

The use of Information and Communication Technologies for inclusive education in Greece

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Abstract

Nowadays inclusive education in European and international educational systems is a fundamental right that has stemmed from the principle of equity. In this context coherent educational policies and practices are needed in order to meet the diverse needs of students and ensure that all students, including the disabled, have equal opportunities in order to participate in educational and learning processes. Access for all students to appropriate educational programs, media and materials is achieved through the diversification of teaching practices, within the framework of the Universal Design for Learning (UDL) and the use of Information Technologies and Communications (ICT). The objective of this paper is to present a methodological approach for the design and the development of accessible educational materials and software for students with disabilities utilizing ICT. The material developed will be fully accessible to students with: intellectual disability, deafness, blindness, autism, attention deficit hyperactivity disorder (ADHD) and motor disabilities. The content is accessible through the use of alternative communication systems (pictograms, drawings, pictures) and easy to read texts. Access is ensured through the incorporation of the Greek Sign Language and Braille via multimedia resources.

Keywords: Inclusive education, Accessibility, ICT, Universal design, Disability

Introduction

Contemporary educational approaches draw on the principles of inclusive education that promote equal learning, participation and opportunities for all students, including students with disabilities (Booth & Anscow, 2011; UNESCO, 2007). In this context educational systems design and develop policies, practices and educational environments that offer access to all students (Barton & Armstrong, 2007).

The design principles follow the guidelines of Universal Design for Learning (UDL) and the strategies of differentiated teaching (Tomlinson 2001; CAST, 2011).

At the same time the rapid development of Information and Communication Technologies (ICT) has significantly affected the field of education providing a new dimension to the learning process in both general and special education (Burnett, 2010). The stimulating innovative products of ICT have enabled changes in education and as such have attracted the interest of the educational community. Educators feel the need to incorporate ICT in their educational practice and generally in the learning process (Zaranis & Kalogiannakis, 2011; Hartley, 2007). Research results demonstrated a significant contribution of ICT use in the classroom as a learning tool (Vernadakis, Avgerinos, Tsitskari & Zachopoulou 2005; Clements & Sarama 2003) and specially in the education of disabled students as it helps to ensure accessibility and active participation for all students (Istenic Starcic & Bagon, 2014; Drigas & Ioannidou, 2013; Passey, 2013; UNESCO, 2011). The use of ICT in education is among the key objectives of the Strategic Framework for European Cooperation in Education and Training ("ET 2020") (CEU, 2009), the guidelines for Education for All by 2015 as well as in the Millennium Development Goals (MDG).

Within this framework the present paper presents a project run by the Greek Institute of Educational Policy that aims to implement inclusive educational practices. The project's title is: "Design and development of accessible educational materials and software for students with disabilities".

Theoretical Framework

Inclusive education is a fundamental part of European and international educational systems (Ferguson, 2008). Institutional documents, declarations and UN policies (UNESCO) promote inclusive education and personalized learning through appropriate support, early identification of special educational needs and appropriate services (UNESCO, 2007). In the context of inclusive education all students are accepted and have the right to attend their neighbourhood schools. Students are also supported to learn, contribute and participate in all aspects of school life. Inclusive education is about how we develop and design our schools, classrooms, programs and activities, maximizing opportunities, instruments, resources and technologies so that all students learn and participate together (Booth & Ainscow, 2011; UNESCO, 2009). Inclusion can be implemented through the differentiation of instruction, the use of the UDL framework and the utilization of ICT tools (Izzo & Bauer, 2015; Istenic Starcic, 2014; Mavrou & Symeonidou, 2014).

Differentiation of instruction is considered a promising educational process for the removal of barriers of homogeneous curricula and traditional teaching approaches. Curriculum differentiation is a key component in creating adaptable learning environments that encourage inclusive practices in general schools (Fox & Hoffman, 2011; Alberta Education, 2015). The principles of differentiated instruction require variations and adaptations of the teaching content, instruments, procedures and materials, resulting in the creation of flexible educational and learning environments allowing each student to follow their own learning path and

direction while developing personal strategies for the acquisition of knowledge (Fox & Hoffman, 2011; Valiande & Tarman, 2011). Thus, in doing so, they respond to the heterogeneous composition of modern schools.

