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EMPLOYING DIRECT INSTRUCTION FLASHCARDS TO TEACH ACADEMIC SKILLS TO STUDENTS WITH HIGH INCIDENCE DISABILITIES: A REVIEW

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Abstract: *This literature review was an examination of current and past research that utilized the Direct Instruction (DI) flashcards procedure to teach academic skills to students with and without disabilities. The studies discussed in the review include students diagnosed with Specific Learning Disability (SLD), Emotional Behavior Disorder (EBD), and Developmental Delay (DD). The age range of students was pre- kindergarten, elementary, middle, and high school. The skill areas included mathematics (addition, multiplication, number identification) or literacy (letter identification, sight words, spelling, letter names, letter sounds, colors, and shapes). Various research studies found that direct instruction flashcards was a highly effective intervention technique when academic skill deficits were seen in students with disabilities. Some of the studies reviewed included a second direct instruction intervention, while other reviewed studies just implemented DI flashcards. Research with differential, delayed, or little effects was discussed. Areas for future research were also presented.*

Key Words: *Direct Instruction (DI), flashcards, classroom, special education students, preschool, elementary, middle, high, pre-kindergarten, racetrack, academic intervention*

Introduction

Students who receive instructional academic support in a special education classroom often need support in a specific subject area, or need full instructional support across all subject areas in order to achieve the academic rigor of their non-disabled peers (Shapiro, 2011). Just as the academic instructional supports needed can vary greatly, the disabilities present in a single special education classroom can vary greatly as well. This literature review included studies across several ages, grade levels, and a broad range of disability categories are discussed as well.

Methodology

Based on the prevalence of each disability category, the primary disabilities that were focused on were Specific Learning Disability (SLD) and Emotional-Behavior Disturbance (EBD). For a study to be included, at least one participant, had to have one of these diagnoses as the primary disability category listed on an Individual Education Program (IEP). Studies included in this review were completed in a special education classroom, and the participants ranged in grade level from prekindergarten to high school at the time the reviewed study was

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done. For investigations completed in an early childhood special education or preschool programs at least one participant had to be between 4 and 5 years old at the time of the study, or transitioning to a kindergarten program within the next school year. The most common secondary diagnoses was Attention-Deficit-Hyper Activity Disorder (ADHD) discussed in many of the reviewed studies included. This was considered a non- exclusionary factor so long as the student received special education services under one of the IDEA definitions of SLD, EBD, or DD as the primary disability category listed on the IEP. ADHD could not be listed as the only disability on an IEP, studies that listed only ADHD as the participant(s) disability were excluded from review. Several studies included students age three- nine severed by special education service category of Developmental Delay as the primary disability on an IEP.

Today, 2.4 million students are diagnosed with a specific learning disability and need support for instruction through special education. The National Research Center on Learning Disabilities (2006) reported that fifty percent of all students who need instructional assistance in special education have a SLD diagnoses (Zirkel, 2006) listed on the IEP.

The 2004 reauthorization of the Individuals with Disabilities Act (I.D.E.A.) continued to support students diagnosed with specific learning disabilities. The I.D.E.A. defines SLD as a disorder in one or more of the basic psychological processes involved in understanding, or the use of language, either in spoken or written format; which impacts a student's ability to listen, speak, read, spell, or do mathematical calculations (American Speech- Language- Hearing Association, 2005; U.S. Department of Education, 2006). One of the most common types of SLD was auditory processing disorders in which the brain has difficulty interpreting what is said because sound travels incorrectly through the ear.

A common co-morbidity of specific learning disability is that of Attention Deficit-Hyper Activity Disorder (ADHD). ADHD can impact a student's school achievement, daily life, and interactions with others (Barkley, 2005). These difficulties can include, paying attention, behavior control, problems with focus on tasks, time management, and organization of skills complete tasks. Hyper- activity or an appearance of inattentive or impulsive behavior are often seen in students with SLD; however, ADHD is not currently defined as a specific learning disability, nor are students with ADHD as the primary diagnose eligible to receive special education support. Currently, ADHD is listed Other Health Impairment (OHI), in addition, some students with a primary diagnoses of SLD also have a secondary diagnoses of ADHD (Barkley, 2005; Heward, 2013).

The other disability focus area for this review was students with Emotional-Behavior Disorder (EBD). Under section 300.8(c) (4i) of IDEA, students with an EBD can receive special education supports when to a significant degree and time span, the student's behavior negatively impacts their educational success in the classroom. These impacts can include a difficulty learning that cannot be explained by intellectual, sensory, or means of other health issues. Difficulty creating and keeping appropriate interpersonal relationships with students and teachers can often be seen in students that have an EBD. Abnormal reactions, behavior, or feelings, toward typical educational demands may be displayed. An example of this would be a student

crying within seconds of a math worksheet being assigned, or shouting profanities in attempt to avoid the undesired task, or a demand that the student perceives as difficult. Pervasive mood and/or periods of depression can also be seen in students diagnosed with emotional- behavior disorders. Throughout this review the terms behavior disorder as well as conduct disorder were used to also describe an EBD diagnose (U.S. Department of Education, 2004.)

In 2005, the U.S. Department of Education estimated that 1% of all students in public school receive support for Emotional- Behavior Disorders (EBD). In respective studies, (Costello, Egger, & Angold, 2005; Kauffman & Landrum, 2009) found the percentage to be closer to 5. Common forms of EBD present in students are oppositional- defiant (ODD) and/or conduct disorders, anxiety disorders, and depression. In a survey completed by the Center for Disease Control and Prevention (CDC) children with an EBD were more likely to be absent from school for 11 or more days each school year (Simpson Bloom, Cohren, Blumberg, & Bourdon 2005). The diagnoses is not limited to families living in poverty; however the analysis found a prevalence in the diagnoses among males, 6.3%, which was almost double that of females diagnosed with EBD. Age was also revealed to be a significant factor for children of all age ranges. For students 8-10 years old the diagnoses rate was found to be 5.5%, age 11-14 years old was 4.9%, and 15-17 years of age was reported to be 6.1%. Families that lived below poverty level and reported to have a diagnoses of EBD was 7.8% of families compared to 4.6% of families not living in poverty. (Simpson, et. al, 2005). It should be noted that these percentage rates are in comparison to families that reported diagnoses other than EBD.

