EFFECT OF ASSISTIVE TECHNOLOGY USE ON THE WRITING PERFORMANCE OF STUDENTS WITH DEVELOPMENTAL DISABILITIES

By

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ABSTRACT

The purpose of this study was to determine the effect of the use of assistive writing technology specifically the Co-writer program for students with developmental disabilities. Students selected for this study were in the 10-12th grades in a self contained function skills classroom. All students are eligible for special education services and are MAP-A eligible. Writing skills were measured using the AIMS web curriculum based measurements which take the form of timed writing probes. This allowed for easy standardized samples. This study found that students made significant gains in both writing speed as well as the mechanics of writing when using the co-writer software.
INTRODUCTION

Background, Issues and Concerns

Strong writing skills are important to not only academic success but also to adult independence and employability.

Peterson-Karlan, Hourcade and Parette (2008) stated “For students with physical and educational disabilities, stronger writing skills offer a variety of benefits. These include (a) more successful academic inclusion outcomes, (b) transfer of improved literacy skills to reading, and (c) greater pass rates on high stakes academic testing. As more and more careers require greater levels of literacy skills, students with disabilities who are unable to write effectively may find themselves increasingly minimized in these adult roles.” p. 14

Students with significant cognitive and developmental disabilities often struggle with writing. Their writing skills can be impaired in multiple ways. These students frequently have difficulty with generating ideas or putting the general thoughts into words. The student who struggle with low working memory which means they may struggle to come up with the next word in a sentence. The physical act of writing by hand may be difficult for students with physical impairments, dysgraphia, or special perceptual issues. Spelling and grammar may also negatively impact student writing.

Technology has fundamentally altered the process of writing. General word processing technology has been shown to have a beneficial impact on the writing of students. A study by Montgomery and Marks (2006) found “Documents students produce with word processors tend (a) to be longer in length, (b) contain fewer mechanical errors, and (c) to be better overall quality than handwritten compositions” (p. 34). They also reported that teachers see an improvement in student engagement and time on task.
Assistive technology was developed to meet the unique needs of students with disabilities. A new branch of technology has been developed. Assistive Technology can be defined as “Technological scaffolding provides a compensatory function in that it permits them to perform at higher levels of proficiency than would otherwise be possible (Perterson-Karlan & Parette, 2007 p.4). IDEA requires that IEP teams consider whether the use of assistive technology could benefit students during IEP team meetings (Peterson-Karlan, Hourcade, & Parette, 2008). Since writing has been shown to be such an integral part of both academic and vocational success, part of the AT consideration should be technology designed to assist students with the processes of writing.

Practice under Investigation

This study designed to investigate the use of assistive writing technology in a specific population of special education students.

School Policy to be Informed by Study

This study is designed to provide information to IEP teams making decisions about if this assistive technology is appropriate for students who have diagnosis of developmental disabilities or cognitive impairments. Data would help teams to understand if the technology is likely to provide a benefit to a student.

Conceptual Underpinning

Assistive writing software is thought to enhance student achievement.

Statement of the Problem

This study investigates the question of “How does the use of assistive writing software with students diagnosed with developmental disabilities effect writing performance?” Many IEP team members assume that writing related assistive technology is only helpful for students who are high functioning or who are mainstreamed. However little data is available to make a
decision about the effectiveness of the use of programs like Co-Writer with students who have lower skill levels and spend more of their academic time in a special education setting. This study was conducted to gain preliminary data on the effect of the introduction of Co-Writer an assistive writing program on the writing performance of students with developmental disabilities in a self-contained setting. IEP teams are increasingly trying to use evidenced based decision making in the selection of instruction and materials including assistive technology. This study aims to provide new data on the effectiveness of Assistive Writing technology for students with developmental disabilities.

Purpose of Study

The purpose of the study is to find out how well this technology is for students with more significant disabilities.

Research Questions

Do students with developmental disabilities show an improvement in writing speed and the use of correct mechanics of writing when they use the Co-writer program?

