

## DAISY Technology and Print Disabled

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**Abstract:** Access to information and knowledge is very important for people. However, there are restrictions on access to this information for certain groups of people. The print disabled who are the blind, partially sighted, dyslexics those with visual impairments, physically handicapped and learning-disabled who have difficulty in accessing print media information. Digital talking books were the significant technology for the print disabled community to access printed media information. Now a days many university and relevant agencies had launched the development of digital talking book services. The one thing that important for digital talking book services was Digital Accessible Information System (DAISY) technology it is an open international standard for accessible multimedia developed by libraries serving persons with print disabilities in collaboration with the target users around the world. The core of DAISY technology is synchronization of text, graphics and audio based around W3C recommendations to meet the needs of people who require diversity of accessibility features of reading materials to share human knowledge and provides much easier access to content for the print disabled. Thus, the DAISY technology provided excellent potentials for the production of digital talking books and effective to access information, it also implied an integrated performance for Print Disabled Learning Methods. This decreases the need for facilities and gap of disability people. Moreover, the knowledge of this studies also creating a society of participatory and a wide sharing of knowledge.

**Key words:** Digital talking books, DAISY technology, print disabled education, synchronization, Thailand

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### INTRODUCTION

The majorities of print disabled people are disregarded and cannot access the technology and facilities (Coombs, 1995). Many studies have demonstrated the advantages of using information and communication technology for print disabled people. These benefits include the enhancement of daily functions and literacy, extension of social networks, improvement in independence and quality of life and the facilitation of empowerment (Davies *et al.*, 2002). In recent years, technology has rapidly become more advanced and affordable. It has been used commonly as therapeutic and training media for disabled people (Aspinall and Hegarty, 2001). However, useful assistive technologies can help handicapped people access information. In the case of the blind, technology for converting text to speech is very helpful. Unfortunately, information has been stored in different languages, formats and locations. Most of it is available on the internet but a good deal of useful knowledge has been commercially stored in paper-based book form and is not easily accessible for the blind.

There is a published standard for formatting paper-based books to the DAISY digital talking book format,

commonly called DAISY or Digital Accessible Information System (ITA, 1997). For many years, DAISY has been made available to print-disabled readers on analog media such as phonograph records and audio cassettes. These media serve their users well in providing human speech recordings of a wide array of print material in robust and cost-effective formats. The DAISY allows the user to easily skip over or read footnotes and also offers the print-disabled users a significantly enhanced reading experience that is much closer to that of the sighted reader using a print book. An additional goal of DAISY books is to develop and provide a system which is easily integrated into digital talking books production and which is able to make use of future software developments. In addition, it will provide equal or better access to the information in a book than is available to a reader of a paper-based book.

The aims of this study are to create a summary of usability, effectiveness and efficiency of DAISY technology and print disabled education. It allows that who are interested to participate in accessing, producing, implement, improving and sharing DAISY books. This can be decreases gap for disability people and a wide sharing of knowledge.

## **DEFINITION OF DAISY DIGITAL TALKING BOOK**

The DAISY Digital Talking Book, like analog talking books, renders the audio in human or synthetic voice (Christensen and Duhring, 2006). Additionally, the DAISY can contain image files and a forthcoming version will also include a video playback capability that offering a wide range of features in order to provide services to a broader audience including deaf and hearing impaired people. The audio file must be either in MP3, WAVE, MPEG-1 or MPEG-2 Layer III or MPEG-4 AAC format. The text of a book is marked up in Extensible Mark-up Language (XML), a World Wide Web Consortium (W3C) standard somewhat reminiscent of HTML, the language used for web pages.

For use in DAISY digital talking books, the XML mark-up must adhere to a specific Document Type Definition (DTD) defining the legal building blocks of the XML file. The DTD for a DAISY is publicly available through the DAISY Web pages. The synchronization is mediated by Synchronized Multimedia Integration Language (SMIL) files which ensure the parallel presentation of the text part and the audio part of a DTB.

