

FLASHCARD EFFECTIVENESS FOR SECOND GRADERS

By Renee L. Husman

Educators are faced with high standards for educating children. Reading and math are the foundation of education and a solid understanding in both subject areas is necessary for achievement throughout students' educational careers. Educational interventions are often necessary to aid students in falling behind academically with their peers. Home environments are not always conducive to homework completion or studying. When educators send extra instructional materials home with students, they want to make sure the materials are effective in helping the students with the instructional material.

This study randomly assigned 16 students to one of two groups. One group received ten sight word flashcards for six weeks and the other group received ten subtraction math fact flashcards for six weeks. Pretests and posttests were given at the beginning and end of the six weeks in both subject areas for reading and math. Oral reading fluency was assessed using DIBELS (Dynamic Indicators of Basic Early Literacy Skills) oral reading fluency probes. Math fact retention was assessed using a 1-minute timed math subtraction fact test. A one-way analysis of covariance was conducted and the students who received sight word flashcards significantly improved over those who did not receive sight word flashcards. The students who received math subtraction fact flashcards had an average increase over the students who did not receive subtraction fact flashcards; however the change was not significant.

Keywords: flashcards, sight words, fluency, subtraction

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by

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Chapter I

Introduction

Educators must keep many different factors in mind when planning instruction. State and district standards, curriculum, and the individual learning needs of the students in their classrooms all come into play when designing the best and most effective instruction for students. The subjects of math and reading are emphasized because they are the foundation of learning and provide access to understanding other material. Sight word instruction has become a prevalent tool for teaching literacy. Learning to read sight words helps students become more proficient in learning to read (Ehri, 2005). Oral reading fluency and word recognition are skills students need to become successful readers (Huang, Nelson, & Nelson, 2008). Similarly, mathematics is based on a solid understanding of core concepts. Research has demonstrated that students who do not master early skills in mathematics fail to reach mastery of future skills at much higher rates (VanDerHeyden & Burns, 2009).

One instructional tool that has been used for academic interventions is flashcards. In reading, flashcards help students read accurately and quickly (Browder & Xin, 1998; Tan & Nicholson, 1997). Similarly, in math flashcards are often used in helping students learn their basic math facts. Brasch, Williams, and McLaughlin (2008) found a functional relationship between mastery and retention of multiplication facts using direct instruction with flashcards.

The question is whether flashcard instruction is also beneficial at home. Bailey (2006) studied the effects of parent involvement on children's homework and found that interactive homework increased the amount of time parents spent with their children on homework. Therefore, could flashcard practice at home translate to higher academic achievement scores in the classroom?

Educators are very busy and their time is filled with instructional planning, teaching, meetings, and professional learning. Teachers' number one priority is their students and time is limited during the school day. Literacy acquisition is a critical element for children to succeed in both school and life (Lane, Pullen, Hudson, Konold, 2009). When teachers initiate a specific instructional approach in their classroom, they want that approach to be effective. They strive to differentiate their curriculum and use best practice in their classroom.

Today's students are experiencing different family situations than ever before. The environment that students come home to may not be conducive to homework or studying. A disturbing statistic declares that more than half of all students in the United States are reading below grade level (Huang, Nelson, & Nelson, 2008). This fact emphasizes the necessity of collaboration between both home and school. It is essential that the materials teachers send home with their students are beneficial to their academic learning.

Direct instruction is a teaching method that explicitly teaches the content. Direct instruction involves scripted teaching and repetition until mastery (Marchand-Martella, Slocum, & Martella, 2004). Flashcards are a more direct instructional approach to

learning material because students are participating in a traditional drill and practice method. Flashcards are shown to the student and they memorize the sight words or subtraction facts.

Research

Researchers have tackled the subjects of homework, sight words, flashcards, and tutoring. Research is currently lacking in combining these elements into one study. Many researchers have compared different methods for teaching sight words. Hong & Kemp (2007) compared activity-based intervention with didactic instruction. Conley, Derby, Roberts-Gwinn, Weber, and McLaughlin (2004) compared the copy, cover, and compare method with the picture-matching method. This study compared reading and math scores for two groups of students. One group received sight word flashcards and one group received subtraction math fact flashcards.

Increased time spent on learning material through tutoring has been found effective in increasing students' learning (Berninger, Abbott, Vermeulen, & Fulton, 2006; Huang, Nelson, & Nelson, 2008). This has been shown to be the case in both reading (Harris, Oakes, Lane, & Rutherford, 2009) and math (Fuchs et al., 2008). Sending flashcards home with the students allows extra time with the material.

Method

This study consisted of two interventions using flashcard practice. In the first, oral reading fluency was assessed using the Dynamic Indicators of Basic Early Literacy Skills

(DIBELS) oral reading fluency probes. The students were timed for one minute and the number of words read accurately was recorded to identify their words per minute score. To increase reliability, students completed three probes and their median score was used as their pretest or posttest score. In the second intervention, the students' mathematical ability was assessed using a 1-minute timed subtraction fact assessment sheet. Students had one minute to answer as many subtraction problems as possible. The number of correct responses was the student's score.

Students were divided into two experimental groups. One group received sight word flashcards and the other group received subtraction math flashcards. Ten new flashcards were sent home weekly for six weeks. A pretest and posttest were administered at the beginning and end of the six weeks. The beginning and end scores were compared to measure the amount of improvement over the six week period. The two groups were compared to see if students who received sight word flashcards had a greater increase on their oral reading fluency scores than the other students. The students who received subtraction math flashcards were compared to the rest of the students to see if they had a greater increase on their timed subtraction math assessment score. The methods are described in greater detail in chapter 3 and the results are detailed in chapter 4.

Limitations of this study included a small sample size and thus the inability to generalize the results as the research occurred in just one classroom with sixteen students. Other limitations included outside influences that may have impacted students' scores besides the flashcards such as classroom instruction or time spent reading for enjoyment.

The study examined whether sending sight word flashcards home increased students' oral reading fluency as measured by their words per minute score from DIBELS oral reading fluency probes. The study also investigated whether sending subtraction fact flashcards home increased students' number of accurate responses on timed subtraction fact assessments.

This study employed a pretest-posttest true experimental design. Using SPSS software, a one-way analysis of covariance (ANCOVA) was conducted to see if the covariate of the flashcards had a statistically significant effect on the students' posttest scores.