UDL refers to a process by which a curriculum is intentionally and systematically designed from the beginning to address individual differences. UDL principles promote and provide multiple means of information presentation, where instruction is accessible and engaging, and students acquire skills and enthusiasm for learning. The design and development of curricula, methods, materials, evaluative procedures and training in different and multiple ways meet the challenges of diversity and the needs of all students, including the disabled, turning the school and the learning environments into a flexible one. The UDL principles build on the diverse types of learners as well as the potential of new technology to provide multiple ways of dynamic interaction with and between learners (Izzo & Bauer, 2015; Mavrou & Symeonidou, 2014; CAST, 2011).

The dynamic relationship between universal design and ICT becomes a powerful tool towards inclusive education (Smith & Throne, 2007). ICT are technological tools and resources used to communicate, create, organize, disseminate, store, retrieve and manage information and learning. ICT support personal access to information and knowledge, learning and teaching situation, personal communication and interaction, and access to educational administrative procedures (UNESCO, 2011). The new concepts of literacies (multiliteracies) demand that ICT, by supporting teaching and expanding assessment methods, provides alternative means of delivering literate practices. ICTs as multimodal tools also expand the transmission of information in multiple ways, not only through enhancing language development, knowledge and thinking, but also by allowing the acquisition of other multifaceted cognitive skills. In addition, with appropriate use, they encourage dialogue and argumentation, the opportunity to formulate a variety of questions and the development of social networking and collaboration. All in all, the use of ICT increases the participation of all students in the learning process and as such it expands their cognitive horizons (Ghaznavi, Keikha & Yaghoubi, 2011; Burnett, 2010; Hartley, 2007).

Research data also demonstrates that ICT practices contribute to better comprehension, assimilation and consolidation of school subjects such as mathematics, science, languages etc. Moreover, what has also been of importance is ICT contribution to acquiring skills such as reading, writing and visual-motor coordination etc. (Zaranis, 2014; Zaranis & Kalogiannakis, 2011; Clements & Sarama, 2003; Vernadakis, Avgerinos, Tsitskari & Zachopoulou 2005).

The contribution of ICT is manifold as it supports students, teachers and generally all those involved in the educational process (Passey, 2013; Alberta Education, 2015; Burnett, 2010; Smith & Throne, 2007).

In the case of students with special educational needs the utilization of ICT in a variety of cases is the only way to access knowledge, information, the curriculum and learning in general. The valuable contribution of ICT to education of students with disabilities in shaping accessible practices and appropriate learning environments is now well supported (Istemic Starcic, 2014; Passey, 2013; Drigas & Ioannidou, 2013; Brodin, 2010; Coleman-Martin, Heller, Cihak & Irvine, 2005).

