

## **Refereed Conference Paper**

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### **Title**

Supporting struggling writers with the use of voice recognition software in class

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### **Abstract**

A case study project found that differentiating support for struggling writers, by adopting a range of learning strategies with the use of voice recognition software (VRS), facilitated significantly improved writing efficacy and learning outcomes. Using their oral and auditory skills, the writers developed planning, composing, editing and evaluating techniques that expanded their vocabulary range, syntactical structures and understanding of the features and structures of a range of genres. The research identified effective metacognitive strategies that bypassed spelling, working memory and processing difficulties when using VRS. The students learned to evaluate their writing and gained greater learning independence. Their increased knowledge of effective learning strategies had positive outcomes on their self efficacy, and improved their writing skills. School accommodations for VRS were also considered.

### **Keywords**

Struggling writers, learning strategies, voice recognition software, metacognitive strategies, positive outcomes in writing.

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## **Introduction: Searching for a technological aid to help struggling writers**

Voice recognition software (VRS) communicates information by recognising speech or producing written text from speech. Its use is widespread now that accuracy problems have been overcome. Occupational therapists and special education teachers have used VRS as assistive technology to overcome physical difficulties (Freeman, MacKinnon & Miller, 2004). Yet, despite large scale research projects that demonstrated significant reading and writing improvement from its consistent use, wider adoption for students with specific writing difficulties has been limited (BECTA, 2000; CALL Centre, 2003; Higgins & Raskind, 2000, 2004; Nesbit, Wilson & Aitken, 2003). The use of VRS with students experiencing specific writing difficulties encourages the separation of thinking and organising ideas and information from composition. Voice recognition software produces text but it cannot assist students to create appropriately written documents. To overcome the struggling writer's lack of writing experience, the teaching of writing techniques is essential.

Two students, selected by their school for the disparity between their verbal performance and writing production were given access to VRS and 20 hours of learning support. Student A, in Year 10, had received remedial assistance for the previous 9 years. Student B, in Year 11, had not received learning support. His disinterest in learning and recent disruptive behaviour was the catalyst for psychological testing and subsequent consideration for learning support. Student A had a breadth of knowledge of computer programming and mathematics, but struggled with other learning. The two students attributed their writing difficulties to poor spelling and organisational skills. During this project each student received a one hour individual lesson weekly for 20 weeks.

Struggling writers share similar characteristics. Their difficulties with completing learning tasks that require a written response include processing information problems and an inability to express their cognitive understandings in appropriate language and styles (Baum, Owen & Dixon, 1991). Writing requires the ability to multitask; to organise ideas and their details, to access the appropriate linguistic features and genre structures, and to use subject specific language appropriately (Freebody & Luke, 2003). Struggling writers often develop strong oral capabilities (Hux, Rankin- Erikson, Manasse & Lauritzen, 2000). Disparities between oral and writing vocabularies caused by spelling difficulties constrain their academic achievements (MacArthur & Cavalier, 2004) A rich speaking vocabulary is developed by participating verbally in social and cognitive experiences (Gee, 2001; Manzo, Manzo & Albee, 2005; Meires & Knight, 2007). Oral linguistic structures and writing syntax are different, and students gain metalinguistic understandings of these differences from exposure to the sound of both structures (Cope & Kalantzis, 1993). Students who are unable to develop writing competence lack a range of positive experiences of completing written work successfully. Both of the students in this project had difficulties processing information, planning and

structuring writing, spelling known and new words, and did not perceive differences in the writing techniques required for different genres. They needed more time to understand a new topic, but once they understood, their recall was detailed and their ability to manipulate ideas indicated a high cognitive ability.

This following paper has three sections. It describes the research process used in this study. Then it considers the results of the two case studies where the writing tool and the teaching of writing techniques were differentiated, to improve writing outcomes and develop independent efficacious learning strategies. The paper concludes by considering the ramifications of those findings for schools.

### **The research process and the school context**

The project was undertaken in a southern Tasmanian Independent school where the teacher researcher had taught English and Writing from Years 9 -12. The project's aims were to identify; (1) the effects of the combination of voice recognition software and the learning of explicit writing techniques on writing outcomes; (2) the effect a different writing tool and more effective self-management strategies had on self-efficacy and (3) the conditions required for the ongoing use of writing assistive technology in schools.

