WORD PREDICTION TOOLS: MEETING THE NEEDS OF DYSLEXIC HIGH SCHOOL STUDENTS

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ABSTRACT: Claims have been made by assistive technology centres that word prediction technology can help improve written work by dyslexic persons. To the author's knowledge no research has been conducted to see if this is a viable tool for these purposes. Poor spelling as a symptom of dyslexia leads to the assumption that word prediction could be of some assistance, particularly due to the research conducted that states dyslexic students are not likely to complete an assignment or ask for help. The aim of this paper is to see if the needs of an Australian dyslexic student when writing an assignment match up with the functionality of word prediction software. A literature review will be conducted to validate the assumptions. Interviews will be conducted with Australian dyslexic high school students of varying age groups to determine what they consider as their needs when writing an assignment. These needs will then form a criteria list that will be used to evaluate word prediction software. Using the social model of disability to collate the findings of the research will allow the findings to be used as a guide for the educational institutions that accommodate dyslexic students, to help advocate change.

INTRODUCTION

Word prediction started as an assistive tool for the physically disabled when using computer equipment [KN95]. Due to the user interface of word prediction tools it as been assumed that these tools could assist people diagnosed with Dyslexia. This paper details current Honours level research into Word prediction tools and the needs of Australian dyslexic high school students to see if there is a correlation. The research question being addressed is, "Can word prediction tools meet the needs of an Australian dyslexic high school student when it comes to writing an assignment?".

The first section of this paper details the background literature to show the significance of the research question. The research method is then detailed by discussion of the questions, assumptions and approach with the research design provided. The models used to guide the research are then discussed. The expected outcomes both practical and theoretical are outlined, followed by the conclusion of the paper showing the next stages of research to be completed.

Background

According to a study by Riddick et al [RSF99] dyslexic university students reported themselves as feeling more anxious and less competent in their written work at [primary and secondary] school in comparison to other students. Riddick et al's study explored self-esteem and anxiety levels of dyslexic students at university. Several students spoke about how negative recollections of their time at [primary and secondary] school still affected how they felt and performed when faced with various literacy tasks [RSF99].

Spelling errors particularly are of high concern for dyslexic students. Written work such as assignments and homework can cause anxiety for such students, and in the event of an assignment that they feel they cannot do, instead of asking for help, they may decide not to turn in the assignment at all [HRS02].

The concept of word prediction started as a simple assistive tool to reduce the number of keystrokes necessary for individuals with mobility impairment, making it easier to communicate and less fatiguing for the user [KN95]. Word prediction tools (WPT) consist of software that allows a user to type one or more letters and then choose a word based on a selected list to complete the word they were typing. WPTs predict this word in context to the previous words used.

The Adaptive Technology Research Centre (ATRC) of the University of Toronto state that word prediction software can be particularly useful for people with dyslexia [ATR03]. The National Centre to Improve Practice (NCIP) in Newton, Massachusetts state that educators are beginning to see the power of word prediction for students with learning disabilities [NCIP03].

> Many students who are poor spellers avoid words they are unsure of and therefore have extremely limited writing vocabularies. Word prediction provides poor spellers on-line assistance, making the whole endeavour less stressful. [NCIP03]

One of the symptoms of dyslexia is poor spelling, which could have an effect on the student's grades. Poor spelling may also have an effect on the student's self esteem as shown in Riddick et al:

> Patrick commented that even when he had put extra time into work, he received it back with red lines under all his spelling errors and comments on this poor spelling. [RSF99, p.244]

While there are centres such as the NCIP and the ATRC that both advocate the use of word prediction tools for dyslexics, there do not seem to be any cases of this being put to practice, at least publicly on the websites, as cases of more pronounced learning disabilities show greater improvement.

Research Questions

The online medical dictionary defines dyslexia as "a term used to describe a condition in which an individual with normal vision is unable to properly interpret written language. Individuals can see and recognise letters but are unable to spell and write words" [OMD03]. This research project is based on the symptoms of dyslexia that include poor spelling and a limited vocabulary.