In particular, the use of ICT practices in educating autistic students has been

proven to be a key element in offering alternative means of communication, in the way language is perceived and comprehended, in anxiety management, in acquiring reading and writing skills and in the development of communicative and social skills (Lucas da Silva & Goncalves, 2016; Obiyo, Etonyeaku & Ofoegbu, 2013; Tanner, Dixon & Verenikina, 2010). In the case of deaf children, research data confirm the benefits that result from giving the children the opportunity to access the curriculum. In general, knowledge can be accessed through the visual channel where they can exploit the existing interactive video applications with the support of sign language (Kourbetis, 2013; Nordin et al, 2013; Fajardo, Parra & Cañas, 2010; Easterbrooks & Stephenson, 2006). In addition, when teaching students with visual impairments the use of ICT has offered many solutions, particularly either through enlarging teaching material such as the magnification of the computer screen, or with the use of the text-to-speech method and tools, and the development of visualised material or text (Soderstrom & Ytterhus, 2010; Presley & D'Andrea, 2008; Papadopoulos, & Goudiras, 2005). Visualising information and developing simplified texts by using the method easy to read and also by employing digital educational applications to students with intellectual disabilities has been proven crucial for their education (Nabil, 2013; Ribeiro & Moreira, 2010; COI, 2010; Standen, Brown & Cromby, 2001). Moreover, digitalising educational material and using technological means and aids for the students with mobility problems is another field that research data support (Lidström Almqvist & Hemmingsson 2012; Murchland & Parkyn, 2011). The use of appropriate (ICT) digital applications play also an important role in the education of students who have attention and concentration problems as they allow students to focus more and engage themselves creatively (Solomonidou, Garagouni-Areou & Zafiropoulou, 2004). Finally, e-books and digital educational applications and programmes can really support the teaching and education of disabled students as they show more interest, attention, concentration and enthusiasm (Lidström & Hemmingsson, 2014). However, regardless of the valuable contribution of ICT to promote inclusive learning, if not used appropriately and is not accessible to all students the risk of widening social inequalities is evident.

Method

This project follows the methodological principles of qualitative research and content analysis (Mason, 2002; Creswell, 2012). Institutional and disciplinary European and international texts and research data related to inclusive education and disability, to the contribution and use of ICT in the learning process and contemporary teaching methodologies, were analyzed. This methodological approach was used for the development of material specifications and evaluation criteria.

We also have utilized principles of emancipatory methodology as the involvement of people with disabilities, especially in the development process of the material, have played a leading and decisive role (emanating from disability studies) (Barton, 2005; Danieli & Woodhams, 2004). In order to finally publish the educational material, the teachers used a pilot sample with students of every disability category and recorded their comments and willingness to respond. This material

was then distributed to the working groups who corrected and reviewed it adding any necessary information and changes until the final publication. It should be added that in the case of deaf students, wanting to reassure the effectiveness of the developed material, sign language translation was carried out by natural sign language users.

For the development of specifications and evaluation criteria of the material we established a group of twenty-one (21) experts – specialists (in service teachers, researchers, school counselors and university professors) for each of the disabilities mentioned above. These specifications concern the educational material and specialised software that will be used in order to differentiate and integrate the educational content into digital environments.

Such specifications take into account the learning and the general characteristics of the students of each disability and involve a) text adaptations, b) the selection of suitable images, c) the adaptation of software interface and d) the creation and use of specialised educational material, for example alternative communication systems such as pictograms or the particular educational resources needed for the translation of the Greek Sign Language.

The methodological approach of the project includes the evaluation of the produced material by a second group of fifteen (15) experts, in three phases:

1. Evaluation of a sample of the material using the developed evaluation criteria.
2. Evaluation of the final material and its pilot implementation.
3. Formative assessment of the overall project to ensure its quality and effectiveness.

In addition, regarding the use of accessible materials in schools, training is provided (in-service, face to face and distance learning) for those involved in the educational process (teachers, school counselors, evaluation staff, etc.). Specific information is available on the use and utilization of the digital and printed materials for each disability.

The Project

The implementation of this project resulted in the following questions and concerns:

1. What kind of training materials could be developed to address and benefit the largest possible number of students? How can universal access to educational and learning processes be provided while at the same time enhance the existing resources?
2. What are the most appropriate technologies to be utilized?
3. What adjustments need to be made in order to establish the appropriate principles, characteristics and procedures that govern the accessible educational materials so as to ensure the maximum participation of students with disabilities in the educational process?
4. How to maximize the design of the learning environment in order to achieve the best use of the educational material, so that all students benefit?

Resulting from the above questions the goal of the project focused on the adaptation and digitalization, through the use of ICT principles, of the elementary grades A and B textbooks for students with autism, hearing impairments, visual impairments, motor disabilities, intellectual disabilities and attention deficit hyperactivity disorder (ADHD). The educational material targets students aged between 4-8. It is important to note that textbooks in the Greek education system are

the key teaching tools that enable access to the curriculum and knowledge, since they are used in schools nationwide.

