

# Biblus – A Digital Library to Support Integration of Visually Impaired in Mainstream Education

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**Abstract.** This paper presents the background, status, challenges and planned future directions of the Danish Biblus project which aims creating a digital library solution to be used to support the integration of visually impaired pupils and students in the mainstream educational system. As a supplement to the RoboBraille alternative media conversion system as well as a stand-alone repository for copyrighted educational material in alternate formats, Biblus was created to allow students, teachers, visual impairment professionals and relatives to access digital versions of educational material. Subject to proper access rights, material can either be delivered directly to the user in the formats stored in the library or indirectly via RoboBraille as mp3 files, Daisy full text/full audio, e-books or Braille books. Future versions of Biblus will be available in multiple languages and include digital rights management as well as support for decentralised contribution of material.

**Keywords:** Digital library, inclusion, integration, mainstreaming, educational material, alternative media, Braille transcription, Daisy, mp3, e-book, blind, partially sighted, visually impaired, dyslexic, dyslexia.

## 1 Introduction

In the Danish educational system, most pupils and students with special needs are integrated in the mainstream system. Of the approx. 2,000 blind and partially sighted pupils in the Danish basic educational system (Danish: Folkeskolen), less than 100 pupils attend special school, bringing the integration ratio well above 98 per cent. In high school and beyond, the integration ratio is even higher. Although the support structure is somewhat different for pupils and students with a reading impairment, the model is similar: The vast majority of children with dyslexia are expected to attend mainstream school, although they may be taught in special reading classes whilst in the basic educational system.

A key barrier to the successful integration of pupils and students with special needs is the availability of educational material in suitable formats. In accordance with section 17 of the Danish Copyright Law, material can be produced in alternative formats for people who are incapable of using printed material. However, although

almost all material is prepared and published electronically, Danish publishers seem somewhat reluctant to make these electronic copies available for alternative media production. As a consequence, printed books may need to be cut up, scanned and the formatting reapplied before they can be made available to the visually and reading impaired [4], [5].

Visually impaired pupils in the basic educational system are supported by Synscenter Refsnæs, the National Centre for Visually Impaired Children and Youth, who operates an efficient alternate media production unit. Its materials, however, have until recently not been available in a searchable format, nor have teachers, pupils, visual impairment (VI) professionals or relatives been able to download such material.

Nota, the national Danish library for the print disabled, does offer a digital library in the form of E17 ([www.e17.dk](http://www.e17.dk)). This library system, however, primarily includes material found in ordinary public libraries, hence lacking educational material. Although international solutions such as Bookshare were considered, an internal survey conducted in the spring of 2011 of existing digital library solutions that might be used, revealed no suitable candidates. As a result, it was decided to create a free digital library solution.

The project has received financial support from the Danish Agency for Culture.

## 2 The Proposed Solution

Consulting teachers, parents, VI professionals and alternative media professionals throughout Denmark as well as partners in selected European countries, a list of requirements to the system was developed. In brief, the solution needed to be able to manage users, titles, digital assets, access rights and various means of delivery mechanisms.

**Users:** Because the contents of the digital library system largely consist of copyrighted material, user management had to be based on those accommodated in the Danish copyright legislation. Consequently, all external access rights have to be linked to the primary user. In Biblus, a primary user is defined as a person with a visual impairment and all other external access from teachers, relatives and VI professionals has to be linked to users in the primary user category. In addition to these groups, the system had to accommodate alternative media professionals, systems administrators and guest users.

**Titles:** Titles constitute representations of printed material; a title consists of meta data such as an ISBN number, an author, a book title as well as information about the publisher, publication year, language, edition, possible translator and similar. To ensure accurateness and limit the resources required to register existing material, the digital library system should be integrated with the official Danish library database, danbib, through its Z39.50-based interface [6]. In addition to published material, the digital library system should be able to manage unpublished material such as lecture notes and PowerPoint presentations.