A dyslexic student's self esteem is affected later in life by the lack of support in high school [RSF99]. Hughes et al show that writing an assignment creates anxiety in learning disabled students and if the assignment is perceived as difficult, it may not be completed [HRS02]. The ATRC and the NCIP both state that dyslexia can be eased with the use of word prediction software, but neither give specific examples of this use. So the research question that needs to be answered is as follows:

Can word prediction tools meet the needs of an Australian dyslexic high school student when it comes to writing an assignment?

To answer this question, two sub-questions are to be explored:
1. What are the needs of dyslexic high school students when it comes to writing an assignment?
2. What are the functional components of word prediction software?

RESEARCH METHOD

Research Assumptions

The ontological assumptions are defined using the framework for paradigmatic analysis as proposed by Iivari and Hirschheim [IH92]. These assumptions assume that a dyslexic student avoids words that they cannot spell, and therefore a word prediction tool would help to write assignments. Due to dyslexia being a learning difficulty, it exists in the mind and is therefore subjective. Antipositivism maintains that the social world "can only be understood from the point of view of the individuals who are directly involved in the activities which are to be studied" [IHK98, p.174]. To understand the needs of these students, interviews will be conducted to explore the opinions and perspectives of the students, thus taking an anti-positivist stance.

Research Strategy

Due to the subjective nature of the assumptions, the research for the first sub-question fits into an ideographic approach. Ideographic models place "considerable stress upon getting close to one's subject and exploring its detailed background and life-history" [IHK98, p.175]. Student's needs with assignment writing are based on their own personal opinion, and as such cannot be examined from outside the mind of the student. While a detailed background and life history will be limited to the student's educational background and history.

Library research in the form of a literature review will be conducted. An effective review creates a firm foundation for advancing knowledge. It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed. [WW02]

A case study in the form of interviews will be conducted to gather data on student's needs. These interviews will be conducted with 4-5 high school students (from one or more high schools) and one or more teachers who supervise and assess homework that these students submit. The students chosen will all have a medium level of dyslexia as defined by their medical assessments. The age groups of the students will be split equally with at least two students of year 8 or 9, and at least two students of year 11 or 12. This will determine if the student's needs have been accommodated for through the experience of high school. There are limitations to the number of students that can be interviewed due to the limitation of time to complete this research and dissertation. While a larger group, across more age groups and different schools might provide a more significant result, this is not possible at this time.

The research for the second sub-question fits into a nomothetic approach which Järvinen describes as laying "emphasis on the importance of basing research upon systematic protocol and technique" [Jär01, p.9]. Due to WPTs being an innovation, they will be evaluated to see if their functionality meets the needs of the dyslexic students.

RESEARCH DESIGN

Case Study

A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one of a few entities. [BGM87] Yin states that "the distinctive need for case studies arises out of the desire to understand complex social phenomena." [Yin94, p.3]. Yin states that there may be explanatory, exploratory or descriptive case studies [Yin94]. Due to this project asking a 'what' question, it fits into an exploratory case study.

There are many factors that go into the design of a case study. These include site selection and data collection methods [BGM87].

Site Selection: The factors that dictate a single case design also determine the site selection. [BGM87] Site selection may be based on the characteristics of sites. In the case of this project, finding a high school with at least one dyslexic student, that attends a public high school of a medium socio-economic level, will help to allow the results to be generalised if the students studied do not attend the same high school.

Data Collection Methods: Benbasat et al state that multiple data collection methods are typically employed in case research studies [BGM87]. "Ideally evidence from two or more sources will converge to support the research findings" [BGM87, p.374]. Data collection methods within case studies include: documentation, archival records, interviews, direct observation and physical artefacts.

As part of the research design, and taking into account the social model of disability and the self-advocacy movement, the views of the students themselves is more important than observed behaviour or results that may have been collected by teachers or a counsellor. As such, documentation and archival records, if offered, would not be used for the purpose of this study. The two data collection methods used will involve interviews and direct observation. A pilot study will also be completed to help define the questions used in the interviews, but also for the use of triangulation.

The interviews will be conducted verbally at all times, due to the nature of dyslexia, and will be informal involving open-ended questions. These interviews will be recorded, but after the results are formulated will then be destroyed to keep the confidentiality of the students. This informality will be used to gain an ease from the students while increasing the safety that the students feel in talking about such a personal topic. The direct observation will be used to monitor the student's emotional expression such as hesitance, enthusiasm and defensive behaviour. This will be recorded before, during and after interviews.