The SMIL files for DTBs follow a DTD of their own. SMIL is a W3C standard. The Navigation Control Center (NCC) consists of a Navigation Control File for XML Applications (NCX) file which is an XML application structured in accordance to a separate DTD. The NCX contains navigation points for both text and audio can be link to a table of contents. Each navigation point in the NCX is linked through a SMIL file to the corresponding location in the audio and XML textual content files, providing direct access to that location. The NCX controls the global navigation and provides access primarily to relatively large parts of the document. The NCX provides an overview of all the points in a text to which a user may navigate and offers direct access to selected structures in the book such as page numbers, notes and figures.

Once an NCX item has been selected, local navigation such as movement within a list or table or among a group of words, sentences or paragraphs it becomes possible. Digital Accessible Information System (DAISY) for Digital Talking Books (DTB) is not required to contain all of the possible constituents (Nes and Stenberg, 2007). The different combinations of elements have given rise to six types of DAISY. The six categories of DAISY types of DTB are the following (National Information Standards Organization (NISO, 2005):

- Full audio with title element: only this is a DTB without navigable structure. Only the title of the DTB is available as text and the content is presented as linear audio only
- Full audio with Navigation Center (NCC or NCX): only this is a DTB with structure. The structure is two-dimensional, providing both sequential and hierarchical navigation
- Full audio with Navigation Center and partial text: this is a DTB with structure as described above as well as some additional text
- Full audio and full text: this is a DTB with structure and complete text and audio. The audio and full text is synchronized
- Full text and some audio: this is a DTB with structure, complete text and limited audio
- Text and no audio: this is a DTB containing a Navigation Center and marked-up/structured electronic text only. No audio is present

## **THE HISTORY OF DAISY**

The history of DAISY started in 1988 by The Swedish Library of Talking Books and Braille (TPB) (DAISY, 2005). TPB is serving public libraries and print disabled university students with additional reading materials and they recognized the dissatisfaction with the then existing audio books.

From the beginning, the intention with DAISY was to provide for the print disabled students better access and use of curriculum literature. Especially organizations for visually disabled were involved. In 1991 a 3 year project was initiated by TPB with funding from a swedish government grant. The two goals were:

- To develop a new digital audio book technique that could: store >20 h of continues speech on a single CD
- Give the reader free access to the contents of the audio book from the table of contents

In 1993, TPB commissioned Labyrinten Data AB, a Swedish computer company, to develop the prototype software. The DAISY concept emerged, based on storing phrases of auditive material.

Additional requirements were added such as: ability to navigate from phrase to phrase or section to section (blocks of text), text search, page search, place and search for bookmarks and make notes. In 1994, the prototype was ready and a growing international interest for the new

audio format emerged. The DAISY Consortium was established in 1996. The aim of the international consortium was:

- Establish DAISY as a standard
- Manage further developments including playback tools
- Manage the use and licensing of DAISY
- Promote the concept

The focus is on offering the print disabled reader increasingly better products. The DAISY 2.0 specification was issued from the DAISY Consortium in 1998, specifying page numbers, tagging of headings (six levels), required bibliographic metadata, the Navigation Control Center (NCC) and SMIL files (linking audio files and text). In 1999 DAISY 2.01 Specification was defined including possibilities to use: Sidebar, note references, producer notes, page numbers and skip elements. An example is the ability to skip reading image captions. Audio Cascading Style Sheets (ACSS) were specified as a way to associate

a structural element to an audio cue and provide resource definition for example tell the user her/his position in the book. In 2001, DAISY 2.02 was launched which clarified extended and revised the 2.01 standard. SMIL metadata set, Master SMIL and supported audio formats were defined. DAISY 2.02 was based on XML/XHTML instead of HTML 4. DAISY 2.02 supported all six types of DAISY books, ranging from all text and no audio to all audio and no text.

In 2002, the DAISY 3 /NISO DTB (DAISY, 2005). Specification (ANSI/NISO Z39.86-2002) was established. In DAISY 3.0 the structure of XML-files was specified so, one master XML-file may be the base for producing DAISY synthetic audio files (to a DAISY book), electronic books and printed books. This is particularly interesting for producing DAISY full text books (NISO, 2002a) (Fig. 1).

