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

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Abstract

The purpose of the study was to evaluate the effectiveness and generalization of an intervention package that included direct instruction flashcards, reading racetracks, and rewards with a single student with behavioral disorders. The participant was a seven-year-old male who qualified for services under other health impairments and received services in a self-contained behavioral intervention classroom. An ABCB design was used to evaluate the effects of our intervention package. The percent of correct and errors in decoding during reading were recorded. These data were gathered over a selected word list developed from the core word list provided by a local school district. The participant demonstrated an increase in correct decoding for both the flashcard and reading racetrack interventions. When generalization to reading in context was evaluated, the participant made a large number of correct responses for the core words in context from classroom books. The benefits of the treatment package were discussed.

Keywords: Reading racetracks, DI flashcards, generalization of outcomes, reading in context, elementary student, behavior disorders, case report

Introduction

Reading is an essential skill that is needed academic and social growth (National Reading Panel, 2001). Learning to read for a variety of purposes is essential to success in school and to learning in general (Law, Rush, Shoon, & Parsons, 2008; National Reading Panel, 2001, Wasik, 1997). Many of the problems encountered by teachers, parents, special educators, and other educational professionals can be traced to deficiencies in basic reading skills (Daly, Martens, Barnett, Witt, & Olson, 2007). The number of students with learning delays as well as behavioral disorders is increasing. Unfortunately, these students have been shown to be one to two years below grade level in reading (Barton-Arwood, Wehby, & Falk, 2005). Many programs serving students with behavior disorders tend to focus on behavior management

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(Knitzer, Steinberg, & Fleisch, 1990; Levy & Chard, 2001; Wheby, Lane, & Falk, 2003) thus, creating a lack in teaching essential academic skills such as reading. Reading is a gateway to content area knowledge and the ability to complete grade-level academic work (Rivera, Al-Otaiba, & Koorland, 2006). When children read out loud with speed, accuracy, and proper expression, they are more likely to comprehend and remember the materials (Adams, 1990). It has also been shown that success in reading can help students find success in other aspects of their schooling (Carnine, Silbert, Kameenui, & Tarver, 2010). Basic academic skills are made up of a generalizable class of behavioral repertoires that need to be applied broadly throughout the curriculum and beyond (Daly et al., 2007). Reading intervention research has demonstrated repeatedly that when students at risk for reading difficulties are identified early and provided with appropriate interventions, many students acquire the necessary skills to become successful readers (Torgesen,1999, Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, & Garvin, 1999). Instruction and academic interventions are all about students "getting it right" when someone else expects them to (Daly & McCurdy, 2002). Generalization is critical to success for students, creating an interesting phenomenon to study because once a learner becomes proficient with repertories like reading, writing, and math, the student then has generalizable skills at his or her disposal (Daly et al., 2007). Therefore, the main goal is to have an academic intervention generalize to other academic areas.

Research has shown that Direct Instruction is one of the most successful ways to instruct students (Marchand-Martella, Slocum, & Martella, 2004). Direct instruction flashcards is an intervention method that involves an instructor presenting flashcards and giving both error correction and immediate feedback (Silbert, Carnine, & Stein, 1981). If a student makes an error, the teacher models the correct word. Next the student and teacher practice together. Finally, the student is presented the flashcard again. If the student makes a correct response, the card is placed back three or four cards in the stack. This insures that the student will be allowed to practice those flashcards where an error occurred. This form of direct instruction, DI flashcards, has been successful in teaching basic skills to students with disabilities (Brasch, Williams, & McLaughlin, 2008; Hayter, Weber, McLaughlin, & Scott, 2007; Hopewell, McLaughlin, & Derby, in press).

Reading racetracks has also been shown to be effective in teaching students sight words (Alexander, McLaughlin, Derby, Cartmell, 2008; Falk, Band, & McLaughlin, 2003; McLaughlin, Weber, Derby, Hyde, Violette, Barton, …. Arkoosh, 2009; Rinaldi & McLaughlin, 1996; Rinaldi, Sells, & McLaughlin, 1997). Reading racetracks allow the students to improve on sight words by reading words around a racetrack; this improves fluency and accuracy of words as they go from practice laps to reading track words in a one minute timed session. Reading racetracks allow for a large number of sight words or other discrete academic skills to be taught to the students in an individualized and systematic and fun way (McLaughlin et al., 2009; Rinaldi et al., 1997).

