InSIDE: Including Students with Impairments in Distance Education

Delivery **PR1.1**	**State of the Art concerning DE programmes**

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Contents

Abbreviations

Acronym	Term
HE	Higher education
HEI	Higher education institution
ICT	Information and communications technology
InSIDE	Including Students with Impairments in Distance Education
IwI	Individual with impairments
JKU	Johannes Kepler University
LMD	Licence, Master, and Doctorate
UABT	University of Aboubekr Belkaid Tlemcen
UAE	Abdelmalek Essaadi University
UB2LA	Blida 2 University
UCA	Cadi Ayyad University
UIT	Ibn Tofail University
UM5R	University of Mohammed V in Rabat
UMMTO	Mouloud Mammeri University of Tizi-Ouzou
UOA	National and Kapodistrian University of Athens
UOM	University of Macedonia
US	University of Sousse
USFAX	University of Sfax
USTO	University of Sciences and Technology of Oran Mohamed Boudiaf
UTM	University of Tunis El Manar
ViHeMo	Visual, hearing, mobility/physical
WP	Work Package
PwSN	People with Special Needs
UN	United Nations
IT	Information Technologies
BMBWF	BundesMinisterium für Bildung, Wissenschaft und Forschung
BKZ	BundesKompetenzZentrum
OER	Open Education Resource
DACH	Germany, Austria and Swizeland

About InSIDE

The aim of the project is to develop accessible DE programmes for individuals with ViHeMo impairments. The concrete aims are to: a) develop an accessible, inclusive and educationally effective model of DE that will deliver key competences for vocational rehabilitation, and provide opportunities for lifelong learning, skills enhancement, and personal fulfilment with the ultimate aim of suggesting an intelligent solution against the problems of limited access or high percentage of dropouts in HE in IwI, b) structure a strong cooperation between organisations with sound expertise in accessible and inclusive HE and organisations where both the modernisation of HE and the promotion of the right to education of IwI is imperative, and c) widen the horizons of local HE towards an international and intercultural education through DE programmes.

The overall objectives of the project are to:

1. Develop new and innovative, accessible and inclusive DE programmes improving the quality of HE for individuals with ViHeMo impairments and offering flexible learning and virtual mobility
2. Upgrade the facilities through establishing accessibility offices and acquiring assistive technology resulting in modernization of university services
3. Build capacity and professional development in administrative and teaching staff in developing and carrying out accessible and inclusive DE programmes, and operating the accessibility offices
4. Involve individuals with ViHeMo impairments in a user-centre design so that accessibility and usability are achieved in conjunction, and the links between education and society are strengthened

The specific objectives of the project are:

- The preparation of the development stage through an extended literature review for precedent trials in DE for IwI
- The development of the most suitable educational material for IwI (ViHeMo) in terms of accessibility, usability and educational efficacy through the study of end-user requirements
- The adaptation of a course delivery system that best serves the needs of IwI (ViHeMo) in DE
- The foundation of accessibility services in HE so that SwI would be supported during their attendance in HE

- The training of advisors in the services of the accessibility offices, and the training of the trainers (advisors and representatives) so that they will be able to train the end-users (teaching staff and IwI)
- The examination of the regular co-operation of all the above to deliver inclusive DE courses effectively when learning and skill enhancement are concerned, considering end-users feedback too
- The dissemination and exploitation of the project deliverables on an international level.

1. Learning Educational Technologies

New technologies are rapidly emerging in the field of education. Kurt (2010) stated that technology could be used as a tool for performing meaningful projects to engage learners in critical thinking and problem-solving. Meanwhile, experts agree that technology should be treated as a tool to promote learning, and it aims to provide an improved student experience of learning by developing resources for academics to enable them to make informed decisions as to the best use of technologies (Craig et al., 2012). We are entering an era in which the Web is changing from a medium to display content, to one in which content is endowed with semantic meaning (Berners-Lee, 1999). Fortunately, the exploitation of technology and the popularisation of the Internet have demolished the bailey of the pedagogical present, and both students and instructors have embraced new technologies in educational settings. Learning (educational) Technologies (LT) are the broad range of communication, information and related technologies that can be used to support learning and can blend traditional face-to-face lessons and online forms of methods. They are often viewed as tools for reducing the inequities in educational opportunities, and they refer to computer technologies such as Internet technology, web resources, mobile devices, hardware and software for design, delivery, evaluating, management, facilitating of learning (Tamim et al., 2011). It includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or videotape, satellite TV, CD-ROM, and computer-based learning, as well as local intranet/extranet and web-based learning. Information and communication systems, whether free-standing or based on either local networks or the Internet in networked learning, underlie many e-learning processes (Antzoulatos, 2017). Technology is a tool and a catalyst to enhance education and can be used as a lever in order to improve learning. Technology has generated many tools and practices exploiting its potential. At the same time, technology is promising and can prompt pedagogical change into a new learning environment. The potential of education through multimedia tools is an active process and is a complete replacement of the traditional courses. Several mediums deliver this process which breaks the traditional barriers of schooling culture and knock down the old role of α simple classroom in order to accomplish the educational goals from a distance and they aim to enlarge learners' opportunities capitalizing on LT. LT are using chatting, text messaging, blogging, and online communities for educational activities, including collaboration on school projects while each one is better suited for a type of instruction or another and the use of technology, can convert a lesson in a game and an in cool new thing which is more effective and fosters it in an attractive approach. LT has an involving role in empowering knowledge to travel faster and further through the internet as it is fast becoming the communication

