Dysgraphia: How It Affects A Student's Performance and What Can Be Done About It

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Abstract

The purpose of this study was to apply two techniques, drill activities and fine motor activities, to find whether they help improve the handwriting of a student with dysgraphia. This action research used an ABAB single subject design to find which technique worked better over an eight-week period. The results were inconclusive on which technique worked better. However, the combination of both improved the subject's handwriting and increased his score by 50%. Therefore, this study suggests that using both techniques can help improve the problems associated with dysgraphia, especially in the area of handwriting.

Keywords
handwriting, dysgraphia

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"*The ability to write is truly one of the most important factors in the academic process*."
Timothy Dikowski

Introduction

Writing is a skill highly valued in our society, even in a time of computers and technology. In the past, handwriting was prized because it was a primary form of communication; people needed to get notes to others that were legible (Ediger, 2002). Now that typewriters and computers are used to communicate between people, handwriting has become a rare form of communication. However, handwriting is still a critical skill and needed for many reasons that people might not readily recognize. Writing notes, recipes, prescriptions, messages, checks, and filling out applications are among a few reasons why the developing and teaching of handwriting skills needs to be continued in the schools and at home. Additionally, research has shown that handwriting is causally related to writing, and that explicit and supplemental instruction of handwriting are important elements in an elementary program to prevent writing difficulties (Graham, Harris, & Fink, 2000).

Unfortunately, many students struggle in school because of dysgraphia, a problem with expressing thoughts in written form (Richards, 1999). Dysgraphia can have a negative impact on the success of a child in school. Many children with dysgraphia are not able to keep up with written assignments, cannot put coherent thoughts together on paper, or write legibly. This disability needs to be recognized and remediated before it creates long lasting negative consequences for the child.

Literature review

The term Dysgraphia is not widely used in schools. One reason is that handwriting difficulties can be included under the label of learning disabilities. Another reason is that there is no consensus in the field on one definition or identification process for dysgraphia. Richards (1999) defines dysgraphia as a problem with expressing thoughts in a written form. Meese (2001) describes dysgraphia as handwriting problems, specifically, a partial inability to remember how to make certain alphabet or arithmetic symbols. For the purpose of this paper, we are using the latter definition, and will be focusing on the mechanics of handwriting.

The treatment of dysgraphia can be elusive. Many instructional strategies have been proposed to help students with dysgraphia, but only some have empirical evidence to support them.

Dysgraphia

Teachers should be aware of the signs and symptoms of dysgraphia and not dismiss a child as simply having sloppy handwriting. If a teacher starts to see a trend of illegible writing, it is appropriate for them to question whether this child has dysgraphia. Teachers should note which parts of the writing process are most difficult for the child. While dysgraphia often occurs along with another disability, many students with dysgraphia can exhibit high academic achievements in other subjects (Richards, 1999). Figure 1 shows an example of the handwriting of a second grade student with dysgraphia, and a typical second grader's handwriting. The characteristics of dysgraphia are varied and students can exhibit any one or more of these characteristics (see box, "Characteristics of Dysgraphia").

Figure 1
An example of a second grade student's handwriting with dysgraphia.

