"What page, Miss?" Enhancing Text Accessibility with DAISY (Digital Accessible Information SYstem)

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Structured abstract: *Introduction:* The provision of specially formatted materials is a complex and increasingly difficult task, given the extensive and burgeoning range of texts and resources available for classroom use. The need to extend the provision of accessible formats to include digital resources (in addition to braille, audio, and large print) led to a study that examined the benefits of providing curriculum materials in DAISY (Digital Accessible Information SYstem). The pilot study—Enhancing Text Accessibility for New Zealand Students, which was undertaken in 2008 and 2009—was designed as a qualitative study to determine the advantages and disadvantages of DAISY books compared with traditional formats and to evaluate the DAISY-related training needs of students and support staff members. *Method:* Purposive sampling was used to select participants who were identified by resource teachers employed by the Blind and Low Vision Education Network New Zealand (BLENNZ) and the Manurewa High School Vision Resource Room. A total of 12 students in years 7–10 attending secondary schools and 13 support personnel took part in the study, which involved training, interviews, and focus group sessions. *Results:* The overall response to DAISY was very positive, with a number of advantages over traditional formats identified. Participants were satisfied with the DAISY training they had received and reported high levels of confidence and competence in using DAISY. *Discussion*: Significant variables were identified as affecting the use of DAISY, including student preferences, abilities, and motivation; availability of DAISY text; reliability of and support for technology; and the provision of appropriate training in DAISY. *Implications for practitioners:* DAISY books provide a valuable adjunct to traditional accessible formats and should be a considered an option for students with visual impairments as part of their literacy provisions or "toolbox."

Print text used in classrooms has traditionally been transcribed or converted into accessible formats (braille, audio, large print, and electronic text) for learners who are visually impaired (that is, those who are blind or have low vision). Given the range of texts and resources that teachers are now able to select for use in the classroom, the provision of specially formatted materials has become a

more complex and challenging task. The key issue, however, remains unchanged. Learners with visual impairments require access to curriculum materials in their preferred accessible format at the same time as their peers. Coupled with appropriate teaching strategies and modifications, the provision of such materials may significantly influence curriculum access, participation, and achievement for these students.

Successful use of DAISY in classrooms in other countries provided the rationale for examining its use for students who are visually impaired in New Zealand. As a consequence, the DAISY Textbook Pilot Study was undertaken in partnership with the Royal New Zealand Foundation of the Blind (RNZFB), the Blind and Low Vision Education Network New Zealand (BLENNZ), and the Manurewa High School (Brebner, Spooner, & Clunie, 2009). Specifically, the study sought to examine the advantages and disadvantages of DAISY books compared to traditional accessible formats (braille, large print, and audio) as perceived by students and their support people, and the supports required for the successful implementation of DAISY books. The viability of producing curriculum material to the DAISY standard was also part of the study; however, the production aspect is not included in this report.

Learning to navigate, interpret, and understand the visual world without vision or with low vision is difficult. Most information for learning is coded in images and text. Print, as the accepted format for almost all text material used in schools, creates a formidable barrier to participation and learning for students who are visually impaired, unless it is provided in accessible formats. Restricted or lack of access to appropriate learning materials significantly impacts on students' learning opportunities (Alton-Lee & Nuthall, 1990) and, as argued by Brophy (2001), there is an obvious relationship between the "opportunity" to learn and achievement across the curriculum.

In New Zealand, the provision of alternate formats for students who are visually impaired is a shared responsibility. Under contract to the Ministry of Education, RNZFB is the major producer of curriculum materials in braille, audio, and large print. Materials are also produced for students by their local Visual Resource Centres. Accessible texts in both circumstances are generally produced on an "as needed" basis and, as a result, are produced only in the particular format requested by the individual student.

Peculiar and situational circumstances can influence the timely provision of accessible materials to individual students. School-based systems for requisitioning materials; teacher planning and organization to ensure transcription requests are submitted in a sufficient amount of time; and materials provider issues associated with access, delivery, and production; all may determine whether or not students who are visually impaired receive their accessible texts at the same time as their sighted peers. Although it is acknowledged that teachers need to retain the ability to make changes to the materials they originally selected to be used in their classes, this flexibility needs to be tempered with an appreciation of the reality of the time constraints that are associated with the procurement or transcription of

accessible materials so no students are disadvantaged.

Traditional accessible formats such as braille and large print require many more pages than their print equivalents. A print copy of the approximately 800-page *Harry Potter and the Deathly Hallows,* for example, transcribes into 10 braille volumes. The size, weight, and portability of specially formatted materials frequently pose physical challenges for students as they change subjects and classrooms throughout each school day. There are associated issues of storage, retrieval, and access to these materials within the school environment. What happens, for instance, when the teacher decides without warning to refer to or use a different volume from the one the student has brought to the class?

