ICT for the disabled: Policies and Issues

PAUL NIKOLAIDIS
Information Systems
IMSIU University
Riyadh, SAUDI ARABIA
Paul01nikolaidis@gmail.com

DIMITRIOS XANTHIDIS
Management Information Systems
Dhofar university And
CIBER-Research.eu
Salalah, Oman
dxanthidis@du.edu.om, www.ciber-research.eu

Abstract: - The concept of impairment (of some extend) rather than disability, shifted the perception of technology usage by the disabled people. The contemporary policy in developed countries for the disabled does not reflect only the commitment of these communities for the development and use of the special technology in support for those individuals but, also, for non-discrimination at any level. The rapid developments and relevant innovations in the ICT field, whether wired or wireless, mainly based on the broadband paradigm promise a better quality of life without exceptions and improved results in the battle against the digital divide. The communities worldwide can, reasonably, hope that the, thought as, minorities of the people with disabilities will suffer gradually less from e-exclusion thanks to ICT innovation and supportive state policies.

Key-Words: ICT, People with disabilities

1 Introduction

The new reality of the Digital Economy brought by the rapid evolution (considered by many even as revolution) of Information and Communication Technologies (ICT), especially the broadband technology, have caused social and economic awareness to shift towards what is often referred to as the Digital Society. This is especially so in the developed countries where all these developments are in a mature stage. These developments touch every aspect of the social, cultural, economic, educational, commercial, even governmental activity worldwide [1].

These developments associated with the Digital Society allowed the societies to facilitate the improvement of the quality of life even for those people with disabilities. However, despite all these technology marvels there are still some special minorities who seem to face exclusions from the Digital Society and its culture. Indeed, even though the Internet and the Web have penetrated deeply worldwide, including the developing countries, the risk of digital divide is always present and it is important to follow all the necessary steps that mitigate it [2].

This paper is an initial effort to basically review the strategies followed by the digital society to embrace people with disabilities and present whatever progress is made in the field of ICT towards that goal as part of the transformation of the societies in the information era. In other words this preliminary desktop research aims to find whether ICT is in the right path to successfully contributing to raising the quality of life of these people.

It is one of the latest studies that describe one of the most important issues that the contemporary digital societies are facing, that is avoiding (or bridging) the digital divide between the disabled people and their societies. It details some of the various policies formed in E.U. and in the U.S. towards that goal and then it explains the way new ICT developments are addressing the relevant problems that the disabled people are facing.

2 Disabled people as equal stakeholders in the digital era

ICTs constitute an integral part of modern life penetrating, all the more, in the activities of the education, health, social, commercial, government sectors and more. It facilitates better opportunities for searching information, utilizing public and private services from the comfort of ones' own place and at the person's convenient time, enhanced enjoyment of leisure activities and easy communication with friends and family and colleagues with no cost and effort. Since all the above are basic rights of all individuals, regardless of their personalities and/or possible personal problems, then, it is obvious to say that the use of

ICT by all people, including those with disabilities, is a matter of not only special priority but, furthermore, basic sensitivity to those with special needs. Despite their deficiencies, be it with the vision, hearing, kinetic, mental or other, people with disabilities can benefit from the use of ICT wherever and however this is possible. This is, certainly, the ideal scenario [3].

A study from Greece highlighted the main reasons that mostly block the way towards ICT access and cause an increase of the digital divide for people with disabilities. One of those, namely, the low level of skills concerning the use of ICT could be tackled by implementing special and well focused technology education programs for those people facing social exclusion. Another worth noting reason suggested by the very disabled people is the fact that they seem to find digital equipment too expensive for them to pay given their other surviving priorities. Yet another significant problem blocking the access of those people is the small availability of special hardware and software for people with disabilities. Last but not least is the shortage of special information about the pros of ICT usage in their everyday life. Referring to those disabled who do not use any kind of technology, most of them believe that the use of ICT is not necessary or relevant to their case [4].