Summary

Students who have academic problems early in their academic careers often experience a continual gap from their peers that increases over time. Early intervention is necessary to try to prevent the gap from increasing. Researchers have studied the effects of early intervention, sight word instruction, tutoring, and flashcards. This study combined those elements to determine whether sending flashcards home with students is effective in increasing their oral reading fluency and math skills. Teachers are stretched thin as they are held accountable on many different fronts from families and district and state requirements. Sending flashcards home is one way teachers could allow their

students extra time with the material. The question is whether this home instructional method is effective and whether it will translate into higher academic scores in the classroom.

Chapter II

Review of the Literature

Reading and math are the foundation of education. Understanding written print is the beginning stepping stone to help students access other curriculum. Reading and math skills are emphasized throughout students' schooling and help them become successful, productive citizens in the future. Students are exposed to literacy from a very young age and literacy instruction starts as soon as children enter school. Basic addition and subtraction facts need to be mastered prior to learning multiplication or division. Flashcards have long been used as an instructional tool. Sight word flashcards and subtraction flashcards can be used to help students practice reading and math facts at home. Home instruction is a challenge because the teacher is unable to ascertain how instruction is being implemented at home. This study will examine the effectiveness of sending flashcards home.

Assessing the effectiveness of using flashcards at home on school assessments involves discussion of a variety of tools including: early intervention, sight words, tutoring, home environment, and flashcards. Research has been done on all of these topics, but rarely has a study combined all of the factors to discover the effectiveness of practice with flashcards in the home on students' classroom assessments. Particularly, this study will evaluate the effectiveness of sight word flashcards on students' oral reading fluency as measured by DIBELS oral reading fluency probes. The research also

will determine the effectiveness of subtraction math flashcards on timed math subtraction assessment sheets.

Theory

In 1986, Stanovich described individual differences in literacy acquisition as Matthew effects in reading, referencing the Biblical story where the rich get richer and the poor get poorer: struggling readers fall further behind their peers annually, increasing the reading achievement gap as students get older. Since math skills build on previously mastered concepts, students again experience a Matthew effect early when they are unable to achieve competency. All teachers have basic skills learning objectives that have to be mastered prior to moving on to higher levels of thinking and learning (Gunter, Estes, & Schwab, 1999). What can be done to prevent students from drastically falling behind their peers? Extra instructional time and supplemental practice offer potential solutions. Flashcard practice at home could allow the student extra time with the material.

Flashcards as an instructional strategy mirror behaviorist theory where students are continually reinforced when they respond with the correct answer. Pavlov, Skinner, and Watson all demonstrated conditioning in their experiments where the subjects eventually come to expect a certain result (Hunt, 2007). Pavlov's famous dog saliva experiment demonstrated that dogs could be conditioned to expect a certain result from a certain stimulus, namely salivating when they heard the sound of a bell. Watson took these experiments a step further and began to study conditioning in humans. Watson's experiments with infants showed that emotional responses appeared innate in humans and

appeared in response to certain stimuli (Hunt, 2007). Behaviorist theory rests on a foundation of reinforcement and students studying using flashcards are reinforced immediately after they give their answer or corrected if their answer is incorrect.

Skinner's (1904-1990) operant conditioning is the rewarding of small steps on the way to the desired behavior. In other words, "shaping" the behavior by breaking down complicated subjects into small steps and then providing students with immediate feedback on whether or not their answer is correct. Programmed instruction believes when students are told they are correct, the right answer is reinforced for them. Immediate reinforcement has been found more successful than delayed reinforcement (Hunt, 2007). Skinner stated "perhaps the most serious criticism of the current classroom is the relative infrequency of reinforcement" (Skinner, 1954, p. 91). Due to the ratio of students to teacher, there may be many seconds or minutes between the child's response and the teacher's reinforcement. In this study, the reinforcement of a correct answer is awarded by the parent. The very nature of flashcards achieves immediate, individualized reinforcement.

The teaching method of direct instruction derives from behaviorist theory believing that explicitly teaching the content will lead students to attain greater understanding and retention. Direct instruction shares principles of behavioral psychology including overt responding and frequent and specific feedback (Magliaro, Lockee, Burton, 2005). Direct instruction involves modeling the learning and students practicing the material demonstrated by their teacher. Skinner wrote in his notes "teachers model the behavior their students are to display; verbally or nonverbally, and

by providing reinforcement when they do so, they strengthen both the behavior and their imitative repertoires” (Skinner, 1980, p. 135, 136). The modeling, continual practice, and repetition lead to retention.

Modeling also is an important variable in Albert Bandura’s social cognitive theory as it promotes self-efficacy and self-regulation. Bandura’s theory surrounds the interactions between the student, behavior, and environment. The students’ beliefs about their capabilities directly affect their learning and achievement. The theory’s propositions also influence students’ feelings and motivations behind homework completion (Margolis & McCabe, 2004). Social cognitive theory provides one explanation why students struggle with homework completion. Homework is usually an independent activity and if students do not feel confident in their ability to complete the assigned task, they may not exhibit effort. Flashcard instruction does not need to be an independent activity; rather the students ideally practice their flashcards with their parents. They are motivated as practicing the same flashcards for one week increases their competency and as a result students feel more successful and are more likely to participate and exhibit effort in the flashcard practice.

Flashcard practice at home involves interaction and immediate feedback and “students who receive encouraging feedback from teachers may feel more personally efficacious and work harder to succeed” (Schunk & Zimmerman, 2007, p. 8). Social cognitive theorists argue students are more likely to engage in an academic task when they see the value and understand the importance of completing the task. These are the underlying reasons why teachers try to include “real-world” problems in their

assignments. Flashcard instruction has “real-world” implications as high frequency sight words will be found in books students read. Their subtraction math fact knowledge will be used to complete other academic math tasks and as a result students will understand the purpose and value in studying their flashcards.

Early Intervention

Researchers have focused on early intervention for struggling students as a way to decrease achievement gaps. Speece and Ritchey (2005) examined the development of oral reading fluency in a sample of first-grade children. They assessed a sample of both at-risk and typically developing first grade students to determine how their reading level affects their growth and performance level at the end of the school year. The researchers found that students who were identified at-risk in the fall of first grade were reading on average less than half as many words per minute and growing at approximately half the rate of their peers by the end of first grade. This study supports the Matthew effect and also shows that early reading instruction should not only address word recognition, but also fluency.