Students with learning disabilities often experience difficulties with classroom instruction. As a result, students with SLDs are at a greater risk to fall behind their peers without disabilities both in classroom academics, and standardized test performance. Having a diagnosis of SLD is a factor in the increase of students who need educational support from special education teachers. In 1977, SLD diagnoses comprised of 8.3% of students who received special education support. Diagnoses of SLD increased to 13.7% in 2005. In 2011, the percentage of students receiving special education support under the category of SLD had decreased to 13.0, reflecting a high need remains necessary within educational settings. From 1977-2011 SLD made up the highest percentage of disability category of students receiving special education instruction (National Center for Education Statistics, 2013.). The third most reported category was OHI, which includes ADHD. EBD was reported to occur in 0.9% of all students who receive special education throughout the day (National Center for Education Statistics, 2013). Although this may seem like a low percentage of students, one must remember, that percentage represents thousands of children that strive for academic success every day.

In recent years, more emphasis has been put on common- core state standards and standardized testing performance. Even when appropriate accommodations are applied to these standards, many special education students experience difficulty and frustration. One of the most beneficial ways to address this is specific instruction designed to directly assess and address students' specific skill deficit(s). Focusing on specific skill deficits can help the teacher provide specific instruction that addresses those skill deficits. All instruction should build to mastery

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through employing academic interventions, while progressing, and checking for skill maintenance over time. A good teacher knows to introduce new skills that require the newly mastered skill, as well as guide toward generalization checks, as well as maintenance, to check that mastery had remained over time. This also allows for immediate identification of needed continued instruction of a skill, rather than a final assessment or other examination to reveal the continued difficulty.

Search Strategy and Methodology

While gathering materials for this literature review, a number of sources were employed. The databases used with the most frequency for this literature review were Academic Search Complete (EBSCO) and Google Scholar. Finally, the first author was provided with PDF's of papers published from Gonzaga University by the second author. The vast majority of the articles came from electronic databases such as Google Scholar, Psych Info, and ERIC. These data sets were surveyed or searched with the key word DI flashcards. The reason for this is threefold. First, these databases allow a user to search large numbers of journals in a short period of time. Second, the search filters allow one to use only journals that are peer-reviewed. Finally, the electronic databases allow a person to quickly access other works referenced in an article. This allows the researcher to collect a quick sample of the available literature.

DI Flashcards

A key component to direct instruction is repeated daily practice on identified skills. This allows for specific skills to be individually targeted and taught in a short time period (Hayter, Scott, McLaughlin, & Weber, 2007; Ruwe, et. al, 2011; Tan & Nicholson, 1997; Skarr, McLaughlin, Derby, Williams, & Meade, 2012; Skarr, Zielinski, Ruwe, Sharp, Williams, & McLaughlin, 2014; Van Houten & Rolider, 1989). One of the most common and largely effective techniques used is the flashcard method of instruction. Originally, Carnine, Silbert, and Stein, (1981) in the first edition of the text, *Direct Instruction Mathematics*. This method has extensive scientific research and support. Direct instruction flashcards involve a target skill area to be focused on based on specific student need. The target skill is typically needed in almost any subject area taught, as well as teach social skills. Most flashcard interventions are completed in a single- subject design which includes a pre-test or baseline phase to identify error trends. Trends can reveal overall skill deficits or specific concept errors. Once baseline or pre-test data is obtained and evaluated for errors, the teacher identifies commonly missed problems and puts them on flashcards that show the correct responses for the skill targeted. For example, if single-digit addition was the target skill, the problem 7+1= would be placed on the card. Correct model of the problem and the correct answer would be provided by the teacher. Problems both mastered and unmastered are then split into practice sets. Most commonly three sets of problems are used. Sets can contain any number of cards, but 10 is the most common amount used per set. The most commonly missed problem from baseline or pre-test appear several times in the first set to increase the student's exposure to the correct response. A correct response results in that card being put in the back of the deck and the student is then presented the next card. The teacher provides the student with specific praise for correct responses as well, such as, "Yes,

that's right 7+1= 8 great!" and prior to presentation of the next card.

Incorrect responses or errors prompt the teacher to implement a correction procedure. Correction procedures require the teacher to correctly model the problem presented, as well correct answer to that problem several times. After multiple exposures, the teacher has the student to say the problem until the student demonstrates mastery of the correct response. The card is then moved two or three cards back within the deck to allow for additional practice with the missed problem. Again, specific praise is given for correct responses and general praise is given toward effort to learn the difficult skill to increase motivation and perseverance.

Hayter et al., (2007) found the use of flashcards to be effective when teaching two high school students diagnosed with developmental disabilities. The technique has been replicated by the same research group from Gonzaga University for teaching multiplication facts, as well as other mathematics skills (Brasch et al., 2007; Harris, Helling, Thompson, Neyman, McLaughlin, Hatch, & Jack, 2015; Skarr et al., 2014). Another subject area flashcards have been effective in is teaching sight words (Hopewell, McLaughlin, & Derby, 2011; Kaufman, McLaughlin, Derby, & Waco, 2011; Ruwe, McLaughlin, Derby & Johnson, 2011; Seines, McLaughlin, Derby, Weber, & Gortsema, 2015), spelling (Cole, McLaughlin, & Johnson, 2012), or preacademic skills (Houglum, McLaughlin, Weber, Neyman, & Gould, 2013). Studies have applied direct instruction flashcards with various disabilities, age ranges, grade levels such as primary, secondary, or early childhood program enrollment. Investigations have also included students without disabilities. It has been hypothesized that use of flashcards along with direct instruction procedures are effective because of daily practice on a known target skill deficit for each student, continuous data allows the instruction to be progressed at rates that are appropriate for individual students as found in the Kane, McLaughlin, and Mortenson, (2015). Key details to the flashcard method include teacher model of correct responses during the initial instruction of the intervention as well as throughout practice sessions when errors occur. Repeated practices allow students to not only learn correct responses at the time, but increases the likelihood of correct responses at a later time. Flashcards can be obtained online or can be created by the teacher. They are easy to use in the classroom can also be used in almost any setting even the home (Mann, McLaughlin, Derby, Williams, & Everson, 2012).