Thus, the inequalities that occur and their relevant impacts, which the disabled minorities have to deal with, revealed once the urgency for contemporary communities to treat these individuals fairly so as to overcome, to the extent this is possible, difficulties in the employability, digital literacy, e-health, re-skilling fields etc. [5].

2.1 The European paradigm

European Union (E.U. from now on) declared their actions against discrimination in every aspect of the lives of people with disabilities, in November of 2010 when they launched the European Disability Strategy till 2020 [6]. It is clear, from this action, that equality and non-discrimination for all remains the desirable goal for E.U. Communities. Hence, in an effort to conform their actions to this strategy associated with the rights of the people with disabilities [7] E.U. countries started systematically transforming their laws and constitutions accordingly.

As far as ICTs, the E.U. countries agreed that utilizing the Digital Society and ensuring ICT access for these individuals, like for anybody else, should be their primary focus towards this direction. Moreover, as the Declaration of Riga, signed by the E.U. member countries in 2006, recommends, the equal participation of all citizens in the Digital Society is not to be seen just as a social necessity but also as an economical opportunity that could enhance the growth of their economies. In that E.U. ministerial declaration, an Internet profile was presented with statistical numbers taken from a 2005 research study that revealed all discriminations and Digital Divide that E.U. minority groups suffer. The participants of this declaration consent to decrease significantly the Digital Divide that affects these minorities of E.U. till 2010. The basic three principals and action priorities set by Riga's Declaration contain [8]:

- The utilization of Digital Society in favour of vulnerable to social exclusion citizens.
- The withdrawal of all relevant obstacles in order to embrace all citizens in the Digital Society.
- The recommendations for action by the E.U. nations and the local stakeholders to cooperate and improve digital access of all citizens.

2.2 Embracing people with disabilities

In an effort to respect the aforementioned three principal directional policies the action plan of 2006-2015, drafted by the European Council, described the appropriate practices that must be applied in the case of the disabled people to ensure they are accepted not only in the Digital Community but also in the social and economical environment they live in. Those practices and provisions, listed below, aim to ensure exactly the success of this effort [9]:

- Digital Information is to be provided in forms and media accessible by all various types of disabled people, e.g. audio or Braille forms.
- There must be provisions for special training in the ICT of the people with disabilities.
- Stakeholders should make an effort to ensure eLearning is available and accessible for all.
- The public and private sector should recognize Braille, or other relevant code, as a formal communication language for disabled people in a working environment and especially in working meetings.
- Stakeholders should make all possible assistive technologies, e.g. digital speech of word processors, available to the disabled individuals to ensure ICT accessibility to all.
- The public sector should ensure that information available in web sites of public

interest is also accessible through the use of specialized apps facilitating this goal.

- The private sector provides the digital information with no discriminations to people with disabilities by adopting special new technologies.
- The private and public sector are encouraged to design and develop ICT capable of increasing the access level for all citizens.

E.U. policies and practices are targeting the maximum possible participation of people with disabilities in the new emerging Digital Era. These social and economical directives have been interpreted in many European countries and included into their legal framework so to become powerful enough to protect vulnerable groups of citizens and facilitate their ICTs' accessibility [10]. Furthermore, most E.U. countries have proceeded to the so-called e-Governance respecting also people with disabilities and providing their sites with special accessibility apps.

On the flipside only a few E.U. members have endorsed the utilization of ICT as a digital channel to facilitate work from distance that would help many disabled people benefit from entering the labour force of their countries. In general only five E.U. members (Ireland, Germany, Great Britain, Spain and Denmark) are close to compliance with most EU directives and strategies of the European Council and the European Committee for people with disabilities. The rest are trying to catch up and perform better so as to fully conform. Greece is one such example. It is a E.U. member state where little legal and other actions have been performed to improve the quality of life of people with disabilities as far as their e-inclusion is concerned. This is despite the fact that the country's constitution recognizes and protects the equal access of disabled people in the Internet and the reality that there are, also, legally enforced conveniences for the technological access of these people including the free acquisition of online connection for severe disabled cases, the right for serious discounts when buying special digital equipment and the provision of priority in digital services like providing Internet connections and solving digital infrastructure malfunctions to people with severe disabilities [11].

