The Effectiveness of Word Prediction Software WORDQ: "...Predict it, Hear it, Choose it, Review it, Correct it, Write it now..."

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ABSTRACT

Our cluster receives a number of referrals from schools requesting support with the implementation of assistive technology tools (particularly word prediction software) to support struggling reluctant writers. It is widely acknowledged that writing is pivotal for academic success, and when a learner has difficulty expressing their ideas they often can become alienated and frustrated. Fledging research suggests that the appropriate use of assistive technology like word prediction software can remove such barriers for struggling writers. A popular word prediction software tool used in New Zealand schools is WordQ. This article discusses the background to WordQ, summarises the research supporting its effectiveness as a tool to support struggling writers, and highights ways to overcome barriers to enable the successful implementation of WordQ in schools.

Practice Paper

Keywords: WordQ; word prediction software, writing

TE KOERO TAHUHU: HISTORICAL BACKGROUND

WordQ is a writing tool that uses word prediction and speech output. The software has been around since the early 1980s. The original purpose of word prediction software was to increase and improve writing speed and accuracy as well as to reduce fatigue for people with physical disabilities (Love, 2003; Smith; Tam, 2009 2010). Word prediction software has evolved over the last 30 years through the work done by software pioneers like Schwejda and McDonald (the creators of Co:Writer) and Dr Shein (one of the creators of WordQ). Today, word prediction software aimed at supporting struggling writers (for example WordQ, Co:Writer, Write Outloud, Dragon Naturally Speaking, etc.) is commonly used in New Zealand schools. Since the release of WordQ in 2001, over 2,000 schools in Ontario (Canada) alone have installed WordQ software, and in recent years it has become popular in New Zealand, USA, UK, Germany and Australia (GoQ software, 2010).

Te Putaketanga: The Purpose/Intent

Word prediction software was originally developed for learners whose keyboarding skills were severely limited by their physical disabilities. Previously, learners who could not use the standard keyboard used slow and clunky alternative ways for choosing letters, for example, switches, trackballs, head and mouth. Word prediction software was therefore developed to reduce the gap by simply reducing the number of selections necessary for encoding words (Schock, 2011). Today, word prediction software has advanced, and research shows that it has some benefit in supporting the writing process for students with learning disabilities (MacArthur, 2009; Mezei, 2012; Smith, 2010). It can be of benefit to all learners who experience difficulties with writing because it helps with word choice, word creation, spelling, and overall typing. It can also be tailored to specific needs of learners, and teachers are able to add specific words into the programme to ensure learners use these words in their work.

The current WordQ software was designed to be used along with standard word processing software to provide spelling, English grammar, and reading assistance. Learners who experience difficulties with writing and editing can benefit, including those who have learning disabilities (LD) such as dyslexia, or who are learning a second language. Although WordQ is advertised as a beneficial writing aid for individuals of all ages (GoQ Software, 2010), younger learners (from Year Three down) might need the support of an adult, a parent or a teacher, because of the computer skills and keyboard skills needed to use the technology. In addition, a level of phonological awareness is required - students who are unable to identify the beginning sound of words will not benefit from using WordQ software because the user has to provide the first letters of the word (MacArthur, 2009).

WordQ has user-friendly functions that work seamlessly with any text-based programme such as graphic organisers (e.g. Inspiration), internet/email, and word processing programmes. The programme suggests words, reads sentences back to students

as they write, and recognises incorrect homonyms and creative word spelling and word flow. It also remembers how each user writes, and can therefore predict what words the learner will use. The basic concept behind the WordQ software is word cueing (Quillsoft, 2010). The cues provided by the software are designed to take advantage of the skills of the user while allowing them to compensate for the problems they might have. As the user/learner writes, on going speech feedback provides cues to help the student self-detect errors (GoQ Software, 2010). These cues are first of all visual; the user/learner is now able to see suggested words that they might use. If they experience problems reading the visual cues, they are able to hear the words by scrolling down through a suggested list of words displayed on the computer monitor screen. Learners are therefore able to see and hear the suggested word (GoQ Software, 2010).