Additional Interventions Combined with DI Flashcards

The instructional procedure of flashcards is often most effective when paired with techniques that also support identified target skills, such as an academic racetrack, (which is most often used to increase fluency of correct responses), or Copy, Cover, Compare (CCC) (which can be used to increase correct written responses of a targeted skill). Flashcards are broken into sets, each set contains targeted incorrect responses identified from baseline for the student. The target problem(s) then appear several times within the set to increase the student's exposure to the target; thus the likelihood of correct responses is increased. The target skill, as well as all other problems within the set, are presented in the correct format and with the correct response (Skarr, Zielinski, Ruwe, Sharp, Williams & McLaughlin, 2014). If the student gives a correct response to a problem in the set, that card is moved to the back of the set. Incorrect

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responses are addressed immediately through a teacher-lead correction procedure. Once the teacher has received a correct response by the student for the missed problem, another problem is presented to the student. The missed problem is placed back in the set, but only 1-3 cards back from the top to increase exposure to the correct response for that problem. The more frequent practice from the time the error correction was implemented allows for easier recall of the correct response by the student. Thus increasing correct responses as well as confidence for the student. Daily record of responses or skill checks after the flashcards are used allow the teacher to identify trends in correct responses and progress the student to a new set, and eventually progress to higher level academic skills that require the newly learned skill. DI flashcard studies will be discussed in the paragraphs that follow.

Cravalho, McLaughlin, Derby, and Waco (2012) evaluated the effectiveness of DI flashcards with two participants enrolled in an elementary resource room. One participant had a target goal in the study of number identification. The participant was in second grade. Number identification is considered a pre- academic skill for all grades kindergarten and above. It is assumed that students have experience with, and have shown and obtained mastery in skills taught in earlier grades, and often new skills build upon this knowledge at higher grade levels. Second grade math skills would require a student to not only recognize numerals, but to be able to apply that skill to higher level or a more complex mathematical problem. The results were that Participant 1 had a mean score of 2.8 in Sets 1 and 2. This stayed the same through the duration of the study. Set 3 reflected in effectiveness in the direct instruction flashcards as a trend in correct responses was seen for the set.

The second participant in this study had a target skill of basic addition facts. The type of addition fact focused on was numerals 1 through 9 + 1. Results for Set 1 showed a mean of 4.5 correct responses for the set once the first author taught the student the correct responses. This is a benefit of direct instruction, teachers can change presentation based on results seen; they don't have to rely on ending assessments or examinations to know if farther or different instruction is needed. Instruction can be changed immediately to address student instructional need. Mastery was reached, and Set 2 was introduced with an overall mean of 3.6 responses given correctly by the student. Set 3 showed similar results of 3.0 correct responses on average across the set. The target skill resulted in three additional sets practiced throughout the remainder of the study for Participant 2. For Sets 4, 5, and 6 a mean score of 2.5, 2.6, and 2.8 was found. All sets in this study had a possible minimum correct response rate of 0 for each session. The maximum correct response rate for each session was a score of 5.

Flashcard daily practice with direct instruction can be used in a variety of educational settings and has been used to assist student learning in both public and private schools. In 2014, research (Altharwa, Neyman, McLaughlin, & Johnson, 2014) was completed in a private elementary school setting; the participant was a female in the 5th grade and received instruction in a special education resource classroom for a learning disability. The study looked at whether DI flashcards improved the student's performance with basic multiplication facts. Baseline resulted in 0 correct responses across three sessions where all three sets were attempted. DI

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flashcards instruction was immediately effective in increasing the correct response rate. In Set 1, the mean correct response was 5.5 of a possible 7.0. This was 78.5% improvement from results seen in baseline. Set 2 contained 5 cards and the mean correct rate was 4.85. This was a 97% improvement. Set 3 had a mean score of 5 correct responses in a set of 6 cards, an 83.33% increase. Additional studies that looked at the use of DI flashcards to teach multiplication facts included (Lund, McLaughlin, Neyman and Everson, 2012) students who participated in the study had a specific learning disability.

Flashcard interventions alone were sometimes found to be not as effective as the researcher intended, or the flashcards were not an appropriate technique to address additional deficits that were seen once intervention began. Effective teachers and researchers know any deficit that can be addressed in order to improve student performance should be intervened upon as soon as possible. Direct instruction is able to be easily changed and adapted for such occurrences without a new study being required. One area this was most commonly seen in the studies reviewed was fluency. Fluency is defined as the rate at which facts can be quickly and accurately be recalled. Common- Core State Standards have increased the focus of fluent correct responses by students and had been identified as a focus area of need within the standards. This focus can be addressed for any age group from preschool (Ehlers, McLaughlin, Derby, & Rinaldi, 2012;Mangundayo, McLaughlin, Williams, & Toone, 2013) to high school (Hayter et al., 2007.) as well as students with, as well as without a disability (McNeil et al. 2011).

Studies have been published that showed additional success that utilized the DI flashcards in other subject domains included, (Ulring, McLaughlin, Neyman, and Waco, 2012) in which flashcards and a direct instruction method was used to increase a target skill of improvement on sight word accuracy rates for elementary students identified for the study based on prior diagnoses of SLD and low academic success with reading sight words. The study included three participants, two were in 4th grade and the third student was in 3rd grade. The study included both male and female participants. The same DI flashcard and racetrack instructional procedures were used as had been discussed in the studies mentioned earlier, however sight words were printed on the flashcard sets and racetrack spaces. Participant 1 scored 6 out of 10 in baseline on Set 1. Mastery was reached after 6 sessions of DI Flashcard instruction. Once Set 2 was introduced, Participant 1 continued the upward trend in correct responses for Set 1, which consisted of final 3 sessions of the study. On Set 2 however, there was a downward trend in correct responses given. Baseline for Set 3 was shown to be a mean of 6.8. Intervention however was not attempted on Set 3 because mastery had not been reached for Set 2, had intervention been attempted that would not have been appropriate.

Participant 2 had a baseline mean score for Set 1 of 6.0. Intervention enabled the student to increase the mean correct response rate to 8.4 on Set 1. Set 2 showed a mean correct response rate of 6.7. Intervention was introduced following three days of mastery of Set 1. Set 2 DI flashcard results were a mean score of 8.0 and this was reached in three sessions. Baseline for Set 3 was 7.6. Intervention was applied to Set 3 and the authors said that mastery was met after a single session (however, mastery requires consecutive days of correct responses, at or above

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80%, so this could not be, the reviewer did not disagree with the data obtained for Set 3, it is the use of the term mastery) that the reviewer disagrees with. Participant 3 was not considered as part of this review due to a DI flashcard intervention not having been part of the intervention used to address that students target skill in the study.

