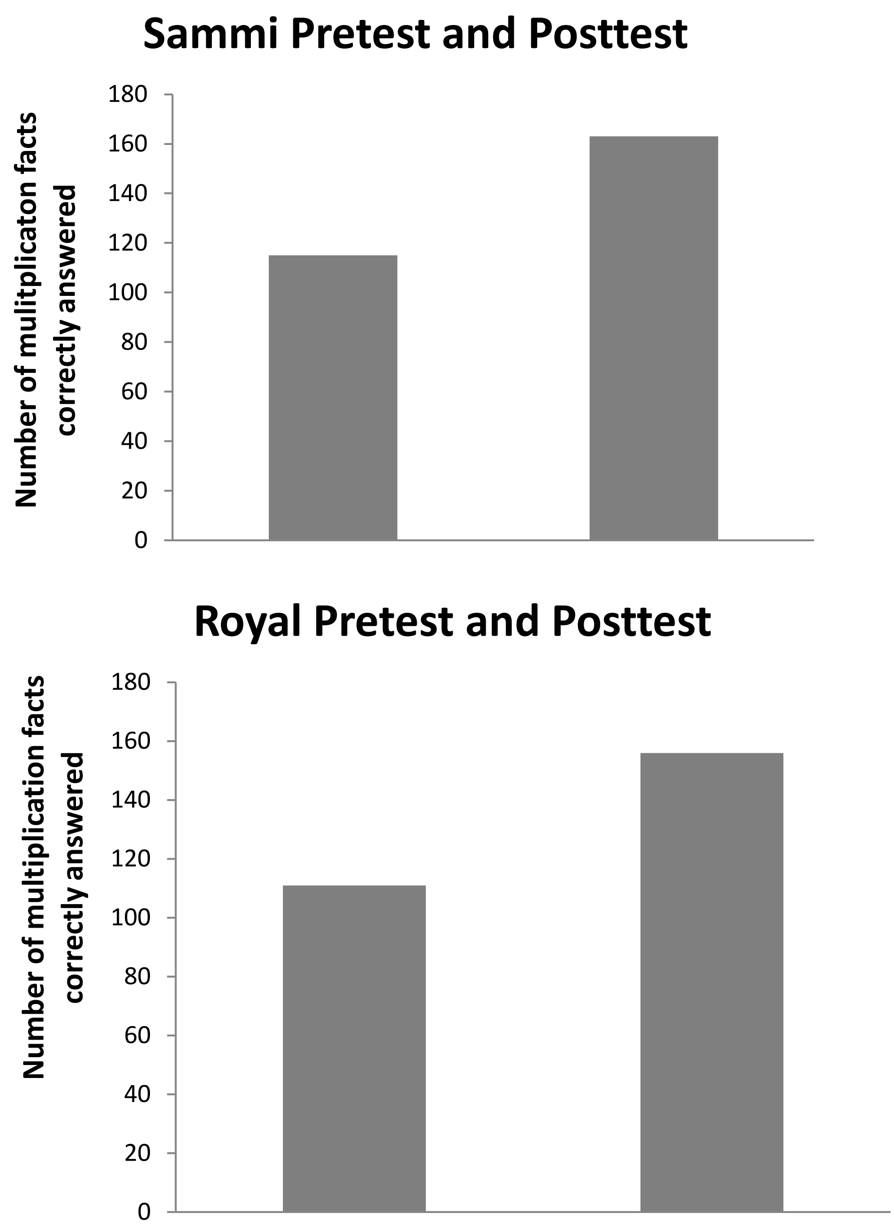


Figure 6. The Pre and Posttest Results for the Multiplication Facts for Each Participant