WordQ is primarily used to support struggling writers. It therefore features a number of components that are aligned with effective practices of writing. Research conducted by Graham and Perin (2007, cited in Smith & Okolo, 2010) supports this – they highlight three research-based practices that teachers would find to be effective with students with learning difficulties and which WordQ can support. These are that teachers should explicitly teach students how to plan, revise, and edit their text; set students specific and achievable goals for each assignment, and teach students word processing skills (Smith & Okolo, 2010). The researchers assert that effective writing practice takes advantage of technological writing tools. They also endorse WordQ as an 'excellent' teaching tool for students with learning disabilities. The word prediction feature provides a list of words on the computer screen as the learner writes: this helps them if they have trouble spelling or choosing the right word. The text reading option makes WordQ a useful proof-reading tool: it allows for auditory proof-reading; a user can hear what they have written in a sentence or passage; – a proven way to develop grammar, spelling, pronunciation, and comprehension skills, plus it motivates learners to edit, correct and improve their personal writing (DTSL, 2012).

NGĀ KAWENGA: WAYS OF KNOWING, RESEARCH, LITERATURE, TIKANGA

Research on the effectiveness of word prediction software is limited to a few controlled studies (Tam, 2009). Since hard evidence is lacking, many educators are questioning the efficacy of word prediction software (MacArthur, 2009; Smith, 2010). However, MacArthur states that because there is limited research available on a particular tool (e.g. word prediction) this does not mean that the tool is not effective. Furthermore, there is sufficient research to indicate that word prediction and speech recognition software can be of benefit for some learners, particularly low-achieving learners when used with evidence-based writing interventions (MacArthur, 2009; Smith, 2010). The benefits highlighted in the research are outlined in the next section.

Achievement and Independence

WordQ is a technology that has the ability to help non-readers and non-writers to read and write, which for learners with learning disabilities can lead to a sense of achievement and independence (Poplin, 1995, as cited in Schock, 2011). The programme features allow for teachers to focus on the learners' strengths and abilities; for example, when the programme starts, the user is prompted to choose a writing vocabulary that they want to use: starter, intermediate or advanced. Teachers and learners also have the option of adding and creating word lists and words banks. All learners can therefore benefit from using WordQ as the programme can be used in different ways, namely whilst typing, proofreading, or to assist with reading. Some users/learners might use it for all three and therefore gain greater independence in the writing process.

Self-Efficacy

Independence leads to a greater sense of self-efficacy (a belief in their own capability), and self-confidence: learners are therefore more likely to try harder on their work. Sometimes, computers are used to address deficits in learning through reductionist means such as completing spelling lists or worksheets. WordQ, however, focuses on the learners' strengths and abilities because it allows learners to compensate for the problems they might have. Teachers are therefore able to create a holistic learning environment (needs and strengths of learners are considered) through strengths-based learning (builds on learners strengths and abilities and reduces the cognitive load for learners).

Cognitive Load Theory/Theory of Chunking

The cognitive load theory suggests that if teachers allow for the learner to lower the level of mental energy used in order to process information, greater energy then can be directed towards crucial learning activities rather than those which are adjunct to learning (Cooper, 1990, cited in Schock, 2011). This is particularly important in writing as most writing tasks demand considerable cognitive resources: even experienced writers need sustained and continuous effort to produce good writing (Torrance & Jeffery, 1999, cited in Schock, 2011). WordQ has

the potential to ease the cognitive load for learners because it has the ability to simultaneously sound out words, comprehend the word choice, spell the word and then determine if the word makes sense. Many users are able to write better and more accurately – WordQ makes it easier for them to get their ideas on the page, spelling is made easier, which translates into saving time and energy. By focusing on their strengths, users have the stamina to write longer, and the quality of the writing improves because users can use the words and sentences they want, instead of only focusing on the words they can spell and the simple sentence structures they are confident with.