An additional study that used DI and racetrack instruction to teach sight words was completed in 2011 (Hopewell, McLaughlin, & Derby, 2011.) with two elementary students. Both student participants were male, and at the time of the study were between the ages of 7 and 8 years old, and had been diagnosed with a conduct behavior disorder that effected academic performance. The second participant had secondary diagnoses of Attention Deficit-Hyperactivity Disorder (ADHD) and a "learning deficit" in multiple subject areas. The study was completed in a self- contained behavior intervention classroom. Baseline results for Participant 1 were a mean score of 6.5 words correct and 21.5 errors. Once DI flashcards were used in combination with the racetrack scores increased dramatically to mean correct of 24.5 and just 3.4 errors. Participant 2 had similar improvements. In baseline, Participant 2 scored a mean of 8.7 correct responses and 19.1 incorrect responses. Intervention was introduced and the mean correct responses increased to 26 and incorrect responses decreased to a mean score of 2.

The same flashcard and racetrack instruction was used to teach sight words to a boy in the first grade who received special education services for an EBD (Fjortoft, McLaughlin, Derby, Everson, & Johnson, 2014). The study was successful for the student. Baseline correct responses ranged from a mean of 0-.25 across three sets. The flashcard intervention improved the correct responses to a range of 3.5-4.33 across all three sets of sight words. In baseline and intervention the highest number of possible correct for all three sets was 5, which was reached in Set 1 and Set 3. The highest correct response reached for Set 2 was slightly lower at 4 correct response.

Direct instruction flashcards has been used to teach two or more academic subject areas within a single research study as (Erbey, McLaughlin, Derby, & Everson, 2011). These authors demonstrated that direct instruction flashcard can be an effective way to address the instructional needs of multiple students, across different, sometimes unrelated subject areas at the same time; while the individual needs of each student were addressed by the instruction. The study involved three participants, all of whom were elementary aged students that received special education support for diagnosed SLDs. Participant 3 had two additional diagnoses of ADHD, as well as a traumatic brain injury; both of which effected the participant's ability to focus on, or remain on task until completion. Participant 3 was 11 years old, while Participant 1 and Participant 2 were both 7 years old; thus, showing that different ages, as well as different learning needs, can be addressed at the same time through the use of DI flashcards.

Initial assessment was completed based on the subject area of focus for each participant. Participants 1 and 2 were recommended for the study for sight-word practice. Letter sounds and letter names were both included in the initial assessment as a pre-skill needed to effectively and fluently read sight words. Pre-skill assessment was done prior to the start of data collection. Assessment demonstrated that both participants knew the correct letter names in both upper and lowercase form. Pre-assessment indicated that Participant 2 had difficulty with most letter

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sounds, therefore for Participant 2, the target skill was changed to correctly saying the correct letter sound for the letters presented on a flashcard. Participant 1 practiced correct identification of sight-words presented on the flashcard. Participant 3 was recommend to the flashcard study for practice with addition facts. This participant was given an assessment of 100 addition problems and was given 10 minutes to complete as many problems as possible. 30 problems of the possible 100 were answered, most were incorrect responses. Thus, for Participant 3, the target skill was correct responses to basic addition problems. The researchers chose a combination of direct instruction flashcards and racetrack to effectively and easily attempt to address the educational needs of all three participants included in a single study.

Baselines for all three participants were completed by flashcard presentation of either a letter, word, or addition problem. Although all three students worked toward completely different targets in the study, all three demonstrated the same trend across the entire study, low baseline correct responses, (less than 50%), with high incorrect response rates. Once DI flashcards and racetracks were introduced all three students showed an immediate improvement; this was true across all academic sets introduced in the study. After interventions were successful on Set 1, a second set was taught to each student and the trend of correct responses continued across all students. A return to baseline was applied that discontinued use of the selected interventions for a short time to evaluate if the intervention was successful or if non- controllable factors were the reason for improvement. In the Erbey study, all three participants showed a decrease in corrects and an increase in errors for all sets when the return to baseline was applied. Once the intervention was reapplied, all participants demonstrated an increase in correct responses and therefore the error rates to decreased. This trend was maintained for final assessment or the correct responses increased, despite the discontinuation of the intervention.

Direct instruction flashcards is highly adaptable for instruction in many different subject areas and can be used to teach a wide range of student ages and disabilities, as well as students without disabilities. Even with this flexibility, not all studies can yield success through use of direct instruction flashcards. A study by, (Kroll, McLaughlin Neyman, Johnson, & Beiers, 2013) demonstrated mixed results with DI flashcard use. In this study, the correct response range mean across two sets in baseline was 3.3-6.8, which had a maximum correct response rate of 14. After DI flashcards were introduced the correct response across both sets was 8.25- 9.25. Although this is not that much improvement over baseline results it is important to note that in both sets there was continual upward trend of correct responses with use of the flashcards, and Set 1 had at least one day where all words within the set were answered correctly.

Similar studies were completed to help improve student performance across multiple subject or skills areas with one participant. Fjortoft et al. (2014) found DI flashcards to be highly effective. Within the Fjortoft et al. study, the researchers completed two separate experiments. Each experiment addressed different skills or subject domains with different participants. In the first experiment, the student received special education services under the DD category and had significant difficulties in several subject areas. The study focused on correct letter name identification and the writing letters correctly; both of which can be difficult for students with

learning disabilities. Letter writing was not evaluated in the current review because the procedure used did not utilize the direct instruction technique. Written completion of letter was merely "practice" of writing the letters sets on a worksheet. Correction was provided using a teacher model and verbal prompt procedure.

Baseline of the letter name recognition on Set 1 was *M*= 1.33 correct responses out of a possible score of 5. The DI flashcard intervention greatly increased the correct responses given to 4.64, which is a 66.2% increase from baseline. In Set 2, the correct responses were *M*= 1.6, which increased to 4.47 after use of flashcards, which is a 57.4% increase from baseline results. Baseline letter recognition for Set 3 was *M*= 1.56 and increased to 4.1. A 49.8% increase from baseline results. For Set 4 baseline was *M*= 1.75 and increased to 3.3, which was a 37.6 % increase over baseline. Lastly, Set 5, baseline was *M*=1.8 responses with an increase to 3 correct responses with intervention, which is a 30% increase.