Generally speaking, E.U. enjoys a high 2nd place worldwide (63.2%) concerning the Internet penetration of its households which in turn and because of the general strategy for the usage of ICT led to greater Internet penetration among its people with disabilities [12] and, to some extend related to the technology advent, the improve of their quality of life.

2.3 The U.S.A. paradigm

At the other side of the Atlantic Ocean, with Internet penetration in the U.S.A. very high (78.6%) as expected [12], the focus is the same as in E.U., i.e. to improve their citizens' well being by ensuring and enforcing equal opportunity in all aspects of their lives. Especially for those with impairment issues there is a serious Strategy Plan against social exclusion from the digital world since 1990 [13].

The Americans with Disabilities Act (ADA) of 2008, enacted by the Senate and House of Representatives of the U.S.A., supplemented the ADA of 1990 and was an attempt to further embrace and protect people with disabilities by eliminating, where possible, any discrimination practices. This federal law constitutes, among other things, the basic U.S.A. accessibility strategy for people with disabilities providing them the right environment necessary for equal opportunities and participation in every activity possible of a citizen's life. As far as ICT, the country is developed in such a way as to provide these people with equal access to digital information as the rest of the population [14].

A research study held in the U.S.A. and published in April of 2012 showed that 27% of the adults living with disability are less likely to go online than other adults (54% vs. 81%). This most likely means that there are still some access hurdles for impaired people that the U.S. society has to overcome with the help of policy makers and technology innovations. The same study also pointed that the broadband Internet penetration figure in the case of the people with disabilities is much lower (41%) than the rest of the population (69%). That by itself, if true, certainly constitutes a very significant problem of inequality [15].

2.4 Similarities between developed countries

Research shows that there is a strong correlation between people with disabilities or older people and limited use of Internet. The actual pattern is very similar to the case of the individuals less educated and/or those living with lower personal or household income [16].

E-mailing and online information search remain the main activities on Internet both in the U.S.A. and in Europe. However, during the last decade there seems to be a growing number of users performing other types of activities like social networking, online shopping, online banking, distance and/or eLearning, receiving online public services, taking medical advices through Internet, working online etc. [17, 18].

Modern communities in developed countries exploit gradually ICT opportunities and relevant

innovations to address all kinds of individuals' needs. The Radboud University Nijmegen Medical Center in Holland is such a case where patients have the opportunity to communicate online with the hospital and make an online appointment with the medical doctors of their preference and accept first level medical care or talk with other patients or hospital staff. No doubt the medical services that this hospital provides have been redesigned from top to bottom focusing on people with disabilities without discrimination of any kind. At the same time the hospital conforms closely to EU policies concerning the impaired [19].

Another interesting case, in the U.S.A., is the University of Washington. Committed to adhere to the United States Department of Justice direction that "covered entities that use the Internet for communications regarding their programs, goods, or services must be prepared to offer those communications through accessible means as well" the University designed its ICT learning facilities to be accessible to all students including the impaired ones. Thus, if any student with disability enrols in a distance-learning program the University has been prepared to provide equal access to all learning facilities. For example a student who is blind may use a computer equipped with text-to-speech software and a speech synthesizer [20].

The way developed countries implement e-inclusion strategies and practices with respect to people with disabilities drives these individuals not only out of e-exclusion but also out of social exclusions. The magnitude of all those technological innovations for impaired citizens gives many promises to the interested parties that these special people will see their disabilities affecting their quality of life in a decreasing intensity to such an extend as to reduce the weight of the very meaning of disability.

3 The shifting strategy

The impact of the ICT-related innovations and developments in the society as a whole is such that it minimizes the effect of possible disabilities of people in their everyday life. Understanding this reality is helpful and useful in designing appropriate and up-to-date strategies, public policies and special programs for people with disabilities.