Advances in learning technology have resulted in new and effective solutions that can be offered to counterbalance some of the existing problems associated with traditional accessible formats used in schools. Digital formats not only offer increased accessibility, but also can enhance motivation for those students who are visually impaired who struggle with reading or who have difficulty coping with the unwieldiness of traditional formats. DAISY originally emerged as a new technology designed to meet the need for accessible audio for individuals unable to read print as easily and efficiently as a sighted person uses a printed book. It is an extensible markup language–based open standard (XML is a set of rules for encoding documents in machine-readable form). A DAISY digital talking book consists of a collection of files that may include any combination of text, audio, or image files together with synchro-nization files. The synchronization files allow for navigation around a book, bringing to the reader an experience similar to that of reading a print book. Readers are able to navigate from a table of contents directly to a desired chapter, jump directly to a particular page, skip to an index or glossary and back to the original place in the text, place bookmarks, and create text notes. Full-text DAISY books also enable readers to search for text.

A full-text DAISY book allows the reader access to text in a variety of formats—for example, simultaneous presentation of digital audio and refreshable braille—and is designed to be highly navigable and usable. DAISY's compatibility with current mainstream technology is advantageous in that, in addition to DAISY books being used on stand-alone DAISY players, DAISY can be accessed on computers using DAISY playback software, on cellular telephones, and on MP3 (digital audio file) players. Accessing DAISY books that contain text files requires either a computer or braille notetaker. DAISY books can be distributed on CDs (compact discs) or DVDs (digital versatile discs), downloaded from the Internet or through USB (universal serial bus) cables, so they are very portable. Text structured to the DAISY standard also facilitates production of hardcopy braille and large-print formats.

Methods

PARTICIPANTS

A representative sample of 12 students in total was selected from only three main Visual Resource Centres in order to limit travel costs for the researchers. To avoid any negative impact on students who

would be preparing for and participating in national qualifications testing in years 11, 12, and 13, the year level for participants was limited to students in years 7 through 10. The participants comprised a heterogeneous group of students with different eye conditions, visual functioning, levels of achievement, skills, school placements, and levels of available support. Four students used braille as their main reading medium. Eight students were large-print readers and used laptops. None of the braille users used laptops in addition to their BrailleNotes or PAC Mates. The main criterion for the inclusion of all students in the study was that they be competent users of their DAISY-compatible technology.

All of the students used audio in addition to braille or large print. *Audio,* in this context, refers to the traditional Talking Books that have human voice narration, as well as to the synthetic voice that accompanies screen reading software on computers and braille notetakers. Audio material provided to students at the time of the study was on audiocassette tapes, some of which were produced in four-track formats that required special Talking Book machines for playback. Unlike new audio technology, these large and cumbersome Talking Book players have little appeal for young people. The capacity for DAISY books to be used with students' existing equipment, either braille notetakers or laptops, eliminates many of the inherent problems with the older technology.

Ten resource teachers who provided support to the students chose to participate in the study. One parent also chose to participate. Although one other parent was present for the training, she chose not to be interviewed. Four teacher aides were present at various training sessions, but only two agreed to be interviewed.

Approval was sought and granted from the University of Auckland Human Participants Ethics Committee in November 2007. Informed consent to participate in the study was obtained from individual school principals and boards of trustees, the students, their parents, and the support personnel involved.

MATERIALS

When the study was planned, the DAISY standard was being updated to include a method of representing mathematical expressions. Thus, no production tools were available for efficiently producing mathematics in DAISY, and only one experimental player supported the updated standard. As a result, it was not possible to produce books that included a lot of mathematical equations, thus eliminating the production of mathematics and some science books in DAISY for the study presented here.

Each school was asked to provide a list of texts for each student participant so that the books could be produced in DAISY format in time for use during the 2008 school year. The number of books produced for each student was set at three to limit project costs. It was difficult to obtain lists of texts for all participants, since some students were starting new schools and testing had to be completed before they were assigned to classes. In addition, some teachers had not selected texts for the following year. Of the 12 students, lists for the following school year were provided for only four students. Production began on these texts, and a range of texts known to be commonly used in schools and suitable for the age range was selected for production. Texts

were produced for the remaining students as their requests were made throughout the year. The texts that were requested by and provided to students were those used in the English language arts curriculum.