In the second experiment, Fjortoft utilized direct instruction flashcards to improve letter sound correspondence in a six-year-old boy diagnosed with an EBD. The mean baseline score across all three sets ranged from 3.5-6.3 correct responses with a possible correct of 14 or 15. In baseline, correct response percentage ranged from 23%-45%. The DI flashcard intervention increased correct responses to a range of 47.64-70.26. This is an improvement of 24.64- 25.26 across all three sets, compared to baseline.

Multiple studies utilizing DI flashcards have been completed with participants in pre-kindergarten classrooms. These classrooms could have the title of preschool (Mangundayao, et al., 2013; Kane et al., 2015; Bechtolt, McLaughlin, Derby, & Blecher, 2013) or early-childhood classrooms. Participants at this age level often received special education instruction under the service category of Developmental Delay (DD) which according to state data collected by (The Individuals With Disabilities Education Act (IDEA), Part B, November 2013 Child Count Report, 2013) comprised of 59.68% of students enrolled in a special education classroom pre-kindergarten classrooms. Students included for this age group had diagnoses of DD for all DI flashcard studies included in this research review. The participants needed to be between the ages of four and five when the intervention study was attempted, Students with other primary IDEA categories listed on IEPS were excluded for review.

Mangundayo et al. (2013) used DI flashcards to teach several pre-academic math skills to preschoolers diagnosed with DD. Targeted skills included number identification, shape identification, and identification of eight basic colors. Number and shape identification are important math skills the students build upon in higher grade levels. Color identification is considered a general knowledge and cognitive domain skill within the early childhood education. Colors are used to teach math related skills such as sorting, matching, how many of a given item is in a larger group of items.

Three participants were involved in the Mangundayao el al investigation; all participants had diagnoses of Developmental Delay, received services, and were between ages 4 and 5 years old. For Participant A, baseline for color identification was a mean score of 5 correct and 6 incorrect responses. A DI flashcard intervention increased correct responses to a mean score of

10.8 out of 11. This is a 53% increase from baseline results. Generalization correct response rate was 11 out of 11. Baseline for shape identification was a 1.3 mean score for eight shapes within the set. The DI flashcard intervention increased identification to a mean score of 6.9; a 70% increase of correct responses given after DI flashcard intervention was implemented. Skill improvement generalized over time to a 100% correct response rate. Baseline for number identification was 0 correct responses out of a possible 5. The DI flashcard intervention increased correct response rate to a mean of 4.8, a 96% increase from baseline. Generalization skills were maintained and actually increased to 5 out of 5.

In the same study, Participant B's baseline mean score was 1 correct and 10 incorrect responses for color identification. An intervention that used flashcards was attempted and resulted in an increase of correct responses by the participant. This increase was a 55.5% increase from baseline. Generalization was assessed and the skill was maintained over a period of time at a rate of 11 out 11. For the same participant, shape identification had a baseline mean score of 1.8 correct responses. Intervention increased results to a mean of 4.8. Although this is not as robust as other results seen in the study, it is still in increase of 27.3% increase in correct responses after the use of DI flashcards.

Within the same study, Participant C had a baseline mean of 0 correct responses for color identification. DI flashcards increased the correct response rate to 5.5, which is a 55% increase over baseline results. Shape identification showed a mean correct response rate in baseline of 0 out of 8. DI flashcards was introduced the correct response rate increased to 3.7. This was a 37% increase from baseline results. Number identification was not intervened on for Participant C.

Additional research studies that demonstrated improvement in the skill of shape identification (Herberg, McLaughlin, Derby, & Gilbert, 2011). Herberg et al. al. study assessed a modified DI flashcard technique. Specifically participant being asked, "What shape is this?" The researchers modified the question to, "is this a triangle?" this adjustment was made because of the participant's dominant-primary response "triangle" for any shape shown. Repeated correction procedures were unsuccessful prior to this presentation modification. The modified technique increased the correct responses given from a mean score of 1.75 in baseline to 5.4 in the modified DI flashcard phase. The second participant in the study had a mean baseline score of 2.4 correct responses. With the use of the traditional DI flashcard instruction, correct responses increased to 5.5 correct responses. For both participants, the maximum number of correct responses possible was 12. Thus, the result of this study could be considered dismal by some, but a good special education professional would see these results as progress toward an annual goal; that may not have otherwise been seen.

Several studies previously discussed in this review involved a racetrack instructional technique in addition to the DI Flashcards instruction. This was most often used with skills taught at the elementary level or beyond. Research by (Ehlers, McLaughlin, Derby, & Rinaldi, 2012) used both techniques to improve number identification. The Ehlers study three students were assessed at the preschool level. Two of the study participants' results met the criteria for

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inclusion in this review. The first participant had an IEP service category other than SLD, EBD, or DD and therefor that participant's results were not included. Participant 2 and Participant 3 were males, received service under the disability of DD, and were both between the age of 4 & 5. Participant 3 had an additional diagnosis of ADHD.

Baseline for Participant 2 was .25 for Set 1, Set 2 was .4 for this phase; the maximum responses correct for each set was 2. Baseline for Participant 3 was 0 across both sets for this phase.

DI flashcards and math racetrack allowed Participant 2 to have immediate steady improvement with Set 1. Mastery was obtained and remained at that level of mastery throughout the remainder of the study. Set 2 results were somewhat unstable until session 11. After session 11 steady improvement was reported for Set 2 as well. Mastery was reached at session 13 and remained for the remainder of the study.

For Participant 3, steady improvement was demonstrated, immediately after DI flashcards and math racetrack were implemented. Mastery of Set 1 was reached following session 9 and remained at mastery of three numbers identified correctly until session 10. From then on results became unstable after Set 2 was introduced.

Results for Set 2 were unstable for the first 3 sessions, ranging from 0 to 1 correct response. Following a return to baseline, an addition component of a reward was added to Set 2, but correct responses remained at 0.

In 2015, Kane, McLaughlin, & Mortenson completed a research study with a female participant diagnosed with a Developmental Delay. The target was to increase the student's number recognition skills, which is a pre-academic skill that is expected to be at mastery level when a child enters Kindergarten. The participant was 4 years old at the time of the study and would transition to Kindergarten within a year. Prior to baseline, the researchers were told that the participant could correctly identify numbers 1,2,3,4 and 5 during group instruction, but had difficulty with the skill during individual assessment. Numbers 6,7,8,9, and 10, were not mentioned as to the student's current ability to correctly identify these numbers, but progression toward identification of these numbers was the target goal of the study. This case study involved an intervention modification that increased the student's correct response rate. The modifications included smaller set size, reduced practice session times, and a match the card response.