What is the effect on the number of total words written and on the number of correct writing sequences on a timed writing probe?

The independent variable in this study is the use of Co-writer. The dependent variables are the total words written and the correct writing sequences written on a timed writing probe.

Null Hypotheses

- The number of total words written on a timed probe will decrease or remain the same with the use of co-writer.

- The number of correct writing sequences on a timed probe will decrease or remain the same with the use of co-writer.
Anticipated Benefits of Study

The aim of this study is to generate data about the effectiveness of the Co-writer Assistive Technology when used by students with developmental disabilities. This would increase the data upon which to make decisions to make IEP team and assistive technology decisions.
REVIEW OF LITERATURE

A though review of literature in this area would include a survey of the professional literature on the importance of writing to overall school success of students. The review would examine the definition of assistive technology and the legal mandates for consideration of assistive technology. An overview of the types of assistive technology available in the area of writing important to understanding the subject.

Reading and math computation have been the main focus of school reform and yearly high stakes testing. In this testing climate, writing seems to have been overshadowed by the laser focus on math and reading scores. However, this review of literature shows that writing is integral to the success of all students. Dave Edyburn has said “The importance of learning to express one’s self through writing has long been considered hallmark of the educated citizen” (Edyburn, 2003 p. 60) National Commission on Writing identified a variety of benefits from good writing skills including success in inclusive settings, improved reading skills, improved test scores, and improved career outlook (Peterson-Karlan, Hourcade, & Parette, 2008).

For people regardless of disabilities technology has transformed the process of writing. The use of word processing programs has been shown to increase the length of student writing, reduce mechanical errors and improve writing quality as compared to writing done by hand (Montgomery, 2006). This effect is even larger for students with low achievement scores (MacArthur, 2009).

Assistive Technology is the use of technology to scaffold and meet the needs of persons disabilities. Assistive technology can aid them in completing tasks they can not accomplish without assistance. Assistive technology can also help people with disabilities to feel less dependent on other people in order to accomplish tasks.

Technological scaffolding provides a compensatory function in that it permits them to perform at higher levels of proficiency than would otherwise be possible (Peterson-Karlan & Parette, in press), especially when instructional or remedial approaches have failed to develop the skills
required by the student are best used to support students who struggle to write (i.e., those who perform below the basic level of proficiency) and to provide “scaffolding” for basic writing skills.

IDEA or the Individuals with Disabilities Education Act requires IEP teams to “consider the potential educational contributions of assistive technology when developing individual education programs” (Peterson-Karlan, Hourcade, & Parette, 2008 p. 26). This would include consideration of programs to assist students who struggle with writing.

There are many types of assistive technology developed to assist students with writing. Include word processing, spell checkers, word prediction, speech recognition, and text-to-speech screen review (Berninger & Amtmann, 2003). There programs can be used to support all phases of the writing process. At the beginning stages of the writing process, there are programs that support the development and organization of ideas. This technology helps students to organize their thoughts in the prewriting stage of the writing process.

In the drafting stage, many students with disabilities struggle with having very slow writing speed. This issue can be either due to physical or educational disabilities. Word prediction software works by generating a list of suggestions or choices from the first letter or two typed. The student can then click on the appropriate word without typing in all of the letters. This increases the speed of writing. Spelling the words becomes easier and requires less cognitive load on the student. This also helps students with physical disabilities by decreasing the number of key strokes (Montgomery, 2006). Additionally simply using a computer can reduce the issue of handwriting difficulties that many students struggle with increase the legibility and speed of the students writing. For students who are not able to input text though a keyboard there is speech to text software. This software is often referred to as “You talk it types.” These programs can provide a way to access computers and increase writing success.

To assist students with the revising, voice output technology has been developed. This technology takes the text written by students and translates that into audio output. This means
the computer will in essence read the student’s writing back to them. According to Montgomery and Marks, research shows that “Students with learning disabilities can identify more errors in written text that is read to them than if they were to read the text themselves” (Montgomery, 2006). p. 33 By reading aloud the text assistive writing programs aim to allow students the benefits of hearing text read to them in an independent way. Caverly states that audio feedback is useful for “fostering metacognition and allowing students with disabilities to monitor their composing” (Caverly, 2008) p. 36.