tool that is unrivalled for its power and the cornerstone of the curriculum of the tomorrow. Further to LT, educators need to be well informed and familiar with the available technologies because they can shift the balance of the new power towards the learners. Besides, LT can help pave the way for both teachers and learners. In today's education systems, these technologies are creating new challenges and opportunities for how a learner approaches knowledge. Every learner is a different situation with different needs, and different potential and technology allow educators to accommodate unique learning styles on a case-by-case basis. From the old desktop computers to tablets and smartphones that someone can carry in a small bag, a new era is dawning. This new era that emerges improves the learning quality in education and vouches to fulfil the learning needs of the individual study-aged students without barriers. A large number of specialized tools with educational potential have been developed that can support and supplement or take the place of traditional learning for students with disabilities. Even though some tools were not created for educational purposes, they can still be used in learning (Orehovački, Konecki, and Radošević, 2008). In other words, the tools create pedagogical opportunities even if they are not always exclusive to a single disability, but some tools can be associated with multiple disabilities.

Progress and innovation in education allow us to serve the diverse learning styles better and enhance the learning process. Many different types of LT can be used to replace the classroom. Each LT plays a different role in the learning process, and each LT represents something different. At the same time, those technologies can collaborate in order to have a better outcome by supporting knowledge harmoniously from many aspects, but sometimes they can pose restrictions or reduce the learning quality if they are not correctly selected (Khosrow-Pour, M., 2006). On the other hand, there are too many variables of LT, so they will always equate the reduction of quality in the learning experience. It is judicious to group them into categories in order to help the human mind to classify them. There are many ways to categorize and organize LTs, but the most comprehensive one is by the type of interaction. The classification is for better guidance. In the case that is mentioned above, the LT are assorted as "representational (or one-way)" and "collaborative (or two-way)" considering how they facilitate learning and in "synchronous" (learner-centered) and "asynchronous" (self-paced) depending on whether the process involves interaction of participants with an instructor via the Web in real-time or not. The synchronous learning looks like a classroom in many ways, but it plays a part in virtual classes where teacher and learner are in different locations without geographical limitation, and it is based on teleconferencing tools which support the visual and audio between people in different locations. Many times, these tools support as well as the share of educational material. Someone can as well share educational material in asynchronous learning, but the teacher or the learner has the opportunity to prepare or store somewhere this material because there is no direct

communication between them. The rhythm of conduction in the asynchronous learning is defined by the teacher in collaboration with the learners, and the services of the asynchronous method aim to the creation of a dynamic environment of education and the management of learning procedure. Synchronous and asynchronous learning does not work as competitive concepts, but they can sometimes be enforced, complementing one another. As technology develops and changes, new expansions of their categorization come to the surface. Mainly, the expansion is taking place in collaborative technologies, and therefore, two subcategories have appeared. The first is the "dialogic", where they confine those which support the dialogue alone, and the second is the "productive", where LT combines two-way communication and facilitates the creation of products. (Khosrow-Pour, 2006).

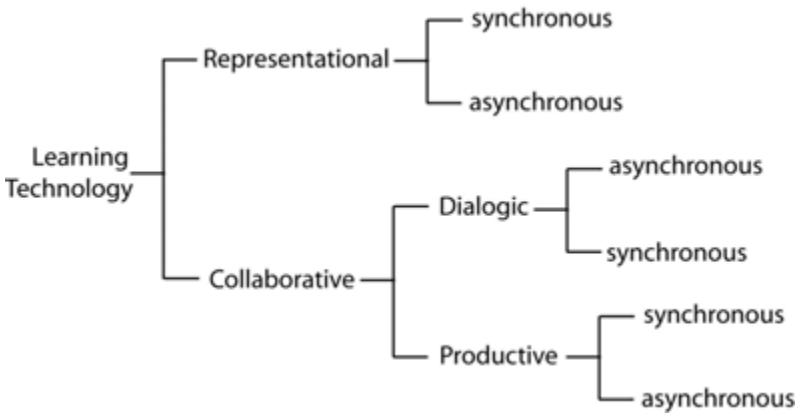

Diagram 1. Time Taxonomy of LTs

1.1. Distance Education

Distance Education has a long history of almost two centuries (Spector, Merrill, Merrienboer, & Driscoll, 2008) and during this period of time, it has been changing depending on how learning occurs and how people from different regions and times periods have been coming in contact with the learning process. The essential goal of Distance Education is to accommodate educational opportunities for individuals that might have missed academic achievement earlier in life but still want to try education in their own pace, irrespective of time and place (Monk & Hitchen, 2005) and students who do not have the ability to attend a conventional classroom programme (Pant, 2005). For this reason, according to Koustriava and Papadopoulos' (2013) research, institutions try to address their programmes to a wide range of students, including ''non-traditional'' students and promoting lifelong learning (Kirkwood & Price, 2005). They try to provide students with the motivation to continue to study and actively participate in lifelong learning. The motivation of students to continue to study and enjoy learning is a factor that critically influences Distance Education (Liao, 2006). Motivation is an important issue that should be included in every research

