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Word Prediction Software for Students with Learning Disabilities

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## Introduction

In recent years there has been an increasing interest in technology applications for students with writing difficulties. Several applications were discussed in the literature. However, the use of word prediction for students with writing difficulties is somewhat understudied (MacArthur, et. al, 2001). The majority of word prediction studies were conducted 5-10 years ago. Several the most recent studies have revealed that writing readability/legibility and spelling of students with learning disabilities improve with word prediction (Handley-More, 2003; MacArthur, 1998, 1999; Williams, 2002). Still, it was noted that the impact of word prediction is quite limited because students have to know the exact beginning letters of the word without the possibilities of phonetic substitutions. Therefore, students with severe spelling problems did not benefit from word prediction programs because very often they did not know the initial letters correctly (MacArthur, 1998). Word prediction technology has developed significantly since then. The major difference is that current software tries to recognize phonetic spelling. That means that it recognizes inventive spelling, what students mean to say, so it is not necessary to enter the exact beginning letters to receive a legitimate prediction. Thus, current technology may be more beneficial for students with learning disabilities than the older versions.

### *Research Questions*

The purpose of this study is to determine the effects of the current word prediction software programs based on phonetic/inventive spelling on legibility, accuracy and length of journal writing by students with severe writing and/or spelling difficulties. The initial comparison of three different word prediction programs including students' preferences will be conducted. This study therefore, is intended to replicate and extend the work of previous researchers (MacArthur, 1998, 1999) by asking the following research questions:

1. Will the accuracy and length of journal writing increase while students with writing difficulties use current word prediction software vs. word processing?
2. Will the speed of writing as well as accuracy and length of writing depend on a program and its features?
3. What program will students find the most helpful and enjoyable?

Method

*Design*

Similar to MacArthur’s study (1999), this study will employ an alternating treatment design. During the baseline phase, students will write journal entries using the word processor. During experimentation phases, they will write using different word prediction programs so that each student will have an opportunity to try 3 programs by the end of the study. Baseline phase will occur during the first week. Then during each following week each student will be writing using word prediction alternating between programs. Students will be assigned to each of the programs for particular weeks randomly in order to control the influence of the increasing mastery and familiarity with word prediction skills.

	Week 1 Baseline	Week 2 Treatment 1	Week 3 Treatment 2	Week 4 Treatment 3
Student 1	Word Processing	Word Prediction 1	Word Prediction 2	Word Prediction 3
Student 2	Word Processing	Word Prediction 2	Word Prediction 3	Word Prediction 1
Student 3	Word Processing	Word Prediction 3	Word Prediction 1	Word Prediction 2
Student 4	Word Processing	Word Prediction 1	Word Prediction 2	Word Prediction 3
Student 5	Word Processing	Word Prediction 2	Word Prediction 3	Word Prediction 1
Student 6	Word Processing	Word Prediction 3	Word Prediction 1	Word Prediction 2

*Sample*

*Setting.* The study will take place during the CompuWrite summer camp at George Mason University. CompuWrite is a four-week long summer camp that uses technology and innovative computer software programs to enhance the writing process and improve written language skills for students experiencing difficulties with the writing process.

*Students.* Participants will be students in grades 3 through 6 participating in the CompuWrite summer camp. All students are referred as having writing difficulties by their parents and teachers. Some of them are also identified as having learning disabilities by their schools. No standardized writing assessment will be completed in order to determine writing difficulties. However, informal writing assessment including writing samples will be collected prior to the study. Those samples will include paper based writing products completed without any technology support. In addition to collecting writing samples, parents' comments on the nature of writing difficulties as well as the discussion with the Camp director will determine the participants for this study. Students with severe spelling difficulties and/or slow writing will be identified as candidates for using word prediction tools. Thus, those students who will be determined as requiring word prediction will participate in this study (approximately n=6). Participants will include children from a variety of ethnic backgrounds and primarily middle-class families. The researcher will attempt to ensure a diversity of students including boys and girls in the study if possible. As soon as the participants are identified (shortly before the study), the researcher will collect the exact demographic data, which will include: gender, age, race/ethnicity, anecdotal notes on the nature of writing difficulties, and identified disability area if any.

*Teachers.* CompuWrite provides a unique internship opportunity for current and prospective teachers working on their master's and licensure in learning disabilities, emotional disturbance, and mental retardation at George Mason University. While gaining authentic experiences with the current technology options for students with mild disabilities, interns are responsible for working with children. The teacher/student ratio is typically 1:2 or 1:3. Prior to the beginning of the CompuWrite camp all interns usually receive trainings on the use and integration in their lesson plans of major writing computer tools currently available. Thus, the utilization of three word prediction programs will not interfere with the CompuWrite activities.

