Accessible Open Educational Resources for Students with Disabilities in Greece: They are Open to the Deaf

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Abstract. The development Open Educational Resources is the main outcome of the project "Design and Development of Accessible Educational & Instructional Material for Students with Disabilities". A portion of the deliverables of the project that mainly concerns Deaf students, a population that is usually under presented, is presented in this article. The Collection of Educational Resources, the Bilingual Hybrid books and the online videos with interactive text navigation cover mainly elementary school needs of Deaf students. Making textbooks accessible, as Open Educational Resources, by all students including the Deaf, on a national level meets the needs of all the students in the country by creating equal opportunities for learning, participating and accessing the curriculum.

Keywords: deaf children, Greek Sign Language, open educational resources.

1   Introduction

The development, availability and use of Open Educational Resources (OERs) offers numerous opportunities to reshape special and general education.

OERs is an umbrella term used to define any type of educational material that is in the public domain or uses an open license. The main characteristic of these open materials is that anyone can legally and freely copy, use, adapt and re-share them. OERs vary from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation [1].

OERs are usually made available under licenses that allow free use, re-use and sharing in order to improve accessibility and foster equity of education for all children. OERs are developed principally for children with disabilities in special educational situations. The rapid expansion of OERs initiatives and the millions of learners they attract is interpreted as an indicator of a forthcoming revolution in education and learning [2].

This paper describes a project that adapts OERs, for specific learning needs. The project is entitled: *"Design and Development of Accessible Educational & Instructional Material for Students with Disabilities"*. The main goals of the project are to

efficiently increase access to lectures, textbooks, video, etc. for students in both special and general education.

The project follows the principles and strategies of differentiation support, part of the principles of Universal Design for Learning (UDL). UDL promotes information and knowledge representation in a variety of ways, especially curricula design and development, as well as methods, material and evaluation procedures [3-5].

In this paper focus has been mainly placed on the development of accessible educational & instructional material for deaf students. Similar projects for the Deaf have been developed recently and made available free of charge via the web [6] or are web-based video lectures on demand [7].

The deliverables of the above project have been developed through peer-based learning, collaboration and individual creativity using rapidly changing information and communication technologies (ICT). The deliverables include production of publicly funded educational resources incorporating universal design to ensure accessibility for all users with special educational needs. Designing for accessibility includes the inclusion of subtitles, interactive transcripts, Easy Read text, Greek Sign Language, symbols, pictograms and audio description using human voiceover. The material available on the web is not merely uploaded as a form of digital library; it includes the capability of educators to choose and adapt these resources so as to be fully accessible for all students.

In what follows, we will present a portion of the deliverables of this project that mainly concerns Deaf students, a population that is usually under represented. Specifically, the focus of this paper will be:

- Collection of educational resources
- Hybrid books
- Online videos with text navigation.

2 Collection of Educational Resources

Comprehensive, up-to-date information on more than 350 educational resources has been collected for the project. Each educational resource has been examined and described according to the following content structure: general information about the resource (e.g., author, publication date, copyright, availability etc.), brief descriptions and educational information (e.g., subject area, topic, target group, educational usage).

Digital educational resources for special educational needs are widely distributed through the web within the framework of this project. All resources can be downloaded, used in their original version or modified through the structure of OERs in order to meet a wide range of special educational needs. The project is also designed for students who are visually impaired, are in the Autism Spectrum Disorders, have motor or mental disabilities, or have attention deficit disorders in addition to the Deaf and hard of hearing.

The educational resources for the Deaf fulfill a number of requirements regarding content, use and accessibility of educational materials by Deaf and hard of hearing students.

With reference to the use and the accessibility of educational materials, there is a generalized trend of using videotext in multimedia format which is narrated and expressed by native signers, focusing mainly on videotext analysis of Greek Sign Language (GSL) stories, narratives, and general educational context.

The resources comprises of 23 distinct support materials; 12 of these educational materials were developed for the learning of Greek sign language and 9 for bilingual (Greek - GSL) education. All educational materials were developed from 1999 to 2013 and are available for reproduction, or use.

Initially, the first products (two out of the 12) were developed to be recorded and reproduced using analogue and digital video tapes. Subsequently, the remaining materials were produced in a CD-ROM format. It is important to note that the first DVD-ROM created in Greece was the bilingual (GSL - Greek) dictionary of Greek Sign Language, containing more than 3.000 signs and also lexicographic and linguistic information about GSL. All video productions have been digitalized and are becoming gradually available on the web, for example see [8].

These resources cover mainly elementary school needs but also include high school needs. All materials are available in a multimedia format in CD-ROM that can be used by individuals or groups for learning and instructional purposes. The content is presented in sign language by native signers, professional interpreters or the collaboration of both.