The United Nations Convention on the rights of persons with disabilities refers to disability as a dynamic concept directly related to a person's impairment as an obstacle, a physical barrier and the relevant attitudes and behaviours attributed to this condition and causing these people to refrain from their active and holistic participation in the society. The more obstacles there are the more disabled a person can be [21].

According to Mirabella *et al.* there are four (4) main types of disabilities. In broad terms persons with disabilities have, usually, long-term or permanent visual, hearing, motor and/or language/ cognitive impairments [22]. Some have more than one form of disability whereas many others will suffer a disability at some point of time in their lives due to physical injuries, various diseases or simply because of aging. Consequently developing and applying assistive technologies for these people is becoming all the more important for societies as a whole. Hence, ICT is helping change the perception of what the effects of disability are for the society and has as a result or aim that these people are no longer treated by national laws, especially in developed countries, as minorities but as a subset of the whole society [23].

The e-inclusion strategies at both sides of Atlantic Ocean have indicated that some certain areas of action are suggested for further ICT innovation and developments in an effort to adhere with United Nation's convention principles on the subject. The accessibility, participation, equality, employment, education, social protection and health care were the main areas suggested to focus on in favour of people with disabilities and general well being [7].

Thereby, one more incentive was offered to digital society to provide the community with special software and hardware adjusted to people's disabilities. As a consequence the digital divide phenomenon among ICT users decreased mainly in developed countries that performed high rates of digital awareness, usability and availability.

3.1 Smart technology in everyday life for the disabled

More specifically ICTs have revolutionized the everyday life of those with acoustic and vision impairments and those with other learning difficulties due to mental or kinetic problems. The following innovations constitute a range of such developments [24]:

- A non-standard hardware, namely, the "head mouse" which behaves like a normal mouse following the head movement.
- The Eye tracker technology opens the way to develop devises and special software designed to control the cursor of a computer screen by following the eye movement of the user.
- The brain wave technology applied for people with acoustic, kinetic or mental disabilities can

facilitate through Brain User Interfaces (BCIs) the seamless use of the Internet even my these people.

- On screen mechanisms allow users to select a key with the help of a mouse, touch screen, glide pad, integral mouse, finger mouse, trackball, joystick, switch or other electronic point device like head mouse, eye tracker or brain signals interpreter.
- Artificial speech has proven to be very helpful for people with visual and, sometimes, mental impairments. It is, basically, a screen reading software that transforms text to speech with the help of a voice synthesizer.
- Electronic Braille Displays, Scanner and Printers mostly for visually impaired people are available.
- Tacking Calculators, Electronic Reading Aids, Screen Magnifications hardware, Video Magnifiers software, Operating Systems modifications like high contrast color schemes and even larger font sizes, digital talking book players are, also, available.
- Specially adjusted applications like National Geographic Tacking Tactile Atlas of the World, online computer games, public services sites and other easily accessed software.

A particular technology suggested by Jutla and Kanevsky [25] back in 2009 was the "wisePad" and similar devices available in the market that effectively transform an image by either magnifying some parts of it difficult to see by the visually impaired or completely converting them to text for the blind.

Generally, sensor technology applications contributed a lot to the widespread of assistive technologies. In every case the technology has enhanced the learning opportunities, health care, improved socialization and employability for many more citizens with disabilities and ICT industry is constantly working on producing more such technologies.

3.2 The smartphone case

Going online has long been disconnected from the need to have desktop computers. Mobility and the exchange of, often, large volumes of data has dominated ICT use the last decade (at least) driving technology industry to produce smartphones and other similar electronic devices, e.g. laptops and tablets, with gradually increasing relevant and powerful features [23].

Recent research in the field indicated that approximately half of the adult population of the developed countries owns a smartphone [26]. It, also, points to the growth of smartphone market in the developing countries. That said, ICT industries have turn their attention to developing applications especially designed for smartphones and wireless exchange of data. Cloud computing and Wi-Fi broadband highways have, further, opened new horizons of the usability of the mobile devices. As expected these technologies complied with the general trend of private and public sector to enforce digital convergence providing at the same time assistance to people with disabilities like enabling even more health, social, educational and leisure activities. The main idea is to embed ICT in smartphones utilities and their operation systems, i.e. Android, Windows mobile, IOS, Blackberry OS, Maemo 5, Symbian etc., addressing, to the extend this is possible, disability issues.