Discussion

Using the direct instruction and math racetrack intervention strategy to increase the students' accuracy and fluency on basic multiplication facts seemed to be effective for both students. Both "Sammi" and "Royal" showed marked improvement from the beginning of the study in their ability to accurately state multiplication facts. In addition, "Sammi" gained a large amount of confidence during the study and was more willing to participate in the flashcards and racetrack than in the beginning of the study. As the study progressed, the amount of time it took "Sammi" to complete the activities decreased and her excitement and accuracy increased. "Royal" grew more willing to work with the first author as time progressed and was learning the facts, but due to his impulsivity the results are all over the place. Experimental control was quite clear with "Sammi", however, with "Royal" it was somewhat less obvious. It took "Royal" a bit longer to become comfortable with the material and to slow down and think before he answered during data collection. After the first author continued to remind him to pause and think before he answered, he started to improve and he was able to move on to Set 2 for intervention. Both students generalized the facts they learned with the first author to what they were learning other materials and skills from their math curriculum. Their overall math skills improved because they were able to quickly recall the basic multiplication facts. Overall, the authors feel this intervention was highly effective as both students showed improvement in their ability to accurately and fluently state the problem and answer to basic multiplication facts.

This study had several strengths. First, experimental control was achieved for both participants. There was a clear functional relationship (Kazdin, 2010) in and participants' ability to state the answer to the multiplication facts. Based on anecdotal evidence generalization (Alberto & Troutman, 2008; Stokes & Baer, 1977) was found. In addition, our students used strategies previously taught to help them master new facts. Directly assessing generalization in math will have to be examined in future research. Finally, our participants enjoyed our procedures, they were absent very little, and they were both highly willing to work with the first author.

There were also some limitations to the present research. At times, "Royal" was easily distracted during sessions by his friends walking by, any noise, and any object within reach. "Royal" also came from a home background with events which affected his performance at school. "Sammi" was also very reliable and picked up his material quickly. However, at times he refused to work with the first author. Since the first author was completing her student teaching, the opportunities to work with the students occurred at different times in the school day. It was difficult to schedule times throughout the week to work with the participants. There were days where they were not available because they were in the general education classroom, engaged in high stakes testing, or learning important required curricula. There were also a few days when the first author was not available to work with the students because she was teaching different children and groups.

The present outcomes extend our previous work employing DI flashcards (Erbey et al., 2011; Glover et al., 2010; Hopewell et al., 2010; Kaufman et al., 2011; Ruwe et al., 2011; Travis, McLaughlin, Derby, & Carosella, 2012; Ulring, McLaughlin, Neyman, & Waco, in press). Also, in the present analysis, a math racetrack (Arkoosh et al., 2010; Beveridge et al., 2009; McLaughlin et al., 2011) was added to the flashcard system. We have been able to add flashcards to teach sight words reading (Falk, Band, & McLaughlin, 2002; McGrath, McLaughlin, Derby, & Bucknell, 2012; Printz, McLaughlin, & Band, 2006), but this was only the third instance one of our candidates employed a math racetrack as part of her intervention package.

For purposes of replication, it would be important to have a specific time to meet and work with students. It would be desirable to be able to work with students more than once or twice a week. We may well have had even more impressive outcomes to take data monitor their progress on a daily basis (see Erbey et al., 2011; Kaufman et al., 2011; McGrath et al., 2012). For purposes of replication, it would be important to have a specific time to meet and work with students. It would be desirable to be able to work with students more than once or twice a week. We may well have had even more impressive outcomes to take data monitor their progress on a daily basis (see Erbey et al., 2011; Kaufman et al., 2011). The first author feels confident that with a more reliable schedule and more times available to the first author to work with the students, she would have been able to have completed more sessions, and the students may have possibly reached mastery on all facts previously unknown.

The direct instruction flashcards and math racetrack intervention was easily implemented. It was easy for a classroom teacher or instructional aide to understand and implement in the classroom. It was very cost effective, the first author made the flashcards and math racetrack template was provided as part of a course packet (McLaughlin, Williams, Williams, Peck, Derby, Bjordahl, & Weber, 1999). The intervention was also time efficient, and each session lasted 10-15 minutes. DI flashcards could be easily implemented on a one-to-one basis, as in this study. The first author and classroom teacher felt this was a very effective program and would be effective in different classroom configurations and with a wide range of disability designations. Our previous work has shown DI flashcards to be effective for students in both resource room and self-contained classrooms. Also, the disability designations where we have been able to employ DI flashcards and a racetrack like procedure have ranged from students with moderate intellectual disabilities to high students with severe behavior disorders. Finally, it appears that addition research using DI flashcards and a racetrack procedure to teach spelling needs to occur. Very little classroom research (Arkoosh et al., 2010; McLaughlin et al., 2011) has employed spelling as a dependent measure while earlier research has employed sight words or math facts.