Accessible educational materials and software for students with disabilities

The development of accessible educational material and software for students with disabilities concerns the adaptation and digitalization of textbooks for the first two elementary grades. The repository of the developed material and also of the existing is hosted in the project's website (<http://www.prosvasimo.gr>) and can be accessed by everyone involved in the learning and teaching process since it is being constructed and designed within the philosophy of Open Educational Resources (Tuomi, 2013). Part of this project is the existing educational materials developed by co-financed projects in Greece and it is hosted in this website.

The digitized accessible textbooks are no different in content from those used by students without disabilities. What the student with a disability sees on their computer screen is a virtual book corresponding to the identical book used in the general school. All the material will be accessible in multimedia electronic format with printing capabilities. The interface presentation aims for a better understanding of the content and is geared towards encouraging the development of cooperation between students, teachers and the computer (Nabil, 2013; Standen, Brown & Cromby, 2001). The material, especially the presented texts, is simultaneously read aloud by a native Greek speaker. This presentation format expands the benefits to students who are not disabled but may have learning difficulties or are auditory learners. The texts are also differentiated to match the different needs in order to be accessible by everyone. Moreover, accessibility-supported material includes features like Deaf native signers, interpretation by certified GSL interpreters, and the use of computer-assisted training materials to cater for all disabilities. In addition to accessible text books, special educational materials were developed for: language readiness in Greek Sign Language (GSL), alternative communication systems (image, sketch, and pictograms), tactile material for the blind, teaching Greek Braille code, mobility and orientation (Lidström, & Hemmingsson, 2014; Fajardo, Parra & Cañas, 2010; Kourbetis, 2013).

More specifically, with respect to students with visual impairments accessible educational material using ICT has been developed facilitating the integration of blind students into the general educational system (Soderstrom & Ytterhus, 2010; Presley & D'Andrea, 2008). The educational materials (textbooks) have been developed in Greek Braille and recorded in natural human voice. The supporting material is proposed to be raised for tactile use, including three dimensional images, such as maps, figures, clocks, flashlights etc. This process is designed to aid in improving mobility and orientation skills for the blind and partially sighted students.

The digitized textbooks for partially sighted pupils have been enlarged in various font sizes (Arial bold 18, 28 and 22 font size) in order to address students with varying degrees of vision loss. All textbooks are available both in digital and

printed format, including Braille. All textbooks required in compulsory education have been completed (Presley & D'Andrea, 2008; Papadopoulos & Goudiras, 2005).

For the deaf and hard of hearing students the accessible digital educational materials include a) all the textbooks of the first two grades of elementary school, developed by using written and spoken Greek Sign Language (Fig 1) b) the development of special educational material for language readiness (Kindergarten) and for using and learning Greek Sign Language (GSL) as a first language in the first two elementary grades. These materials have been designed by deaf native signers in collaboration with certified interpreters of GSL. In particular, the implementation of GSL material includes the creation of multimedia electronic and printed educational materials on two levels:

1. Basic GSL vocabulary and
2. Basic phrases for teaching GSL in kindergarten.

Fig. 1 Screen from an accessible interface presenting the text with the use of Greek Sign Language for the Deaf and Hard of Hearing students



The presentation of GSL is video format and the accompanying text is read aloud by a native Greek speaker. The sign language is presented via interactive video streaming technology providing the user access to a video sign language library, which stores recordings of 'text' or 'phrases' in GSL (Kourbetis, 2013).

Fig. 2 Screen from an accessible interface presenting the text with the use of Easy to Read for students with Intellectual Disabilities



The accessible educational materials for students with intellectual disabilities

are designed to meet the needs of these students. Differentiating textbooks include the adaptation of the text in an "easy to read" format (COI, 2010). Educational content will be simplified with a focus on presenting concepts using images and providing the text in print and digital format (Fig. 2). The simplified version not only contributes equal content to the education of students with intellectual disabilities and other special educational needs, but also combats functional illiteracy in non-disabled students.