Using a qualitative, ethnographic methodology, the study was positioned within a sociolinguistic and sociocognitive approach to teaching and learning, which considers writing a social and cognitive act (Charmaz, 2006; Foley & Valenzuela, 2005, McCutcheon, 2000). Data collection was based on the two students' responses to their learning experiences, and observations from their teachers and mothers (Kincheloe & McLaren, 2005). The students were considered expert witnesses of their own case (Stake, 2005). Data analysis identified relationships between writing improvement, the use of VRS and changed writing efficacy. The observations were descriptive and reflective, and were verified or challenged by other participants' observations. Constructivist grounded theory informed the inquiry method and built theories through data analysis related to issues about writing and self efficacy (Charmaz, 2006; Charmaz & Mitchell, 2002). Grounded theory building uses flexible, analytical methods that observe a specific context and interprets changes that illuminate processual relationships (Charmaz, 2006). Diverse field notes, records of conversations, emails and reports were interpreted to create contexts for subsequent research action, ensuring that the methodology was both sequential and circular in progress (Charmaz, 2006; Strauss & Corbin, 1990). These methods seek to establish relationships between complex, interwoven variables and note differences or similarities in terms of magnitude or consistency (Charmaz & Mitchell, 2002).

### **Differentiating the writing tool**

Four positive changes were noted as the students learned to use voice recognition software. Reading aloud, using a 'news reader's' voice, produced the most accurate transcriptions. Both boys' mothers noted that they were consistently speaking more clearly, an outcome also

noted in the BECTA (2000) project. The students attributed this to positive feedback from the accuracy of their transcriptions. Secondly, the students recognised the sound of good writing, first by dictating published texts and later by editing their own writing. The third positive change was the students' application of their knowledge of writing syntax and punctuation conventions, added first during dictation then when rereading for meaning. Finally, the use of genre specific writing techniques impacted positively on their vocabulary use and the quality of their writing outcomes. VRS use encouraged bimodal editing; visual and oral checking drew their attention to subtle spelling differences, aural checking aided sentence structure, punctuation and clarity (MacArthur, Ferretti, Okolo & Cavalier, 2001; Nesbit, Wilson & Aitken, 2003).

Published texts, in the genres the students needed to use, were dictated into the software for three purposes; to learn the sound of written language structures, to learn to edit written texts, and to create a memory bank of writing styles. After transcription the texts were edited for accuracy, by reading, listening to and correcting each sentence on screen. This developed the students' editing skills, using texts with which they had no emotional attachment. If the corrections were done without using VRS the corrected texts were uploaded into the software for better accuracy.

### **The effects of the combination of speech recognition software and learning explicit writing techniques**

When consistently accurate texts were transcribed the students began creating their own texts. Writing instruction was informed by sociolinguistic and sociocognitive learning theory and writing process and genre pedagogy (Anstey & Bull, 2004; Cope & Kalantzis, 1993; Freebody & Luke, 2003; Hayes & Flower, 1986). By using the writing process the students were able to complete written tasks in discrete achievable steps. Samson and Radloff (1992) used The De La Harpe five stages model in their project to improve the writing skills of tertiary students. The strategy separates a writing task into (1) Preplan, where the audience and purpose are established; (2) Plan, where information is gathered and issues, form and structure decided on; (3) Compose, where the writer speaks/ writes the text; considering the links between paragraphs; (4) Review, where the expression of the ideas and format are checked; and (5) Evaluate, where the writing and the development of thinking are checked for accuracy and appropriateness.

The preplanning stage proved to be particularly important for the students to order, incorporate and articulate new learning. The students had well developed oral skills so they were able to dictate their understandings with increasing detail. Writing plans focused and scaffolded their thinking towards completing a specific task. Scaffolding produced from discussion, reading and note-taking tested out ideas by preparing questions to be answered during planning (Hayes & Flower, 1986; Murdoch & Wilson, 2006). Composing then became part of the process rather than the major focus, and the reviewing and evaluating stages

centred on checking that their written response met the challenge of a specific context. They used writing for learning strategies effectively (Meires & Knight, 2007). The five stages also placed reviewing firmly within the writing/learning process (van Kraayenoord, Jobling, Koppenhaver & Elkins, 2004).