The smartphone's camera, microphone, accelerometer, GPS receiver, touch-screen and electro-magnetic sensors can be used for specific assistive purposes leading to new applications for all people facing some short of deficiency. One such example is the Magnifier programs that uses the camera for its zooming functions, navigation systems especially designed for blind and low-vision people utilizing the smartphones' GPS antenna, receiver and accelerometer. Other examples include the voice recognition software for dialing or searching using the mobile's microphone and the text speakers that can scan some text and transform it to voice, over the phone's speaker. There are, also, smartphone applications (SPA) with the opposite function, i.e. producing text from voice like the application of "Evernote" for Android Smartphones the "Dragon Dictation", "Voice Assistance", etc. [27].

Furthermore the high-resolution camera of a smartphone can help heart rate monitoring. Current developed SPAs can detect the heartbeat and calculate the pulse rate by scanning even the slightest - and not visible to the eye – color changes in someone's face or figure. This kind of innovation can facilitate remote healthcare quite accurately [28] monitoring for people with temporary or chronic disabilities.

Despite a smartphone's limited screen size and access to peripherals latest remarkable developments from leading industry players point to the direction of turning the smartphone to a handheld computer device. This new trend lead to the development of an application which can allow a person with disability to make a phone call with the aid of a headset by selecting a contact from a list only with the use of its mind.

Modern SPAs can assist individuals with disabilities to measure their physical and health condition at any moment, entertain themselves regardless of location and time (like everyone else), socialize online, often work from the comfort of their own place and, maybe in the near future, vote through the Internet once security frameworks are established and tested.

All these innovations demonstrate that the modern mobile industry design strategy has been directed to improve accessibility and usability of SPAs taking into account all citizens with or without disabilities without stigmatizing anyone [23].

3.3 Education for the disabled

One of the areas where this race to equality has significantly positive results is the education. The advent of eLearning marked the beginning of a big effort towards including the people with disabilities more intensively in the educational process from kindergarten to the tertiary level. There are a number of serious, and largely successful, efforts to provide a systematic process of how to address the issues related to the different types of disabled people.

One such effort [29] by Gabrielli *et al.* was the "no-frills" methodology. It suggests a three steps process: a. categorize the potential learners in terms of disability or impairment, b. identify the type of the content to be taught and analyse its impact on each of the categories of learners in terms of its physical but also effective (comprehension) accessibility as well, c. seek alternative content as close to the original but in a way effective for the disabled.

Coming to the aid of the previous systematic methodology is IEEE's learning object meta-data [30] that identifies and describes in some detail the 6 types of learning objects i.e. diagrams, figures, graphs, tables, multimedia and math/ scientific expressions.

The results of this effort are rather positive and welcomed even since the early ages of eLearning. For example a study suggests [31] that audio-visual training through various computer programs' interventions improves the pre-reading skills of the children at kindergarten prior to formal schooling and facing, otherwise, the risk of developing a reading disability. This is also true in the case of children with dyslexia in which cases these children have great difficulty in acquiring reading skills, even though they are intelligent enough, receive tuition like all other students and do not exhibit any obvious neurological or other physical disorders.

One of the main issues is that, quite often, educators at all levels are downgrading the level of alternative content as opposed to what is expected, i.e. content as close to the original quality as that is possible [32]. Perhaps there is lack of motivation (of all types including financial) and/or lack of interest to dedicate some time and effort on this task.

3.4 The effect of the Internet and the Web

It is also worth to mention some mostly known facts about the effect of the Internet and the Web in everyday life of the disabled. A study by Barak ans Sakovsky [33] pointed out some positive realities that everyone is suspecting but not many had proven.