For students with motor disabilities of the upper limbs, textbooks are accessible by using a single keyboard key. Access to the textbook content can be achieved by simply scanning the screen using touch- screen technology (Murchland & Parkyn, 2011).

The accessible materials for students in the autism spectrum are presented in the following ways: a) with the alternative language and communication programs best suited to Autism Spectrum Disorders (ASD), (Picture Communications Exchange System, Pictograms etc.) b) using the appropriate educational approaches suitable to autism, such as the structured teaching approach of TEACCH, the use of ICT and interactive teaching approaches. The special software for accessing text (basic vocabulary, pictures, drawings, pictograms) will be widely available using a free, online digital library (Tanner, Dixon & Verenikina, 2010).

Evaluation Results

Table 1 Evaluation of the sample and the final material

Disabilities	Deaf and HH	Deaf and HH	Intellectual disabilities	Autism spectrum	Motor disability	ADHD
Subjects	GSL (N2)	HB (N4)	Easy read (N4)	ACS (N1)	ILS (1)	EF (1)
Sample	109	109,4	106,2	104,40	103	107,7
Final	110	109,5	107	105	106	109

The evaluation of the sample of the material was based on the evaluation criteria developed by the expert committee and resulted in the above mean results. The evaluation scale was developed to either decline the deliverables if they were rated below 80, accept them if they were rated from 80 to 100 and strongly accept them when the deliverables were rated from 100 to 110. All the accepted samples were rated from 103 (Motor disability) to 109,4 (Signing books for deaf and hard of hearing), all the final material was rated between 105 (Alternative Communication Systems for the autism spectrum) and 110 (Teaching Greek Sign Language for the deaf and hard of hearing). Similar, as expected, were the results of the evaluation of the final material as seen on Table 1. This high rating of the final material is very encouraging and in line with the overall evaluation.

Evaluation of the pilot implementation is currently underway and will be completed by the end of the school year 2015-2016. The accessible educational material was presented in four regions of Greece (Ioannina, Alexandroupoli, Volos and

Rhodes) with impressive quantitative and qualitative initial results. More than 2000 in-service teachers are currently evaluating the material.

A formative assessment of the overall project was implemented to ensure its quality and effectiveness when put in proper practice. The project and its deliverables were evaluated by the European Union (European Social Fund – ESF). As a result of this evaluation the project was rated as the best of the IEP, one of the 11 best of the Ministry of Education and one the 30 best in Greece. These results are very encouraging, particularly for continuing the development of accessible educational material for students with disability and special educational needs.

Conclusions

The contribution of ICT in supporting inclusive practices and ensuring accessibility is undeniable (UNESCO, 2011). Given the rapid development of technology and its increasing utilization in schools, conditions must be created to enable every student to have equal access to technological innovations. The use of this digitized material creates opportunities for training teachers in the appropriate instructional practices, resulting in better accessibility and more effective education.

This innovative adaptation and digitization of textbooks, in order to be accessible by all students, with or without disabilities, has to be implemented on a national level. Therefore, the needs of all students are met by creating equal opportunities for learning, classroom participation and equal access to the curriculum.

The broad applicability of the accessible educational material is ensured and can be used by students, teachers, school counselors, parents and others for teaching and training purposes.

In conclusion, access to the curriculum through ICT with accessible digitized textbooks promotes respect, acceptance of diversity and expansion of differentiated pedagogy, thus improving the quality of education in Greece. This material helps to remove obstacles to the education of students with disabilities, meet the objectives of the curriculum, foster a sense of competence and increase self-esteem in students. Finally, what has become feasible is the possibility of integrating ICT into classroom practice, including learning and teaching, curriculum and instructional design, learning media and environments, and finally teacher education and professional development.

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