Their first task for text production was to decide on the purpose and focus of the writing and collect the appropriate language, then to create a detailed plan. They then dictated the first draft of their text. The planning process was time consuming which was a point of tension for these students. However, the subsequent speed and quantity of text generation was so markedly improved that this tension dissipated. As well, their teachers noted they used a wider range of writing and learning strategies in class when not using VRS. The use of more effective learning strategies, the teachers and the students reflected, were the reasons for improved cognitive and affective outcomes. Pre-assessing students' writing knowledge and learning skills before teaching new techniques indicated their previous inability to access or rehearse whole class teaching. Their lack of writing knowledge at such a late stage in their academic career was overcome through individual tuition.

Using scaffolding thinking techniques provided the students with strategies for framing their thinking. Initially mind maps were modeled and reflected on. When the student had greater dictation accuracy graphic electronic organizers were used with VRS. Graphic organizers fulfill a range of purposes including identifying relationships between topic subsections. Collecting topic specific words in context from the beginning of a new topic aided working memory capacity, added detail to concept development and reduced composing time. Both students embraced the practice of collecting subject specific words. Improvement was multifaceted. Student A's first planned English assignment in March, a book review, produced in two tortuous one hour sessions, was 173 words long. In late May he planned and dictated a 773 word English essay, under test conditions, in 50 minutes. His teacher was delighted with the content, although his editing skills were still under developed. The two students connected new learning with past understandings through visual graphic organisers, which resulted in an increased capacity to embed knowledge. Within twelve hours of instruction both students were able to plan and initiate editing independently and reflect on their writing achievements. Student B wrote,

*I have just written my best essay ever in an Enviro test last lesson.*

(Student B, email to teacher/researcher, July, 2007)

Test essays, a frequent occurrence in Year 11/12 for Student B, were no longer times of considerable stress. Their knowledge of writing techniques and language in context, and their developing skills to create a logical progression of ideas in a discussion, enabled the students to use time in tests more effectively.

Drawing the students' attention to word choice had positive outcomes but initially impacted

negatively on the clarity of meaning in their writing. The students were challenged to use more than 45 different words in any 100 word sample from their texts, with at least 20 topic specific words, a goal they consistently achieved within 8 sessions. They were given topic and genre specific examples with word counts between 55 and 80 words. Word analysis tasks were jointly undertaken regularly by taking two 100 word samples and making two lists, one listing all the words used and the second the number of subject specific words in each sample. Repeated words were counted once, as were verbs from the same root and words that served the same function like 'it', 'she' and 'they'. This exercise, completed in minutes, rewarded the students with numerical evidence of improved vocabulary use and provided opportunities to discuss syntax, grammar and punctuation. The students then concentrated on writing clarity. One student wrote, when analysing a poster,

*The artist employed, to create this poster, colours/shades to their full effectiveness to bring forth the tone and mood of this graphic piece.*

(Student B, English assignment, July, 2007)

The words related to art but did not describe the specific poster. The syntax lacked fluency and details were absent, which the student recognised when completing the analysis. These novice writers required frequent modeling in structuring thinking (van Kraayenoord et al., 2004). By reflecting on the purpose for the writing during the planning stages they kept their focus on the appropriate detail for the content and genre. By evaluating their writing, the students focused on fluency, accuracy, language use, meaning and structure. One student wrote in his learning journal,

*I thought my editing was better than it was when you went through it. I tried to use a rich vocabulary but I knew some of the words were too strong for this piece. I was pleased that I had a good mixture of opinion and fact. Adam [teacher] said my ideas are developing greater detail*

(Student B, Learning journal, June 2007).

The message and the meaning within a specific genre became a major focus as the students' knowledge of writing techniques developed. The students gained practical knowledge as code breakers, by analysing published/excellent student examples, and applying their acquired grapho-phonetic and semantic knowledge to their own compositions. They wrote, read and edited by rereading and rewriting, all processes expert writers use (Graham, 1991). The deeper a student's language and topic knowledge and the more fluent their language generation, the easier they found structuring compositions (Anstey & Bull, 2004; McCutcheon, 2000).