This learning gap is not limited to struggling readers, but rather research acknowledges that there is a socioeconomic status related gap for mathematics that increases throughout childhood. Klein, Starkey, Clements, Sarama and Iyer (2008) researched whether a pre-kindergarten math intervention was effective. Teachers received training and sent math activities for the students to work with at home. One activity was sent home every 1 to 2 weeks and included manipulatives for the parents to use with their

children as well as a narrative and picture strip to describe how to complete the activity. The study found that students who participated in the intervention made significantly greater gains than those in the control group at posttest.

VanDerHeyden & Burns (2009) studied 432 students in grades 2-5. They investigated whether curriculum-based measures were accurate predictors for future mathematics retention and learning of math related content. Each week the students completed a timed probe for the intervention skill and previously mastered skill. Results indicated that students who did not master early skills failed to reach mastery for future skills at much higher rates. These same students also scored lower on the remaining skills compared to their peers who attained mastery earlier in the series of tasks. This study supports the necessity of early math intervention because math builds on previous knowledge.

Sight Words

Sight words and word walls have become a popular addition to literacy programs. Sight word recognition is the ability to retrieve frequently used words from memory without decoding while reading. Sight word flashcard instruction is one option when teaching sight words. Hong and Kemp (2007) studied the difference between teaching sight words to preschoolers using activity-based intervention (ABI) and didactic instruction (DI). The activity-based intervention included a grocery shop where the target sight words were presented with the objects and a shopping list for the student to read their words and find the correct items. The didactic instruction involved explicit

demonstration of the sight words using matching, pointing, or reading words during the lesson. Four participants were included in the study and a single-subject alternating treatment design was used. The two teaching methods were compared to determine the differences in acquisition, maintenance, time efficiency, and opportunities to engage with the target words.

The results found there were “no differences between the two instructional approaches in relation to acquisition and maintenance of sight word reading for three of the four children” (Hong & Kemp, 2007, p. 89). In one case, the student read all of the sight words in the DI condition, but only read one or two words during the sessions in the ABI condition. The student was more interested in being the shop keeper than the customer in the grocery store scenario and as a result his contact with the target words decreased. There was only one activity used for the six weeks so halfway through the students began to lose interest. Also, the sample size was very small and the ability to use the target skill across different situations and with different people was not tested so the generalization of the skill is limited. The researchers concluded that teaching sight words using an activity-based intervention is effective; however it is important to keep individual students’ needs in mind when planning instruction and intervention approaches.

Educators can also teach sight words by using the copy, cover, and compare (CCC) method. This method teaches words in isolation. The students are asked to first trace the words and then write them on their own. In contrast, the picture-matching method asks students to match words to pictures. Conley et al. (2004) compared these

two different teaching methods for acquisition and maintenance of sight words with five kindergarten students. After being taught with the CCC method students correctly identified words in isolation 96% of the time. Using the picture-matching method students misidentified words. It is interesting to note that students mastered matching words to pictures at twice the rate of using the CCC method. However, word recognition with isolated words was not acquired with the picture-matching method. Limitations include the lack of follow-up data and the understanding that the assessment favored the CCC procedure.

Sight word instruction is important because Farrington-Flint, Coyne, Stiller and Heath (2008) found that students used sight word knowledge as a reading strategy. A sample of sixty-five children, ages five to seven, were asked to read forty real word items on three separate occasions. Immediately after the reading, students would verbally self-report their reading strategy. Over time, children relied more on directly retrieving words from memory than on phonological strategies. The study also found that as time progressed students relied on fewer reading strategies. Retrieval was found to be the most accurate strategy as it was the strategy used to achieve the highest level of reading performance. This study supports the importance of learning sight words as students use their knowledge of sight words to be successful readers.

Research on sight words supports learning sight words as a method to increase students' reading strategies. Activity-based instruction, didactic instruction, and copy, cover, and compare teaching methods have been proven to be effective in teaching sight

words. Further research is necessary to determine if teaching sight words using flashcards is effective.

Explicit Timing

Mathematics assessments are often focused on time constraints. Brookhart, Andolina, Zuza, & Furman (2004) worked with 41 third-grade students to predict their test scores on weekly timed tests for multiplication facts. The students predicted their score and graphed their prediction on a bar graph for the 5-minute timed test. They also graphed their results and reflected on how well their strategy worked and what strategy they would use the following week. The students' prediction accuracy and achievement scores both increased. Students articulated that flashcards were their preferred mathematics strategy to prepare for the timed assessment.

Timing students was also used in a study with reading Dolch word phrases. The phrase cards were three word phrases such as "by the house" and "has run away" from a deck of Dolch sight phrase cards. Cates and Rhymer (2006) used an ABAB withdrawal design with four elementary students to study the effects of explicit timing. Dolch three-word phrase cards were used. The teacher used a wrist watch during baseline and a stop watch during explicit timing and recorded the number of Dolch word phrases that were read correctly per minute. During explicit timing the students were told that the teacher was going to see how fast and accurately they could read. The results showed that explicit timing increased the accuracy of responses. The study did not assess generalization; the data do not indicate whether the students' increased Dolch word phrase rate will transfer

to the classroom reading passages. Another limitation was the small homogeneous sample. The study supports the idea that students are motivated by time constraints.

Tutoring

Providing students activities to complete at home, such as flashcards, increases the students' time spent on the material. One way teachers find extra time for their students to work on content is through tutoring. Working on flashcards at home is a form of tutoring. Tutoring can be done with any subject area.

Extra instructional time was found to improve early literacy skills for eight first graders with behavior problems (Harris, Oakes, Lane, & Rutherford, 2009). The students participated in a thirty-minute per day supplemental reading intervention. The intervention contained three components: phonics instruction, fluency building, and a behavioral component. Using DIBELS oral reading fluency probes and nonsense word fluency probes, the results indicated students' scores increased from the intervention. Replication is necessary to generalize the findings. This study demonstrates increased time spent on content can increase students' scores on academic assessments.

Increased time practicing also was beneficial in a study of at-risk second-grade readers. Berninger, Abbott, Vermeulen, and Fulton (2006) compared two groups of students based on time spent in a supplemental reading program. The treatment group participated in supplementary before or after school clubs to receive reading instruction. Students in the treatment group "improved significantly more in phonological decoding and state standards for reading fluency than the control group" (Berninger et al., 2006, p.

334). Both groups reading fluency improved significantly on their developmental reading assessment scores, but the treatment group improved significantly more than students in the control group. Once again, supplementary time spent on reading instruction increased students' reading assessment scores.