According to Schock (2011), Miller's (1956) theory of 'chunking' has relevance to users of WordQ. Miller suggests that learners at an early stage of skill acquisition normally have to monitor several external stimuli at a time and coordinate a number of discrete responses (cited in Schock, 2011). However, learning the responses becomes integrated into one unit and the skill is then simplified and requires less attention for execution. This allows for 'automaticity', in other words, like with any new skill, the more it is practised, the more the task becomes automatic. Automaticity reduces the cognitive load placed on the working memory. Keyboarding is an example of such a skill requiring mastery to increase automaticity (Schock, 2011). A foundation skill necessary for the effective use of WordQ is keyboarding skills; the more students use the WordQ, the more they develop their keyboarding skills.

Scaffolding

WordQ aligns with Vygotsky's (1980) theory of scaffolding. According to Vykotsky, optimal learning occurs when the learner is working in the Zone of Proximal Development (ZPD), the area of development between what the learner can achieve by themselves and what they can achieve with assistance. This means that the task must be slightly too difficult to perform independently (instructional level) and the learner should be supported or assisted by a knowledgeable other (teacher or peer) to scaffold (support or guide) in order to complete the task. Learners are able to write with the support of WordQ without stifling their creativity. The programme offers just enough support and prompts to enable all learners to write confidently. This programme also allows them to learn by being active participants in their writing. This software offers a comprehensive writing environment as it includes both a word prediction (which can be a fixed word prediction window or a floating prediction box) and 'word banks' to assist and scaffold writing.

Universal Design for Learning

In a universally-designed classroom, teachers provide students with the tools necessary to adapt methods and materials to their individual needs, flexible goals for learning, and continuous assessment (Hitchcock, 2001, cited in Schock, 2011). WordQ meets the needs of many learners, not only a few - it helps teachers differentiate their teaching and therefore embraces the principles of Universal Design for Learning. The software offers multiple options for students to access information, demonstrate what they know, and get excited about learning. When integrated with mind-mapping software - for example, Kidspiration or Inspiration - this allows the teacher to plan, organise and structure almost any learning task (Grant, 2006). In addition, Inspiration/Kidspiration provides a variety of ways of representing, engaging and expressing: working in tandem with mind-mapping software, WordQ is able to support learners as they brainstorm ideas, organise their inquiry, develop written responses and present their findings – definitely a universal design tool (Grant, 2006). WordQ is also endorsed by the Centre for Assistive Technology Team's top 10 universal design for learning tools (Education, 2012; New Zealand Ministry of Education, 2011).

Social-Cognitive and Socio-Cultural Models of Writing

WordQ is closely aligned to the social-cognitive and socio-cultural models of writing. With the development of social-cognitive and socio-cultural models of writing (e.g. Englert & Mariage, 2003; Flower & Hayes, 1981; both cited in Schock, 2011), the teaching of writing shifted from teaching grammar and mechanical aspects to teaching about the processes of writing, text features and organisation, and the meaningfulness of content. There are six key components in the development of writing based on the social-cultural model. First: creating a supportive environment comprising more-knowledgeable writers as models. Second: recognising writing approximations as success. Third: using supportive dialogue which shapes the students' thinking as they write. Fourth: developing planning strategies for creating text. Fifth: using editing and revising strategies. Sixth: publishing and sharing writing with real audiences (Bereiter & Scardemalia, 1987; Dyson, 1995; Englert & Mariage, 2003; Flower & Hayes, 1981; MacArthur, 2009, cited in Schock, 2011). Using the Cognitive Process Theory of Writing, developed Flower and Hayes (1981, cited in Cunningham, 2013)), learners who have difficulty with writing may experience difficulty in three areas associated with writing, namely planning, translating

and reviewing (Cunningham, 2013). Planning involves organising and developing ideas for writing; translating involves converting ideas into visible language, and reviewing involves examining what has been written and making changes where identified (Flower & Hayes, 1981, cited in Cunningham, 2013). WordQ satisfied all of the above.

Family/Whanau Centred

WordQ's unlimited school-wide licence provides for school and home access. This benefits the family – children then have access to the software at home, which means they can complete homework tasks more independently, more time to use the programme and develop their skills; parents are less stressed because their children will have more support to complete homework.