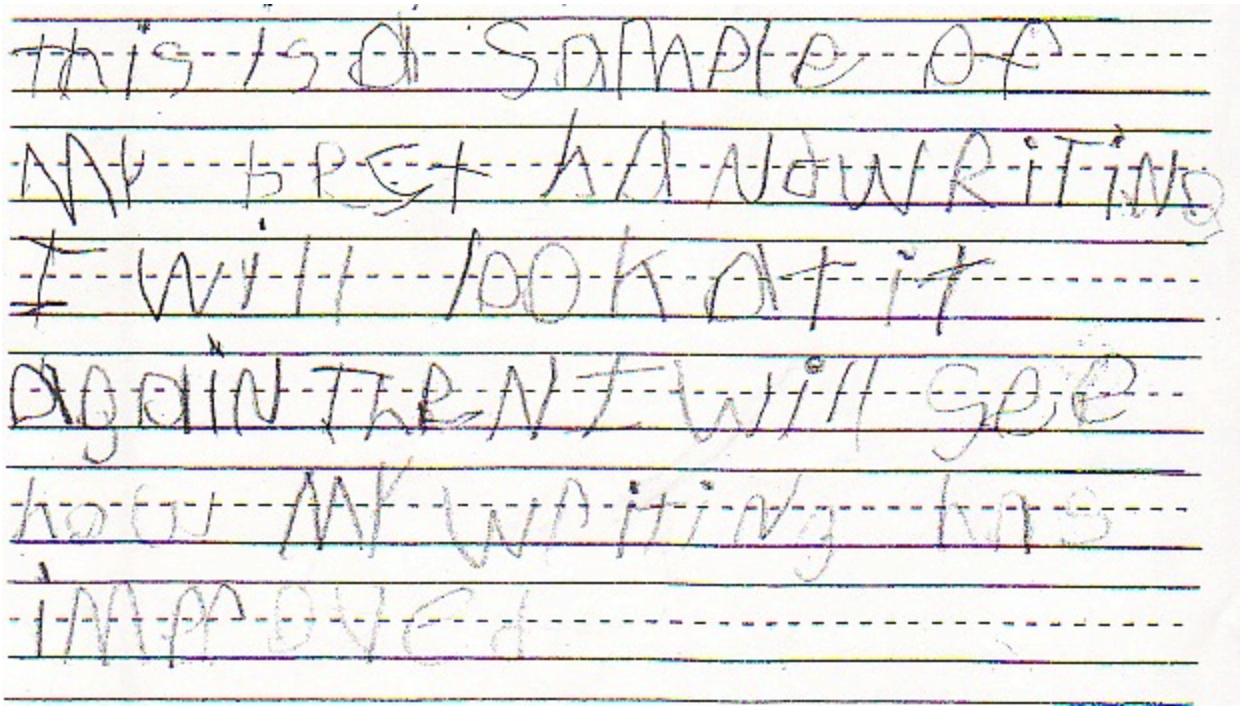
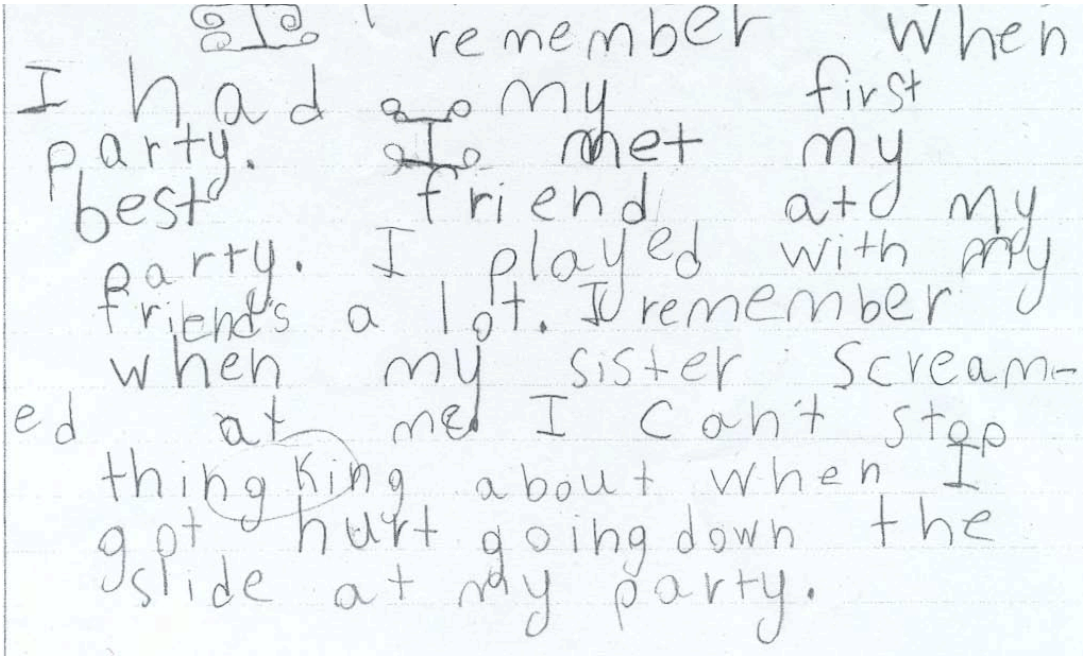