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Combining DI flashcards with reading racetracks has also been shown to improve the reading skills of students with disabilities (Falk, Band, & McLaughlin, 2003; Green, McLaughlin, Derby, & Lee, 2010; Kaufman, McLaughlin, Derby, & Waco, 2011). These procedures have been effective in teaching sight words, math facts, and letter sounds (Erbey, McLaughlin, Derby, & Everson, 2011; Green et al., 2010; Kaufman et al., 2011).

Generalization of academic skills continues to be a very important topic in behavioral research (Alberto & Troutman, 2009; Cooper, Heron, & Heward, 2007; Stokes & Baer, 1977; Stokes & Osnes, 1989). Generalized behavior refers to the transfer of a learned response across time, stimuli, or behaviors (Strokes and Baer 1977). Accurate and fluent responding is an essential part of learning, the desired outcome for educators is for students to use, or generalize, taught skills across a variety of activities and contexts (Haring & Easton 1978). Unfortunately, a majority of instructional approaches rely on a "train and hope" method of generalization where educators assume students will generalize taught skills (Haring & Eaton 1978, Strokes & Baer 1977). Generalization can occur because stimuli belong to classes that are similar according to some shared characteristic; therefore, once a behavior comes under stimulus control of one member of the stimulus class, it is possible for other members of that class to elicit the response (Shahan & Chase 2002). The use of generalization strategies is not an after-thought or a mere add-on to the intervention. Rather, programming for generalization starts at the very beginning of instruction—with the very first learning trial (Skinner & Daly, 2010).

The major purpose of this research was to evaluate the effects of DI flashcards or reading racetracks on the accuracy and generalization of reading sight words. Both DI flashcards and reading racetrack interventions were implemented separately to determine whether a flashcard system or racetrack intervention would be superior for obtaining generalization in the context of a reading textbook. Finally, data were gathered both at school and in the home.

Method

Participant and Settings

The participant was a seven-year-old male, whose eligibility fell under other health impairments. The participant and his twin brother are medically fragile children with a diagnosis of Glutaric Acidemia Type 1, also known as GA1. At birth the parents were informed that with GA1 the boys would most likely not live past one year of age, biological parents gave up the boys, and they were taken in by Grandmother, she is now the legal guardian. GA1 is a rare, genetic enzyme deficiency order characterized by hypoglycemia (low blood sugars), dystonia (involuntary muscle contractions), and dyskinesia (difficulty moving voluntary muscles). It is not yet understood how or why, but GA1 causes brain damage, it occurs when a crisis causes an acidic environment in the blood created by excess

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protein byproducts. The participant also suffers from seizures ranging from petit mal seizures to grand mal seizures. The participant has been known to "fake" seizures. Current medications include Focalin, Topamax for seizures, and a multi-vitamin. Due to the GA1 he has a special diet, which limits proteins. The participant was transitioned into a behavioral classroom due to increasing behavioral concerns from his general education and resource room teacher. Behaviors included aggression (hitting and kicking), threatening language, noncompliance, off task behavior, and out of seat behavior. It was hypothesized that the participant engages in these problem behaviors to escape non-preferred tasks. The participant was evaluated using the Wechsler Preschool and Primary Scale of Intelligence, the third edition. The participant intellectual functioning was in the Extremely Low range of intelligence. The participant receives services in all educational areas math, reading, and written language. He also receives services in communication, behavior/social skills, and gross motor. His full-scale IQ score was 69, verbal 74, and performance 75. It has been noted that he has ADHD behaviors, but an official diagnosis has not been made.

The study was conducted in a self-contained behavior intervention classroom and at his day care facility. In the BI classroom there were a total of 15 students enrolled in the classroom, serving kindergarten through 6th grade. The participant worked one-on –one with the first author a certified teacher. There were a minimum of 3 adults in the room, including 2 Instructional Assistants, and another certified teacher. The other students had various disabilities. Sessions were held Monday, Tuesday, Wednesday, and Friday during designating classroom reading hour. The sessions held at the participant's daycare were conducted in a private workroom. These sessions lasted from 30 minutes to 45 minutes.