For Set 1, Baseline results were a mean of .17 which had a maximum correct score of 4 for each session. With Sets 2 and 3, the mean score was 0 within all baseline sessions and would remain 0 across all intervention phases as well.

Intervention of DI flashcards showed immediate improvement from that seen in baseline with 40% correct, however after three sessions correct response rate became unstable. Several intervention techniques were attempted over the span of this study, which reflects a benefit of the Direct Instruction flashcard method used, components can be added or removed based on the results seen. The intervention components attempted included DI Flashcards paired with an edible tangible reward, DI flashcards paired with a combination of a reduced set size and reduced session time. Student performance remained unsteady across all of these intervention

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combinations. The final intervention combination was match to sample, reduced session time, and an edible reward for correct responses. This intervention resulted in an immediate mastery level trend for the final three sessions of the study.

Differential, Little or No Effects with DI Flashcards

Studies have been reported in the literature where the use of DI flashcards has resulted in delayed or little positive effects (Kroll et al., 2013; Chandler, McLaughlin, Neyman, & Rinaldi, 2012. This has been seen in young preschool children (Chandler et al., 2012) as well as with children enrolled in resource rooms (Johnson, McLaughlin, Derby, & Bucknell, 2014), and children enrolled in self-contained classrooms (Kroll et al., 2013; Pierce, McLaughlin, Neyman, & King, 2012). Also, this has occurred with a wide range of disability designations. However, most of these failures have occurred with young children with disabilities (Chandler et al., 2012; Ehlers et al., 2012; Higgins et al., 2012; O'Loughlin, McLaughlin, Derby, & Rinaldi, 2014) In fact four of these were found in the same preschool classroom. The reasons as to the lack of powerful effects may well be a result of not being able to take data each day (Kroll et al., 2013), the severity of the disability of the participant(s) (Higgins et al., 2012; O'Loughlin et al., 2014). However, the failure of Johnson et al., was with well-behaved elementary school students with mild disabilities. Daily practice was difficult due to high stakes testing and there were large gaps in data collection and being able to work with their participant. The participant's performance continued to improve over time. This may also suggest that once the participant learned how to identify sight words, this skill was maintained either through his time in reading in general education or he managed to practice on his own without the first author's knowledge (Malone & McLaughlin, 1997). Malone and McLaughlin reported that eight grade general education students made flashcards on their own and tutored each other after school even in baseline. It appears that the differential outcomes need further research and analysis. Also, having replications of the effects of DI flashcards by other researchers would also add or detract of these issues.

Conclusions, Suggestions, and Recommendations

Carnine (1981) first stated that Direct Instruction techniques, specifically the use of flashcard practice would be effective to teach students with disabilities mathematics skills that students had shown difficulty in acquisition or maintenance of a skill over time. Hayter and colleagues (2007) tested Carnine's theory that disabled students could improve mathematics performance with daily practice on flashcards, and found it to be true. Several research studies have also found direct instruction flashcards effective for teaching a wide range of academic subjects areas. The method is also effective for teaching social skills to students with disabilities. The reviewed studies included here represent farther support Carnine's theory. Also reflected, was the ability for direct instruction flashcard instruction to be changed based on results obtained while the study was still being conducted; there was no need to wait until an end of research assessment to address further instructional needs for the target skill. In studies with multiple participants, DI flashcards have been adapted to each student's individual instructional needs

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with ease; thus, individual student strengths and weakness can be addressed as seen within a single study. Lastly, the review demonstrated how DI flashcards can be effective across prekindergarten to high school. Recently, this method was also shown to be effective when addressing skills for students at higher grades as well (Lebrun et al., 2014).

Direct Instruction flashcards have shown to be moderately to highly effective for most of the participants in the reviewed studies. Most studies were only a short term glimpse of the effectiveness of direct instruction flashcards in, which all studies evaluated showed mastery or improvement toward mastery of at least one set. It is that improvement in skill that special education teachers should focus on; not just short-term results (Stokes & Baer, 1977, 2003) but longer analyses examining generalization across time or skills. The research by Cravalho and colleagues (2014) is a nice beginning of such an analysis. Clearly, longer evaluations of DI flashcards and the assessment of generalization of treatment effects (Stokes & Baer, 1977) must need to take place. Direct instruction is most effective when applied and adapted to current student needs, however a longer analysis needs to occur. Another important evaluation would be to carry out a more traditional between groups comparison of DI flashcards. One could also employ reading racetracks with and without DI flashcards as a way to determine whether have an additional intervention in needed. Finally, a single case comparison using an alternating treatments design (Kazdin, 2011) could answer this same question. The only comparison with and with DI flashcards was brief (Skarr et al., 2012).

DI flashcards were shown to be most effective when paired with additional instructional methods, such as a racetracks or matching. This was due to additional skills found within the studies that needed to be addressed by the authors. In some studies, (Kane, McLaughlin, & Mortenson, 2015; Skarr et al., 2014) several variations or different combination of techniques had to be attempted until the effective combination was found. This may appear to lessen the effectiveness of the study, but instead it reflects how direct instruction can be adapted quickly and effectively to increase student performance. Within a classroom setting, the effective combination that was found would have been applied and continued and student performance would likely have increased over a long-term. Given the findings of this review, it appears that DI flashcards is effective.

Additional research could focus on a single component through in depth analysis. An additional area that could be research is a specific skill area tested via standardized tests. The best that has taken place is giving of the pretest as a posttest (Bechtoldt et al., 2014; Brasch et al., 2007). The research would need to be a long-term study in order to compare preparation to test via direct instruction flashcards compared to test results not using flashcards.

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References

Altharwa, H., Neyman, J., McLaughlin, T. F., & Johnson, G. (2014). An evaluation of the effectiveness of implementing a DI flashcard procedure to teach basic multiplication facts with an elementary private school student with learning disabilities. *International Journal of Innovation and Research in Educational Sciences, 1*(1), 24-27. Retrieved from: http://ijires.org/administrator/components/com_jresearch/files/publications/IJIRES_07_Final.pdf

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders (Revised ed-RT)*. Washington DC: Author.