Figure 2
A second grade student's handwriting who does not have a disability.



Characteristics of Dysgraphia

Cramped fingers on writing tool
Odd wrist, body, and paper positions
Excessive erasures
Mixture of upper- and lowercase letters
Mixture of printed and cursive letters
Inconsistent letter formations and slant
Irregular letter sizes and shapes
Unfinished cursive letters
Misuse of line and margin
Poor organization on the page
Inefficient speed in copying
Decreased speed of writing
General illegibility
Inattentiveness about details when writing
Frequent need of verbal cues and use of sub-vocalizing
Heavy reliance on vision to monitor what the hand is doing during writing
Slow implementation of verbal directions that involve sequencing and planning
(Richards, 1998, p. 15)

Feifer (2001) believes that dysgraphia can be categorized into four subtypes. The first subtype is phonological dysgraphia, that is "writing and spelling disturbances in which the spelling of unfamiliar words, nonwords, and phonetically irregular words are impaired" (p. 1). These students tend to have trouble spelling by sounds and rely on the visual aspect of letters; therefore, because spelling is an auditory task, they will have trouble with spelling tests. The second subtype is surface dysgraphia where students have trouble with orthographic representations of words, which makes the student rely too heavily on sound patterns; the opposite of phonological dysgraphia. Mixed dysgraphia is the third subtype of dysgraphia. This type refers to students having trouble with mixing up letter formations and having trouble with spelling tasks, a combination of the first two types. Recalling letter formations is hard for these students to do because there are so many instructions or rules that they get confused and; therefore, have inconsistent spellings of words. Finally, semantic/syntactic dysgraphia is a grammatical problem in which students have difficulty with how words can be joined to make complete and comprehensive phrases.

In addition, children with dysgraphia usually have some type of problem with automaticity that interferes with the retrieval of letter formation (Richards, 1999). The concentration on how to form the letter overwhelms the child to a degree that the letter is written poorly. Incorrect letter or word formation can also lead to exceeding the margins or lines. Letter formation is automatic for most students after initial skill attainment. When letter formation is automatic, students can concentrate on spelling, grammar, sentence structure, and other aspects of written language. However, for many students with dysgraphia, letter formation is a cognitive task which leaves little mental capacity to devote to these other aspects. Children with dysgraphia can become frustrated, leading to low motivation to use and practice written language.

Students concentrating too hard on letter formation may develop problems with gripping the pencil (Richards, 1999). A list of

characteristics of a poor pencil grip can be seen in the box below. Gripping the pencil a "wrong" way can interfere with performance because the child focuses on holding the pencil instead of writing the letter. Richards (1998) suggested a proper pencil grip that included placing the fingers about one inch above the tip of the pencil, maintaining a 45 degree angle with the paper, and using moderate pressure. Teachers should be aware of a child holding the pencil in an improper way and aim to correct the grip.