**Digital Assets:** A fancy name for alternate versions of printed books or other material. The digital library solution should be able to contain one or more digital versions of the printed books in alternative formats such as plain text documents in text, Microsoft Word and ODT, audio books and audio pictures in mp3-format, structured talking audio books in Daisy format, image and pdf files with large-print versions, movies and more. As some alternative versions of titles – such as math books – consist of a combination of electronic files and tactile material, the digital library system should also be able to manage the administration and shipment of tangible assets.

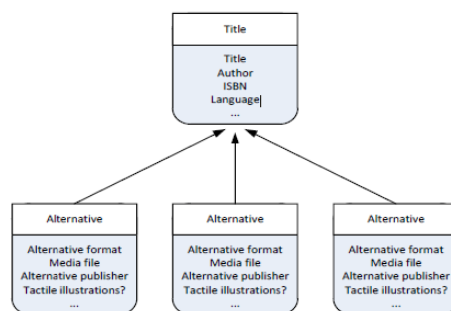
**Access Rights:** Although the vast majority of the contents of the digital library is expected to consist of copyrighted material, the library should also be capable of handling unrestricted material. As such, the solution should implement a hierarchy of access rights ranging from guest rights (can only access unrestricted material and search the index), via teachers/VI professionals/relatives (must be linked to a primary user; can access all material) to primary users (can access all material). Furthermore, the solution should be able to manage alternative media professionals (can add titles and digital assets) and administrators (can manage users).

**Delivery Mechanisms:** Once the user has identified a digital asset and subject to adequate access rights, the solution should make it possible to deliver this directly to the user by email or via a download link, or indirectly via the RoboBraille document conversion system.

To ensure that the digital library can be accessed by all types of users and to accommodate a future decentralised upload model, the solution should be web-based, comply with the W3C web accessibility guidelines [7] and work across all major architectures, operating systems and browsers. It should furthermore be possible to localise the solution to other languages and to support different copyright regimes.

### 3 Biblus Implementation

Based on the requirements listed, the Biblus digital library was successfully implemented during the second half of 2011. The solution was implemented as a web application in a Microsoft Windows environment using Active Server Pages, .NET 4.0 and SQL Server. Figure 1 below illustrates the relationship between titles and alternatives in Biblus:



**Fig. 1.** The relationship between titles and alternatives in Biblus

The user interface adapts to the rights of authenticated users, making it usable for library consumers (primary users, professionals, relatives), as well as producers (alternative media professionals) and administrators.

Table 1 below summarises how different users may access the digital library:

**Table 1.** Functionality by user category

	Search/ Retrieve	Order	Manage titles	Reports	Manage users	Manage system
Administrators	✓		✓	✓	✓	✓
Producers	✓		✓	✓		
Primary users	✓	✓				
VI professionals	✓ *	✓				
Relatives	✓ *	✓				
Guests	✓ **	✓				

\* Must be associated with a primary user  
 \*\* Can only retrieve non-restricted material

The primary user must exist in the digital library before associated VI professionals and relatives can be created. Similarly, once a primary user is deleted, the access privileges of associated users are revoked. Access to the digital library is typically granted for a period of one year, but access privileges can be revoked at any time in case of misuse of the system or other circumstances.

Library consumers may search the digital library using simple as well as advanced search functions. Once a particular title has been located, the user can review available alternatives and order an electronic copy. Biblus supports two direct delivery methods and one indirect: Smaller files can be delivered directly through email whereas larger files need to be retrieved via download. The user may also use the download option in case of local limitations in his or her email system. Alternatively, the user can select to have documents delivered through RoboBraille [1 - 3], thus expanding the available formats beyond what is actually stored in the library. As an example, a user may locate an rtf version of a particular book and decide to have it converted by RoboBraille to a full-text/full-audio project, an mp3 file, an electronic Braille book or an e-book in EPUB format before it is actually delivered to the user. In cases where a piece of education material is not available in alternative format, users can place a request and be notified when it becomes available. Biblus can furthermore manage tactile illustrations and other tangible assets, informing the system administrator in cases where the user requests copies of these to be sent by ordinary mail.