that focuses on detecting future participants' attitudes towards a distance learning programme or their desire to thoroughly engage in distance education. It has been suggested that self-motivation is the best way to achieve learning (Ghani & Deshpande, 1994), as well as to desire the upgrade of knowledge and succeed (Chan & Ahern, 1999).

The most widely known form of Distance Education is Online Learning that made its appearance in 1980, but there are more other terms used to refer to this form of education, each of which adding some variations to the general term of Distance Learning, based on the learning objective, the target audience, the way of access to the learning material (physical, virtual or a combination of them) and the type of the learning content (Harasim, 2000).

The truth is that researchers use a variety of terminologies ending up many times to refer to the same form of learning process. This phenomenon derives from the fact that learning technology and its associated fields continue evolving rapidly, providing to researchers and educators with various ways of sharing their educational material with their students (Lowenthal & Wilson, 2010; Volery & Lord, 2000). As a result, it is difficult for researchers to perform meaningful cross-study comparisons among the conflicting findings of Distance Learning, e-Learning and Online Learning.

The quality of Distance Education is based on the design and the adequacy of communication and higher education is increasingly being encouraged to carry out the form of eLearning. In recent years this model has grown steadily as an option and is expected to continue expanding across the globe. For example, in 2013, more than 6 million students took at least one online course, and the prediction for 2019 is that nearly half of all classes worldwide will be done online. Furthermore, the U.S. and Europe account for over 70% of the entire global education industry, but Asia Pacific's use of online coursework is growing the quickest. In Greece, Distance Education is still in an early stage with many uncertain issues to be clarified, albeit experiments have demonstrated that eLearning can be at least as effective as conventional classroom learning under certain situations (Goyal, 2012).

Meanwhile, many of the country's academic institutions are active in this field, but the only university that provides official and certified titles of studies is the Hellenic Open University because there are institutional gaps. Surpassing this, the fact that there are severe infrastructures in more universities that can support such methods and other educational needs and have not yet been sufficiently exploited is underwhelming. On the other hand, more and more institutes amalgamate traditional learning with Distance Education, and the institutes have web pages with many details about educational subjects (Kyrma and Mavroidis, 2015).

Apart from the regular privileges that Distance Education offers, it can tailor the curriculum and make the learning process more manageable in order to reach the goal of quality educational

opportunities for different audiences, like people with disabilities. A disabled person can set its place in order to match his needs no matter the kind of disability. For example, a person with autism can be distracted in a traditional class, a person with a wheelchair cannot pass the corridor, and a person with a hearing impairment cannot attend the lecture. With Distance Education, all these are possible and boost their self-esteem. Also, it is a hope for the disabled to find quality education, an action to ensure equal citizenship for them and a significant rise in their participation in society (Antzoulatos, 2017).

1.1.1. Distance Learning

As computers became involved in the delivery of education, a proposed definition identified the delivery of educational material in both print and electronic way, widely known as Distance Education or Distance Learning (Moore, 1990). This way of learning design includes an educator, physically located in a different place from the students, who possibly provides students with knowledge in an asynchronous way. Dede (1996) elaborated on the definition by comparing it with the pedagogical methods used in the traditional learning process and referring to it with the term "teaching by telling". This definition also stated that distance education uses emerging media and associated experiences to produce distributed learning opportunities. Both these definitions recognized the changes that were apparent in the field of education and attributed them to the new technologies that were being made available. Keegan (1996) went further by suggesting that the term Distance Education is an "umbrella" term, and as such, has terms like correspondence education or correspondence study that may have once been synonymously used, being clearly identified as a potential offspring of distance education.

King, Young, Drivere-Richmond and Schrader (2001) do not support the interchangeable use of the terms distance learning and distance education, because both terms do differ. Distance Learning is referenced more as ability of learning conduction remotely, whereas Distance Education is an activity within the ability of learning at a distance. As new technologies become apparent, the term Distance Learning evolved to describe other forms of learning, e.g.: Online Learning, e-Learning, Technology-mediated Learning, Online Collaborative Learning, Virtual Learning, Web-based Learning, etc. (Conrad, 2006).

Distance Learning can be applied in all the levels of education, as one of its fundamental characteristics is the educational material which is especially designed as well as the utilization of ICT (Ko & Rossen, 2001). At the same time, a basic requirement for the effectiveness of distance training is the frequent communication between the teachers and the students, as well as supporting activities applied by the teacher him/herself, who functions in an encouraging manner as an advisor (Race, 1989).