Learning new writing strategies concurrently with using a new tool, that combined speaking and writing, reinforced both communication modes; one that had been a strength, the other

emerging in significance (Higgins & Raskind, 2004; Hux et al., 2000; Kress, 2005; Litten, 1999). Higgins and Raskind (2004) found that their primary school aged students' spelling did not significantly change from VRS use but their reading comprehension and vocabulary use improved, whereas these older students were impressed with their spelling improvement. Student A was particularly impressed, suggesting that his spelling had improved because he was a visual learner; previously his spelling errors had been reinforced by his learning style.

When the students were able to create lengthy texts, explicit analysis of paragraph structures was undertaken. Two strategies were employed, first by listing the topic sentences to check for the development of the text. If their collection of topic sentences do not summarise the text, or one idea did not flow to the next, the text was reordered or modified. Listing and reflecting on sentence beginnings highlighted the need for variety and the structure of the text. Verbs were listed and edited for continuity of tense, genre appropriateness and specific meaning. These analytical exercises developed the students' expertise in writing clarity and fluency, and knowledge of genre writing styles. Stronger code-breaking skills enabled the students to recognise successful elements of their writing style (Freebody & Luke, 2003). The more informed these writers were about the differences between speaking and writing, the more effectively they were able to dictate in a writing style (Applebee and Langer, 2006).

The students used three editing practices when dictating text. First the writer checked the phrase as it was transcribed. Secondly, they replayed their dictation or read the text on the screen to differentiate between fluent and disjointed sentence structures (Hux et al., 2000). The third editing practice was checking for meaning. At first the students expected VRS to lessen then eradicate their writing problems. One student, when asked if he was completing his written tasks more successfully by dictating the text replied,

*Wrong question. Did I finish any writing assignment in High School? I don't think so.*

(Comment by Student B to Vice Principal, July, 2007)

Early in the project the students were excited by producing quantities of readable text, but failed to recognise the missed years of learning about writing. They would come to a session, pleased with a lengthy draft, only to be disappointed by the poor quality of the text when they read it aloud. There were times of great excitement, when a task that would not previously have been attempted was completed without difficulty. Celebrating improvement and reminding the students of their learning journeys towards competent independent writing was an irregular but necessary reflection task.

*He is far more confident and happy with himself. So many teachers have commented on his improved study habits and his application in class. So his introduction to dictation has made an enormous impact on him.*

(Student A, Email from tutor, July, 2007)

The students' learning journals enabled them to identify and reflect on changes to their writing techniques and learning strategies and celebrate success.

*I am enjoying writing. It is as hard and as creative as ceramics. I began the year as the level of a Year 8 boy. Now I am performing as a Year 11 student.*

(Student B, Learning journal, April 2007)

Both students demonstrated improvement in academic achievement and in learning efficacy as is evident from their school reports all subject areas (Engstrom, 2005; Nesbit, Wilson & Aitken, 2005).

*Student B has continued to make good progress and the standard of his work is improving. He seems to be gaining confidence as the year progresses. His second term exam paper was one of his best efforts so far.*

(Student B, Environmental Science Report, July 2007).

The stages of their writing improvement that they and their teachers noted were creating; (a) detailed writing plans; (b) a lengthy written text; (c) an accurately written text; (d) texts using subject specific language; (e) a range of texts using appropriate syntax; (f) accurate fluent texts with appropriate genre features and structures; (g) accurate texts with logical, detailed development of themes in the appropriate genre. Each stage was a milestone, an evolving skill to be celebrated. The students' abilities to accurately express their thoughts in detail deserved recognition, which their teachers and parents did admirably. Student A struggled to produce 200 words in March. By September the 880 word draft he brought to a session used appropriate language and detail but the syntax needed editing for style and meaning. In the following extract he has not captured a writing style.

*Flannery goes on to say that in 10 years he would love to see Australia with a population policy in place, so that Australians would be heading for a more flexible immigration system that would allow Australia to plan the population to some degree for the next two centuries.*

(Student A, Draft of a Geography essay on overpopulation, September 2007)

By the final term he was producing written work to the standard of his verbal communication. Functional, goal oriented and relevant strategies were practiced with the software, bypassing the physical act of writing (Nesbit, Wilson & Aitken, 2003).