Alternative media producers and administrators may create new titles and upload available alternatives of these titles to Biblus. Rather than having to type substantial amounts of meta data, available meta data may be retrieved through Z39.50 from the official Danish library database danbib by merely supplying the ISBN number of the title. In addition to standard meta data, producers and administrators can add specific information on the alternative media format such as Braille math in LaTeX, standard text with page markers for Braille, scanned document without OCR or plain text.

Likewise, it is possible to add information on the readability, suitable age groups and subject matter for the material. Figure 2 below shows the main interface of the Biblus digital library when logged in as an administrator:



**Fig. 2.** The main Biblus interface when logged in as an administrator. The menu include Search and Retrieve, Order, Title administration, User administration, System administration, Reports and Personal settings. The user can furthermore switch between simple and advanced search.

To prevent abuse and copyright infringement, all activities are logged and material is made available to users with strict stipulations on acceptable use: Primary users may only use the material for their own, individual purposes. Teachers, professionals and relatives may on only use the material for their registered primary user. And producers and administrators may only use the material as part of their administration of Biblus.

## 4 Preliminary Results

Access to a searchable index of educational material in alternative media and the ability to download copies has long been on top of the requirement lists amongst teachers, VI professionals and parents. Although Biblus is still running in trial mode and is being populated with titles and alternatives, the digital library is expected to

have a significant impact on the successful integration of visually impaired pupils and students through the Danish educational system. Not only will teachers be able to search and retrieve material when they prepare for class in order to find titles that are available in both print and suitable alternatives. VI professionals such as consultants and psychologists may search the index and propose suitable titles to parents and teachers, and parents and grandparents may retrieve material to study with their children and grandchildren.

During 2012, Biblus will be promoted to schools and other educational institutions, amongst VI professionals and through parents associations. Furthermore, the service will be localised to Polish, Hungarian, Bulgarian and Romanian and offered to similar groups in Poland, Hungary, Bulgaria, Romania and Moldova as part of RoboBraille-projects in those countries. Once the solution is operational, Synscenter Refsnæs will collect and publish information on its use and impact on a regular basis.

## 5 Conclusions and Future Activities

Creating a digital library for alternative media is a non-trivial activity with many caveats. As Synscenter Refsnæs has the intention of extending the Biblus user community to include different types of users as well as users outside of Denmark, the issue of copyrights is bound to become a challenge, not least the ability of the system to accommodate different copyright regimes.

Over the course of the coming years, Synscenter Refsnæs anticipates the following activities:

**New Languages, New Countries:** As a natural companion of RoboBraille, Biblus will become part of national RoboBraille implementation projects. Currently planned activities include a generic, English-language version as well as versions in East and Central Europe.

**New user groups:** Although the current version of Biblus has been created with the blind and partially sighted in mind, alternative media may also benefit the dyslexic, people with learning difficulties, people with poor reading skills and others. Subject to the provisions in the copyright legislation across Europe and elsewhere, Synscenter Refsnæs intends to target such groups as well.

**Digital Rights Management (DRM):** The current version of Biblus relies on access rights for protection. As the solution is offered to more users and user groups, a DRM mechanism is likely to be needed to digitally “watermark” media files in the library as well as the ability to supply material in accordance with different DRM implementations.

**Decentralised Contribution:** All material in the current version of Biblus is supplied by Synscenter Refsnæs and associated alternative media producers. Future versions will include the ability for decentralised contributions by teachers, relatives and volunteers to upload material. In order to facilitate such contributions, a quality management workflow must be added.

**Integration with other Library Databases:** As Biblus is introduced in other countries, the need arise for integration with other databases of library meta data. These include databases such as Google Books, Amazon and the US Library of Congress, and well as national databases.

**Material Production Workflow:** At present, the workflows in Biblus mainly support the needs of the library consumers, who can search and download material, and order material not already in the digital library system. To support the use of Biblus as a protected internal repository of alternative media as well as the process of receiving orders and converting material into alternative formats, a workflow component will be added to Biblus.

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