Compared to the conventional types of training, Distance Learning manages to overcome a number of restrictions, such as the mandatory presence of the student in the space where the class takes place. In addition, the public to which it is targeted is much wider, due to the fact that this type of training offers more educational opportunities through the utilization of ICT (Lionarakis & Likourgiotis, 1998; Lionarakis, Panagiotakopoulos & Xenos, 2005; Ali, 2008).

In greater detail, within the framework of this type of training, learning is based on the personal study of the educational material by the trainee, and its effectiveness depends, to a great extent, on the communication and cooperation of the latter with the trainer. At the same time, Distance Learning needs to be perfectly designed, have clearly defined teaching objectives, and analyze the pedagogical requirements of the educational process (Moore, 1993; Holmberg, 2005; Peters, 1993). Moreover, a basic characteristic of Distance Learning is that it is based on three structural elements: the trainer, the trainee, and the training material.

1.1.2. e-Learning

The origins of the term e-Learning are not certain. Tavangarian and his partners (2004) included the constructivist theoretical model as a framework for their definition by stating that e- Learning is not only procedural, but also shows some transformation of an individual's experience into the individual's knowledge through the knowledge construction process. Both Ellis (2004) and Triacca and his partners (2004) believed that some level of interactivity needs to be included to make the definition truly applicable in describing the learning experience, even though Triacca and his partners (2004) added that e-Learning was a type of online learning. Other authors believe that the term e-Learning can be used synonymously to other terms such as Online Course/Learning, Web-based Learning, Web-based Training, Learning Objects or Distance Learning (Dringus & Cohen, 2005; Khan, 2001; Triacca et al., 2004; Wagner, 2001). What is abundantly obvious is that there is some uncertainty as to which exactly the characteristics of e-Learning are, but what is clear is that all forms of e-Learning can eventually provide a learning opportunity for individuals.

e-learning is an interactive method of education using the Internet, TV or other common means of communication. The most popular and widely used medium is the Internet. This form of interactive education can usually provide (Mikołajewska & Mikołajewski, 2011):

- home education, which is important for people with limited mobility
- a flexible program: the time and place can be adapted to suit each student’s situation
- access to a wide range of multimedia sources, including publications, images, movies, simulations and interactive exercises and exams

- access to sources inaccessible in other ways, e.g.: rare specialists, native speakers of uncommon languages or research on unusual medical conditions
- lower costs, because there is no need to commute to classes
- integration with telemedical systems (including telerehabilitation systems) and health-care educational programs (e-health), which can be inexpensively introduced, since they usually use the same communications medium as e-learning systems
- useful training with e-work technology.

All of these advantages make e-learning an excellent opportunity for the disabled. e-learning can be used separately, but a more effective solution is to integrate it with the disabled person's integrated IT environment. This environment allows for full interoperability among the assistive devices used, making it easy to switch from one to another as needed and to add new ones when required. Access to mobile internet increases the mobility of e-learning users, regardless of whether they use a wheelchair, scooter, exoskeleton or car (Mikołajewska & Mikołajewski, 2011).

e-Learning can involve students studying fully online and also, a blend of online and face-to-face education. Teaching can involve the use of formal online learning management systems such as Blackboard, WebCT and Moodle, web-based lecture technologies, such as Lectopia or the Massive Open Online Course sites such as Coursera or edX. It can also take advantage of other less dedicated online platforms such as video hosting sites like YouTube and social networks like Twitter and Facebook. In 2012, more than one in three students in the United States (33.5%) were taking at least one online course and online enrolments were growing at a rate of 6.1% in an environment where overall enrolments were growing at a rate of only 1.2% (Allen & Seaman, 2014).

1.1.3. Online Learning

Online Learning can be the most difficult of the three abovementioned terms to be defined. Online Learning is described by most authors as access to learning experience via the use of some technology (Benson, 2002; Carliner, 2004; Conrad, 2002). Both Benson (2002) and Conrad (2002) identify Online Learning as a more recent version of Distance Learning which improves access to educational opportunities for learners described as both non-traditional and disenfranchised. Other authors mention not only the accessibility of Online Learning, but also the connectivity, flexibility and ability to promote varied interactions that provides to students (Ally, 2004; Hiltz & Turoff, 2005; Oblinger & Oblinger, 2005). Moreover, Benson (2002) made a clear statement that Online Learning is a newer version and improved version of Distance Learning.

1.1.4. Web-based Learning

Web-based learning is associated with learning materials delivered in a Web browser, including when the materials are packaged on CD-ROM or other media (Tsai & Machado, 2002).

1.2. Massive Open Online Courses

A modern movement in online education is the Massive Open Online Course (MOOC). This educational phenomenon, which started in late 2011, is hailed by many as an opportunity for democratization in education while existing higher education providers increasingly adopt it as a mode of provision, and it has supported the emergence of a new model in instruction. This model is due for an online course that has open access and interactive participation utilizing the Web, and they give students the option of studying a subject in depth without constraints, regardless of whether or not they have considered before. This model also is prevalent in Greek HEIs (Antzoulatos, 2017).