Fuchs et al. (2008) assessed the effects of small-group tutoring on at-risk math students' problem solving. The researchers also studied differences between validated problem-solving instruction and conventional instruction. One hundred nineteen third-grade students were randomly assigned to conventional instruction or validated problem-solving instruction. Validated problem-solving instruction was a research-based small group instructional technique. Conventional instruction was the students' regular classroom instruction. Within these conditions at-risk students received or did not receive tutoring. Results showed that students who were tutored and received validated classroom instruction achieved better than students who were tutored and received conventional classroom instruction. However, the advantage of receiving tutoring over no tutoring in either of the classroom conditions was similar. The study found that tutoring, not validated classroom instruction reduced the pervasiveness of math difficulty.

Huang, Nelson, & Nelson (2008) found that reading tutoring sessions done after school or in the evening led to significant increases in sight word vocabulary, fluency, and comprehension. The study involved two second grade students, two high school reading tutors, a parent, and an older sibling. The tutoring method utilized repeated reading and was implemented over a ten-week period. There were six, thirty-minute sessions per week. The increase in sight words was significant. Limitations included the

small number of students as well as limitations for replication. It may be difficult to find someone at school to tutor and a one-on-one format is difficult to attain. Finally, home participation can be problematic as it is difficult for researchers to fully ascertain the degree to which a program is being implemented at home.

Fuchs et al. (2009) assessed the efficacy of tutoring for third graders with difficulties in math. They focused on specific tutoring interventions. There were three conditions: control (no tutoring), tutoring on automatic retrieval, and tutoring on word problems. Tutoring lasted for 16 weeks with 3 sessions per week and a total of 20-30 minutes per session. Both tutoring conditions resulted in superior improvement compared with the control group.

Home Environment

Increasing parent involvement at home was the main focus of Bailey's (2006) study dealing with interactive homework. The study included two experimental groups and one control group. Bailey examined whether parent training was effective for implementation of second grade Interactive Homework Assignments (IHA). The parents from School One received training, the parents in School Two received IHA training packets, and the parents in School Three was the control group so did not receive the training or training packet. The experimental groups reported spending an additional twenty-three minutes per night with their children on homework. The results indicated there were significant gains made on inference tests by participants from School One. School Two made only a slight gain and School Three scored slightly lower on their

posttest. This research provides important evidence that teachers need to be trained on how to involve parents and parents need to be trained on how to help and interact with their children during completion of homework assignments.

In a Turkish study, Korkmaz (2007) surveyed teachers' perceptions about the responsibilities of parents in enhancing student learning. One hundred forty eight teachers were surveyed and 48% articulated that parents should provide a good atmosphere for their children to study at home including access to printed materials. Of the one hundred and forty eight teachers surveyed, 82% believed that parents should take responsibility for their children's education, including discussing schoolwork and encouraging children to complete homework on time. The study also found that 61% of teachers think that parents should have good communication with teachers and staff in school. Cultural limitations existed for this study as all of the teachers surveyed were residents of Turkey. This study identifies teachers' feelings about parental involvement and the importance of parents being involved in their children's education.

Reading outside of school was found to be very important when Papanastasiou (2008) studied a group of 3,001 fourth-grade students to ascertain which factors differentiate between more and less effective schools. He identified six factors that explained school differences in reading achievement, the second most important factor being reading outside of school. Papanastasiou used student questionnaires and reading literacy tests to identify the school characteristics. Reading outside of school included the student reading aloud to someone at home or reading material other than their text books. The sample size is large, but all of the students come from the country of Cyprus, which

could impact the generalization of this study. This study clearly connects reading achievement in effective schools with reading outside of school.

Topping, Kearney, McGee, & Pugh (2004) compared tutoring in math problem solving by parents at home and traditional math problems homework. Thirty students aged nine- to ten years old with below average mathematical ability were randomly assigned to the experimental or control conditions. Pretests and posttests showed the experimental group gained significantly while the control group did not. Results acknowledge that the gains could be attributed to extra mathematics time and attention.

Flashcards

Flashcards are used as an instructional tool that can be used to teach sight words. In 2008, Nist and Joseph researched the effectiveness and efficiency of flashcard drill on first-graders' word recognition, acquisition, maintenance, and generalization. Six first-graders who demonstrated reading difficulties were selected as participants in the study. Words taught were considered mastered when they were read correctly within three seconds by the student the next day. There were three conditions: traditional drill and practice, interspersal training, and incremental rehearsal. The data indicated that students read more words accurately when taught under the incremental rehearsal condition. After the conditions, students were asked which condition they preferred and they unanimously chose the traditional drill and practice method. They articulated they chose this method because it took the shortest amount of time to complete. Teachers agreed the traditional drill and practice method was the most efficient, but felt the other approaches may be

considered for students with special needs. Limitations included small sample size, effect of transference since multiple instructional methods were presented simultaneously, and use of a questionnaire rather than classroom observations.

Brasch, Williams, & McLaughlin (2008) used the direct instruction flashcard procedure with two high school students with attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). A single-subject multiple baseline design across three different sets was used to determine the effects of the direct instruction flashcards on mastery and retention of multiplication facts. The researchers demonstrated a large increase in correct responses from baseline to intervention for both students, indicating a functional relationship between mastery and retention of multiplication facts and the use of direct instruction flashcards. Implications for further research include using direct instruction flashcards as an effective technique for teaching math facts.

Summary

The studies' results demonstrate the effectiveness of sight words, flashcards, and after school instruction. However, there is a lack of data surrounding the combination of these elements. Additionally, many studies have articulated the need for parental involvement in students' success (Bailey, 2006; Korkmaz, 2007; Topping et al., 2004). Sending flashcards home with students could increase parent participation in children's academic work after school. The question that remains is "Do students achieve a greater increase in their academic assessment scores when flashcards are sent home?"

Chapter III

Methodology

Sight word instruction and math flashcards have long been used as instructional tools in the classroom. Many times teachers must find ways for students to continue their academics outside of the classroom. Research has shown that interactive homework increases parental involvement (Bailey, 2006). Teachers understand that it is hard to ascertain the instruction that takes place for students outside of school hours. Teachers must decide if it is effective to send home academic tasks to complete. Do skills students work on at home translate into the classroom? This study focused on the effect of oral reading fluency scores when sight word flashcards were sent home with students and timed math achievement scores when subtraction flashcards were sent home. To ascertain the effectiveness of sending flashcards home with students, a pretest and posttest was given.