Characteristics of Poor Pencil Grip

Inconsistent letter formations and slant
Irregular letter sizes and shapes
Misuse of line and margin
Poor organization on the page
Decreased speed of writing
General illegibility
Frequent need for verbal cues and use of sub-vocalizing
(Richards, 1999, p. 66)

In addition to pencil grip and automaticity, retaining information in the working memory is not something most students have trouble mastering. Children with dysgraphia, however, often exhibit trouble with working memory because so much of their cognitive energy is put into the mechanical level of writing letters or words (Richards, 1999). It is similar to the seven plus or minus two phenomenon; the hypothesis that claims one can only hold seven items in memory plus or minus two. For example, a social security number is nine items long. However, by clustering the nine digits into three groups, most people can easily recall their social security number. Children already have a limited number of spaces to hold information in memory and therefore have a harder time remembering many pieces of information. Dysgraphia can magnify this problem. For children with dysgraphia, recalling the letter needed and how to form it takes up at least two spaces. Trying to process all of these formations and letters can cause "processing fatigue" (Richards, 1999). "Motor fatigue" can also occur when the student has poor motor skills, which leads to a decreased automaticity of movements for handwriting (Richards, 1999).

Smits-Engelsman and Van Galen (1997) conducted a study trying to find the cause of dysgraphia in children. They found that poor writers possess either an inherently noisy neuromotor system or exhibit dysfunction in controlling the inherently noisy neuromotor system. Furthermore, their research supported that the failure to control spatial accuracy was the most significant discriminating feature between poor writers and good writers. In other words, writers with dysgraphia fail to obey spatial constraints, exhibit more variability in letter size and shape, and lack consistency in letter formation. This study did not support the opinion that dysgraphia is a temporary developmental delay for children. While this study did not involve an intervention, the researchers theorized that dysgraphia may be sensitive to training that addresses better movement strategies.

Strategies to Use

There are two different approaches to address dysgraphia (Richards, 1999). The first is using systematic techniques that improve functioning; this is referred to as a remedial treatment. Remedial treatments are those that seek to correct handwriting either through direct instruction of handwriting or a fine motor program. The second strategy is using bypass strategies, such as technology, to find a way around the handwriting difficulties. Compensatory techniques or ways to alleviate the problem would be bypass strategies. For

the purpose of this strategy review, only remedial treatments were included.

One such remedial treatment is using drill and practice. Ediger (2002) suggested that the teacher should provide a clear example of good handwriting and then the children should practice and drill using the teacher's model. People with dysgraphia struggle with the display of letters because often the letter that is asked for in the brain is not the letter that is retrieved and produced (Richards, 1998). Repetitive practice, along with correct position and pencil grip can help with this process.

Another remedial treatment that has empirical evidence is building fine motor skills. Using drills that build the muscles used for fine motor activities can help improve hand functioning, which can lead to better handwriting (Berry, 1999). Keller (2001) used such activities in a club she created to help the handwriting of students with dysgraphia.

Activities of a Handwriting Club

Rub hands together
Squeeze tennis balls
Rub hands in circles on the carpet
Play with Wikki Stix
Build with small Lego blocks
String small beads
Roll clay between fingers
"Walk" fingers up and down the pencil
(Keller, 2001, p. 11)

Dikowski (1994) studied children's visual-motor skills related to handwriting. He found schools offered little help to students with handwriting or visual-motor disabilities. He observed that when children had visual-motor integration problems this led to problems with hand-eye coordination. Since the brain, hand, and eye all work together to perform anything written, Dikowski believes that it is important to work on both fine and gross motor strengthening to increase the ability to stabilize the hand when writing.

Orton (1937) found that children with dysgraphia tend not to advance as quickly as other children in school and their handwritten work suffers because of its illegibility. He found that incorrect paper position could lead to cramped fingers, which can directly lead to poor handwriting. He suggests that one correct the paper position and the slant of letters for better handwriting. Orton also found that some students focus on their hand rather than on the formation of letters. Orton blindfolded some students to see the effect on their handwriting. He found that for students who overly focused on their hand, being blindfolded helped them concentrate on the feel of formation and thus, on the legibility of the letters.

Methods

The purpose of this action research was to apply two techniques, drill activities and fine motor activities, to find whether they would help improve the handwriting of a student with dysgraphia. The intervention took a total of eight weeks to complete. The action research used an ABAB single subject design to find which technique worked better for this student.