In 2005, the 2002 specification was revised to ANSI/NISO Z39.86-2005. The current DAISY standard (NISO, 2002a, b, 2005). Contains at least the features that are represented.

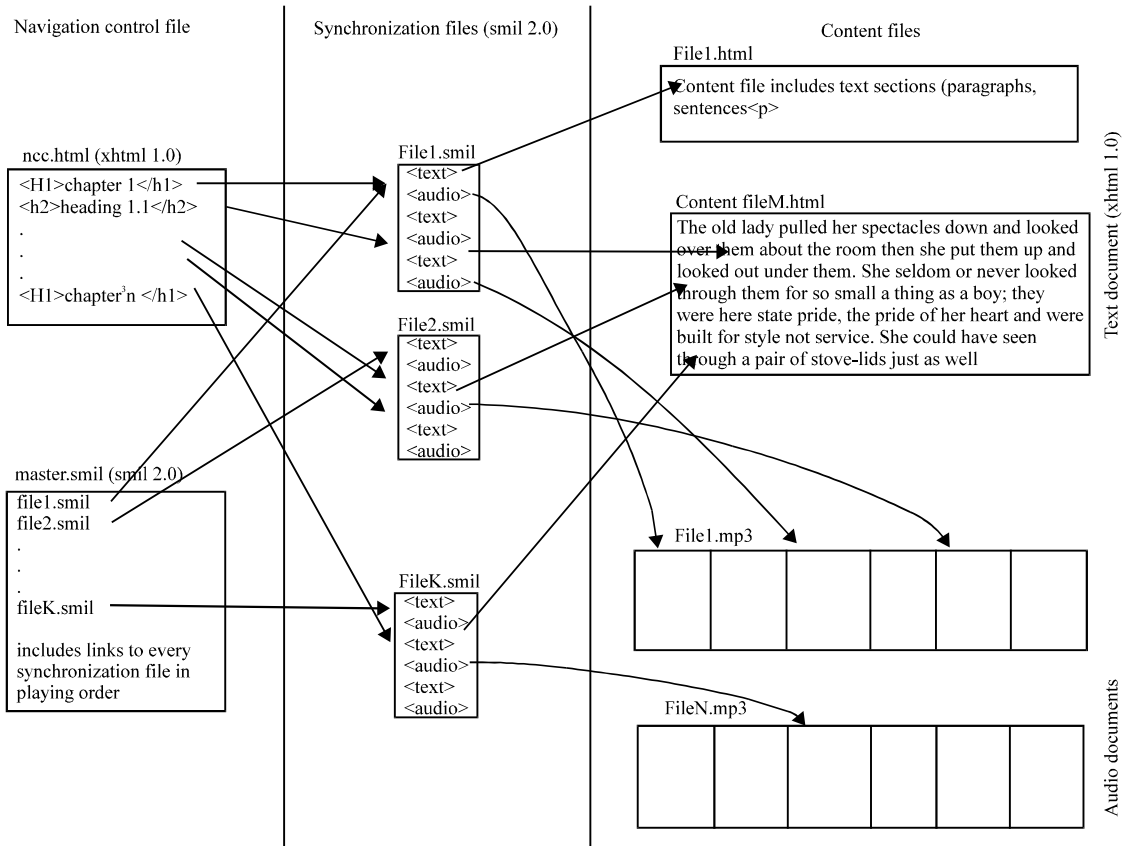


Fig. 1: DAISY 3.0 structure

## **DAISY 2.02 AND 3.0 SPECIFIED POSSIBLE FUNCTIONALITY**

### **DAISY features specified by the standard:**

- Move through text one character, word, line, sentence, paragraph or page at the time
- Read the book from beginning to end without navigating
- Move back and forth by time segments specified by the user
- Jump to specific chapters, sections, headings and other segments
- Fast forward and reverse through the book (increase audio speed and indicate elements)
- Reading at variable speeds (while maintaining constant pitch)
- Navigational presentation of structure and content in table of contents and Navigation Control File (NCX) (includes cover, comments, materials, lists of footnotes/figures/other objects)
- Adjustable NCX (level of granularity (collapse/expand), circularity (top-bottom-top))
- Move between NCX and actual book, choose where to jump (beginning or to certain point)
- Navigational indexes by hypertext linking
- Flexible (audio) presentation of notes and note-references, return-point in text immediately following
- Cross-reference access by hypertext links (audio signal when cross-reference is encountered), return to point in text immediately following the reference
- Possible to determine whether a cross-reference link is to external or internal target
- Possible to retrace cross-reference paths
- Large sets of bookmarks possible to insert and browse
- Bookmarks stored in a separate, synchronized file and exportable to other compatible devices
- Tagging bookmarks by searchable text or voice labels, equal labels compose bookmark sets
- Automatic placement of unlabelled bookmark at point when stopping playback
- Highlighting elements (section, phrase, etc.) and assigning labels and label sets (text or voice)
- Highlighting stored in separate file
- Highlighted elements indicated in book where read
- Browse and jump to highlighted elements
- Excerpt capability (copy and paste elsewhere)
- Search for text strings, structures and tags
- Spell-out capability for words