### *Materials*

*All conditions.* In both conditions students will be asked to write daily for 20 minutes in response to the journal entry prompt. The purpose of such journal writing is to provide students with more writing opportunities and daily practice. Personal narrative prompts will be randomly assigned to students from a list of 30 pre-design prompts. They will be interesting and unbiased based on gender, ethnicity and socio-economic status (e.g., "What is your favorite part of the day?", "What is something that makes you feel happy or sad?", etc.)

*Baseline condition.* In the comparison/baseline condition students will use Microsoft Word for journal writing. Students will not be able to use spell checkers and grammar checkers during writing.

*All experimental (treatment) conditions.* In the experimental conditions students will use Co:Writer, WordQ, and WriteAssist programs. These are word prediction programs. A student types the word either in the separate program application or in the Microsoft Word. As each letter is typed the list of predicted words appears in the small window located by the cursor. If the intended word appears in the list, a student can select the word by clicking on it or typing the

number of that word. That selected word is automatically added to the sentence. If the intended word does not appear in the predicted list, a student continues to type. All three programs provide speech feedback so students have an option to hear predicted words before selecting one of them. These programs also have an option for the teacher to decide how many words will be predicted for the student (usually between 1 and 9). While the number of predicted words is usually individual based on student's needs, for this study in all programs the number of predicted words will be limited to 5. All three programs have spell checkers build into them. However, for the sake of this study spell checker option will be disabled in all word prediction programs as well as in the word processing. While these three programs are somewhat similar in their features, they are slightly different in the level of sophistication and the size and diversity of the dictionary. Condition-specific materials are described next.

*Co:Writer.* Co:Writer SOLO Edition is the latest version of the Co:Writer word prediction program developed by Don Johnston Inc. It utilizes Linguistic Word Prediction intelligence. With that function, the word prediction list does not depend on the correct first letters. It is based on the phonetic, inventive spelling that is very typical for students with learning disabilities and writing difficulties. In addition, Co:Writer offers such functions as eWordBank and Topical Dictionary. Such features support student's writing on different topics and in different genres predicting the most appropriate words for the selected topic and/or genre.

*WordQ.* WordQ by Quillsoft is a word prediction tool used with a standard word processor. State-of-the-art word prediction suggests words when students have trouble spelling or choosing the word. However, WordQ does not correct grammar or punctuation so the quality of writing still depends on students.

*WriteAssist.* WriteAssist by Second Guess software is a dyslexia-oriented word predictor. This program features include context-dependent prediction. Such feature ensures that a student will be offered suggestions even without typing anything. The program will make a prediction of the possible next word based on grammatical patterns and the context.

#### *Data Sources*

The dependent variables examined will include: total number of words, proportions of legible and correctly spelled words, correct word sequences, and typing speed including composing time and composing rate of words per minute.

*Total number of words.* Total number of words will be calculated in each of students' writing samples. The differences will be calculated between the length of writing and the use of word processing vs. word prediction. In addition, the differences in length will be compared among the three different programs.

*Proportions of legible and correctly spelled words.* As defined by MacArthur (1998) legible words are those words that can be correctly decoded even when taken out of context. In order to identify the number of legible words, the independent graduate assistant will start with reading each word in isolation covering the rest of the words. The purpose for this is to identify if the words make sense separate from the context. In order to avoid guessing such procedure begins with the last word in the passage and goes backwards towards the beginning. Then, reading the whole passage together it's important to make sure that a student meant that word and not another one in the particular context. Homonyms are not considered legible words but considered as spelling errors. Again just like in the replicated study the proportion of legible and correctly spelled words will be determined by dividing their number by the total number of words.

*Correct word sequence.* Another measure, correct word sequences, will be determined by counting word sequences of correctly spelled words, grammatically correct and using capital letter at the beginning of the sentence and the punctuation at the end. This measure as all the previous ones will be compared across the programs.

*Composing rate.* The investigator will observe the composing time as well as composing rate of typed words per minute. That will include the recording of how long it takes a student to complete writing from the very beginning till the very end as well as measuring how many words students type in each minute. In addition, the software that counts all keystrokes and mouse clicks will be used. With the help of such software it will be possible to count the number of words selected from the predicted list and therefore, examine the use of the words prediction feature. At this point, it will be possible to compare the composing time, rate and the frequency of word prediction feature use to features of each of software programs. Furthermore, the use of the keystroke counting software will help to determine the frequency of word prediction feature use in each program. It will be interesting to see if the level of sophistication of the program as well as the size of the topic dictionary influences the speed and length of students' writing as well as their use of word prediction features.

*Students' preferences.* In addition, at the end of the study, students will be interviewed on their preferences of the word prediction software. They will be asked about which program is the most helpful for their writing and which program they enjoy the most. Students will be asked to explain what particular features they like and/or dislike about each particular program and which of the programs they will recommend to other students.