1. The hearing-impaired adolescents are motivated to use the Internet more frequently, more heavily and for more extended period of time than those with no disabilities.
2. It seems the more a disabled person uses the Internet the better the state and personal feeling of his well being and the more similar this becomes to those with no disabilities.
3. "Internet provides a unique, convenient, non-auditory communications tool by which deaf people can efficiently enhance their communication with others, as well as access numerous information resources without having to use special means. This is not only a technical and practical advantage for the deaf people but also a psychological since they can interact as never before with people and resources in ways similar to a hearing person. This gives them a feeling of ability, control and independence".

Internet's particular character and architecture that protects one's anonymity and invisibility through texting (among other things) helps the disabled reduce the feelings of inferiority and gives them a sense of security, confidence, elevated mood and connectedness of deaf people as compared to their hearing counterparts, i.e. a feeling of empowerment state.

4 Conclusions

Although there is an explosion of published papers on anything related to ICT developments in all parts of the globe but there is only a (relatively) very limited number of papers relevant to ICT for people with disabilities and, likewise, a relatively very small number of conferences organized on the subject. The authors strongly believe that the relevant scientific and industrial communities dramatically and wrongfully underestimate the number of people with disabilities and refuse to admit certain projections about it.

First, the community should only expect that the number of people with disabilities will only dramatically increase not because of the actual number of the people with clinically defined disabilities but because of the people that will face some type of disability in the near future as a result of growing numbers of chronic diseases such as the diabetes or even just aging. Given the increase in life expectancy in the developed and developing countries it is only reasonable to expect various difficulties of the increased population of elders to keep a relatively good quality of life. It is interesting that according to a study by Jutla and Kanevsky [25] in the future in the U.S. 60% of the working-age adults would somehow need to access technology that will reduce their partial disabilities. The same study revealed that back in 2006 about 17% of the U.S. population, i.e. around 36.5 million people, were facing some type of hearing problem (2006, National Center of Health Statistics, www.cdc.gov./nchs/). In the cases of people diagnosed with hearing disabilities captioning is one of the most useful technology-based service.

Add to this the trend that has it, in many developed and developing countries, to constantly increase the age limit for retirement, hence asking for more people to keep on being productive for a very significant time (measured in several years) and one will see the need to further develop the technologies of the disabled.

Actually, it might be even more appropriate to revisit and redefine the term "people with disabilities" and, henceforth, to reanalyse the situation that will result from current trends in all aspects of everyday life after 20-30 years. Only this way the societies will be able to keep up with the pace of the technological developments and, largely, avoid the risks of digital divide. Such planning will lead to further growth of the national economies as a result of the dynamic increase of the technology sector but, also, the inclusion of these people in the economic life of their societies. While access and usability to assistive ICT are important for people with disabilities, evaluations of the effects of those technologies on their everyday activity and quality of life remains an issue.

The author's intention was not to enumerate and fully describe all available ICT apps or SPAs for people with disabilities but to highlight the basic strategies followed worldwide in the developed and developing countries, to revisit the disability concept as it is changed during the past decade in developed countries so as to create a safety net for less digital discrimination actions. ICT assistive technologies have greatly contributed to this transformation. Remote access and service availabilities in sectors like Health, Education, Social Media and generally private and public organizations have been augmented due to assistive ICT apps proliferation.

Another major issue related to the concept is the definite need for increased expenditures in order to apply the aforementioned suggested model to enforce relative management decisions. This is because, despite the dedication to facilitate equal access to the various activities and functions of the society, e.g. education, health, etc., political pressures to reduce expenditures on public or private sector in most developed and developing economies worldwide would make such inspiring programs vulnerable, especially in times of economical crisis such as the current one [34].

Another approach of innovation is to design technologies accessible to every citizen. Such examples are the government sites been designed to be available to almost every interested citizen. Additionally, designing new ICT software and hardware globally could be more cost-effective than reconfiguring existing solutions and adjusting production to include those with special disabilities. In a sense, the thought is that insisting in designing adaptive technologies only for people with disabilities could lead them out of mainstream technology because of the limited functionality that these adaptive technologies might, and quite likely, have as compared to their mainstream counterparts [34].