- Auditive indications of text attributes (bold, etc.) and punctuation (space, exclamation mark, etc.)
- Adjustable reading of tables (one row/one column at a time, locating cells, etc.)

- Nested list presentations (including determine levels)
- Skipping user-selected text elements
- Tagging of text elements or informing of layout and structure of text elements
- Information on logical, physical and temporal aspects of location in book (auditive and visual)
- Summary (title, author, playing time, number of parts/chapters/pages, etc.) and reporting (if within a chapter how many sections, number of pages, etc. in this chapter)-(auditive for visually impaired)
- Try to present scientific and mathematical information, organizational and flow charts, trees etc.
- Visual formatting of textual content through CSS and XLS (and Audio CSS)
- User control of presentation styles, selecting and modifying styles (layout, view, text font/size and colours of background, foreground, text, highlighting, controllers and other elements)
- Content rendering defaults

The features specified by the standards are not always present when reading a DAISY book. This is due to two reasons:

- Either the DAISY book is not produced to enable the features
- The features are not implemented in the playback device

For example if one wants to move through text one line at the time synchronized with the audio narrator, the DAISY book needs to be a full text version as well as having tagged each line of text to an audio file within the SMIL file. In addition, the playback device has to be able to both play audio files and present text on a screen, i.e., computer software (Nes and Stenberg, 2007).

## **DAISY PLAYBACK**

It is possible to play DAISY books on special players on PC and on standard MP3 or DVD-players. The special Players, PTN1, Victor Reader Stream and Milestone is designed for the needs of people who cannot read displays and have only limited computer skills as shown Fig. 2.

DAISY Software player also have many kind. However, in this study will show two kinds are following: TAB Player and AMIS. They can be used free of charge. They can be used to play the audio content, navigate into the book structure and to read the text of the book on the screen or on a refreshable Braille-display.