Materials

A reading racetrack was used following the design by Rinaldi & McLaughlin, 1996; Rinaldi et al. 1997. The racetrack contained 28 cells drawn in a racetrack format; the track was enlarged to an 8" by 14" size and laminated. The participant was allowed to choose colors to have track and cars outlined in his favorite colors. The DI flashcards consisted of core words played on three by five inch index cards. These words were taken from the core words list provided by the school district. Age appropriate books were used for the generalization from classroom. Data sheets were used on plain 3" by 5" note cards marking plus sign to indicate the correct responses and minus sign to indicate incorrect responses.

Dependent Variables and Measurement Procedures

The dependent variable was the percent of correct responses and incorrect responses. Direct instruction flashcards a correct response was defined by the participant saying the word within 3s of presentation of the card. Incorrect responses were defined when the participant responded with the incorrect word, or said "skip". The flashcards consisted of 20 core words each data point reflected the participant moving through the flashcards once, correct responses were indicated with a plus sign and incorrect responses were indicated with a minus sign.

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During the racetrack intervention 27 core words were used and split into four groups of seven. Each track consisted of seven words that were presented on the track four times. The participant was given one minute to work his way around the track. A correct response was defined by correctly saying the word or when the participant self-corrected before moving onto the next word. Incorrect responses were defined when the participant responded with the incorrect word, or said "skip". Correct responses were indicated by writing a plus sign. Incorrect responses were indicated with a minus sign. During generalization of words in context correct responses were defined when the participant correctly said word, or when self correction was made before moving onto the next word. Incorrect responses were defined as incorrectly saying word, of not attempting the word.

Experimental Design and Conditions

An ABCDC single case design (Kazdin, 2010) was used to assess and evaluate the effects of the intervention and generalization for the participant. Baseline data were collected across three days. Once baseline was collected the interventions using flashcards, reading racetracks, and generalization probes to words in context began. Each session of intervention ran between 30 to 45 minutes.

Baseline (BL). Baseline began using flashcards with 20 core words, presented on 3" by 5" note cards. Baseline was conducted at the participant's public school. The participant was asked to say the words and was not given and feedback regarding correct or incorrect responses. If the participant did not respond or incorrectly stated the word it was marked as incorrect. Baseline data were gathered for three school days.

DI flashcards and generalization (WIC). After baseline direct instruction flashcard intervention was implemented. (DI flashcards intervention also took place only in the participant's self-contained behavior intervention classroom). At the beginning of each session the participant practiced by reading the words on his flashcards. The flashcards were presented and the student was given feed back after all responses. Correct responses received positive reinforcement in the form of verbal praise from the first author. If the participant made an error or attempted to "skip" the flashcard the first author would repeat the word correctly and have the participant repeat the word. This word was then placed two to three cards back to provide additional practice. Once the participant had practiced and reviewed words for 3 minutes he joined his classroom reading group for 15 minutes. Before reading groups were to come to a close, the participant would be presented with the 20 flashcards again. Data was collected across all 20 cards, and correct responses were indicated the plus signs and incorrect responses were indicated with minus signs. Generalization to words in context was scored to determine if the participant had generalized his DI flashcard words to correctly identify those same 20 words when they were presented in his classroom books. Books were chosen based of the following criterion; they were books currently used in his

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classroom reading groups, they were an appropriate in level of difficulty, and they contained at least 20 presentations of any of his DI flashcard words. Data was collected across three days; correct responses were defined as correctly identifying a flashcard word within 3 seconds or self correcting before he read the next word. Incorrect responses were defined as incorrectly stating the flashcard word or skipping the word. Data for correct responses were indicated with plus signs and incorrect responses were indicated with minus signs.

Direct   Instruction
Flashcards

Core sight words chosen

dad	no	to	dog
the	me	from	mom
of	cat	that	was
it	in	a	with
and	I	is	love

Reading racetracks and generalization (WIC).   Next, the racetrack intervention was presented. 27 words were taken from the core word list to create four different set of track words, each consisting on seven words. Half of these sessions took place in the self contained BI classroom and the other half were conducted at the participant's daycare. The participant was told he would have one minute to read the words on the racetrack. If the participant was stuck on a word, he could skip the word. The timer was started when the first author said "Get ready, Go". The first author would point to each word with a pencil while the participant read around the track. Positive reinforcement in the form of praise was given as the participant moved around his track to encourage him to keep trying and start with first sound in his words.   The participant was timed twice during each session to provide participant with a chance to become comfortable with timed sessions, the timing with the best percentage of correct responses was use for data. For each of the timings the participant was informed that the first author would be keeping track of their correct and incorrect responses, this data was collected in the same manner as the DI flashcards. At the end of the timings the correct and incorrect responses were tallied and the percentages of correct and incorrect responses were graphed. The participant worked on each racetrack a total of four times. Every 5th data point reflected a racetrack that consisted of all 27 words presented one time each. When data for all four racetracks were completed and the last racetrack with all 27