European Commission defines a MOOC as "an online course open to anyone without restrictions (free of charge and without a limit to attendance), usually structured around a set of learning goals in an area of study, which often runs over a specific period of time (with a beginning and end date) on an online platform which allows interactive possibilities (between peers or between students and instructors) that facilitate the creation of a learning community. As it is the case for any online course, it provides some course materials and (self) assessment tools for independent studying". MOOCs have gained traction in education in a remarkably short period without evidence that learning or instruction is significantly improved, and since it, success a range of both topics and platforms have emerged. The idea of MOOCs is appealing to some universities and schools (Daniel, 2012). One single course may admit even thousands of students, and the MOOCs are a recent progression in distance education (Antzoulatos, 2017).

The term originated in the US in 2008 to describe free, easily accessible, completely online courses. MOOCs run a couple of times a year and last for weeks. Although there are no tuition fees, and they allow anyone to register and follow the course, MOOCs seem to be less open than Open Education Resources (OER). During a MOOC, someone can use a wide range of tools, free of charge. Sadly, MOOCs do not currently offer professional accreditation, although they acknowledged positively as a great way to support and create education especially in the developing world (Antzoulatos, 2017).

Furthermore, MOOCs differ from other web-based formats of knowledge transfer, such as webinars, which often lack comparable interactivity. Finally, Clow (2013) distinguishes two fundamental types: cMOOCs and xMOOCs. cMOOCs are based on the pedagogical principles of connectivism where the interaction of the participants is the main source of the creation of knowledge while xMOOCs have

evolved from the digitization of traditional lecture formats and use behavioristic teaching approaches and they consist of short video sequences for the mediation of learning contents (Vardi, 2012) and as a result, a number of MOOC platform providers emerged including Coursera, Edx, and Udacity. Although different types of MOOCs exist and reflect varying learning theories, they all provide universally accessible and affordable quality education to thousands of learners who otherwise would not have access to it, either because of financial, geographical, time, or other barriers (Carr, 2012). However, the claim that MOOCs are democratizing and revolutionizing education is still questionable as recent reports show that most MOOC participants are technology-savvy working adults and not the marginalized population MOOCs are meant to serve. This problem is exacerbated in developing countries where poor digital infrastructure, lack of computer literacy skills, language barriers, and cultural differences limit participation (Antzoulatos, 2017).

2. Distance Learning and Disability

Correspondence courses using printed materials, postal mail, and television have brought together instructors and students separated by great distances for a long time. The Internet is the latest vehicle used to deliver these learning opportunities. Online courses, in the early days delivered via electronic mail, are now dominated by Web-based instruction (National Education Association, 2000; Technology Counts 2002; Waits & Lewis, 2003). The widespread availability and flexibility of this multimedia tool has led to an explosion of online learning offerings worldwide (Waits & Lewis, 2003). Although the ultimate goal of distance learning is to make education available to anyone anywhere at any time, this goal cannot be realized unless courses are designed to be accessible to all potential students, including those with disabilities (Burgstahler et al., 2004).

The social model of disability argues that disability is located in social practice rather than an individual body. A person may have a particular impairment, but it is the impact of decisions made by society that causes it to be a disability (Oliver, 1996; Finkelstein, 1980). A person who uses a wheelchair may have a specific mobility impairment, but it is the lack of wheelchair ramps on a university campus that causes disability. However, disability is activated differently online. Impairments that might encounter significant disabling environments in the analogue world, such as for a wheelchair user, may have less impact when using the internet. Other impairments such as print impairments related to vision, cognition, and manual dexterity and, increasingly, with the use of video and audio through the internet, people with hearing impairments may find different online environments can be significantly disabling (Ellis & Kent, 2011; Goggin & Newell, 2003).

While accessibility and the internet is an ongoing struggle it can also provide significant opportunities for many people with disabilities. For people with many impairments, access to the internet is not a disabling experience. The network provides many opportunities for social interaction and options regarding disclosure that might not be available in an analogue environment interacting with people face to face. For people who have problems navigating the analogue world the internet provides many opportunities for work, leisure and commerce. As Dobransky and Hargittai (2006) note, access to digital communications technology can increases a sense of independence and self-determination for people with disabilities, and allow people to take advantage of online support without leaving their homes. Similarly, Guo, Bricout and Huang (2005) observed that the internet can remove barriers inherent in the physical environment and reduce discrimination towards disabled people.

For other people with disabilities the internet can prove a difficult environment to access. As the internet becomes more a part of everyday life, the impact of digital disability on people's lives increases. Increasingly being unable to access the internet can be seen as a form of disability in itself (Tănăsescu, Stegăriou & Păunescu, 2010). Dobransky and Hargittai (2006) found that people with a disability are less likely to have access to information technology. Similarly, Fox (2011) found in the United States people with disability are significantly less likely to use the internet.