Fig. 2: DAISY player

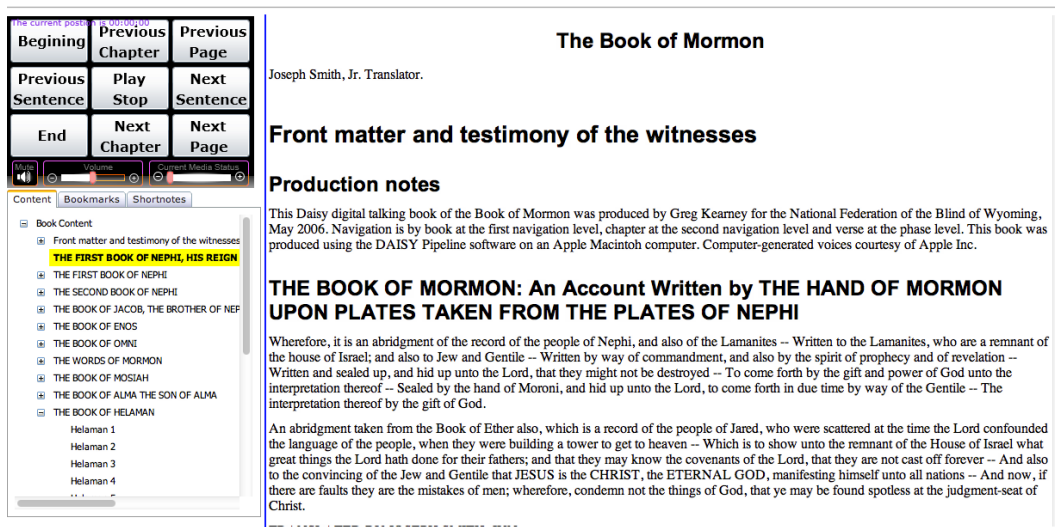


Fig. 3: DAISY Software player

TAB player, playback software developed in KMUTT, Thailand, it can be downloaded from: <http://www.daisynow.net/tabplayer>. AMIS is a software program that you can use to read DAISY books. It is self-voicing meaning that no specialized screen-reading software is needed in order for it to be used by visually impaired people. AMIS is open source software and is provided free of charge can be downloaded from: <http://www.daisy.org/amis>. Standard DVD and MP3 Players also play DAISY books but they do not support the advanced DAISY features like the navigation and browsing capabilities. Usually these devices can only be used by reading out the information from the display. Blind people do not have access to these off the shelf products shown in Fig. 3.

### DAISY AND PRINT DISABLED

The focus of this study is the print disabled and DAISY talking books. Print disability is defined as

blindness, visually impairment, a learning disability (such as dyslexia) or a disability that prevents physically holding a book (National Institute for the Blind (CNIB)) (CNIB, Library for the Blind, 2000). Often, print disabled people are perceived as information inhibited. But as digital information is increasing, the divide between print disabled and their access to information is decreasing (Coombs, 1995). Instead of denoting groups within the society as information inhibited, one could as well view society as information inhibiting. In other words, disability may be viewed as contextual and thus removing designed obstacles (such as printed information is for the print disabled) is enabling the disabled. Thus, it is particularly important that technological engineers, designers and developers avoid the creation of contexts that reinforce digital divides. The aim should be to find mediating formats that satisfy the demands of universal design, i.e., formats that can be used by all members of society.

According to dictionaries, the verb read may have several meanings such as (to) follow characters with the eyes and reproduce them as language to understand script (signs) and interpret, understand. In the classroom, the focus is usually on the first two interpretations the decoding of signs. With such an understanding of what it means to read, the adaptations and adjustments of exams and tests for those that cannot read in a traditional manner proves difficult (Cobb, 2005). However, one may instead focus on the outcome or aim of reading. Here the understanding and comprehension of what is being mediated is the core of the reading process, not the decoding activities or the type of medium. From such a perspective, there are many approaches to reading-printed text, audio recording, and video with sign language, electronic text and braille. Such a perspective on reading simplifies the integration of print disabled students in the regular school system.

Full text DAISY books (type IV) are viewed by some as a universally designed format: those that cannot read visual text can listen to the contents, those who like reading printed text can do so on a computer screen, the electronic text can be enlarged for the less-sighted and deaf-blind may read braille via Braille display. However, the use of full text DAISY is currently limited. The main reason is assumed to be that few full text titles have been released. Therefore choosing only full text versions when examining the usefulness of DAISY is difficult and audio DAISY books must be considered. The ease and efficiency with which one can navigate is still one of the key aspects of DAISY's success. In addition the storage, up to 50 h of continuous speech may be stored on one CD is a lot more efficient than previous audio books. One DAISY book usually equals one CD, instead of seven or eight.

### **DAISY AND EDUCATION**

DAISY books are used as additional educational material for print disabled student of all ages. The educator and trainer are responsible for the development, supervision and government of primary and secondary education and is the executive agency for the Ministry of Education and Research. The directorate manages the Norwegian Support System for special education and national statistics concerning primary and secondary education. It is also responsible for the production of all study literature for lower education.

Since, May 2008 many Nation Blind Library is responsible for the production of DAISY books as additional educational material. Nation Blind Library is part of the Support System for Special Education, its

focus on visual disabilities. Other library in Thailand units focuses on other disabilities and difficulties for example Nation Library of Thailand focuses on speech, language difficulties (including dyslexia), read training and research on reading and writing difficulties and dyslexia.