Innovation Evaluation

The evaluation of the WPTs will be completed using a criteria list of needs provided from the interviews of the students. The WPTs will be evaluated for specific functionality required; functionality needs raised by members of the pilot study and of the case study.

Triangulation

Triangulation is "the combination of methodologies in the study of the same phenomena" [Jic79, p.620]. It is used to allow for greater accuracy of results by providing multiple viewpoints [Jic79]. The effectiveness of triangulation rests on the premise that the weaknesses in each single method will be compensated by the counter-balancing strengths of another [Jic79].

Triangulation in this study will be used in the following method: By conducting a literature review and pilot study, the research questions will be organised for the interviews with the students. The students will also be observed for any changes in apparent emotional moods during the questioning. The pilot study subjects will also comment on their experiences in high school to see if their coping strategies match those of the current students' strategies to complete an assignment. These needs will then be matched with the components of word prediction tools.

MODELS AND FRAMEWORKS

Social Model of Disability

Chappel et al introduce the social model of disability as an alternative approach to understanding disability [CGL01]. This idea was initially developed by the Union of Physically Impaired Against Segregation during the mid-1970's. The social model distinguished between impairment and disability, and recently this definition of impairment has been broadened to include sensory, and 'intellectual' or 'developmental' impairments.

The social model of disability (SMD) has had a significant impact on social research that engages with the experiences of people with physical and sensory impairments [CGL01]. The SMD has provided researchers with the view of the impairment being not of the person, but of the environment. However, the social model is often overlooked in research and writing about learning difficulty [CGL01].
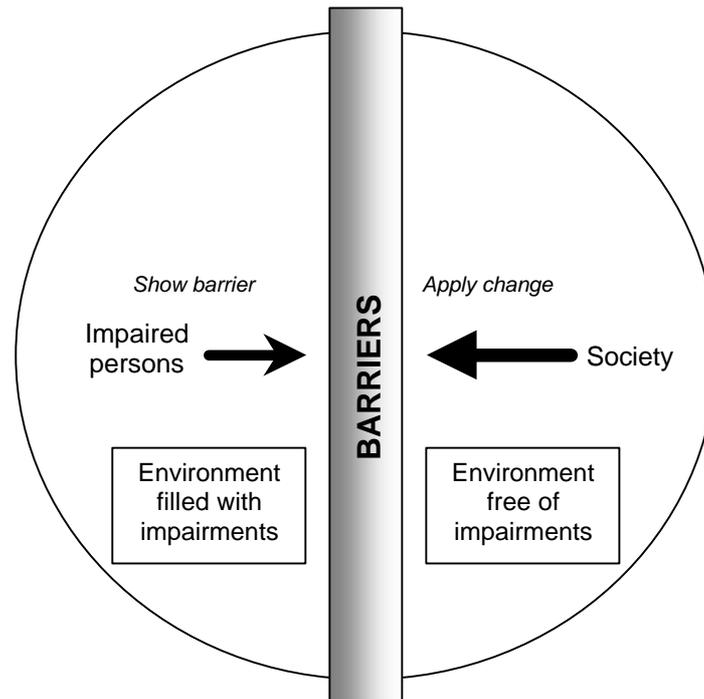
Figure 1. The social model of disability [Adapted from [CGL01]]

Figure 1 is a conceptual model as put in diagrammatical form by the author; it has been adapted from the image perceived as written in [CGL01]. The SMD sees the environment of the person as having an impairment or barrier that the person cannot overcome, and as such the society environment should change to allow everyone the ability to function [CGL01]. Self-advocates use this model, but are mostly unaware that they are using it, and as such the terminology is not used correctly [CGL01].

The SMD sees the impaired persons trying to enter an environment free from impairments. Instead of forcing the change themselves they make society aware that it isn't their impairment, but the impairment of society and the environment. This forces society to change by removing the barriers.

Using this model will help guide the research for the benefit of the participants. The results and findings are to be used as possible guidelines to improve educational environments of the students, and not have the students change to suit the environment.

Analyst Metaphor

By defining the role that an analyst plays when specifying the requirements of a system, the strengths and weaknesses of the analyst can be defined. [BW98] These roles are based on the subjectivism or objectivism stance of the analyst, and regulation and consensus vs. conflict and change.