Setting

Sam (name changed for confidentiality) and I worked one-on-one in a familiar environment, the second grade classroom where Sam was a current student. Our sessions were after school. During the school day, Sam had preferential seating near the teacher so he could be helped or reached quickly if a problem arose.

Participant

Sam was a second grade student who was eager to please and a friendly child. Sam was identified as Other Health Impaired and qualified for Special Education services in 2003 (second grade) under the Individuals with Disabilities Education Act. According to Sam's IEP, he was strong in listening comprehension and in mathematics. He had weaknesses in reading, comprehension, and writing. Sam's poor motor skills negatively affected his written assignments. Furthermore, Sam's work was often inconsistent and he displayed poor attention to task. Sam also exhibited the following characteristics: excessive erasures, mix of upper and lowercase letters, inconsistent letter forms, irregular sizes and shapes, misuse of line and margin, poor organization on the page, general illegibility, inattentiveness about details when writing, and slow implementation of verbal directions. These characteristics are consistent with surface dysgraphia.

Procedures

Sam and I met after school for a half hour, five days per week, for eight weeks to work on his handwriting. For the first two weeks Sam was given direct instruction and intensive practice in handwriting. The next two weeks he used fine motor activities to increase his hand muscles. The third two weeks returned to drill/practice and the last two weeks were spent on continued development of Sam's fine motor activities. I was looking to see if one type of remedial intervention was more effective than the other. In other words, I was looking to see if Sam made greater gains during one type of intervention. I was interested in determining if one intervention worked better so that Sam's learning could be optimized. Students who lag behind academically need to make greater gains in less time in order to catch up to their peers. Using instructional strategies which are the most effective towards reaching this goal should be used over other strategies.

Phase 1 and 3. Phases one and three were exactly alike. Each phase lasted two weeks and used the drill/practice technique. Each day in these two-week periods, Sam and I sat down at a desk and I gave him specially formatted paper to practice his letters. A different set of letters were given to him each day consisting of three consecutive letters beginning with A. I demonstrated how to write the letters using the same paper and verbally stating how to write the letters using Richards' list of Manuscript Verbal Cues (Richards, 1999). Each day his work was graded using a rubric and then charted to see Sam's progress on a writing piece used throughout the eight weeks. This writing piece (probe) was given to him with five minutes remaining in our half hour time frame. The probe consisted of all the letters in the alphabet and was 15 words long.

Probe Sentence:
(This sentence was used as a probe after each intervention session. The probe uses each letter of the alphabet at least once and three capital letters.)

My crazy friend Quint likes baking in his pajamas with his pet ox named Zovi.

Phase 2 and 4. Phases two and four used fine motor activities to increase his handwriting ability. These activities varied between using scissors, finger painting, gluing and cutting, and sewing and weaving. In the last five minutes of the session, Sam was

given the same writing piece (probe) as in phase one to copy as much as he could. His writing piece was graded against the same rubric used in phases one and three.

Data collection

Every day a copy of his work was taken and Sam's progress was charted against a rubric (see Rubric below). Anecdotal notes were also taken to note any changes or comments that he made in reference to his writing. At the end of the eight weeks of after-school help, I compared Sam's beginning and end pieces and noted if there was a difference in progress made between the four phases. Drilling was to help his hand get used to writing enough so that it would hopefully become more fluent and automatic. The fine motor exercises were hopefully going to strengthen his hand and arm muscles to help him feel comfortable writing and for him to have more control over how the pencil moved.