References

Adelman, C. (1999). *Answers in the tool box. Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC: U.S. Department of Education.

Altwerger, B., Arya, P., Jin, L., Jordan, N. L., Laster, B., & Martens, P. (2004). When research and mandates collide: The challenge and dilemmas of teacher education in the era of NCLB. *English Education, 36,* 119-133.

Anthony, C., Rinaldi, L., Hern, C., & McLaughlin, T. F. (1997). Reading racetracks: A direct replication and analysis with three elementary school students. *Journal of Precision Teaching and Celebration, 14,* 31-39.

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/

Barlow, D. H., Nock, M., & Hersen, M. (2008*). Single case research designs: Strategies for studying behavior change* (3rd ed.). New York: Allyn and Bacon.

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. Retrieved from: http://www.internationaljournalofspecialeducation.com/

Bishop, L., McLaughlin, T. F., & Derby, K. M. (2011). A comparison of direct instruction flashcards and reading racetracks on the acquisition and generalization of core words in context for a seven-year-old elementary student with health impairments, learning delays, and behavioral concerns. *International Journal of Social Science and Education, 1*(4), 525-539. Retrieved from: http://advasol.net/?q=node/19

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

Erbey, R., McLaughlin, T. F., Derby, K. M., & Everson, M. (2011). The effects of using flashcards with reading racetracks to teach letter sounds, sight words, and math facts to students with learning disabilities. *International Electronic Journal of Elementary Education, 3*(3), 213-226. Retrieved from: http://www.iejee.com/index.html

Falk, M., Band, M., & McLaughlin, T. F. (2003). The effects of reading racetracks and flashcards on sight word vocabulary of three third grade students with a specific learning disability: A further replication and analysis. *International Journal of Special Education, 18*(2), 51-57. Retrieved from: http://www.internationaljournalofspecialeducation.com/

Gersten, R., Beckmann, S., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting students struggling with mathematics: Response to intervention (RtI) for elementary and middle schools (NCEE 2009-4060).* Retrieved January 20, 2012, from http://ies.ed.gov/ncee/wwc/publications/practiceguides/

Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities, 38*, 293-304.

Glover, P., McLaughlin, T. F., Derby, K. M., & Gower, J. (2010). Using a direct instruction flashcard system employing a back three contingency for errors with two students with learning disabilities. *Electronic Journal of Research in Educational Psychology, 8*, 457-482. Retrieved from: http://www.investigacion-psicopedagogica.org/revista/new/english/index.php

Hayter, S., Scott, E., McLaughlin, T. F., & Weber, K. P. (2007). The use of a modified direct instruction flashcard system with two high school students with developmental disabilities. *Journal of Physical and Developmental Disabilities, 19,* 409-415.

Heward, W. L. (2013). *Exceptional children: An introduction to special education* (10th ed.). Upper Saddle River, NJ: Merrill/Pearson Education.

Individuals with Disabilities Education Improvement Act of 2004. Pub. L. No. 108-446, 20 U.S.C-1425 et seq

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.

Kroesbergen, E. H., & Van Luit, J. E. H. (2003). Mathematical interventions for children with special educational needs. *Remedial and Special Education, 24,* 97–114.

Johnson, K. R., & Layng, T. V. (1994). The Morningside model of generative instruction. In R. Gardner III, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. W. Eshleman, & T. A. Grassi (Eds.). *Behavior analysis in education: Focus on measurably superior instruction* (pp. 173-197). Pacific Grove, CA: Brooks/ Cole.