The study examined whether sending sight word flashcards home increased students' oral reading fluency as measured by their words per minute score from DIBELS oral reading fluency probes. The researcher also wanted to determine whether sending subtraction fact flashcards home increased students' number of accurate responses on timed subtraction fact assessments.

Setting and Participants

The study took place in a suburban school district in a north central state. The research was conducted in one of the district's fifteen elementary schools. The school enrollment included 236 students, of which 83% are white, 6% Hispanic, 3% Black, 7.6% Asian, and 0.4% American Indian. School wide, 91% of the students do not have disabilities while 9% have been identified as having a disability. Based on participation in the National School Lunch Program, a common indicator of student poverty, 47.9% of the students are economically disadvantaged and 52.1% are not economically disadvantaged. Finally, 90% speak English, 6% Hmong, 3% Spanish, and 1% other. The school has been in operation since 1952 and their classroom teacher has been an educator for 25 years.

Sixteen second-grade students from a regular education classroom participated. The students were between the ages of eight and nine. The students were randomly assigned to one of two groups. One group received math subtraction fact flashcards and the other group received Dolch sight word flashcards. The group who received math subtraction fact flashcards consisted of seven girls and one boy. One student from the math flashcard group was identified as having a learning disability. The group who received Dolch sight word flashcards consisted of five girls and three boys. One student from the sight word flashcard group received speech and language therapy and another student received ELL services.

Method

This study employed a pretest-posttest true experimental design. Pretests and posttests were used to analyze the difference between the academic achievements of the students after six weeks of practicing with flashcards. Two separate statistical analyses were conducted. First, independent t-tests were used to compare the pretest scores and posttest scores in each of the subject areas for both groups. The independent t-tests were conducted using SPSS software to establish if the two groups were comparable in skill level.

The data was then assessed using a one-way analysis of covariance (ANCOVA) using SPSS software. The ANCOVA allows us to determine the influence of the pretest scores and group membership on their posttest scores. These methods provided an opportunity to ascertain the effectiveness of home flashcard work. All sixteen students received a set of ten flashcards every Monday for six weeks. Eight of the students received flashcards with subtraction math facts and the remaining eight received flashcards with Dolch sight words. The sight word list included 10 first grade Dolch sight words, 46 of the second grade Dolch sight words, and 4 of the third grade Dolch sight words. The flashcards were on unlined index cards and typed using 48 Century Gothic font. Flashcards were sent home in a plastic bag with a note reading: “Please practice these with your child at home.”

Prior to any flashcards being sent home all students were assessed using DIBELS oral reading fluency probes (see Appendix C). The students read three oral reading fluency probes for one minute; their median score was used as their pretest score. The

students were again assessed using three oral reading fluency probes at the end of the six weeks. Three probes were given to increase the reliability of scores. All students were also assessed using a 1-minute timed subtraction fact sheet (see Appendix D). Their pretest score was the number of correct responses. The students took the same timed subtraction assessment for their posttest. All of the students took both the reading and the math assessments; however, students received either the sight word flashcards or the math flashcards during the study. The design was developed to investigate the question of whether the students who received sight word flashcards increased their oral reading fluency score more than the students who did not receive sight word flashcards. This method also helped determine if the students receiving math flashcards had a greater increase in their math assessments than the students who did not receive math flashcards.

Variables

The independent variables for this experimental design are the flashcards. This includes either the sight word flashcards or the subtraction fact flashcards. One of the dependent variables is the oral reading fluency score as measured by the words per minute score using a DIBELS oral reading fluency probe. An additional dependent variable is the number of accurate responses on the 1-minute timed subtraction fact assessment.

Consent

The researcher applied for approval for the study from the UW Oshkosh Institutional Review Board for Protection of Human Participants (IRB) and the committee approved the research (see Appendix A). A consent form was sent home and parent signatures were required prior to the beginning of the study (see Appendix B).

Data Collection and Timeline

Students were assessed in both math and reading during the fall semester of the 2010-2011 school year. Students were assessed at the end of October and received their first set of flashcards on the following Monday, November 1st. They received a set of flashcards every Monday for the following five Mondays. The final assessments were given on Friday, December 10th, six weeks after the initial flashcards were sent home. An outside data collector, not their classroom teacher, came into the classroom and assessed students at the back table in the classroom.

Data Analysis

To inspect for statistical significance between the two groups of students in relation to their pretest and posttest scores, independent t-tests were conducted using SPSS software. A one-way analysis of covariance (ANCOVA) was also conducted using SPSS software to understand the effect of the pretest scores and grouping of students on the posttest scores. The independent variable was the grouping of students with or without flashcards and the pretest scores were the covariate.

Evidence from the analysis could provide evidence for several research questions. First, the data could provide evidence as to whether students sent home with sight word flashcards increased their oral reading fluency scores more than students who were not sent home with sight word flashcards. Second, the data could indicate whether students sent home with subtraction math flashcards increased their subtraction math assessment scores more than the students who were not sent home with subtraction math flashcards. Finally, the data could support whether sending flashcards home in reading and math effectively increases oral reading fluency scores and timed math assessments, respectively.

Chapter IV

Results

Research drives instruction in education. Teachers must use effective instruction to engage learners and promote improvement for the students in their classroom. This study focused on flashcard instruction for second graders. Derived from behaviorist and social cognitive theory, students received ten flashcards to practice with at home for six weeks in the areas of math or reading. The students were randomly assigned to one of two groups. One group received sight word flashcards and the other group received subtraction math fact flashcards. The students completed pretests and posttests to measure their improvement over the six weeks using the flashcards. Analysis of the tests indicated changes in scores after the six week intervention.

The study examined whether sending sight word flashcards home increased students' oral reading fluency as measured by their words per minute score from DIBELS oral reading fluency probes. The study also wanted to answer whether sending subtraction fact flashcards home increased students' number of accurate responses on timed subtraction fact assessments.

Pretest Results

During the ninth week of school students were assessed on their oral reading fluency using three DIBELS oral reading fluency probes. The students read each passage for one minute and their words per minute score was recorded. Their median score was used as their oral reading fluency pretest score. The students also were given a timed math subtraction fact assessment. The students were given one minute to complete the subtraction problems; the number of correct responses was their pretest score for math. Table 1 displays the pretest results.