TE WHAKATINANATANGA: IMPLEMENTATION/ USE IN PRACTICE

There are various ways in which the software programme could be implemented in schools, depending on the type of software purchased, the school's IT infrastructure and the willingness of the school to implement assistive technology to support all learners. Schools have the option of purchasing a single-user licence or an unlimited school-wide licencing that includes student-at-home privilege.

Below is an outline of the implementation and decision-making processes I employed to support the school-wide implementation of WordQ at a primary school, in my role as an RTLB. Research has shown that intermittent or one-off training sessions would not bring about change in the classroom (Zhang, 2010). Therefore the classroom teachers in Years 1 - 6 were provided with on going professional development and in-class support that focused on integrating the WordQ software technology into the curriculum and teaching. Below is a graphic (Figure1) I designed using mind mapping software describing the implementation process - how it works in action, the people involved and roles, training or additional educational support needed, the goals that are to be achieved, and how these are measured.

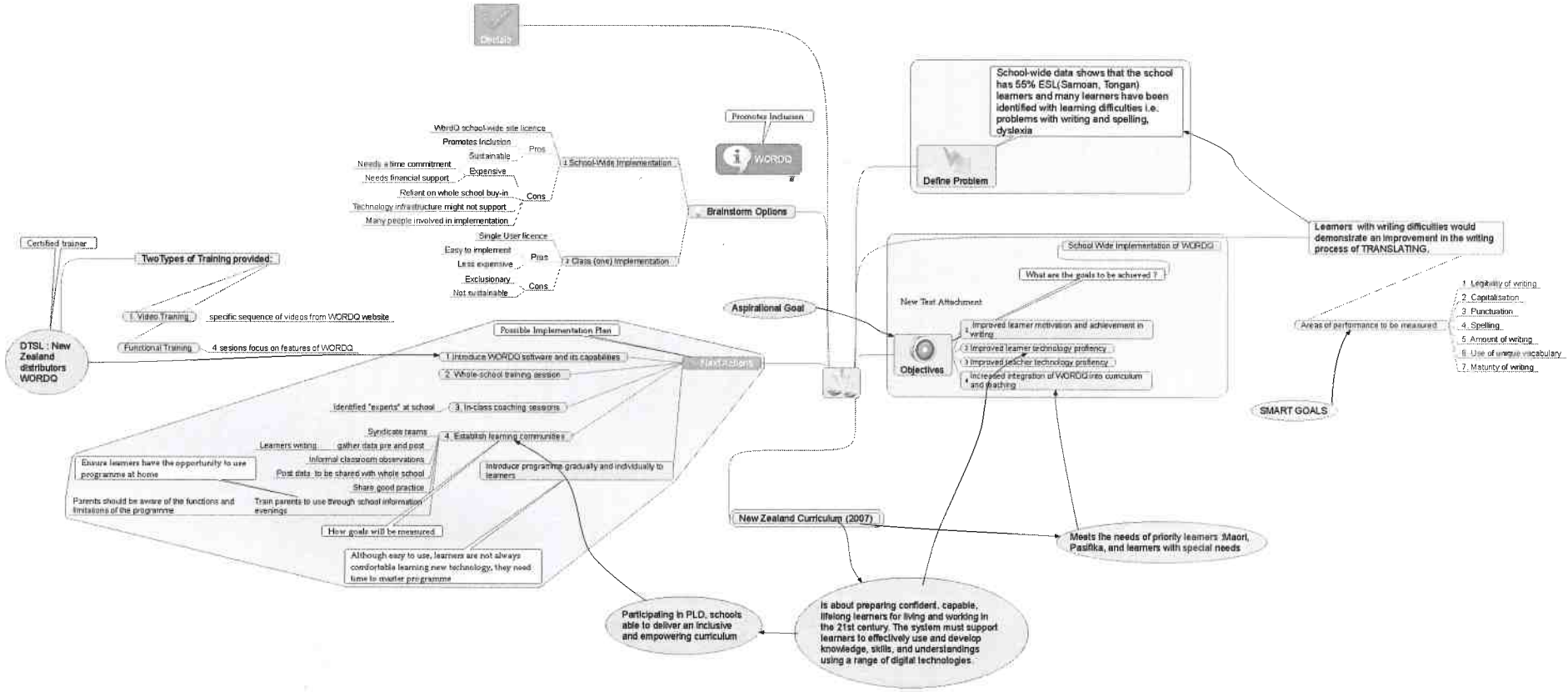

Figure 1: The Implementation Process.