Figure 3. Rubric

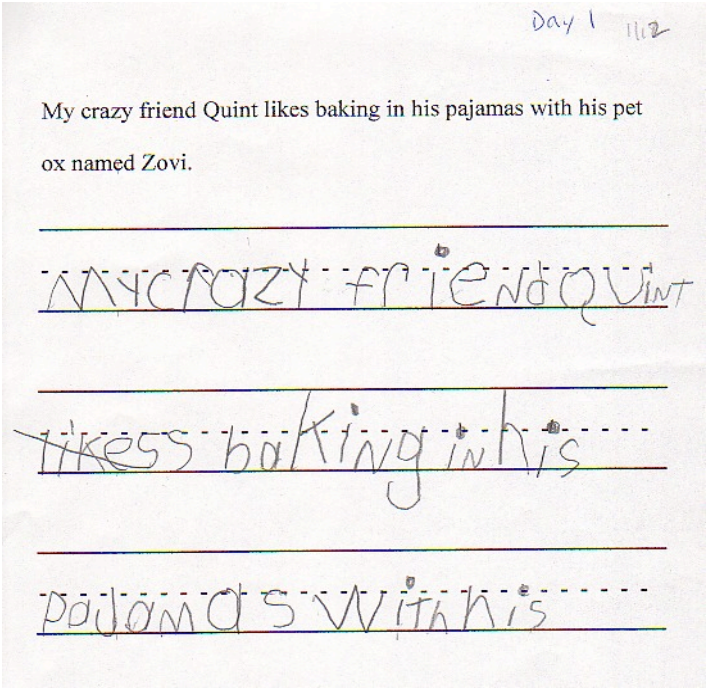
Standards	**Exceeds (3)**	**Meets (2)**	**Does Not Meet (1)**	**Score**
Letters are mostly on the lines.	Letters are always on the lines.	Letters are mostly on the lines.	Letters are sometimes on the lines.	
Letters mostly start at the top or middle.	Letters always start at the top or middle.	Letters mostly start at the top or middle.	Letters sometimes start at the top or middle.	
Usually uses capital letters appropriately.	Always uses capital letters appropriately.	Usually uses capital letters appropriately.	Sometimes uses capital letters appropriately.	
Letters are mostly formed in the correct manner.	Each letter is formed correctly every time.	Letters are usually formed in the correct manner (80%).	50% of the letters are formed in the correct manner.	

Rubric based on: (Clarke, 2004; Indian Prairie School District, 2004)

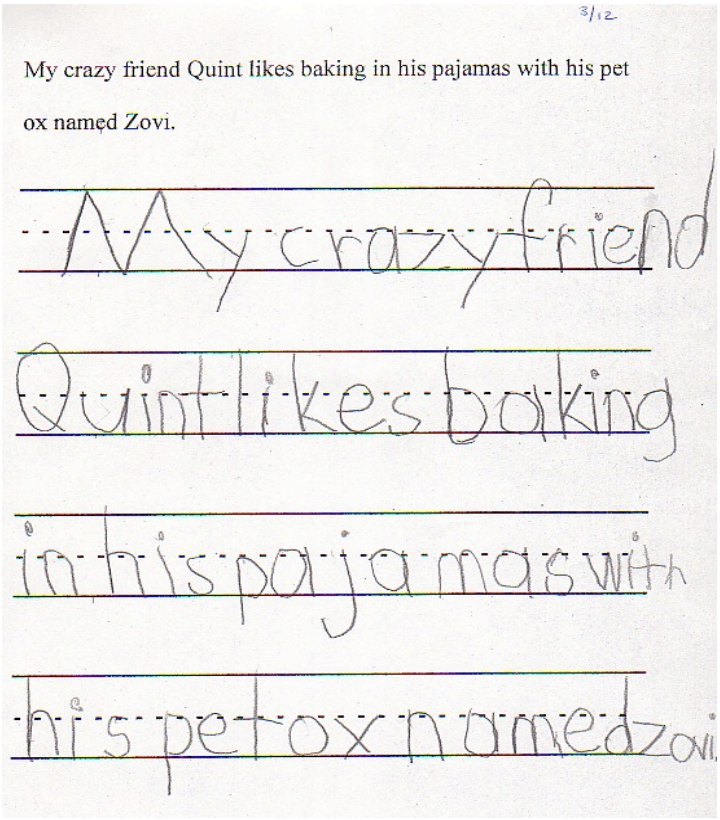
Results

Sam's overall performance improved drastically over the eight weeks of training (see figure 2). However, I was not able to see a difference in gains between phases, making it impossible to determine if one approach was more effective than the other. A possible explanation for this is that during the drill trials, I was teaching him how to write each letter. During the fine motor trials, I was only focusing on strengthening Sam's hand muscles to control his pencil and grip better. An

Figure 2.
A sample of Sam's handwriting on day 1.