Requested books produced in the DAISY standard contained full electronic text, digital images, and either synthetic speech or human-narrated audio. Students were provided with texts in DAISY and their preferred hardcopy format, either large print or braille, for use during the 2008 school year. Updated lists of available DAISY books were made available to students and resource teachers throughout the study. Students chose when and where they would use their DAISY texts during the course of the year. DAISY use was monitored by individual resource teachers during regular school visits and support was provided as needed.

PROCEDURES

In January and February 2008 pretrial structured individual interviews were conducted with students and support personnel prior to their receiving training. Only one interviewer was present for each interview. The student pretrial interviews comprised 35 questions designed to gain information about students' current special format preferences and the availability of text for both their recreational reading and school work, their perceived confidence and competence with reading and research activities, and the factors that influenced their reading performance. Students' attitudes about technology were also sought, as well as their current knowledge of DAISY books. Research questions were designed in conjunction with the University of Auckland's lecturer in vision impairment for the Graduate Diploma Special Education,

and input also came from a vision resource teacher with expertise in reading skills. The 21 pretrial questions for support people requested information on their personal use and proficiency with new technology, their summation of their students' reading and research abilities and competence, the current availability of students' texts, and their own knowledge of DAISY.

As DAISY use on a computer requires playback software, Dolphin EasyReader was installed in the computers of the laptop users. The BrailleNote and PAC Mate notetakers used by braille readers had their own DAISY reading software. A training program and documentation for DAISY use for both laptops and Braille-Notes were developed. The documentation included step-by-step instructions for using DAISY, as well as lists of hot-key commands. The students and their teachers were provided with hard copies of the training documents in their preferred formats, as well as electronic copies. Each student was provided with three DAISY books on a USB drive for use during training. They were allowed to keep the books at the end of the training sessions, so they could further practice the skills they had learned.

Two centers each hosted three students and their support staff members for one day of training involving approximately four hours of actual engagement with DAISY. Instruction was provided in a group situation and involved hands-on participation with students using their own equipment. Resource teachers were present to observe and provide support. Organizing group training in the other two centers proved difficult, and training was provided in a one-to-one situation for six students and their support staff members. No subsequent training was provided to students other

than the regular support provided by their resource teachers during the year.

At the end of the 2008 school year, students were interviewed individually to evaluate their experiences in using DAISY textbooks. The 45 post-trial interview questions for students were designed to investigate what they thought about DAISY books, the perceived advantages of DAISY books compared to the special formats they currently used for recreational reading and school work, whether any changes in their attitudes towards reading and research had occurred over the trial period, and their reactions to the training they had received during the study. Three questions specifically asked students to comment on how easy DAISY was to use and their perceived confidence and competence in using DAISY books. Each question required a response using a using a scale of 1–10 (where 1 was "not very easy, confident, or competent," and 10 was "extremely easy, confident, or competent").

Separate focus groups with students and support people were also held at the end of the year in each Visual Resource Centre. Questionnaires provided structure to the focus groups and provided opportunities for participants to comment on their general response to DAISY books, the use of DAISY as compared to their usual formats, and the training and support they had received during the study. Key points from the discussions were recorded.

Pre- and post-trial interviews and focus group responses provided extensive qualitative data. Participant responses to each question were paraphrased and entered into an Excel spreadsheet. Direct quotes of interest were highlighted on the hardcopy of the transcripts. Responses were then analyzed to determine any common themes or variances. Triangulation of data from student and teacher interviews, the focus groups, and by observation was considered to provide validity to the findings. Two researchers, in addition to the author, were involved in the interview process and focus groups in each Visual Resource Centre and were able to interpret the data from their different perspectives and areas of expertise, as an experienced teacher of students with vision impairment and a special formats librarian.

Results

ADVANTAGES AND DISADVANTAGES OF DAISY BOOKS COMPARED WITH OTHER FORMATS

Variables associated with different school settings, technologies, and levels of available support were reported by participants as factors that influenced the students' use of DAISY. Most students indicated they were frustrated by technology problems involving their own equipment or software other than DAISY. Table 1 presents the advantages and disadvantages of DAISY identified by students as compared to their usual braille or large-print formats.

Overall, students were satisfied with the training. They commented that features were well explained and that they had the opportunity to practice the functions until they were mastered. Group sessions provided opportunities for students to engage with other students with vision impairments and discuss relevant technology issues. Several students commented that they had later enjoyed the books used in training as recreational reading.

Students accessing DAISY through software on their braille notetakers found DAISY easier to learn and use than did

Table 1
Advantages and disadvantages of DAISY.