Today, the Nation Blind Library produces DAISY literature for the education. The Nation Blind Library of Thailand started producing all their audio books in the DAISY format in 2008. They produce around 100 titles yearly including literature for higher education but it not enough for print disabled users (Chaisanit and Surachai, 2009). In addition Nation Blind Library have produced some full text books for the upper secondary grades. In addition, audio-libraries offer DAISY books and some organizations distribute material in the DAISY format.

The many disagreements on how dyslexia should be determined is partly due to divergent research is dyslexia phonologic or visual defects? Some claim dyslexia is a biological deficit thus different from other types of reading disabilities. Others believe dyslexia is a delayed maturing process and only differ from other reading/writing difficulties in the degree of the problem. The common agreement is that dyslexia is a major and persistent reading or writing difficulty. This study does not distinguish between dyslexia and other reading/writing disabilities. There is however, an awareness of the possible differences between the two: the diagnose' general reading and writing difficulty is given are additional problems exists (cognitive aspects, low IQ and social emotional issues) whilst the diagnose dyslexia is given only if one has a normal or high IQ. The assumption is made that all DAISY student users have large reading and writing difficulties, else they would not have received additional learning material (Nes and Stenberg, 2007).

### **RESEARCH ON DAISY IN EDUCATION**

Most studies have focus on DAISY as additional learning material in primary and secondary schools and are qualitative using observations and interviews.

Eklund and Zlatintsi conducted in 2004 as a part of their exam work, a Swedish study comparing how teachers and students experienced a DAISY book compared to a printed folder containing the same information (Zlatintsi and Eklund, 2004). Their research questions encompass how the product was used why if not used, problems, the playback software (EaseReader) and whether DAISY was fitting for all. They experienced problems with reliability which provides an uncertain base for general conclusions: of 21 schools that had used the

material, only 4 schools, 11 teachers responded and tests and interviews were conducted with 5 students from the same class, all aged 12 two of the students had reading and writing difficulties and one concentration problems.

The same year, Bredtvet Centre of Competence conducted a Norwegian study with similar aims: to test how DAISY books work for students with moderate to serious reading/writing difficulties. About 7 students from 6th-10th grade were monitored >5 months. In addition, 6 parents and 5 teachers of the students were informants.

In 2005, Hilden observed and interviewed 32 Swedish children the age of 9-13 years over a time span of 3 months. Her focus was on what print-disabled students needs have to audio and digital books. Her study is broader than the others but her angle is pedagogical on different reading methods and not so much aligned with the research questions of this study.

In 2006, Lundeland (2006) did her masters in special needs education related to The DAISY Project. She focused on topics similar to those of this study such as: use, technical issues, different types of books, motivation and user training. She interviewed 6 students from 4 lower secondary schools and their 5 teachers. Her study is reported to suffer the same disadvantages as that of Bredtvet and Eklund being in depth and not generalizable and in addition she only used one instrument to collect data-weakening data reliability (Zlatintsi and Eklund, 2004).

In 2006, NLB finished their trials aimed at gathering experience with synthetic speech in DAISY. Also, MediaLT wrapped up an open informal on-line survey on DAISY having received 77 replies. About 63 respondents were visually impaired however, most were adult.

## CONCLUSION

Many educators identify three basic styles of learning: auditory, tactile/kinetic and visual. Auditory learners prefer lectures and discussions to textbooks. They interpret meaning by paying close attention to tone of voice, pitch and speed. Tactile/kinetic learners prefer a hands-on approach. They may be easily distracted by their need for exploration and activity. Visual learners often think in pictures and prefer graphical representations of concepts through charts, diagrams or tables.

Some individuals can't be categorized into these three simple learning styles. Print disabled may require a combination of two styles to understand and comprehend

new material. Others may have to adapt to new learning styles as their lifestyles change. For example, a visual learner who is experiencing the effects of aging on their eyesight may need to shift toward a more auditory learning style. Conversely, a learner who has successfully learned through hands-on, tactile methods may need to adapt to more visual and auditory learning as they enter higher education. By synchronizing audio, text and soon, video, DAISY multimedia can address the needs of each type of learner.