Table 1. Pretest Results

	<i>n</i>	Mean	SD	<i>t</i>	Lower CI	Upper CI
Reading						
With Flashcards	8	73.25	30.26	-.116	-36.60	32.85
Without Flashcards	8	75.13	34.38	-.116	-36.60	32.85
Math						
With Flashcards	8	8.63	2.722	-.189	-4.625	3.875
Without Flashcards	8	9.00	4.899	-.189	-4.625	3.875

Independent t-tests were conducted using SPSS software to ascertain if there was a significant difference between the two groups prior to the beginning of the intervention. For the subject area of reading, the test was not significant, $t(14) = -.116$, $p = .394$. The test was also not significant for math, $t(14) = -.189$, $p = .853$. To obtain statistical significance, the p-value needs to be less than .05; therefore, neither group was statistically different than the other group in reading or in math. This illustrates that both groups of students began the intervention at similar levels of reading and subtraction

fluency. The confidence interval allows us to state with 95% certainty that student scores would fall between 36.65 WPM and 106.10 WPM on the reading pretest and between 4.00 correct answers and 12.51 correct answers on the math pretest. The confidence interval is very large for this study due to the small number of students.

Posttest Results

After completing the pretests, students were sent home with either ten subtraction flashcards or ten sight word flashcards every Monday for six weeks. Final posttests were administered at the end of the sixth week. For reading, students were again given three DIBELS oral reading fluency probes; the median score was used as their posttest reading score. In math, the students completed the same one-minute timed subtraction math fact sheet; the number of correct responses was their posttest math score. Table 2 displays the posttest results.

Table 2. Posttest Results

	<i>n</i>	Mean	SD	<i>t</i>	Lower CI	Upper CI
Reading						
With Flashcards	8	91.50	36.86	.424	-34.50	51.50
Without Flashcards	8	83.00	43.10	.424	-34.50	51.50
Math						
With Flashcards	8	13.63	5.37	.879	-2.88	6.88
Without Flashcards	8	11.63	3.54	.879	-2.88	6.88

Independent t-tests were conducted to see if there was a significant difference between the two groups after the intervention. In the subject area of reading, the test was

not significant, $t(14) = .424$, $p = .678$. The test was also not significant for math, $t(14) = .879$, $p = .394$. Again, the p-values were greater than .05 and therefore one group of students did not score statistically different than the other group in reading or math. This demonstrates that the two groups of students were still statistically similar at the end of the intervention. The confidence interval for the posttest results allows us to assert with 95% confidence that student scores would fall between 57 WPM and 143 WPM for the reading posttest and between 10.75 correct answers and 20.51 correct answers for the math posttest. Again, these confidence intervals are very large due to the small number of students.

As a next step in the analysis, individual student scores were examined to identify whether changes had occurred from pretest to posttest. Table 3 displays the changes in the students' scores based on their pretests and posttests for both math and reading. The math group who received math subtraction fact flashcards improved an average of 5.0 points compared to an average 2.6 point improvement for students who did not receive math flashcards. The reading group who received sight word flashcards improved their oral reading fluency score by an average of 18.25 words per minute, where as the group who did not receive sight word flashcards improved their score by an average of 7.88 words per minute.

Table 3. Pretest and Posttest Change

Math Tests		Reading Tests	
Students who received math subtraction fact flashcards	Students who received sight word flashcards	Students who received sight word flashcards	Students who received math subtraction fact flashcards
-1	-1	+26	+3
+4	+8	+8	+1
+8	+2	+8	+17
+7	-1	+28	+20
+3	+4	+22	-5
+7	+3	+28	+29
+4	+1	+3	0
+8	+5	+23	-2
<u>Avg.</u> +5	+2.63	+18.25	+7.88
<u>Improvement</u>			

Since there appeared to be differences in the oral reading/subtraction fluency for students, a one-way analysis of covariance (ANCOVA) was conducted using SPSS software to further investigate these differences. The ANCOVA provides a way to test whether there were statistically significant gains in oral reading fluency. In this analysis, the independent variable was the grouping variable representing whether students

received flashcards. The pretest scores served as the covariate variable. Table 4 displays the analysis of covariance for the reading posttest.

Table 4. Analysis of Covariance for Reading Posttest

Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	eta ²
Pretest Score	1	21326.27	234.21	.000***	.947
Flashcard Group	1	462.66	5.08	.042*	.281
Error	13	91.06			

* $p < .05$. *** $p < .001$

The ANCOVA model was statistically significant, $F(1,16) = 5.08$, $MS = 462.66$, $p < .05$. The p-value of .042 is less than .05; therefore the higher posttest scores for students who received flashcards compared with students who did not receive flashcards were statistically significant.

The ANCOVA allows us to determine the significance of the contribution of the pretest score as well as other factors like the independent variable of grouping over and above the effect of the covariate. The relationship between the pretest score and the posttest score was statistically significant ($p < .001$). The results demonstrate the biggest determining factor of the students' posttest score was their pretest score. The ANCOVA also allows us to determine practical significance when looking at the eta² figure. For the

reading posttest the η^2 for the grouping of students was .281 and for the pretest scores .947. Using the criteria for practical significance, both the pretest scores and the grouping of students had a large effect on the students' posttest scores. The mean score difference was 8.5 WPM. The group with flashcards scored an average of 91.5 WPM compared to 83 WPM for the group without flashcards.

A one-way analysis of covariance (ANCOVA) was also conducted for the subject area of math. The independent variable was the grouping of students with or without flashcards and the pretest scores were the covariate. Table 5 displays the analysis of covariance for the math posttest.

Table 5. Analysis of Covariance for Math Posttest

Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Pretest Score	1	160.53	16.15	.001**	.554
Flashcard Group	1	21.48	2.16	.165	.143
Error	13	9.94			

* $p < .05$, ** $p < .01$

The ANCOVA model was not statistically significant, $F(1,16) = 2.16$, $MS = 21.48$, $p = .165$. Since the p value was greater than .05, the increased scores of students who received math flashcards were not statistically significant.

However, the relationship between the pretest score and the posttest score was statistically significant ($p < .05$). This means that the students' pretest scores had a statistically significant effect on their posttest scores. The results again demonstrate the largest factor in determining the posttest achievement score was the student's pretest score. Using the η^2 to determine practical significance we see that the pretest score of .554 had a large effect on the students' posttest scores where as the flashcard grouping η^2 value of .143 shows a medium effect on the posttest scores of the students. The mean score difference was 2 points. The flashcard group scored an average of 13.63 compared to 11.63 for the group without flashcards.