Advantages and disadvantages	Braille	Large print
Advantages		
Light and easily portable on USB as opposed to hard copy	X	X
Simultaneous audio and text improves reading speed for less proficient readers (improved ability to keep pace with the rest of the class)	X	X
Ease of navigating text and audio	X	X
Setting bookmarks more efficient	X	X
Choosing text easier than selecting hard copy book from shelf	X	
Access to entire book, not just the volume currently in current use	X	
Similarity of commands with BrailleNote (except marking and unmarking places and writing text notes)	X	
Speed and ease of locating particular quotes or passages	X	X
Text highlighting during narration assisted reader's navigation: "I don't get lost"		X
Ability to customize text (font size, text and background colors, text highlighting color)		X
Capacity to adjust text size improved reading speed		X
Human narration as opposed to synthetic speech (also assisted with pronunciation of words)	X	X
Clarity of audio (due to digital delivery of the voice files) maintained interest and engagement in task	X	X
Audio option preferred when poor lighting or eyestrain affected reading ability		X
Audio provided opportunity to "have a rest" or "space out," and was therefore more enjoyable for recreational reading	X	X
Disadvantages		
Additional time to set up laptops in every class as opposed to the ease of taking out a hardcopy large-print book		X
Absence of tactile diagrams when diagrams are important to the text (detailed verbal descriptions of diagrams, along with digital image files that cannot be accessed in tactile form)	X	

those students using laptops (see Figure 1). Braille notetaker users felt more confident and also scored their competence levels as higher than the students accessing DAISY via laptops. Two students said they found it "pretty simple" and had no trouble learning it. This rating is probably a reflection of the similarity of the commands used for both DAISY and other functions on the braille notetakers.

SUPPORT REQUIRED FOR SUCCESSFUL IMPLEMENTATION OF DAISY

Students' use of technology is likely to be influenced by the level of their teachers' knowledge and skills (International Society of Technology in Education [ISTE], 2000). Teachers and support staff members included in the study presented here expressed positive responses to embracing new technology in general. Although resource teachers considered their own DAISY training and student training to be interwoven, they suggested that teacher training should occur prior to student training. They also recommended that training be inclusive of all members of students' support teams, acknowledging the essential requirement that all staff members have the required specialized technology skills to provide appropriate instruction and support for students. As a prerequisite to
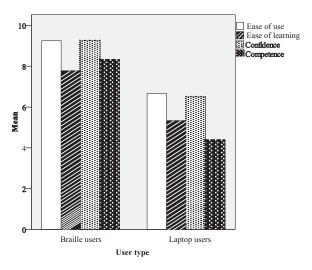
Figure 1. A comparison of self-assessments from braille and laptop users.

specific DAISY training, the need for general technology training focused on the equipment used by students to access DAISY (braille notetaker or laptop) was considered to be essential. Resource teachers also recommended that DAISY software be provided on their own laptops so they could familiarize themselves with and review DAISY functions as needed.

The need for training to be structured in sequential learning steps, so that mastery of easy and commonly used functions is achieved first, was identified. It was suggested that student progress be monitored against a checklist, to ensure that training is appropriate and focused. Ongoing training was also noted as being important. Also recommended by participants in the study was the establishment of support networks via e-mail, web-based technical support, and a DAISY helpdesk staffed by a person with appropriate expertise.

Discussion

AVAILABILITY OF DAISY BOOKS

Resource teachers commented on the lack of availability of DAISY books, and on the lead times involved in their production. Part of the problem with lead times lies with late requests for texts from teachers, which prevents production being completed in a timely manner. This problem can be compounded further by the amount of time involved in obtaining electronic files from publishers from which DAISY books are produced. The production team reported that in one instance it took six months for requested files to arrive from the publisher.

PERSONAL PREFERENCES

Participants shared their own preferences regarding the technology used in the study. The on-screen function buttons of the Dolphin EasyReader software were identified as being too small. Participants indicated that these buttons were not well contrasted against the background color, and the icons that depict their function were very difficult for students with low vision to identify. As part of their training, students were given a list of hot-key commands that could be used instead of the icons on the screen. One student (who

rated her computer skills as being poor), however, commented that she found remembering commands difficult. Problems with mastery of the hot-key commands indicate the need for students' skills to be monitored and for further training and support to be provided. The text in the dialogue windows, although supplemented with audio, could not be enlarged. The software producers have been asked to make these features more visually accessible.