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words data was collected generalization was again measured. Generalization of words in context was measured by the same standards as it was for the DI flashcards. Different books were chosen for generalization after the reading racetracks using the same criterion as the DI flashcards. Data was collected across three days; correct responses were defined as correctly identifying a racetrack word within 3 seconds or self-correcting before he read the next word. Incorrect responses were defined as incorrectly saying the racetrack word or skipping the word. Data for correct responses were indicated with plus signs and incorrect responses were indicated with minus signs.

Race Tracks			
Track 1	Track 2	Track 3	Track 4
was	love	mom	we
they	and	by	in
a	to	were	what
dad	this	it	I
of	when	that	me
dog	is	with	cat
have	the	from	no

Reliability of Measurement

Interobserver agreement was gathered for the participant. The educational assistant, behavior interventionist, or the certified teacher would take the data when doing agreement for that day. During the DI flashcard and reading racetrack sessions the observer agreement was collected using a separate 3" by 5" note card and the correct and incorrect responses were indicated by marking a minus or plus sign. Observer agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. An agreement was if the two observers scored the word in the same manner. Any differences in scoring were scored as disagreements. Interobserver agreement was taken 44% of the DI flashcard sessions and 40% of the sessions for reading racetracks. Interobserver agreement for DI flashcards was 100%. Interobserver agreement for reading racetracks ranged from 90% to 100%.

Results

During baseline (BL), the participant had a mean of 55 % for correct responses and a mean of 45% for errors. Once the DI flashcard intervention was implemented, the participant reading

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slightly improved to 60 %. In addition, his error rate decreased to a mean of 39%. When the DI flashcard words were generalized to words in context (WIC) the participant's mean average of correct was 76%, with a mean of 24% errors.

During the reading racetrack intervention the participant was presented with one track at a time consisting of seven words each presented four times in the 27 cell track data was taken on each track across four sessions. During the first track the participants mean average of correct responses was 58%, with an error mean of 42%. The second track the participant's mean average of correct responses increased to 63%, with an error mean of 37%. The third track the participant's mean percent for correct words 47%, and with a 53%. mean for errors For the forth and final track the participants mean average of correct increased to 92% with an 8% mean for errors. After each track was presented four times, the participant was timed on a track that consisted of all 27 sight words, occurring every fifth session during the reading race track intervention and again after the generalization to words in context data were gathered. The participant's mean average of correct responses was 65%, with a mean of 35% for errors. When the reading racetrack words were assessed with words in context, the participant's mean average of correct increased to 93%, with a mean of 7% for errors.
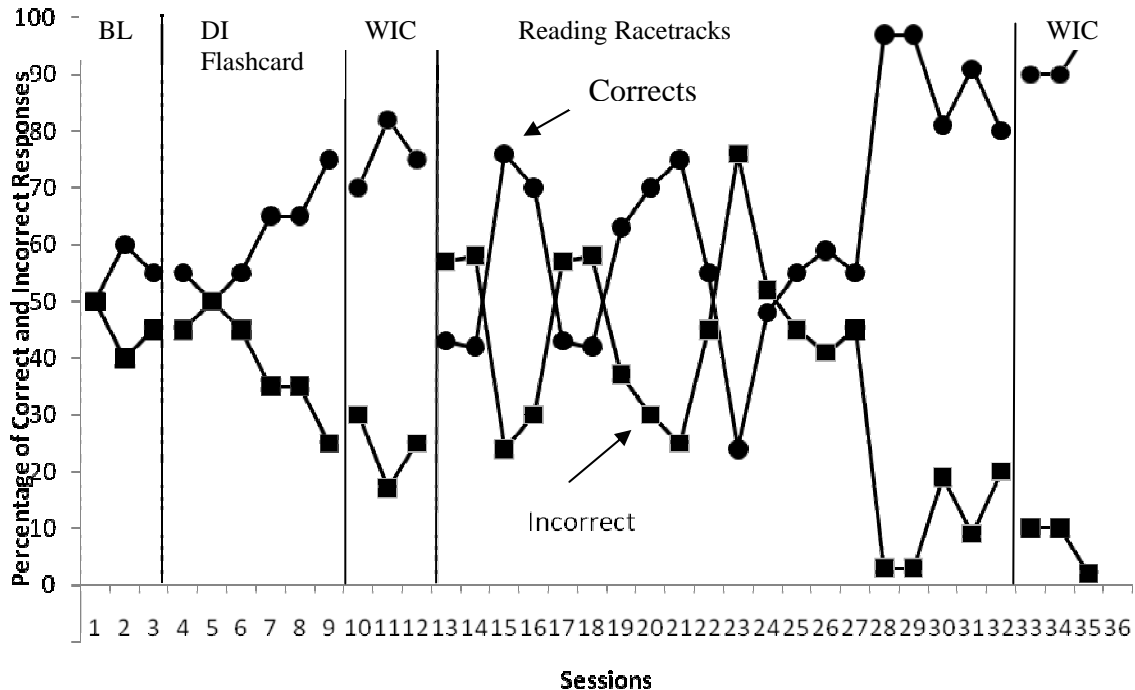
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Discussion