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Figure 1 graphic highlights that successful implementation is reliant on a structured approach: identifying the need, then setting goals and how they will be measured; the support needed, and making links to key documents i.e. New Zealand Curriculum. In addition, the success also depends on the following key elements to be considered before, during and after its implementation (Zhang, 2010). The graphic below – Figure 2 (I designed using mind-mapping software) - outlines the key elements, namely hardware, software, facilities, resources, support, people, budget/finance, and organisational change.

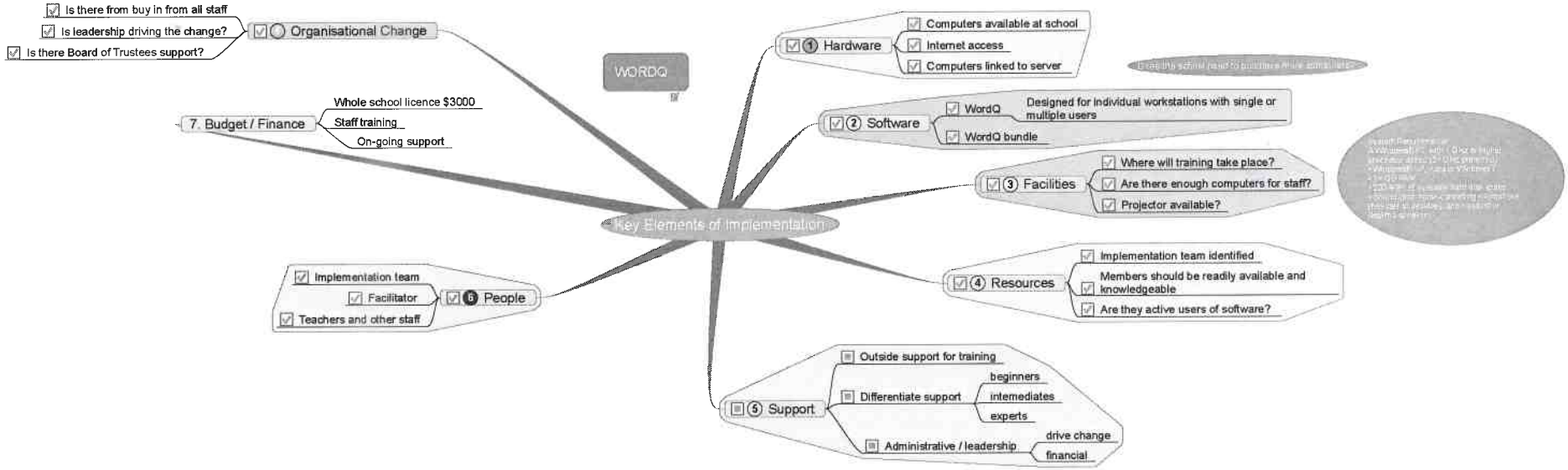

Figure 2: Key Elements to the implementation of WordQ

Figure 2: Key Elements of Implementation (adapted from Zhang, 2010).

Table One highights some strengths and limitations of the programme

Table 1: Strengths and Limitations of the Programme

Strengths	Limitations
• User-friendly – interfaces with other Windows-based word processing programmes or graphic organisers • Can be used online to read internet pages • Read feature – great for proof-reading • Teachers can tailor software to meet individual needs • Scaffolding of learning helps learners to become independent writers • Improves their skills in spelling, grammar and punctuation • Boosts their self-confidence • Allows for home use • Promotes inclusion • Least-expensive in comparison to similar word prediction software • Promotes digital learning	• WordQ and SpeakQ must be installed on individual computers, not on a network • Classroom teachers need to know the basic functions of WordQ • Limited teacher-training • School culture that does not support technology adoption • Lack of funding • Identification and consideration of how technology can support learners • Limited knowledge of teachers/school of what technological tools can be used to support all learners • Limited research on the effectiveness of technological tools to support learning