Spelling and grammar check functions are also frequently a part of assistive writing programs. This can have a very positive effect on for students with learning disabilities. One study found a 28% increase in the errors corrected by middle school LD students when using spell check (MacArthur, 2009).

Research conducted in the area of Assistive Technology has shown that a minimum level of skill is required before students can make use of a writing program. The main prerequisite is either an ability to type or activate a switch. If a student cannot use this type of physical method of input then they must have speech (MacArthur, 2009). To make good use of predictive text functions students must be identify the first letter of a word and to recognize the word on sight or when read aloud from a list (Caverly, 2008).

Many of the programs being developed and used currently combine a number of these elements into one assistive writing program. These programs may help organize thoughts, have a predictive text feature and read text aloud after a student’s finishes writing. Putting all of the features into one program increases the likelihood that a program will meet the needs of many different students.

Co-writer is an assistive technology program for writing. It was developed by Don Johnston Assistive Technology inc.. The program combines many of the functions discussed previously including organizational tools, spelling and grammar check, word prediction, and audio output (Caverly, 2008). Co-writer was the program used in this study.
While assistive writing programs hold a lot of potential for meeting students needs, more data is needed to assess who could best benefit from this technology Perterson-Karlan & Parette, 2007). Not enough data is available to make evidence based decisions around writing technology. Part of the reason that adequate data is not available is that there is a lack of standardized procedures for the measurement of writing performance. Edyburn states, “Unfortunately, there is a considerable void in the literature regarding the standardization of data collection procedures, timelines, and instruments for measuring assistive technology writing outcomes” (2003 p. 62).
RESEARCH METHODS

Research Questions

Is there a difference in the total number of words written by students prior to the use of Co-writer compared to after the use of Co-writer?

Research Design

A pre-experimental, post-post research design was used to collect data for this investigative project. The t-Test was used to determine significance at the 0.10 Alpha level to challenge the null hypothesis. This study will compare writing performance of student prior to use of assistive writing technology and after the use of the technology for several months.

The independent variable in this study was the use of the Co-Writer assistive technology program. Some students were selected to be introduced to the program and to use it for a period of one year. The remaining students were not using any assistive technology.

The dependent variable in this study was the change in the writing scores over the period of the study. These scores were expected to be effected by the use of the Co Writer.

Null Hypotheses is that there is no difference in the total number of words by students prior to the use of Co-writer compared to after the use of Co-writer.

Study Group Description

Data were collected from a high school self contained special education teacher’s CBM data collected to assist in IEP team decisions. The data is collected during a timed writing probe. Data on both writing speed or the total number of words written (TWW) and the correct use of mechanics or the correct writing sequences (CWS) was collected.

Self-contained special education students are assessed at twice each year. The assessments are used to report student’s performance to the IEP team. This study used the raw scores in writing to compare change in student performance for one year period based on the use of Co-Writer assisted writing program or not. The data was collected from a population of sixteen students.
with developmental disabilities and who have been determent to meet the Missouri MAP-A eligibility criteria.

Data were collected from the curriculum-based measurements conducted in a self-contained special education class. Total words written (how many words contained in the sample) and correct writing sequences (which measure writing mechanics) will be investigated.

Data Collection and Instrumentation

Each year students are assessed twice to monitor progress in all of core academic areas and to give a moving snapshot of a student’s academic achievement. The writing CBM or probe scores of students using Co-Writer and those who had not been introduced to the program were used to complete the comparison. The data for this research project will be collected though unidentified students TWW and CWS rates obtained from special education teacher.