Chapter V

Discussion

The purpose of this study was to ascertain the effectiveness of flashcards on oral reading fluency and math subtraction fact fluency. Based on the analysis, flashcards were found to be effective at improving oral reading fluency for second graders. The students who received reading sight word flashcards made statistically significant improvement in reading fluency compared with classmates who did not receive sight word flashcards. While not statistically significant, students who received math flashcards did improve subtraction fact fluency with an average increase of 5.0 facts per minute compared to an average increase of 2.6 facts per minute for the group who did not receive math subtraction fact flashcards. The findings from this study support earlier research that suggested extra instructional time improved students' assessment scores in both reading and math (Berninger et al., 2006; Fuchs et al., 2008; Fuchs et al., 2009; Harris et al., 2009; Huang, Nelson, & Nelson, 2008).

Flashcard Effectiveness

Flashcards have been researched as an instructional tool within the classroom (Brasch, Williams & McLaughlin, 2008; Nist & Joseph, 2008). This study took the research a step further to see if additional practice with flashcards at home would translate to higher assessment scores in the classroom. The assessment results support the

finding that flashcard practice at home translates into higher scores on the DIBELS oral reading fluency probes and the timed math subtraction fact assessments.

Teachers make instructional decisions throughout the day to enhance the learning in their classroom. Choosing to give students work to be completed at home is an instructional decision. At the same time, teachers are unable to ascertain the studying that takes place at home, and so they must select carefully the work that needs to be completed in the home environment. Previous research has shown that parents' role in enhancing student learning is beneficial in instructional acquisition (Bailey, 2006; Korkmaz, 2007; Topping et al., 2004). This previous research supported the use of flashcards as a form of interactive homework, where students are able to benefit from immediate feedback.

The DIBELS oral reading fluency probes were used as the assessment tool to ascertain whether there was a significant improvement between the two groups in their oral reading fluency scores. It is interesting to note that one of the reading probes for the final assessment accounted for thirteen of the sixteen students' lowest posttest scores. The selection was non-fiction and titled *The Wind Has a Job to Do*. This suggests that even though the students all read second grade DIBELS oral reading fluency probes, the passages may not all have been at the same reading level.

Similarly, the math assessment was not the DIBELS subtraction fluency tests and therefore the reading and math assessments were not comparable which could account for why the flashcard grouping was not significant for math. The DIBELS subtraction fluency tests would have been able to ascertain the rate which is more comparable to the

DIBELS oral reading fluency probe words per minute rate. Also, three tests would have been given for pretests and posttests, once again using the median score as the students' pretest or posttest score and thus increasing the validity of the measure.

The incompatible assessment measure is one possible explanation for why flashcards were found statistically significant for reading, but not for math. Other possible explanations include the amount of time spent in the classroom on literacy compared to math. Students participate in a 150 minute literacy block every morning compared to a 75 minute math class, thus spending twice as much time on literacy than math. Also, the classroom used for this study uses the Everyday Math curriculum which is a very cyclical curriculum that does not focus on mastery of core concepts prior to beginning new information.

In both the reading and the math analysis, the biggest determining factor for student's posttest achievement was the pretest score. This finding is logical as the student's starting point will influence where they end up. The supplemental instructional tool of flashcards did not influence the student's posttest score as much as their pretest score reflected their achievement outcome. The intervention may not have been long enough or rigorous enough to overcome student's beginning academic achievements.

Implications for Classroom Practice

The research suggests that sending home flashcards with students is beneficial for classroom learning. The students who received sight word flashcards made statistically significant gains over students who did not receive sight word flashcards. The flashcards

increased student's oral reading fluency as measured by their words per minute rate using DIBELS oral reading fluency probes.

Classroom interventions are necessary to attempt to close the achievement gap between struggling readers and their classroom peers. Sending home flashcards as a supplemental instructional strategy allows the students extra time with the material. However, given the wide array of other responsibilities and activities, students and parents may not get the opportunity to practice the flashcards outside of school hours.

Teachers also need to acknowledge the organizational commitment to making and keeping track of flashcards being sent home. In a classroom of twenty, if the teacher were to send ten flashcards home every week of the school year, this could amount to 7,200 flashcards annually. Teachers choosing to differentiate by sending home flashcards at the students' specific reading levels would need to be even more organized and would need to develop a form of record keeping to track which words had been sent home and studied for each student.

Implications for Future Research

The main purpose of this study was to ascertain both the effectiveness of flashcards and the effectiveness of sending home study materials. To better research the effectiveness of flashcards, future research should implement flashcard instruction within the daily classroom routine. The teacher would be responsible for enacting the intervention and practicing the flashcards with the students. This would allow the researcher better data, information, and accountability. The intervention would be

enacted with fidelity. To better research the effectiveness of sending home study materials, the home environment should be monitored better. Parents would need to receive a more detailed explanation on how to use the flashcards and for what amount of time they should be practicing with their student every night. It would be beneficial to have parents come to an informative meeting where the correct usage of flashcards would be modeled so parents knew how to work with their students on flashcards at home. Also, sending home a signature sheet asking for verification of the amount of minutes would increase the accountability of the intervention.

Since there was not a statistically significant change for students who received math subtraction fact flashcards, replication studies could be done to support or refute this study's findings. As mentioned before, using DIBELS subtraction fluency probes instead of the timed math assessments in future research would be a more compatible assessment tool with the DIBELS oral reading fluency probes. The research could determine if using a different assessment tool demonstrates a statistically significant gain for math flashcard students or not. Further research should examine if the effect sustains over time.

Limitations

The study had several limitations. For instance, the investigation included just one classroom, so generalizing the results is difficult. Only sixteen students were involved in the study and the small number of students impacted both the findings and the analysis. As demonstrated by the huge confidence intervals, it is hard to find statistical significance

with such small numbers of participants. An additional limitation of this research is the short time for implementation. The study took place over six weeks; so time for the intervention to be effective was limited.

There was no monitoring of whether the practice of the flashcards actually took place in the home environment, thus limiting the researcher in determining the effectiveness of the flashcards. The lack of accountability also meant the intervention may not have been enacted with fidelity. The analysis was thus impacted as it is unclear for the subject of math if the flashcards were ineffective or if the students did not practice the flashcards at home. As demonstrated by the pretest score being the biggest determining factor in the students' posttest scores, the intervention did not close the achievement gap. All of the students receiving sight word flashcards received the same flashcards. The flashcards were not differentiated and some students may have been practicing flashcards they had already mastered. The students may have made greater gains if they were given flashcards specifically tailored to their sight word identification ability.