Lerner, J., & Johns, B. (2011) *Learning disabilities and related mild disabilities: Characteristics, teaching strategies, and new directions* (11th ed.). Boston: Pearson Education.

McGrath, G., McLaughlin, T. F., Derby, K. M., & Bucknell, W. (2012). The effects of using reading racetracks for teaching of sight words to three third-grade students with learning disabilities. *Educational Research Quarterly, 37*(3), 50-66.

McLaughlin, T. F., Weber, K. P., Derby, K. M., Hyde, C., Violette, A., Barton, C., Petersen, P., Green, C., Verduin, S., Printz, K., Gonzales, R., & Arkoosh, M. (2011). The use of a racetracks procedure to improve the academic behaviors of students in special and remedial education: Suggestions for school personnel. In M. L. Falese (Ed.). *Encyclopedia of educational research (2 volume set).* Columbus, OH: Nova Science Publishers, Inc.

McLaughlin, T. F., Williams, B. F., Williams, R. L., Peck, S. M., Derby, K. M., & Bjordahl, J. (1999). Behavioral training for teachers in special education: The Gonzaga University program. *Behavioral Interventions, 14*, 83-134.

Marchand-Martella, N., Slocum, T., & Martella, R. (2004). *An introduction to direct instruction*. Boston: Allyn & Bacon.

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel*. Washington, DC: U.S. Department of Education.

No Child Left Behind Act of 2001, Pub. L. No. 107-110, 20 U.S.C-1425 et seq.

Peterson, L., McLaughlin, T. F., Weber, K. P., Derby, K. M., & Anderson, H. (2008). The effects of a model, lead, and test technique paired with visual prompts with a fading procedure to teach "where" to a 13-year-old echolalic boy with autism. *Journal of Developmental and Physical Disabilities, 20*, 31-39.

Printz, K., McLaughlin, T. F., & Band, M. (2006). The effects of reading racetracks and flashcards on sight word vocabulary: A case report and replication. *International Journal of Special Education, 21*(1), 103-108. Retrieved from: http://www.internationaljournalofspecialeducation.com/

Ravitch, D. (2010). *The death and life of the great American school system: How testing and choice are undermining education.* New York: Basic Books.

Rinaldi, L., Sells, D., & McLaughlin, T. F. (1997). The effects of reading racetracks on sight word acquisition of elementary students. *Journal of Behavioral Education, 7*, 219-234.

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.

Sante, D. A., McLaughlin T. F., & Weber, K. P. (2001). The use and evaluation of a Direct Instruction flash card strategy on multiplication facts mastery with two students with ADHD. *Journal of Precision Teaching and Celeration, 17*(2), 68-75.

Silbert, J., Carnine, D. W., & Stein, M. (1981). *Direct instruction mathematics*. Columbus, OH: Charles E. Merrill.

Stokes, T. F., & Bear, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10,* 349-367.

Treacy, R., McLaughlin, T. F., Derby, K. M. & Schlettert, E. (2012). The effects of flashcards and student selected reinforcers with goals and additional practice with multiplication facts for two intermediate elementary students with behavior disorders. *Academic Research International, 2*(1), 469-476. Retrieved from: http://174.36.46.112/~savaporg/journals/issue.html

Swanson, H. L., & Jerman, O. (2006). Math disabilities: A selective meta-analysis of the literature. *Review of Educational Research, 76*, 249–274.

Ulring, A. M., McLaughlin, T. F., Neyman, J., & Waco, T. (in press). The differential effects of direct instruction flashcards and reading racetracks on sight word accuracy for three elementary students with learning disabilities. *Academic Research International, 2*.

Van Houten, R., & Rolider, A. (1989). An analysis of several variables influencing the efficiency of flash card instruction. *Journal of Applied Behavior Analysis, 22*, 111-120.

Wilson, C. L., & Sindelar, P. T. (1991). Direct instruction in math word problems: Students with learning disabilities. *Exceptional Children, 57*, 512— 519.

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