Sam's handwriting on the last day of intervention.



other possibility is that the phases were too short or that the rubric was not sensitive enough to small changes.

The rubric created was unique to Sam's handwriting strengths and weaknesses. I scored his performance on four things: letter formation, letters on the lines, letters start at the top or middle, and correct capital usage. Letter formation is critical and only the letters that I had taught him were scored using the rubric. Other letters were not taken into account because he had not yet been taught how to write them. Letters also had to be on the lines, not going below the bottom line or going above the top line. In addition, letters needed to be initiated in the proper placement between the lines. Capitals were to be used correctly; there were three in the sentence he had to write.

Sam's beginning performance was an average of 4.88 for these four areas. The second two weeks he scored 6.82, during his third two weeks was 9.55, and the last two weeks Sam scored 11.5. The increase from the first week to the last week was 6.62 points on a 12-point scale. These results show that he more than doubled his handwriting ability score over the eight weeks.

Discussion

The need to have clear, neat handwriting is of utmost importance in today's society. Communicating ideas, writing and signing checks, signing legal agreements, and other daily activities need clear handwriting that is legible by others. One may argue that technology can replace the need for handwriting. For example, paying bills is now available online. However, computers cannot be relied on for everything. One factor to consider is the technology gap. There are many homes and work places that do not have computers, and there are many other instances in daily life when a computer is not readily available.

Furthermore, as young children learn the writing process and how to formulate thoughts in writing, the use of technology may not be practical. The physical act of writing down one's thoughts is part of the cognitive process of learning to communicate through writing. A young child who has not yet learned these skills would not be able to transfer the skills to a word processing program.

The outcome of this study provided evidence that using drill and fine motor activities together greatly improved the handwriting of a second grader with dysgraphia. While Sam showed improvement over the eight weeks during the after school sessions, he had a hard time generalizing what he learned to his class work. His written work improved, but Sam continued to make a few letters the same way he did before the intervention. Over time, it is my hope that he will continue to generalize and remember how to write each letter.

There were some limitations to this action research. One limitation was that the study used only one participant. The purpose of action research is to identify a problem within a classroom and address the problem within that specific environment. While this study met this purpose of action research, the findings are not generalizable. However, other teachers can learn from this case study both in terms of knowledge regarding dysgraphia and options for intervention. Teachers who work with children struggling with handwriting can gain information and techniques to help guide handwriting remediation, even if the child is not diagnosed with a writing disability. Students in all elementary grades could benefit from structured instruction on handwriting and how to form letters.

Automaticity of handwriting skills should be a part of any effective writing instruction program (Graham & Harris, 1988).

Another limitation was Sam's inability to generalize to the extent that I would have desired. While a draw back to an after school program is the acquiring of a skill in a different environment from where the skill will be used, the advantage is the one-on-one intensive, remedial intervention tailored to the student's specific needs. In future interventions, I would integrate a component into the classroom to bridge the gap from the after school environment to the school day classroom.

Future research ideas would be to incorporate these ideas and extend the program to larger groups. It may also be possible to integrate some of the handwriting intervention methods into the classroom.

In conclusion, drill activities and fine motor activities were effective in helping correct the handwriting of a second grade boy with dysgraphia. The combination of the two interventions increased Sam's handwriting legibility, which in turn, I hope, will increase his ability to function successfully in the classroom.

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