## **The efficacious effects of writing improvement**

At the beginning of the project both students' writing efficacy was low and their memory bank of successful writing experiences was minimal. Efficacy is a measure of belief about personal abilities in a particular situation, and judgment about capabilities necessary to attain the desired performance (Bandura, 1995). Efficacy judgments influence students' decision making about learning and the effort, use of time and degree of anxiety and confidence they bring to their studies. Students A and B both demonstrated increased motivation after writing successes. They invested time in their studies beyond the classroom by viewing films on topics being studied and researching on the internet. The students increased the quality and frequency of their oral communications with their teachers, another indicator of improved efficacy. They engaged in conversation confidently, demonstrating increased command of knowledge and engagement in their learning. At the beginning of the project Student B struggled with concentration.

*Student B was very upset by a comment from the previous lesson. The teacher called him "a waste of space" in front of the class. He said his teachers thought he was stupid. He concluded that he often behaved as if he was easily distracted. He said that was because he couldn't write, not because he couldn't think.*

*(about Student B, Research journal, March 2007)*

Later in the year, in the same subject but with a different teacher, he was perceived differently.

*He is able to tackle a wide range of questions in assignment and class assessments, and displays a genuine interest in the material, so he has a good foundation for further study.*

*(Student B, Science Report, November 2007)*

Perceptions of efficacy are a result of past mastery experiences, verbal persuasion and psychological states, and are affected more by what the learner believes to be true than is the actual case (Bandura, 1995). A student's learning efficacy results from perceptions of success. Both students became more independent, confident learners. Student A lost an almost completed task on his computer. His mother emailed saying

*He said he had a detailed plan so it wouldn't take long to dictate again. Previously he would have been very upset to lose any writing.*

*(Student A, email from mother, May 2007)*

The two students in this study developed more successful learning strategies, and increased the time they spent thinking and structuring their learning using topic specific language, creating a structure for developing their thinking and transforming new learning into text which

demonstrated their increased writing efficacy (Lin, Monroe & Troia, 2007). Teacher directed reflective journal writing was effective in identifying writing improvement that provided an impetus for improving writing efficacy (MacDonald & Cooper, 1992). Student A was asked to mentor a new student user of VRS, a task he undertook enthusiastically and effectively. He was proud to share his writing expertise (Higgins and Raskind, 2000).

VRS use supported these students' needs for learning independence. MacArthur and Cavalier (2004) researched its use as an examination accommodation and compared the assessments students received using it with their results from handwritten and typed answers, and when using a scribe. They found the software use improved struggling writers' assessments but did not change other students' results. Both students used VRS in their final exams at the end of the year. The speed of dictation using VRS helped to overcome their difficulties completing tasks because they needed greater time for thinking and planning (De La Paz, 2007).

### **The implications for schools of implementing VRS as a form of assistive technology**

The student use of VRS was researched by the British Educational Communications and Technology Agency- BECTA (2000) through trials in 23 schools, followed by Scotland's Department of Education and Training with The Communications Aids for Language and Learning - CALL Centre (2003) whose study involved 32 schools. Both educational agencies reported disappointing school interest and found that successful VRS use relied on a committed teacher. The CALL Centre produced excellent material for teachers to explain the benefits of using VRS and a 10 lesson booklet to assist teachers to begin working with the software with students. Higgins and Raskind (2000, 2004) also researched its use at The Frosting Centre, and they found that significant literacy improvement resulted from its continued use. However, none of these studies considered the environmental conditions the school needed to provide for successful implementation. This project began with some, but not all, of the conditions Edyburn (2001) argues are necessary. The students' WISC IV and WIAT II test results demonstrated that both students had the inherent ability and literacy skills to benefit from the supported use of VRS. The school also resourced the students with the software and cognitive support. At times the physical environment provided challenges but the students' teachers worked to overcome them.