American- Speech- Language- Hearing- Association. (2015). *Specific Learning Disability.* Retrieved from: http://www.asha.org/advocacy/federal/idea/04-law-specific-ld/

Barkley, R. A. (2006). *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment* (3rd ed.). New York, NY: Guilford Press.

Bechtolt, S., McLaughlin, T. F., Derby, K. M., & Blecher, J. (2014). The effects of direct instruction flashcards and a model, lead, test procedure on letter recognition for three preschool students with developmental disabilities. *Journal of Developmental Disabilities, 20*(1), 5-15.

Brasch, T., Williams, R., & 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.

Chandler, A., McLaughlin, T. F., Neyman, J., & Rinaldi, L. (2012). The differential effects of direct instruction flashcards with and without a shorter math racetrack to teach numeral identification to preschoolers: A failure to replicate. *Academic Research International, 2*, 308-313. Retrieved from: http://174.36.46.112/~savaporg/journals/issue.htm/

Cole, M., McLaughlin, T. F., & Johnson, R. (2012). The effects of direct instruction flashcards with oral sentence creation on the spelling accuracy of three middle school students with disabilities. *International Journal of Basic and Applied Science, 1*, 308-319. Retrieved from: http://www.insikapub.com/

Costello, E. J., Egger, H. H., & Angold, A. (2005). One-year research update review: the epidemiology of child and adolescent psychiatric disorders: methods and public health burden. *Journal of the American Academy of Child and Adolescent Psychiatry*, 44, 972–986.

Cravalho, C. J., McLaughlin. T. F., Derby, K. M., & Waco, T. (2014). The effects of direct instruction flashcards on math performance with measures of generalization across elementary students with learning disabilities and autism spectrum disorder. *International Journal of Basic and Applied Sciences, 2*(4), 16-31. Retrieved from: www.insikapub.com

Ehlers, E., McLaughlin, T.F., Derby, K.M., & Rinaldi, L. (2012). The differential effects of direct instruction flashcards and math racetracks on number identification for three preschool students with disabilities. *Academic Research International, 2*(3), 285-295. Retrieved from: http://www.savap.org.pk/journals/ARInt./2(3)/2012(2.3-34).pdf

Erbey, R., McLaughlin, T.F., Derby, K.M., & Everson, M. (2011). The effects of using flashcards with reading racetrack to teach letter sounds, fight words and math facts to elementary students with learning disabilities. *International Journal of Elementary Education, 3*(3), 213- 226. Retrieved from: http://www.journals.indexcopernicus.com/issue.php?id=8349&id_issue=857078

Fjortoft, A., McLaughlin, T., Derby, M., Everson, M., & Johnson. (2014). The effects of two direct instruction teaching procedures to basic skills to two elementary students with disabilities. *Multidisciplinary Journal of Educational Research, 4*(2), 151-181.

Harris, M., Helling, J., Thompson, L., Neyman, J., McLaughlin, T. F. Hatch, K., & Jack, M. (2015). The effects of a direct instruction flashcard system to teach two students with disabilities multiplication facts. *International Journal of Applied Research, 1*(3), 59-65. Retrieved from: http://www.allresearchjournal.com/vol1issue3/PartB/issue/vol1issue3.html

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

Herberg, K., McLaughlin, T.F., Derby, K.M., & Gilbert, V. (2011). The effects of direct instruction flashcards on shape recognition and recall for two preschoolers with disabilities. *Academic Research International, 1*(3), 59-64. Retrieved from: http://www.savap.org.pk/journals/ARInt./2(2)/2012(2.2-26).pdf

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

Hopewell, K., McLaughlin, T. F., & Derby, K. M. (2011). The effects of reading racetracks with direct instruction flashcards and a token system on sight word acquisition for two primary students with severe conduct disorders. *Electronic Journal of Research in Educational Psychology, 9*, 693-710. Retrieved from http://www.investigacion-psicopedagogica.org/revista/new/english/anteriores.php

Houglum, R., McLaughlin, T. F., Weber, K., Neyman, J., & Gould, C. (2013). The effectiveness of direct instruction flashcards with guided practice activities to instruct two elementary students diagnosed with autism spectrum disorder and delays in pre-academics and communication. *International Journal of Basic and Applied Science, 2*(1), 11-38. Retrieved from: http://www.insikapub.com/

Johnson, C., McLaughlin, T. F., Derby, M. K., Barretto, A., & Bucknell, W. (2014). The effects of direct instruction flashcards and computer time to teach sight words to an elementary student with a learning disability and ADHD: A failure to demonstrate a functional relationship. *International Journal of English and Education, 3*, 581-584. Retrieved from: Retrieved from: Retrieved from: http://www.ijee.org/.

Kane, C., McLaughlin, T. F., & Mortensen, S. (2015). The effects of DI flashcards with and without match to sample with edibles on number recognition using reduced set size and DI discrimination training: a case report. *International Journal of Multidisciplinary Research and Development, 2*(1), 224-231. Retrieved from: http://www. researchgate.net

Kauffman, J. M., & Landrum, T. J. (2009) Characteristics of emotional and behavioral disorders of children and youth (9th ed.). Upper Saddle River, NJ: Prentice Hall.

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.

Kroll, L., McLaughlin, T.F., Neyman, J., Johnson, K., & Beiers, K. (2013). The effects of direct instruction on reading first grade high frequency sight words with a student with severe conduct disorders. *Educational Research International*, *2*(1), 13-21.

LeBrun, C., Jones, S., Neyman, J., McLaughlin, T. F., & Schuler, H. (2014). The effects of a modified direct instruction flashcard system on a 14 year-old-student with learning behavioral issues enrolled in a behavior intervention classroom. *International Journal of Undergraduate*

Education and Creative Activities, 6, Article 5, 1-9. Retrieved from: http://commons.pacificu.edu/ijurca/

Lund, K., McLaughlin, T.F., Neyman, J., & Everson, M. (2012). The effects of DI flashcards and math racetrack on for two elementary students with learning disabilities. *Journal of Special Education Apprenticeship, 1*(1), 1-15. Retrieved from: http://josea.info/index.php?page=vol1no1.

Malone, R., & McLaughlin, T. F. (1997). The effects of reciprocal peer tutoring with a group contingency on quiz performance in vocabulary with seventh and eighth grade students. *Behavioral Interventions, 12*, 27-40.