Ellis and Kent (2011) outlined three stages of accessibility to online environments for people with disabilities. In the first instance an online platform or technology will be accessible, but not distributed widely. In the second stage it becomes more widely distributed, but as part of the redesign that leads to this popularity it often becomes no longer accessible. A third stage is reached where there is enough political pressure placed on the platform to make it accessible. In this last case, designers/programmers retrofit access measures into it. Ellis and Kent argue that to avoid this cycle repeating with each new platform, a fourth stage must be reached where accessibility and universal design are built in at the earliest stages of development. While these stages will not fit to each and every situation they do map well onto eLearning over the past twenty years.

In higher education in the United States and United Kingdom, the percentage of students with a disability is between eight and fourteen percent. This contrasts with eighteen percent in the working age population (Sachs & Schreuer, 2011). In Australia, the representation of students with a disability has been reported as low as four percent (Ellis, 2011). eLearning has great potential to help both existing students with disabilities in their studies and also facilitate a more equitable representation of this group of people in higher education. However, as Seale (2013) has observed, the relationship that disabled university students have with both their technologies and institutions is poorly understood. In order for this potential to be realized the eLearning platforms need to be as accessible as possible for students with a range of different impairments. According to Seale and

Cooper (2010), accessibility in relation to e-learning (e.g.: virtual learning environments, digital repositories, multimedia, web portals and discussion boards) is understood as ensuring that learners are not prevented from accessing technologies or content and experience offered by technologies on the grounds of their disability.

As well as technical accessibility Sachs and Schreuer (2011) found that the attitude of faculty towards people with disabilities influences the success or failure of those students. It will also affect the likelihood of students, particularly those with invisible disabilities, from disclosing and requesting any necessary accommodation. As Seale (2013) observed, non-disabled students are viewed in the context of what they can do with technology, whereas students with a disability are viewed in terms of what they cannot do. Sachs and Schreuer's study focused on on-campus students, once students are online the nature and number of what can be considered invisible disabilities grows. Roberts, Crittenden and Crittenden (2011) found that this unwillingness explicitly to disclose a disability and request accommodation also is a feature of students studying fully online. Guglielman (2010) also cautions that eLearning courses need to address both technical and pedagogical aspects of accessibility and inclusion.

The reduced access to information technology experienced by people with disabilities, noted above by Dobransky and Hargittai (2006), creates an initial barrier to this type of learning. Those people with access to technology then encounter a number of problems that have been documented by Fichten et al. (2009). These include the accessibility of websites and learning management systems, the accessibility of digital audio and video content and alternatives, inflexible time limits built into online exams, the accessibility of PowerPoint presentations, and also course material in inaccessible PDF formats and the lack of access to needed adaptive technologies. Van de Bunt-Kokhuis and Bolger (2009) also highlighted problems with the inaccessibility of online chat rooms, and particularly the incompatibility of screen readers with these forums for students with vision impairments. Kelly (2009) found that almost one-third of students who used assistive technology to access online educational material found that this material was unreliable or inconsistent if it could be accessed at all.

Many online courses are not designed with accessibility in mind (Roberts, Crittenden & Crittenden 2011). This means that students who do not disclose that they have a disability maybe disadvantaged. It also means that when students do request accommodation to access the learning environment it requires a process of design-redesign to accommodate the students, adding additional costs. Roberts, Crittenden and Crittenden (2011) suggest that courses should be designed to be accessible from the beginning. Implementing universal design principles at the outset avoids costs caused by the need to engage in a digital retrofit and serves to include those students who

would otherwise be excluded by an unwillingness to request accommodations. Following Ellis and Kent (2011) disability access needs to be built into the design process at the beginning, not retrofitted. These technical moves to provide access will need to be done in conjunction with a pedagogical approach to course design that is inclusive for people with disabilities and the overcoming of ableist bias or discrimination on the part of teaching staff (Kent, 2015).

Disabled people's needs in e-learning can be specified as follows (Mikołajewska & Mikołajewski, 2011):

- The education programs should be addressed and easily adapted to the needs of a wide spectrum of people in terms of age, education level (course, high school, university, postgraduate), type and degree of impairment, their capabilities for community participation, etc.
- Two stages of e-learning are needed: a first stage to prepare disabled people for the learning process (including adaptation to their type and degree of impairment), followed by the second stage, which is e-learning proper.
- Rather small groups of participants are desirable, since distance education for people with disabilities often requires more of the teachers' time than courses for other types of groups.
- A wide range of courses is needed, often directly preparing disabled students for specific jobs, e.g.: in customer service, many IT posts, remote control of logistic, maintenance and transportation systems, human-resource (HR) management and accountancy.
- Because some disabled people are shy and have low self-esteem, successful e-learning for disabled people should contribute to their psychological and social development.
- Online helpdesks and stationary support systems are needed for e-learning customers, for both disabled people and their carers (or parents in the case of disabled children).