Two models were trialed, Zabala's SETT model and Wile's model of Human Performance Technology (1996), as discussed in Edyburn (2000). These models were used to reflect on the school's ongoing support for technology. Information required by Zabala's model was collated on the (i) student's learning capacity; (ii) tasks the technology could assist; (iii) school's cognitive resource tools and (iv) environmental accommodations that the students needed. Wile's model proved more effective as an ongoing evaluation tool. Learning attributes and the school environment were evaluated on seven variables, organisational

systems, incentives, cognitive support, tools, the physical environment, and each student's skills and inherent ability. The first five are external to the student and can be addressed by the school. The student's inherent ability and motivations for producing performance gains require the technology is constantly available (Edyburn, 2001). Factors required for successful interactions between technology and student users were found to be (1) its ease of use, (2) ability to ameliorate the disability, the response effort required and the immediacy of reinforcement. The software performed well, but difficulties arose from faulty equipment, a sound card and less than robust headphones that needed replacing. Although many factors influence a successful introduction, the breakdown of only one factor may cause abandonment (Johnson & Evans, 2005). The Wile model was used to evaluate the school's future accommodations, with a teacher aide being trained to support a development of the program and Macintosh compatible software universally adopted.

In this school the impact of using VRS was positive and wide-ranging but varied in magnitude. Student A enjoyed the enthusiastic support of his teachers for the impressive changes to his written communications and academic achievement. Student B did not make the same impressive improvement. He was ill then experienced computer difficulties in the final school term. A faulty sound card caused the software to become dysfunctional. He was not reequipped until two weeks before the exams. Student B was able to produce written texts without the VRS but at a reduced speed. His dictation was more accurate and faster than his typing. He found he was more easily distracted when typing rather than dictating, so he put less effort into editing. For Student B the software's accuracy was consistently over 90% but that still meant many transcription errors. Strong editing skills were vital for the successful use of VRS, and the value of mature writing techniques cannot be overstated. Student B did not commit enough time to careful editing.

VRS frequently cannot be used in a classroom so the development of strong planning and note making skills were paramount for subsequent successful dictated text production. Both students became experienced note makers and planners. When teachers made significant adjustments to their classroom organisation to accommodate the students' needs, like finding a space close to the classroom, they were rewarded with the students' more engaged learning behaviour. The students' teachers were enthused by their improved writing outcomes.

*I am delighted to see Student A gain an 'A' rating on the relevant topic criteria in his recent exam. This has confirmed my impression that he has an excellent grasp of the concepts that we have been dealing with.*

(Student A, SOSE Report, November, 2007)

*His teachers have made positive comments about him and seem pleased with the improvement he has shown; we find him a capable young man and are impressed with his level of maturity. He has performed well in the mid year exams and we hope he is*

*encouraged by his success.*

(Student B, Tutor Report, July,

2007)

The ongoing support from teachers and parents was significant in signposting and maintaining learning improvement.

### **Conclusion: The school and differentiating writing tools**

Writing by dictation with ongoing teacher support provided these two students with affirmation of improved learning outcomes as their writing skills developed to meet their academic challenges. A wider repertoire of writing skills and independent learning strategies enabled both students to achieve greater academic success than had been previously expected of them. The software facilitated experiences of writing success and some teachers' targeted involvement affected their holistic achievement.

By correctly attributing personal learning strengths and difficulties, and selecting appropriate learning strategies to overcome these difficulties these two struggling writers changed their cognitive and affective outcomes. They learned to persevere with assignments to achieve markedly better writing performances. Practising learning strategies required time and support, but the rewards of improved writing efficacy and included greater concentration, confidence and engagement in class (Goldberg et al., 2003).

The three questions posed in this study are answered by the powerful impact that differentiating the learning and writing process and the use of different writing tool had for these students. Voice recognition software enabled both students to find their writing voices, to create texts that appropriately communicated their knowledge and understanding of the subjects they studied. They still needed more time than their peers to create quality texts. By the end of the year, they were consistently meeting the writing requirements achieved by their peer group. The school recognized the importance of individually supporting new learning with a different writing tool.

The Independent school where this research was undertaken currently has 16 students using the software. The Tasmanian Qualifications Authority and the International Baccalaureate accommodate its use for final examinations. Students with a specific writing disability can become competent writers with the supported use of VRS.

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