The participant increased his percent correct and reduced his errors over time. Throughout the interventions, the participant was excited to work with his flashcards and racetracks. The participant was able to generalize words from his flashcards and racetracks to books within his classroom. Overall, this was a successful intervention package for the participant, not only academically but socially. he was excited to share news of his racetrack accomplishments with school staff, family members, and peers. The participant was often found pointing out racetrack words to other staff members in the classroom.

There were several strengths to the present case report. These included, low cost (all items for flashcards, racetracks, and data collection) were created by using supplies that were easily and readily available in the classroom, and another strength was the ease of the procedure and that it could be implemented at any time in the school day, which in a behavioral classroom is a huge benefit. This intervention also gave the participant a special task to complete, and finally, he showed great pride in participating in this project.

There were also limitations to the present study. This study only evaluated the effects on a single male subject. Reliability data for the dependent variables was limited due to the demanding nature of a BI classroom, with limited extra assistance available during some of the sessions. The main limitations and struggles revolved around working with such a unique child. The participant had such a wide range of concerns that affected the consistency of the interventions. The participant was a medically fragile child that upon his arrival to the BI classroom had struggled with making it through the morning. The participant would often suffer from seizures and rarely made it till lunch time before he was sent home. Given his medical concerns (often going home early or being absent due to illness), his learning delays, and behavioral concerns it was difficult to get consistent instruction and data collected, leading to the intervention continuing after the school year at the participant's day care. It should be noted that during the middle of the third racetrack the participant was ill and missed school resulting in the gape in instruction. The participant was then visited at his daycare to implement the remainder of the study. At times it appeared that the participant was not excited to be working on his racetrack during the summer.

A major concern was the appearance from a data stand point that he started the intervention with high percentages of correct responses to his sight words. The participant scored consistently with the flashcards, but there was concern that he wasn't transitioning the words to reading in context. Upon collecting data of words in context he again scored high percentages for correct responses. However he would often make a correct response for a word on one page and then immediately incorrectly identify the same word on the next page. The implementation of the racetracks was used to hopefully foster some fluency and accuracy with his sight words. Once the four racetracks were completed the participant scored the

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highest percentages of correct responses while reading words in context. Throughout the present study the main focus was to engage the participant in reading, and to cultivate an ability to transfer his reading interventions into other academic reading areas. When a child's generalized reading skills improve, it requires less effort for the student to read and comprehend material, which in turn makes it more likely that the child chooses to read (Billington, Skinner, & Cruchon, 2004; Friman & Poling, 1995). This study was successful in that it created an environment for the participant to seek attention for positive behaviors and increase his learning ability as well. As children read more frequently their reading becomes more rapid, allowing the child to access rewards (e.g., teacher praise, opportunity to engage in other behaviors) more immediately and at a higher rate which also increases the probability of the child choosing to read (Skinner, 1998).

To further determine generalization the participant should be monitored across different reading materials, across subjects, classrooms, and with different instructors. This intervention combining DI flashcards and reading racetracks have shown to be effective in increasing the percentage of correct response while reading sight words. Overall, it is the first author's belief that the out come of this study shows potential in the implementation of these interventions within a BI classroom. Further research should be completed to generalize reading across more settings and subjects.

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