Most of the titles can be used for learning GSL both as a first and second language [9]. Specifically, five titles have been developed in GSL and three of them have also been interpreted into spoken Greek. Some of the materials are trilingual (with written English as the third language) for their potential use in other countries. Therefore, they can be used for comparative analysis in documenting various signed languages. The materials cover different content vocabulary; namely, specialized terminology (math & science) and vocabulary about nature (e.g. Biology), ICT and political content.

The main purpose of making the collection available as an OER of all existing educational materials is for the teaching and learning of GSL as a first language, using GSL to learn Greek as a second language and using GSL to teach academic content.

3 Hybrid Books

A recent study [10] of dyslexic children in Denmark showed that "The positive correlation between use of audiobooks, well-being in school, reading frequency and time spent on homework combined with the high amount of hybrid reading, suggest that hybrid audio books are in many ways an obvious candidate for a standard format for accessible schoolbooks for people with reading difficulties" (p.211). Still, questions regarding the appropriate formats for different end users or contexts, the use of speech synthesis, typography and structure remain unanswered.

A similar technology used by the Masaryk University known as "Hybrid Book" [11] was used as a model for the creation of study materials aimed at users with different disabilities; that is, visual, hearing, motor, mental and others

Our initial focus group consists of students with disabilities attending the first two grades of primary school. As a consequence, the format that has been developed in order to cover the educational needs of this age group follows the original text format of the national curriculum books.

3.1 Development of Hybrid Books as Bilingual Applications for Deaf Students

The multimedia electronic form of the **Hybrid books** (either in the form of a single copy or a web application) combines the presentation of the original printed book in a video using GSL, the meaning in subtitles overlaying the screen presentation of the GSL video, *videos with text navigation (see Online videos with text navigation)* as well as the voicing of the text by a native speaker. The data in multimedia PDF, video and audio files will be available as independent files for multiple uses.
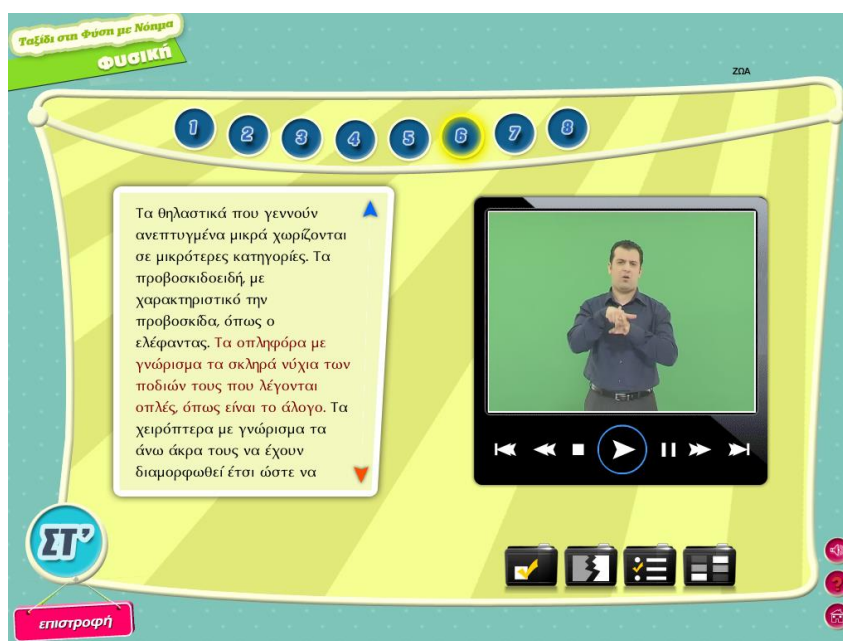

Fig. 1. A bilingual science hybrid book.

Major attention has been paid to the relationship between written and sign language text, so that the end-product will be used effectively in bilingual educational practices (Fig. 1).

The signed text is in accordance with the Greek text at a word, phrase or sentence level. The quality of the text in GSL is the most important aspect of accessibility and

will play a key role in the evaluation of the end-product. The translation of a text in GSL can be either very close to the original structure, interpreting the meaning, or a free translation. Within the same textbooks, the authors sometimes either look for content comprehension or emphasize learning vocabulary, Modern Greek grammar or the acquisition of phonological awareness. If the objective is to understand the text, then the signers - interpreters may follow a more liberal approach. If the objective is grammatical, syntactic or phonological awareness, then interpretation mostly follows the original source.

It is made evident from all the previous productions that signing Greek texts is an extremely demanding and difficult task. The signing of the texts is done in cooperation with experienced native signers, deaf tutors or consultants (all fluent in Greek) on the one hand and professional interpreters of GSL on the other. These two categories of professionals work collaboratively in order to achieve an accurate bilingual translation. When choosing consultants and interpreters, the subject knowledge, knowledge of the target group and experience in educational interpreting are also important factors and are taken into account.