Source: Prupas, 2010: Smith & Okolo, 20

NGĀ HURIHANGA: ADAPTATIONS AND IMPLICATIONS FOR PRACTICE

Writing is a complex skill and therefore many learners may experience difficulty with many aspects of writing. This includes problems with the mechanics (spelling, punctuation, etc.) and written content expression. However, word prediction software like WordQ can enable learners to bypass their deficits and support them through all stages of the writing process (Evmenova et al., 2010; Zhang, 2010). Smith and Okolo (2010) suggest that one way to understand the effectiveness of technology use is to examine what we know about effective evidence-based instructional practices, that is, the strategic and procedural support for writing, and link the critical features of this evidence practice with technology-based solutions, for example, WordQ.

WordQ can be adapted to meet the learning needs of all writers including English as second language (ESL) learners, learners with specific learning difficulties, and learners who experience difficulties with writing. The programme is especially powerful when used in tandem with Inspiration and Kidspiration (Grant & Shein, 2006). These two programmes working together can support writers throughout the entire writing process; not just at the drafting stage but from brainstorming to research to organisation and final copy.

The joint use of the two programmes enables teachers to create flexible digital writing frameworks in which the structure and organisation of writing is both supported and enhanced (Grant & Shein, 2006). Using WordQ in the writing process ensures that writers are not limited by spelling, memory, lack of ideas for writing or language production issues. WordQ provides immediate auditory feedback, in-context word prediction and a read-back feature that complements the graphic organiser programmes like Inspiration and Kidspiration. Used jointly, these two programmes provide a seamless, flexible supportive learning environment to meet the needs of a range of struggling writers.

Figure 3 is a mind-map graphic of how WordQ can be adapted to work in tandem with graphic organiser software like Inspiration and Kidspiration to support the writing process - from brainstorming, research and reading, organising information, writing frameworks, and editing and proofreading.