*Procedure*



*All conditions.* Once teacher, student, and parent permissions are obtained, students will be engaged in the journal writing for 20 minutes first thing in the camp session. The study will be conducted over a period of four weeks of writing camp. Teachers will give students the personal narrative prompts for writing encouraging them to do their best. Students can take more time writing if needed but the general time for this activity will be approximately 20 minutes. Later during the day students will be engaged in other writing activities including brainstorming, drafting, revising, editing and production. Thus, the purpose of journal writing activity is just another opportunity to write without spending time on editing. However, if students write less than 3 sentences, teachers will ask them to say more, provide more details on the topic. Students are also encouraged to figure out the spelling of the words on their own so that teachers are not helping with that verbally. The research investigator will be in the classroom during the journal writing activities to gather observational data on the writing speed as well as the students' use of word prediction functions.

In both conditions, after completing the journal writing activity, students will save the copy of the work on the computer. In addition, they will print two copies: one to include in their folder and the second one for the researcher.

*Baseline condition.* During the first week of the camp, students will be writing their journal entries using a word processor. Depending on students' typing and computer skills, they will receive some instruction in typing and using the word processor if needed. Such instruction may include one-on-one training from a teacher and/or using Learning2Type software program with interactive lessons to teach how to type and lessons to improve the speed.

*Treatment condition.* Students and teachers will receive instruction on how to use each word prediction program. The researcher will conduct a training session with students as well as

a separate training session with teachers addressing the main features of any word prediction program. Participants will learn how word prediction works. Training session will include a short PowerPoint presentation addressing the basic information students and teachers have to know about word prediction features. Then, it will be demonstrated that every time students do not know how to spell any word they can look at the predicted list and move the mouse over the words so they are pronounced out loud. Students will learn about the speed-feedback option where they can hear any word, phrase, and sentence as many times as they want. However, the use of this feature is optional. Students and teachers will be encouraged to try and type a sentence using word prediction.

In addition, one program each week will be modeled for students using that particular program that week based on the design. Students will learn how to start a program, enable the word prediction feature, ensure speech feedback feature if chosen, and where to look for the predicted list. Due to the fact that all programs are very similar in use, teachers will be responsible for simulating journal-writing activity for students addressing specific functions of the particular program on Monday of each week. All teachers will be trained on the use of each of the programs as a part of their internship requirement. In addition, the researcher will develop a short training including the handout for teachers to make sure that children are introduced to the program the same way. After that, students will have some time to practice using each software program.

#### *Reliability or Fidelity of Treatment*

The independent observer will randomly observe the activities during the journal writing to make sure that teachers and students are doing what they suppose to do. Any misconduct will be addressed immediately.

*Scoring Procedures and Reliability of Scoring*

All writing prompts will be scored on 3 dependent variables: total number of words, proportions of legible and correctly spelled words, and the correct sequence of words. In order to provide scoring reliability, random writing samples (25%) will be given to the independent person in order to make sure he/she scores them the same way as the researcher. The reliability of the composing time and rate as well as the frequency of the word prediction feature use will be reached by the comparing observations with the reports on the keystrokes and mouse clicks from the software.

*Proposed Data Analyses (bonus points section)*

All students' writing samples in both baseline and three treatment conditions will be analyzed. Data on the number of total words, proportions of legible and correctly spelled words, as well as correct word sequences in each writing sample will be calculated. As mentioned before the proportion of legible and correctly spelled words will be determined by dividing the number of legible and correctly spelled words by the total number of words in each writing sample. Furthermore, the composition rate as well as the frequency of word prediction features use will be analyzed and compared to the outcomes in order to conduct the primary programs comparison.

A visual analysis and randomization tests will be conducted for the data collected across all measured dependent variables for each student. Randomization tests and analysis will be conducted with the help of special software for single-subject designs (Todman & Dugard, 2001) and SPSS.

References

- MacArthur, C. (1998). Word processing with speech synthesis and word prediction: Effects on the dialogue journal writing of students with learning disabilities. *Learning Disabilities Quarterly, 21*, 151-166.
- Handley-More, D. (2003). Facilitating written word using computer word processing and word prediction. *American Journal of Occupational Therapy, 57*(2), 139-151.
- Williams, S. (2002). How speech-feedback and word prediction software can help students write. *TEACHING Exceptional Children, 34*(3), 72-78.
- MacArthur, C., Ferretti, R., Okolo, C., & Cavalier, A. (2001). Technology applications for students with literacy problems: A critical review. *The Elementary School Journal, 101*(3), 273-301.
- Todman, J. & Dugard, P. (2001). *Single-case and small-n experimental designs: A practical guide to randomization tests*. Mahwah, NJ: Lawrence Erlbaum Associates.