However, exciting as this technology is, its potential will be nullified if it is not readily available. It is therefore important that staff recognize its potential and where necessary, advocate for its provision. Thus with the DAISY technology, libraries and educator in the world are going to extend the reach to share accessible contemporary human knowledge world-wide to tackle global issues as one of key players and transfer diversity of human knowledge and culture to the future in accessible format.

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## REFERENCES

- Aspinall, A. and J.R. Hegarty, 2001. ICT for adults with learning disabilities: An organisation-wide audit. *Br. J. Educ. Technol.*, 32: 365-372.
- CNIB, Library for the Blind, 2000. Canadian National Institute for the Blind. <http://www.cnib.ca>.
- Chaisanit, S. and S. Surachai, 2009. A study of problems need and tendency of digital talking book production system for the blind. *SPU Res. J.*, 6: 64-72.
- Christensen, T.K. and M. Duhring, 2006. Access to information on demand by the aid of digital talking books. *Intell. Paradigms Assistive Prev. Health Care*, 19: 117-132.

- Cobb, R., 2005. Assessing the attainment of children with visual impairment in public tests and examinations. *Int. Congr. Ser.*, 1282: 806-810.
- Coombs, N., 1995. The information highway and the print disabled. Proceedings of the IFLA International Federation of Library Association conference in Istanbul. August 20-25, 1995, Istanbul.
- DAISY, 2005. Technical specifications. DAISY Consortium. <http://www.daisy.org/specifications>.
- Davies, D.K., S.E. Stock and M.L. Wehmeyer, 2002. Enhancing independent time-management skills of individuals with mental retardation using a palmtop personal computer. *Ment. Retard.*, 40: 358-365.
- ITA, 1997. Overview of accommodation solutions. Information Technology Accommodation. [http://www.dinf.ne.jp/doc/english/Us\\_Eu/ada\\_e/gsa/coca/sect\\_3.html](http://www.dinf.ne.jp/doc/english/Us_Eu/ada_e/gsa/coca/sect_3.html).
- Lundeland, N., 2006. Daisy-Book, digital talking book for everyone. The University of Oslo, Faculty of Education.
- NISO, 2002a. Digital talking book standards committee-document navigation features list. National Information Standards Organization <http://www.loc.gov/nls/niso/navigation.htm>.
- NISO, 2002b. Specifications for the Digital Talking Book: An American National Standard. National Information Standards Organization Press, Bethesda, USA.
- NISO, 2005. Specifications for the Digital Talking Book: An American National Standard. National Information Standards Organization Press, Bethesda MD. USA.
- Nes, M. and E. Stenberg, 2007. Appraising and evaluating the use of DAISY. For Print Disabled Students in Norwegian Primary and Secondary Education, Norway. University of Oslo. <http://www.duo.uio.no/sok/work.html?WORKID=57590>.
- Zlatintsi, A. and C. Eklund, 2004. I want to say something-digital book as textbook and teaching aid in school-evaluation. School of Computer Science and Communication Report, Stockholm University, Sweden.



All published information should be available for people with print disabilities at no greater cost. We develop and maintain international open DAISY standards.Â Library for All: Also for the print disabled. inABLE Gets Children Reading, Laughing and Learning. RNIB Celebrating 80 years of Talking Books. RoboBraille: Updated Web Interface and New Functionality. Sections: DAISY Marketplace. Your Stories. The information highway and the print disabled. Proceedings of the IFLA International Federation of Library Association conference in Istanbul. August 20-25, 1995, Istanbul -. DAISY, 2005. Technical specifications. DAISY Consortium. <http://www.daisy.org/specifications>. Davies, D.K., S.E. Stock and M.L. Wehmeyer, 2002. Enhancing independent time-management skills of individuals with mental retardation using a palmtop personal computer.Â Appraising and evaluating the use of DAISY. For Print Disabled Students in Norwegian Primary and Secondary Education, Norway. University of Oslo. <http://www.duo.uio.no/sok/work.html?WORKID=57590>. Zlatintsi, A. and C. Eklund, 2004.