Such an example, mentioned earlier, is the high penetration level worldwide of the SPAs, which are cheaper than a laptop and more than just mobile phone devices. The result is the significant impact of SPAs to the transformation of the meaning of disability over time decreasing also Digital Divide Worldwide [35].

In the developed countries while the broadband penetration rate in mobile devices is low (8%), Smartphones sales penetration rate is high (51%) [23]. This fact indicates that the adaptation of Smartphones' communication applications has a lot of distance to cover. However, due to more SPAs development trends and having already a healthy legal infrastructure build for digital access convenience, developed communities, like E.U. and U.S.A., are sustaining a technology innovative environment. In turn, they are closer to transform the very meaning of disability to just a deficit that needs to be addressed with the aid of technology in every form. Their paradigms of awareness, accessibility and usability dedication to new ICTs reinforces the hope for good health prosperity among citizens [34].

The technology progress is constantly transforming the meaning of disability to the state of just a particular human condition that needs to be addressed. This conceptual turn can eventually transform the people with disabilities from a minority group to equal standing society members.

References:

[1] E. Brynjolfsson, A. Saunders (2010), "Wired for innovation", The MIT Press, Massachusetts, 2010.

[2] T. Berners-Lee (2014), "Introduction to web accessibility", Retrieved: 12/2014, Available at: www.w3.org / WAI/ intro/ accessibility.php.

[3] K. Dobransky & E. Hargittai, "The disability divide in Internet access and use", *Information, Communication & Society*, Vol. 8, Issue 3, 2006, pp. 313-334.

[4] Observatory Studies (2014), "Estimation of digital divide for disabled people", Immigrants and Senior Citizens in Greece, 10/ 2007, Retrieved: 12/ 2014, Available at: www.observatory.gr/ files/ meletes/ AMEA_ap.pdf.

[5] L. J. Davis (2013), "The Disabilities studies reader", Routledge, 2013, pp. 17-33.

[6] European Commission (2010), "European disability strategy 2010-2020", November 2010, Retrieved: 12/2012, Available at: eur-lex.europa.eu/ LexUriServ/ LexUriServ.do?uri = COM:2010:0636: FIN:EN:PDF.

[7] United Nations Convention (2006), "Promotion and protection of human rights", 12/2006, Retrieved: 12/2014, Available at: www.un.org/ disabilities/ convention/ conventionfull.shtml.

[8] Ministerial Conference in Riga (2006), June 2006, Retrieved: 12/2012, Available at: ec.europa.eu/ information_society/ events/ ict_riga_2006/ doc / declaration_riga.pdf.

[9] Council of Europe Committee of Ministers Action Plan (2006), "Improving the quality of life of people with disabilities in Europe 2006-2015", April 2006, Retrieved: 12/2012, www.coe.int/t/e/ social_cohesion/ soc-sp/ Rec_2006_5% 20 Disability % 20Action%20 Plan.pdf.

[10] D. Ferri, G. A. Giannoumis (2014), "Behavioral Sciences & Law", Wiley Online Library, Vol. 32, Issue 1, 2014.

[11] Observatory Studies (2007), "Estimation of digital divide for disabled people, immigrants and senior citizens in Greece", October 2007, Retrieved: 12/2014, Available at: www.observatory.gr/ files/ meletes/ amea_ap_ac.pdf.

[12] International World Statistics (2012), "Usage and Population statistics", June 2012, Retrieved: 12/2012, Available at: www.internetworldstats.com/ stats.htm.

[13] ADA act of 1990, Retrieved: 12/2012, Available at: www.ada.gov/ pubs/ada.htm.

[14] ADA amendments act of 2008, Retrieved: 12/2012, Available at: www.access-board.gov/about/laws/ada-amendments.htm.

[15] Pew Internet Project report (2012), April 2012, Retrieved: 12/2012, Available at: pewinternet.org/Reports/2012/Digital-differences.aspx.