Mangundayao, J., McLaughlin, T. F., Williams, R. L., & Toone, E. (2013). An evaluation of the direct instruction flashcards system on acquisition and generalization of numerals, shapes, and colors, for pre-school aged students with developmental delays. (2013). *Journal of Developmental and Physical Disabilities*, 25, 461 – 473.

Mann, Z., McLaughlin, T. F., Williams, R. L., Derby, K. M., & Everson, M. (2012). The effects of direct instruction flashcards and rewards with math facts at school and in the home: acquisition and maintenance. *Journal of Special Education Apprenticeship*, 1(2). Retrieved from: http://josea.info/index.php?page=archives.

McNeil, M. N., Fyfe, E. R., Peterson, L. A., Dunwiddle, A.E., & Shipley –Brletic, H. (2011). Benefits of practicing 4 = 2+2: nontraditional problem formats facilitate children's understanding mathematical equivalence. *Child Development, 82*, 1620 – 1653.

Office of Superintendent of Public Instruction. (2013). *Individuals with Disabilities Education Act (Idea), Part B, November 2013 Child Count Report* [Data Set]. Retrieved from: http://www.k12.wa.us/SpecialEd/Data/Childcount-Placement.aspx#1/

O'Loughlin, E., McLaughlin, T. F., Derby, K. M., & Rinaldi, L. (2014). The differential effects of a color racetrack and color flashcards on the acquisition of basic color facts for a preschool student with behavior disorders. *International Journal of English and Education, 3*(1), 487-498. Retrieved from: http://www.ijee.org/

Pfaff, E., McLaughlin, T. F., Neyman, J., & Everson, M. (2013). The effects of direct instruction flashcards with math racetrack with addition facts for an elementary school student with ADHD. *International Journal of Basic and Applied Science, 2*(1), 124-130. Retrieved from: http://www.insikapub.com/

Pierce, K., McLaughlin, T. F., Neyman, J., & King, K. (2012). The gradual and differential effects of direct instruction flashcards with and without a DRH contingency on basic multiplication facts for two students with severe behaviors disorders. *i-manager's Journal on Educational Psychology*, 6(2), 35-44. Retrieved from: http://www.imanagerpublications.com/Archives.aspx

Rivera, G., Heric, K., Williams, R. L., McLaughlin, T. F., & Johnson, G. (2014). The use of direct instruction multiplication flashcards and a modified math racetrack procedure on mastery of multiplication facts for an at risk 6th grade girl. *The Open Education Journal, 7*, 7 -11. Retrieved from: http://www.benthamsciece.com/open/toecij/

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

Seines, A., McLaughlin, T. F., Derby, K. M., Weber, K. M., & Gortsema, K. (2015). The effects of direct instruction flashcards on sight word skills of an elementary student with a specific learning disability. *International Journal of Advances in Scientific Research, 1*(3), 167-172. Retrieved from: http://www.ssjournals.com/index.php/ijasr/issue/view/218

Shapiro, E. S. (2011). *Academic skill problems: Direct assessment and intervention* (4th ed.). New York: Guilford Press.

Shahtout, L., McLaughlin, T. F., Derby, K. M., & Arenez, T. (2012). The effects of direct instruction flashcards and reading racetrack on sight words with two elementary students with behavior

disorders: A brief report. *Academic Research International*, *2*(2), 303-308. Retrieved from: http://174.36.46.112/~savaporg/journals/issue.html

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

Simpson, G. A., Bloom, B., Cohren, R. A., Blumberg, S., & Bourdon, K. H. (2005). U.S. children with emotional and behavioral difficulties: Data from the 2001, 2002, and 2003 National Health Interview Surveys. *Advance Data: From Vital and Health Statistics, 360, 1-14.* Centers for Disease Control and Prevention. Retrieved from: http://www.cdc.gov/nchs/data/ad/ad360.pdf

Skarr, A., McLaughlin, T. F., Derby, K.M. Williams, R. L. & Meade, K. (2012). A comparison of direct instruction flashcards and copy, cover, compare to teach spelling to elementary school students. *Academic Research International, 2*(2), 247-263. Retrieved from: http://www.savap.org.pk/journals/ARInt./2(2)/2012(2.2-26).pdf

Skarr, A., Zielinski, K., Ruwe, K., Sharp, H., Williams, R. L., & McLaughlin, T. F. (2014). The effects of direct instruction flashcard and math racetrack procedures on mastery of basic multiplication facts by three elementary school students. *Education and Treatment of Children*, *37*, 77-93.

Stein, M., Kinder, D., Silbert, J., & Carnine, D.W. (2005). *Designing Effective Mathematics Instruction: A direct instruction approach* (4th ed.). New York, NY: Pearson Education.

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

Stokes, T. F., & Baer, D. M. (2003). Mediated generalization: An unfinished portrait. In K. S. Budd & T Stokes (Eds.), *A small matter of proof: The legacy of Donald M. Baer* (pp. 125-138). Reno, NV: Context Press.

Tan, A., & Nicholson, T. (1997). Flashcards revisited: Training poor readers to read words faster improves their comprehension of text. *Journal of Educational Psychology*, *89*(2), 276-288. Retrieved from: http://psycnet.apa.org/journals/edu/89/2/276/

Ulring, A. M., McLaughlin, T. F., Neyman, J., & Waco, T. (2012). The differential effects of direct instruction flashcards and reading racetracks on sight word accuracy on three elementary students with learning disabilities. *Academic Research International*, *2*(2), 406-420. Retrieved from: http://www.savap.org.pk/journals/ARInt./2(2)/2012(2.2-46).pdf

U. S. Department of Education. (2004). *"Building the Legacy: IDEA 2004 Sec. 300.8 Child with A Disability. Ed.gov.* Retrieved from: http://idea.ed.gov/explore/view/p/,root,regs,300,A,300%252E8,

U. S. Department or Education. (2013). *Children 3 to 21 years old served under Individuals with Disabilities Education Act, Part B, by type of disability: Selected years, 1976-77 through 2010-11* [Data Set]. Retrieved from: https://nces.ed.gov/fastfacts/display.asp?id=64

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

Zirkel, P. A. (2006). *SLD Eligibility: a user's guide to new regulations*. National Research Center on Learning Disabilities. Retrieved from: http://eric.ed.gov/?id=ED494604