As far as the process of translating Greek texts to GSL is concerned, the following methodology is proposed. First, the text is divided into smaller sections, so that it can be easily memorized and explained in front of the camera. Second, the GSL interpreter who is a native speaker of Greek will translate the text into GSL. Finally, the native signer and the interpreter will watch the signed text twice or three times and compare the signed text with the Greek text. It is emphasized that, during the conversion of textbooks in accessible educational materials, signed text is crucial because the efficiency of GSL is the core of the project.

4 Online Videos with Text Navigation

In the past decade publishing sign language videos has been a widely accepted and effective practice. However, searching the video content is very difficult and has proven to have questionable effectiveness.

Various technologies have been combined for the development of interactive text for video including the use of CaptionBox Interactive transcripts [12], the EdX open source platform created by Harvard and MIT [13], the YouTube video capabilities and numerous other plugins.

In our attempt to design an easy to navigate and search sign language video for educational uses, a true interactive educational tool for interactive video transcripts has resulted. Specifically, through interactive video transcripts viewers can refer to the transcript as the video plays. Viewers are able to navigate to different parts of the video by clicking on the text. Namely, viewers are offered the choice of selecting parts of interest, moving backwards and forwards, searching for signed quotes within the video and modifying its quality.

In order to implement the International Convention on the Rights of Persons with Disabilities (Public Law 4074/11-4-2012) for developing integration policies and practices in the Greek educational system and the use of Information and Communi-

cations Technology (ICT), and in particular interactive applications, within our project, a supportive interactive open source application customized to the needs of Greek deaf students was developed. The development process consisted of using and adjusting an existing open source media archive platform, which incorporates interactive video transcripts, with concomitant use of the Greek Sign Language. Such applications are necessary to access the material of the project and specifically to maximize the efficient use of customized textbooks in the first two elementary grades for deaf students.

4.1   Design Approach

For deaf students it is extremely important to introduce the use of information and communications technology on all levels of education [7]. It has been suggested that signed language videos added to text hyperlinks improve Web search efficiency for Deaf Signers [14]. Viewers' perceived understanding significantly improves when using transcripts over captions, even if they were less easy to track [15]. The "SignOn" project [6] encapsulates interactive video transcript in an application to enable sign language users to use written English for international communication via the Internet.

The application has to fulfill some basic criteria, it has to be: licensed as open source, quick and easy to navigate, easily adapted to the needs of deaf students and able to use the content of the educational material in Greek Sign Language (GSL) with the interactive subtitles. Flexible customization and database search and support of the uploaded material are also necessary.

Bearing the above guidelines in mind the *pan.do/ra* platform [16], was chosen for the development of the application, which is an open source media archive platform that allows management of large decentralized collections of video, creation of metadata and of time-based annotations collaboratively and serving an archive as a desktop-class web application. The platform is based on OxJS [17], a javascript library is used to build pan.do/ra's frontend and it is consisted of both javascript and python files.

4.2   Development of the System

The pan.do/ra platform was installed at an Ubuntu 12.04.3 LTS 64 bit system and configured to run on nginx webserver. The whole platform content was translated into Greek, by editing the javascript and configuration files and the new language was added to the platform's language options. Also the layout of the platform was edited by enlarging and customizing the menus and fonts in order to meet deaf student's needs. Additionally the initial categories were changed to reflect the educational material. The platform offers the possibility for the viewers to sign up but since this wasn't desired or needed, it was disabled.

The application is free and accessible to all interested or involved in the educational and learning process of deaf children and other students. Access to the platform will be available from the website [18]. The application provides easy navigation to

the videotaped content by choosing timed subtitles. The educational content is attributed both to natural voice of the speaker, the natural speed of sign language and the associated built-in video captions which can be read by the user.

The interactive application concerns a) the use of interactive subtitles and b) promoting the creation and enrichment of an online library archive- depository.

Videos with Interactive Subtitles. The *pan.do/ra* platform can accept videos in .webm or .mp4 format, which are uploaded and then automatically converted to .webm format (in case the uploaded file is in .mp4 format) at the server. The uploaded videos are stored on the local server and the reproduction is made from the same server without using a central video service like YouTube. This offers more autonomy and is not limiting our bandwidth as well as the quality and the size of downloaded files. Furthermore, the upload time of the added material is much less since it's done through the local network. The uploaded video then can be freely downloaded within the video player in .webm format.