[16] D. Xanthidis, P. Nikolaidis (2014), "A pilot study of the challenges associated with eLearning developments in Saudi Universities", *International Journal of Technology Diffusion*, 5(4), October-December 2014, pp. 63-79.

[17] D. Xanthidis, A. S. Alali (2014), "Effects of Social Media on eLearning development in the GCC. Case Study: Saudi Arabia," IEEE Xplore, 4/2014.

[18] D. Xanthidis, A. S. Alali (2014), "Investigating the attitude of the average Saudi towards the Social Media", ACACOS '14, WSEAS, pp. 86-94.

[19] EpatientGr's Blog (2011), Disability & New Technologies, 7th July 2011, Retrieved: December 2012, Available at: epatientgr.wordpress.com/2011 /07/07.

[20] S. Burgstahler, University of Washington, "Distance Learning", Retrieved: 12/2012, Available at: www.washington.edu/ doit/ faculty/ strategies/ academic/ distancelearning/.

[21] M. Schulze (2010), "Understanding The UN Convention on the rights of persons with disabilities", *Handicap International*, New York, July, 2010.

[22] V. Mirabella, S. Kimani, S. Gabrielli, T. Catarci (2004), "Accessible e-Learning Material: A No-Frills Avenue for Didactical Experts", *The New Review of Hypermedia and Multimedia*, Vol. 10, No. 2, pp. 1-16.

[23] S. Dredge (2011), "Smartphone technology as an accesibility platform", The Guardian, November 2011, Retrieved: December 2012, Available at: http://www.guardian.co.uk/smart-ccessibility/.

[24] M. D. Chester (2012), "Access to Learning Assistive Technology and Accessible Instructional Materials", Massachusetts Department of Elementary and Secondary Education, November 2012, pp. 4-11.

[25] D. N. Jutla, D. Kanevsky (2009), "wisePad services for Vison-, Hearing-, and Speech-Impaired users", *Communications of the ACM*, January 2009, Vol. 52, No. 1, pp. 64-69.

[26] Key statistical highlights: ITU data release (2012), June, 2012, Retrieved: December 2012, Available at http://www.itu.int/ ITU-D / Ict/ statistics/ material/ pdf/2011%20 Statistical%20 highlights_ June_ 2012.pdf.

[27] C. Boris (2013), "3 Mobile Apps for Converting Voice to Text", Entrepreneur, January 2013, Retrieved: November 2015, Available at: www.entrepreneur.com/article/225584.

[28] E. Roth, K. Cherney (2015), Healthline, August 2015, Retrieved: November 2015, Available at: www.healthine.com/health/heart-disease/top-iphone-android-apps.

[29] S. Gabrielli, V. Mirabella, S. Kimani, T. Catarci (2006), "A Boosting Approach to eContent Development for Learners with Special Needs",

Educational Technology & Society, Vol. 9, No. 4, pp. 17-26.

[30] LTSC (2004), IEEE LTSC Learning Object Meta-Data LOM_1484_12_1_v1_Final_Draft, November 2004. Available at: ltsc.Ieee.org/wg12/files/.

[31] A. Magna, J. Ecalle (2006), "Audio-visual training in children with reading disabilities", *Computers & Education*, Vol. 46, pp. 407-425.

[32] S. Gabrielli, V. Mirabella, S. Kimani, T. Catarci (2004), "Steering the Development of Accessible eLearning Content", Proceedings of the 3rd ECEL Conference, Paris, France, 517-526.

[33] A. Barak, Y. Sakovsky (2008), "Internet use and personal empowerment of hearing-impaired adolescents", *Computers in Human Behavior*, Vol. 24, pp. 1802-1815.

[34] P.H.Wise (2012), "Emerging technologies and their impact on disability", *Future Child, The future of children*, Vol. 22, Issue 1, Spring 2012, pp. 170-171.

[35] K. Doughty (2011), "SPAs (smart phone applications) - A new form of assistive technologies", *Journal of Assistive Technologies*, Vol.5, Issue 2, 2011, pp. 88-94.