As the research of this project is interpretive, by interpreting others thoughts and opinions, and the project's aim is to implement change, at the minimum on a personal level with the students I will be interviewing, my role is that of an emancipator, which Bell and Wood-Harper define as "a catalyst assisting others to change their own lives" [BW98, p.35].

PRACTICAL AND THEORETICAL OUTCOMES

The expected theoretical outcomes of this research project will be to define the needs of a dyslexic student when completing an assignment and to see if this matches up with what WPT can provide. The SMD is usually overlooked when learning difficulty research is conducted, so by using the SMD in this project it provides an example of its use in the learning difficulty field of research.

The expected practical outcomes of this project are to provide the students interviewed with the feeling of being able to make a change in their environment, and help them to realise the power of self-

advocacy that they may be unaware of. This project will also provide evidence that can then be taken to an administrative figure in the student's educational institution to show how their learning can be aided with the use of WPTs if the conclusions of the research are found to support this theory.

CONCLUSIONS

Currently the pilot study for this project is being conducted, with the interviews being negotiated. The next stage of this research will be to conduct the case study and then triangulate the data. From this, a list of criteria to evaluate the word prediction tools will be comprised, which in turn will aid the emergence of research outcomes.

This research has the potential to validate the claims made by the assistive technology centres. Word prediction tools could prove to be a valuable tool for dyslexic students, and provide an avenue for further research into testing the hypothesis.

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REFERENCES

[ATR03] Adaptive Technology Research Centre. Word Prediction. http://www.utotonto.au/atrc/reference/tech/wordpred.html. 2003

[BGM87] I. Benbasat, D. K. Goldstien and M. Mead. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*. 12:368-386

[BW98] S. Bell and T. Wood-Harper. *Rapid Information Systems Development.* McGraw Hill, London. 1998

[CGL01] A. L. Chappel, D. Goodley and R. Lawthorn. Making connections: the social model of disability for people with learning difficulties. *British Journal of Learning Disabilities.* 29:45-50

[HRS02] C. Hughes, K. Ruhl, J. Schumaker and D. Deshler. Effects of Instruction in an assignment Completion Strategy on the homework Performance of Students with Learning Disabilities. *Learning Disabilites Research & Practice*, 17:1-18. 2002

[IH92] J. Iivari and R. Hirschheim. A Paradigmatic Analysis of Four Emerging Information Systems Development Approaches. *Proceedings of the Third Australasian Conference on Information Systems.* 115-119. 1992

[IHK98] J. Iivari, R. Hirschheim and H. K. Klein. A Paradigmatic Analusis Contrasting Information Systems Development Approaches and Methodologies. *Information Systems Research.* 9:164-193. 1998

[Jär01] P. Järvinen. *On Research Methods*. Opinpajan Kirja, Tampere, Finland

[Jic79] T. D. Jick. Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrtive Science Quarterly.* 24:602-611. 1979

[KN95] J. Klund and M. Novak. If word prediction can help, which program do you choose?. *1995 Closing the Gap Conference.* http://trace.wisc.edu/docs/wordprediction2001. 2001

[KY94] L. Knight and A. Young. *Paperback Dictionary and Thesaurus.* L. Knight and A. Young (eds). HarperCollins, Glasgow, GA. 1994

[MWD03]Merriam-Webster Dictionary. Merriam-Webster Online. http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=advocate. 2003

[NCIP03] National Centre to Improve Practice in Special Education through Technology. NCIP Home. http://www2.edc.org/NCIP/. 2003

[OMD03] Online Medical Dictionary. Dyslexia from Online Medical Dictionary. *Online Medical Dictionary*. Retrieved: 26th May 2003 from http://cancerweb.ncl.ac.uk/cgi-bin/omd?dyslexia

[RSF99] B. Riddick, C. Sterling, M. Farmer and S. Morgan. Self-Esteem and Anxiety in the Educational Histories of Adult Dyslexic Students. *Dyslexia,* 5:227-248. 1999.

[WW02] J. Webster and R. T. Watson. Analysing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly.* 26:xiii-xxii. 2002

[Yin94] R. Yin. *Case Study Research.* Sage Publications, Thousand Oaks, California. 1994