Accessible e-Learning provides a number of affordances to students and also teaching staff with disabilities. For many there potentially are more choices in terms of disclosure for a variety of impairments. The reluctance of students to disclose that they have a disability, even when necessary to seek access to inaccessible content found by Sachs and Schreuer (2011) and Roberts, Crittenden and Crittenden (2011) points to the value this choice has for many students with disability. Learning material that is made available online can have far more options for accessibility than analogue content, electronic text can be read aloud and translated to braille, audio files can be electronically transcribed as text. Finally, the eLearning environment can provide students with a much greater degree of flexibility, lectures can be listened to when circumstances allow rather than at a set time and place. Tutorial discussions take place on asynchronous discussion boards again, free of the time and place restrictions of their analogue counterparts. These three features of disclosure,

accessibility, and flexibility provide great potential for people with disabilities to engage in a higher education learning environment. However, these benefits are not just limited to students with a disability, accommodations made for accessible course design help all students. Technology such as web-based lecture systems are valuable for both students with disabilities and the broader student population (Williams & Fardon 2005). Text made available as an audio file can be listened to in different settings. Subtitles can be used to read the content of a video presentation when sound is not appropriate. Information that is less fixed to a specific format can be accessed in multiple ways and is more easily searchable (Kent, 2015).

e-Learning accessibility is a complex endeavor that involves a multidisciplinary effort mainly for a technological, didactic and administrative perspectives. In this respect, an e-Learning platform should be accessible, but the most important part is the e-Learning content in order to have an effective solution. The technical staff in an educational institution should be aware of the different accessibility standards and assistive technologies. However, teachers, tutors and instructional designers should be encouraged to understand the needs of a diverse population of students in order to create accessible content (Fichten et al., 2009) improve alternative teaching methods and evaluate different strategies for assessment. Therefore, there is a need to have a holistic approach for the implementation of accessible virtual educational projects in different contexts (Amado-Salvatierra, 2016).

3. Learning Education Technologies and Disability

Some disabilities limit the possibility of using a classic PC. In such cases, assistive devices can adapt computers to the needs of the disabled person (Bruyère et al., 2006; Hedrick et al, 2006; Mikołajewska & Mikołajewski, 2011). The appropriate solution depends mainly on the type and degree of impairment. Assistive devices help compensate for functional limitations, enhance computer utilization and improve the person's ability to compete for employment (McKinley et al., 2004).

Technological accessibility, or e-accessibility, has evolved primarily from webpage accessibility. Adapting learning platforms improves e-accessibility and accessibility in the educational environment. However, several technical issues should be considered to adapt a learning platform, including the nature of the learning objects (LOs) and their adaptations, the accessibility metadata provided for LOs and their adaptations, and students' personal needs and preferences (PNPs). In order to use an adapted platform, content creators must produce and upload adaptations of LOs,

and they also have to fill out accessibility metadata. In addition, students must provide their PNPs in their profile (Batanero et al., 2019).

Assistive or enabling technology includes devices, tools, hardware or software, which enable, partially, people with disabilities to use the computer. It presents an alternative way to access the content on screen, command the computer or process data. Specific adjustment software or devices for manipulating the computer include (Arrigo, 2005). The main solutions, consisting of both hardware and software, are as follows (Mikołajewska & Mikołajewski, 2011):

1. for people with motor impairments (depending on the type and severity):
    - alternative keyboards (e.g.: with larger buttons or alternative key configurations) and typing aids
    - on-screen keyboards
    - alternative mice, trackballs, joysticks and/or electronic pointing devices, often with built-in or separate large buttons
    - touch screens with wands/sticks
    - sip and puff switches
    - voice control and speech recognition.
2. for people with vision impairments:
    - screen enlargers
    - screen readers, reading tools, word processors and other text-to-speech devices
    - voice control and speech recognition
    - adapted keyboards instead of mice or trackballs
    - advanced options for Flash web sites (e.g.: synchronized narration).
3. for people with hearing impairments:
    - adaptive devices to support hearing
    - software for point-to-point video connections or videoconferences, for people using sign language or lip-reading
    - voice-to-text converters
    - advanced features for subtitle reading
    - advanced multimodal Flash web sites with on-screen graphics, animation and text equivalents of the audio.
4. for people with very severe impairments of the spinal cord:
    - neuroprostheses and Brain-Computer Interfaces (BCI), usually with simplified navigation tools.
5. for people with cognitive impairments (depending on the type and severity):

- simplified controls
- simplified and/or enhanced on-screen information, e.g.: with animation, help menus and content description.

These assistive technologies can be either devices or equipment (hardware) e.g.: Braille or software applications e.g.: screen reading software. However, these technologies do not seem sufficient for providing full support to people with disabilities. Web content providers should also participate in the inclusion process by making arrangements that allow particularities of people with disabilities to be taken into account when creating web content. Several efforts were conducted toward addressing this issue (Laabidi et al., 2014). Moreover, wireless communication among these systems is desirable to avoid an excess of cables.

Future adaptive devices for disabled computer users include voice-controlled computers, advanced multimodal interfaces and Ambient Intelligence environments. It is very important to develop such technology, which can be very useful on the job and in everyday life.