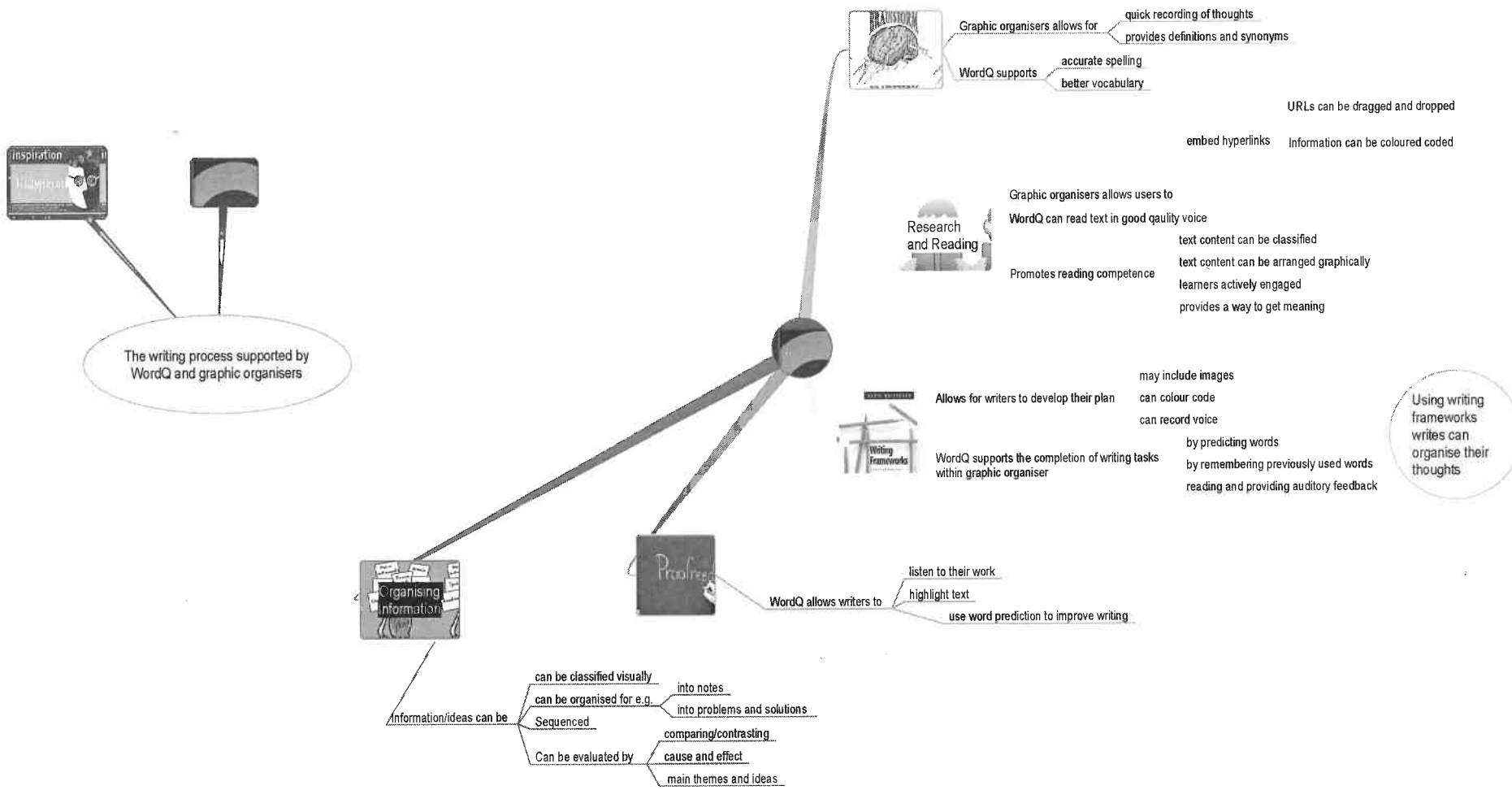

Figure 3: How WordQ can be Used with Graphic Organisers (adapted from Grant & Shein, 2006).

CONCLUSION

Overall, the research evidence suggests that when used as support for evidenced-based interventions i.e. strategic and procedural support for writing, word prediction software can be very effective with all learners but particularly beneficial for learners with learning difficulties (i.e. dyslexia) and ESL learners (Smith & Okolo, 2010). WordQ can be used specifically for ESL learners: ESL learners can be considered as learners who have spelling difficulties. They are likely to feel frustrated in writing due to the failure to find proper words or the failure to spell the words correctly. WordQ, therefore, can work well in supporting ESL learners in the writing process. The programme learns new words automatically, and can also filter the misspelt ones, further supporting ESL learners. In addition, the word prediction list can be bilingual; it can therefore also be used to help learners with spelling in Māori or any language.

For learners with dyslexia, writing and proofreading can be very challenging. Identifying mistakes can be extremely difficult. WordQ's word prediction, text-to-speech, and voice recognition features allow for dyslexic writers to hear misspelled words. They are able to hear what they have written in order to check for spelling, grammar, and punctuation (Marshall & Raskind, 2010).

IMPLICATIONS FOR RTLB PRACTICE

As a Resource Teacher of Learning and Behaviour, I would strongly recommend WordQ to be implemented school-wide in schools. However, schools need to adopt a step-by-step implementation process (as outlined in Figure 1 and Figure 2). Patience is called upon when adopting new technologies like WordQ. It takes time adjusting to new ways of doing things. For teachers and learners' alike, accepting new technologies can be difficult. Following a structured implementation process will lead to the successful adoption of the new technology. (Prupas, 2010) cautions that WordQ does not work for everyone and the success of WordQ depends on the nature of the learners' disability, but also on their personality, maturity and comfort level with technology.

As demonstrated in Figure 3, the software does not replace the writing process. Learners need to be taught how to use the programme in tandem with graphic organisers to plan out their ideas, write a rough draft, and then revise and edit their work.

In summary, assistive technology (AT) is recognised in the literature as a means of addressing problems learners might have with writing. The AT tools (for writing) consists primarily of software and these include graphic organisers, word prediction and speech recognition software. When used together (as demonstrated in Figure 3) it can support writers who are struggling.

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