The platform's embedded video player offers various features, such as automatic resizing, full screen play and automatic replay of a scene. The video view quality ranges from 240p to 1080p. Also the video timeline can be shown beneath the video in four different formats (Anti-Alias, Slit-Scan, Keyframes and Waveform). The video subtitles can be uploaded in .srt format and the interactive transcripts are synchronized and shown along the video automatically. The user can navigate through the video by clicking on the corresponding transcript. Along with the transcript the uploader can also insert other information like keywords and notes. Moreover, the transcripts are searchable and the matching information is highlighted. The subtitles can be seen along with the video (Fig. 2). Another feature is the ability to copy the video URL at a specific time and use this address for video playback from the time it was copied. Finally, the entire application with the material can be easily transported and installed in schools or locations that do not have network access, operating on a local basis. This feature is of great importance to rural or island schools in Greece.
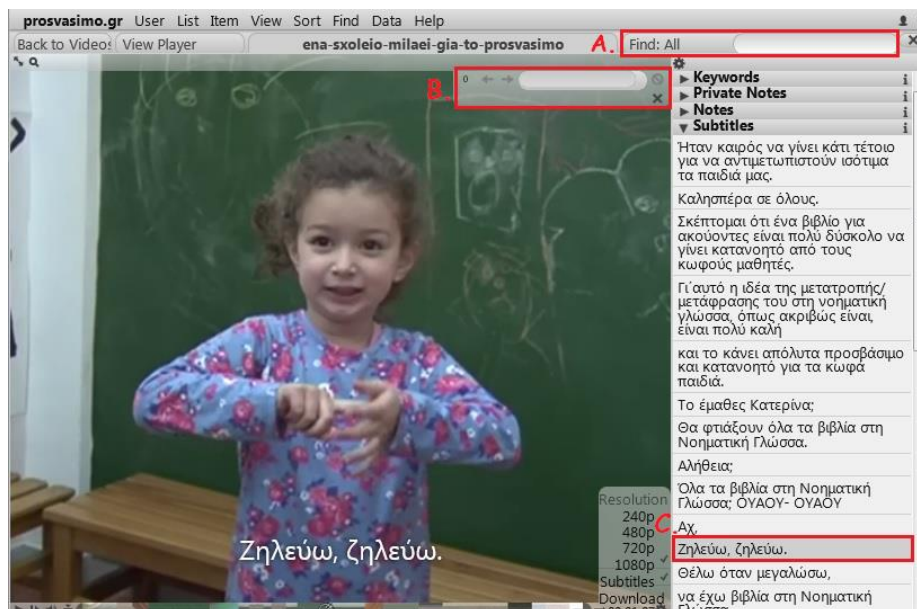
Fig. 2. Interactive video transcript. A: search database, B: search transcript text, C: the text reflects the current position of the video. Clicking on the other subtitles moves the video to another position. The above interface has been translated to Greek as well.

Online Media Archive. The videos uploaded to pan.do/ra create a digital database that it is easily searchable and customizable. It consists of a repository of audiovisual material that can accept also documents (pdf, word) which can be combined and connected to specific videos, creating thus a comprehensive database. The system is using the postgres database system. The interactive application as a digital library provides the ability to archive and search the deposited material by several criteria: thematically and geographically (showing them on a map) or by calendar, with the option to view a histogram of the deposited files. All accessible text material has printing capabilities and data (documents, audio and video) are distributed automatically during upload to independent files and directories on the server.

5   Conclusions

This innovative action of making textbooks accessible, such as the Open Educational Resources, by all students including the Deaf, on a national level meets the needs of all students by creating equal opportunities for learning, participating and accessing the curriculum.

Deaf students gain access to knowledge and information and sign language learning is promoted, increasing their involvement and supporting their ability to understand and process the incoming information.

The viability and functionality of the educational material developed within the project is ensured, on the one hand, from the broad use of the material produced for educational purposes and, on the other hand, the specifications and data evaluation methodology can be used in the design and implementation of other similar ventures in the adaptation of textbooks for all subjects in all grades of compulsory education. This process enables and ensures accessibility for students with various disabilities. In addition, the material can be used by students, teachers, school counselors, parents and also for learning, teaching and training purposes.

Approaching the curriculum through accessible textbooks, promotes respect and acceptance of diversity and, more widely, differentiated pedagogy and inclusive education thereby improving the quality of education in Greece.

Additionally, given the rapid development of technology and its increasing use, schools must create conditions that will allow each student to understand the role of new technologies, to have access to them, and to learn using them. The use of digitized material creates opportunities for expanded use of information technologies and communication, and familiarizing students with these or implementing training courses on the proper use of the material by teachers in the classroom.

In conclusion, the development of accessible material contributes to increasing the participation of students in inclusive education and moreover, improving the quality of education provided.

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