Statistical Analysis Methods

The data in this study was analyzed using a computer program called ASP- A Statistical Program. This program was used to conduct a T-test to analyze the data.
FINDINGS

The raw student data for the change in the number of Total Words Written for each student was used as shown in Table 1. The raw student data for the change in the number of correct writing sequences for each student was used as shown in Table 2.

An analysis of the survey results was conducted using ASP software. As shown in Table 1, a T-Test was performed to determine the differences between the use of Co-Writer and the average change in TWW.

**Table 1**

<table>
<thead>
<tr>
<th>Source</th>
<th>Mean</th>
<th>Mean D</th>
<th>t-Test</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Words Written</td>
<td>-6.375</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Co-writer</td>
<td>11.875</td>
<td>-18.25</td>
<td>-3.34721</td>
<td>14</td>
<td>0.00479053</td>
</tr>
</tbody>
</table>

Note: Significant when p<=0.25

This showed p-value of 0.00479053. This is below the criteria for significance (p<=0.25) which means the difference between the number of Total Words Written (TWW) by the using Co-Writer and the group not using it is scientifically significant.

Further as shown in Table 2, a T-Test was performed to determine the differences between the use of Co-Writer and a change in CWS.
Table 2

**t-Test Analysis Results**

<table>
<thead>
<tr>
<th>Source</th>
<th>Mean</th>
<th>Mean D</th>
<th>t-Test</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct Writing Sequences</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Co-writer</td>
<td>8.875</td>
<td>-8.75</td>
<td>-2.99572</td>
<td>14</td>
<td>0.00963282</td>
</tr>
</tbody>
</table>

Note: Significant when p<=0.25

This showed p-value of 0.00963282. This is well below the criteria for significance (p<=0.25) which means the difference between the number of Correct Writing Sequences (CWS) written by the group using Co-Writer and the group not using it is scientifically significant.

The null hypotheis was rejected since the analysis of the difference in the Total Words Written by students who used Co-writer in this study and the students who did not showed a statistically significant difference. The analysis of the difference in the Correct Writing Sequences also showed statistically significance.
CONCLUSIONS AND RECOMMENDATIONS

This study used a very limited sample group and was not conducted using a random control group. Therefore the implications of the study are limited and further research is necessary to have a full picture of the effects of assistive writing technology and its use with students with significant cognitive impairments. However the initial data is promising.

In general, when using Co-Writer students increased both the number of total words written and well as the number of correct writing sequences. The use of Co-writer seems to have a larger effect on the total words written a measure of speed and a smaller effect on the correct writing sequences measure of writing mechanics.

The major limitations of this study are that it did not include intensive instruction for students on the use of the Co-writer software. It is unknown if additional gains might have been possible if students received instruction on how to best make use of the program. Another major limitation of the program is that it used timed writing probes to measure writing performance. This does not give a whole picture of the impact of the program on the student’s academic or function performance. While an improvement in the performance on a timed probe is good, it is more important that students improve their performance on academic or real world tasks. This would have a practical benefit to a student and make it more likely for the use of the program to generalize to outside of school. Unfortunately, this type of data is far more difficult to measure and standardize for a comparative study.

In the past, students who had significant developmental disabilities were not thought to be good candidates for the use of assistive technology in the area of writing due to their very low skill levels. However, based on the data collected in this study, the use of assistive writing technology to increase the writing skills of students with developmental disabilities is promising. For this reason, assistive writing technology in all its forms should be considered when IEP team decisions about assistive technology are made.
For further study, a larger, random sample of students is recommended. In order to measure the effect of the technology on writing scores over a longer time period further studies should follow students introduced to this technology at a younger age. Further study should also compare the effect of writing technology on students of different skill levels to see if there is more or less benefit to students based on their starting skill levels. Anecdotal data from this study seems to point to a minimum proficiency level below which students did not show much benefit after the introduction of Co-writer. Further study of this idea might aid IEP team decisions.

This study also lacked any intensive instruction for students in how best to use the technology or any structured practice in the use of the technology. Further research should also be attempted to determine the best types of instruction and practice to use with the program.
REFERENCES