INDIVIDUAL LEARNING OUTCOMES

It was beyond the scope of the research to determine the effectiveness of DAISY textbooks in assisting students to achieve individual learning outcomes. However, the research indicated that DAISY had clear benefits for students who are visually impaired, especially for the English language arts curriculum, which requires students to engage in text-based activities. Success in English is considered to be "fundamental to success across the curriculum" (Ministry of Education, 2007, p. 18). Students in the study were working at levels 3–6 of the New Zealand English curriculum. The achievement objective for level 6 requires that students will: "Integrate sources of information, processes, and strategies purposefully and confidently to identify, form, and express increasingly sophisticated ideas" (n.p.). Implicit in this goal is the assumption that all students have the same access to information. DAISY has the potential to effectively facilitate this access.

SOCIAL INTERACTION

Students' acceptance and use of any adapted learning materials or technology may be influenced by their own and oth-
ers' perceptions. Peers' reactions to the students' special formats varied widely. Electronic books were viewed favorably and considered "cool." One student noted that he thought his classmates were jealous of the audio component of his electronic books. Several students commented that their classmates took an interest in the books they used, particularly braille. In contrast, five other students indicated that they were unaware of what their classmates thought of their alternative formats, as their opinions had never been expressed.

Curzon, Selby, and Ryba (2005) argue that coupling technology with "the human compulsion to interact" (p. 194) enables strong communication partnerships to develop and thus, when used effectively, has the capacity to enhance relationships between adults and students and between learners and their peers. DAISY books in some instances facilitated positive social interactions with classmates, since physical barriers associated with the need for separate space and desks to accommodate braille or large print were removed. However, the fear that their technology accentuates their differences or attracts attention was a concern expressed by several students. As one student commented, "I just want to be like everyone else." In response to being asked whether there was anything she disliked about large print, another student replied, "Probably only the fact that it's different from everyone else's and that, I don't know, you just look different." Several of the students with low vision reported that they endeavoured to cope with regular print over electronic or large-print formats because they wanted to be the same as

their classmates. That their peers became "arbiters of inclusion" (Blamires, 2012, p. 103) through their influence raises important social issues for students who rely on different technologies to access learning.

In summary, the study identified a number of important variables that affected the degree of success of DAISY use by students in New Zealand. These variables include the individual preferences, abilities, and motivation of students, including their self-advocacy skills; the individual technology requirements and proficiency of students and their support staff members in the use of technology; the quality and reliability of available technology and technology support for students within the school environment; the tension between some teachers' ability to be responsive to student learning needs as a result of formative assessments, and the need for foresight in planning and ordering class texts; the availability of texts required in DAISY format; and the quality and nature of training available to students, parents, teachers, and paraeducators.

Conclusion

The results of the DAISY pilot study concur with the findings of the Scottish Royal National Institute of the Blind (RNIB) study in 2006, which considered DAISY as "not a one size fits all solution" (with large print, braille, and audio still being the most preferred formats), but offering "an innovative solution to making information accessible to blind and partially sighted pupils" (p. 7). DAISY has the potential to be a valuable addition to the existing literacy "toolbox" for New Zealand students, not just those students who

are visually impaired but for all students for whom printed text is challenging. As Tank and Frederiksen (2007) argue, new "digital formats provide new possibilities to counter the risks of social exclusion of print-disabled people and promote equality in access to information and knowledge" (p. 934).

Although decisions to adopt DAISY and actions to move forward the recommendations from the pilot study report were initially formulated by the key research partners, (RNZFB, BLENNZ, and Manurewa High School), full implementation of DAISY has been limited. Approximately 80 DAISY players were issued by RNZFB to visually impaired students in 2012, enabling them to access DAISY books. However, lack of familiarity with DAISY by both resource teachers and students has influenced demand for and, therefore, the provision of DAISY books. This, and the subsequent limited availability of DAISY books, has contributed to DAISY being a less-considered option by teachers and students alike. Of greater concern is that no DAISY textbooks have been produced since the pilot study due to a shortfall in resourcing for special formats provision.

An obvious gap therefore exists between research that demonstrates the effectiveness of DAISY and what is currently available to students. Given DAISY's potential to enhance text accessibility—not only for students with visual impairments, but also for all students who find print challenging—further investigation of the current factors that are restricting DAISY use in New Zealand schools is needed. Enhancing text accessibility for students will facilitate opportunities to learn and achieve. As Blamires (2012) argues, technology presents:

teachers and learners with potentially richer environments to learn in and from. For some learners these are not just powerful catalysts for engagement and understanding, they are vital. Without them, learning and participation will not occur, or will occur only with much difficulty and effort (p. 98).

Being "on the same page" is important in every sense. For students with visual impairments, being on the same page means having the ability to work from the same edition, the same volume, and the same page as their classmates. The call of "What page, miss?" by a student using DAISY in class might not, therefore, be considered a simple question, but rather a cheeky, yet joyful, declaration: "I have access to the same information as everyone else!"

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