Conclusion

During a time of instructional accountability, where teacher expectations are high and resources can feel scarce, it is important to use educational interventions that are effective. Teachers want to send home instructional materials that will aid the student in reading acquisition and math maintenance. Sight word flashcards increased student's oral reading fluency scores as measured by the DIBELS oral reading fluency probes and

subtraction math fact flashcards increased student's subtraction fact recall on timed subtraction fact assessments. Sight words and math facts are building blocks to attain higher learning. In both subjects of reading and math, initial components need to be firmly mastered before going on to higher order concepts. Flashcards were found to be effective as a supplemental instructional tool sent home to increase student learning.

APPENDIX A

IRB Approval Letter



October 4, 2010

Ms. Renee Husman
1371 Maricopa Dr.
Oshkosh, WI 54904

Dear Ms. Husman:

On behalf of the UW Oshkosh Institutional Review Board for Protection of Human Participants (IRB), I am pleased to inform you that your application has been approved for the following research: Flashcard Effectiveness for Second Graders.

Your research has been categorized as NON-EXEMPT, which means it is subject to compliance with federal regulations and University policy regarding the use of human participants as described in the IRB application material. Your protocol is approved for a period of 12 months from the date of this letter. A new application must be submitted to continue this research beyond the period of approval. In addition, you must retain all records relating to this research for at least three years after the project's completion.

Please note that it is the principal investigator's responsibility to promptly report to the IRB Committee any changes in the research project, whether these changes occur prior to undertaking, or during the research. In addition, if harm or discomfort to anyone becomes apparent during the research, the principal investigator must contact the IRB Committee Chairperson. Harm or discomfort includes, but is not limited to, adverse reactions to psychology experiments, biologics, radioisotopes, labeled drugs, or to medical or other devices used. Please contact me if you have any questions (PH# 920/424-7172 or e-mail: rauscher@uwosh.edu).

Sincerely,

Dr. Frances Rauscher
Dr. Frances Rauscher
IRB Chair

cc: Stacey Skoning
1884

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APPENDIX B

Informed Consent Document

Informed Consent Document

Project Title

Flashcard Effectiveness for Second Graders

Explanation of Procedures

Renee Husman, a graduate student at the University of Wisconsin Oshkosh, is conducting a study of the effectiveness of flashcards on classroom assessments. Every Monday for six weeks students will be sent home with flashcards. Students will take a math and reading assessment at the beginning and end of the six weeks.

Risk and Benefits

Similar measures of assessment would be conducted as a routine part of their educational experience whether they participated in the study or not. Participation will benefit educators when making instructional decisions on what to send home with students.

Safeguards

Data will be anonymous.

Freedom to Withdraw

You can withdraw from the study at any time.

Contact Information

Feel free to contact the researcher, Renee Husman, with any questions or concerns.

Third Party Referral

If you have any concerns about your treatment as a participant in this study, please call or write:

Chair, Institutional Review Board for Protection of Human Participants
c/o Grants Office
UW Oshkosh
Oshkosh, WI 54901
920-424-1415

I have received an explanation of the study and agree to my child's participation. I understand that my child's participation in this study is strictly voluntary.

Printed Name:

Signature:

Date:

APPENDIX C

Sample DIBELS Oral Reading Fluency Probe

ORF Progress Monitoring 16

Going to the Movies at Home

I love going to the movies. My favorite place to go to a movie is not at the theater, though. My family doesn't like to go to the theater. Mom says we have to plan ahead so we don't miss the first part of the movie. Dad says we have to hunt for a parking place. My big brother says if we are late we have to take the worst seats. My sister says it's too noisy.

The favorite place for my family to see movies is at home. We don't have to find a parking place. We have the best seats in the house, our big soft couch. We can even lie on the floor on pillows if we want to. We don't even have to wear shoes.

We can watch a movie anytime we want. Even our dog, Boots, can watch the movies with us. Sometimes I can invite my friend or my cousin over. The popcorn is free at home and we can have all the seconds we want.

Sometimes Mom and Dad let me pick out the movie with their help. We go to the video store and rent it for the night or the weekend. On special nights Mom and Dad let me rent two movies. Dad makes the popcorn and we all get comfortable in the family room. I love going to the movies.

Total words: _____ errors: _____ = words correct: _____

Retell:

ORF Total:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94						

Retell Total:

ORF Progress Monitoring 5

The Wind Has a Job to Do

I learned that the wind is important for more than flying kites or making our wind chime make music. Without the wind, our world wouldn't have any people, food, or animals. Wind moves the heat from the sun all around the planet. Without the wind, about half of the earth would be too hot for any living thing. Most of the rest of the earth would be too cold. In fact, most of our country would be under ice.

Wind is useful to all living things. It brings moisture up from the oceans into the air. Then the wind blows the moisture around. The moisture falls as rain, dew, or snow and ice.

Many plants and trees depend on the wind. The wind helps them spread their seeds to new places. Wind also blows pollen around so trees, grass, and grains can ripen. Without the wind, farmers couldn't grow corn or wheat. Bees help the wind spread pollen. Their job is to fly from blossom to blossom with pollen on their feet and wings.

You can see for yourself how the wind spreads seeds. The next time you see a yellow dandelion that has turned into a white puffball, blow it. Or, if you find a maple tree seed with wings that looks like a helicopter, throw it. You'll see all of the seeds go flying and you will be helping the wind do its job.

Total words: _____ errors: _____ = words correct: _____

Retell:

ORF Total:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94						

Retell Total:

APPENDIX D

Timed Math Subtraction Fact Test

Name: _____

Subtraction Basic Facts 0 - 9

SPEED SUBTRACTION

$\begin{array}{r} 7 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 6 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 1 \\ \hline \end{array}$
$\begin{array}{r} 4 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ - 1 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 6 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ - 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 6 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 5 \\ \hline \end{array}$
$\begin{array}{r} 4 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 1 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 2 \\ \hline \end{array}$
$\begin{array}{r} 7 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 6 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ - 7 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 3 \\ \hline \end{array}$
$\begin{array}{r} 6 \\ - 1 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 0 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ - 8 \\ \hline \end{array}$	$\begin{array}{r} 0 \\ - 0 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ - 3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 6 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ - 1 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ - 2 \\ \hline \end{array}$
$\begin{array}{r} 5 \\ - 2 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ - 1 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ - 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ - 7 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ - 5 \\ \hline \end{array}$

Time: _____ Score: _____

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