Proper assessment and selection of assistive devices can be essential. Because of the various types of available assistive technology products, it is crucial to find ones that are compatible with the computer operating system and programs on the particular computer being used. The help of an experienced physical therapist, occupational therapist or biomedical engineer is needed when choosing the appropriate technology (Mikołajewska & Mikołajewski, 2011).

The availability of a wide range of assistive technology makes it possible for individuals with almost any type of disability to gain access to computers and telecommunications technologies (Carlson et al., 2001; Closing the Gap, 2004). For example, individuals who are blind often use text-to-speech systems that read what appears on the computer screen with a synthesized voice. These systems only provide access to the text content of Web pages, software, and other electronic resources. Text-based course tools such as electronic mail do not present accessibility challenges to people who are blind, but content embedded in graphics images is inaccessible unless text descriptions are provided. Individuals who cannot use a mouse can participate in a distance learning course only if it can be accessed with a keyboard alone.

Real-time chat communication, in which students communicate synchronously, is difficult or impossible to use by someone whose input method is slow, perhaps because of limited hand function or a learning disability, and some chat systems are not accessible to those who are blind. Therefore, it is important that an instructor who typically uses a synchronous tool such as chat is prepared to provide an accessible alternative, such as electronic mail, if a student who cannot use chat enrolls in a course. Similarly, when telephone conferencing is an option for small group

discussions in a distance learning course, instructors should give students an alternative method (e.g., to conduct the discussion online using electronic mail) that is accessible to everyone in the group. Such an option assures that students who are deaf, are hard of hearing, or have speech impairments can participate in this course activity.

Avoiding some access barriers is simple. For example, text alternatives such as <alt> tags can be provided for graphics images in order for blind students and instructors to make sense of the content. A text-only version of the content of a PDF document also makes content of the document accessible to individuals who are blind. Likewise, captions on video and other multimedia products make content accessible to students who are deaf (Burgstahler et al., 2004).

4. Disability and special needs

4.1. Visual Disability

4.1.1. Key Facts1

- Globally, it is estimated that approximately 1.3 billion people live with some form of vision impairment.
- With regards to distance vision, 188.5 million people have mild vision impairment, 217 million have moderate to severe vision impairment, and 36 million people are blind (Bourne et al., 2017).
- With regards to near vision, 826 million people live with a near vision impairment (Fricke et al., 2018).
- Globally, the leading causes of vision impairment are uncorrected refractive errors and cataracts.
- Approximately 80% of all vision impairment globally is considered avoidable.
- The majority of people with vision impairment are over the age of 50 years.

4.1.2. Description

Impairment is defined as “any loss or abnormality in an anatomical structure or a physiological or psychological function.”

Similarly, a disability is “any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.”

This places an individual in a handicap that is a person's disadvantaged position in society due to an impairment or disability.

People with vision impairment are more likely than those without to experience higher rates of poverty and disadvantage. Population growth and ageing will have an impact on the number of people needing eye care in the future. Globally, the majority of vision impairment is avoidable. There are effective interventions to prevent eye diseases, as well as prevent, delay or reverse vision impairment. Vision rehabilitation helps to improve functioning for people with an irreversible vision impairment visual (World Health Organization, 2019).

Following these definitions and prerequisites, a visual impairment is the limitation of actions and functions based on the individuals´ visual system and discriminates following a combination of visual acuity and visual field that interferes with the ability to perform activities of daily living between low vision and (legal) blindness, both not correctable by standard glasses, contact lenses, medication or surgery.

Globally, the leading causes of vision impairment are:

- uncorrected refractive errors
- cataract and glaucoma
- age-related macular degeneration
- diabetic retinopathy
- corneal opacity
- trachoma

There is some variation in the causes across countries. For example, the proportion of vision impairment attributable to cataract is higher in low- and middle-income countries than high-income countries. In high income countries, diseases such as diabetic retinopathy, glaucoma and age-related macular degeneration are more common.

Among children, the causes of vision impairment varies considerably across countries. For example, in low-income countries congenital cataract is a leading cause, whereas in high income countries it is more likely to be retinopathy of prematurity.

Following WHO´s ICD-11 (2019) there are specific categories for low vision and blindness. Differences in categories are also related to laterality (one or both eyes concerned in different categories) and are only to be seen as one possible (medically determined) category framework for distance vision impairment:

- Mild – presenting visual acuity worse than 6/12

- Moderate – presenting visual acuity worse than 6/18
- Severe – presenting visual acuity worse than 6/60
- Blindness – presenting visual acuity worse than 3/60

In addition to that, some countries (e.g. Australia and the United States of America) use an additional definition:

- Legal blindness means visual acuity of 20/200 or less with the best possible correction, or a visual field of 20 degrees or less.

For near vision impairment, the threshold is a near visual acuity worse than N6 or M08 not correctable by standard glasses, contact lenses, medication or surgery.

WHO´s ICF (2019) went further by implementing the difference between impairment and disability and thereby shedding light on environmental factors (worsening or being beneficial).

4.1.3. Symptoms & Impact

A visual impairment leads to severe problems in:

- Orientation and mobility in unknown surroundings
- Using unknown inaccessible and untrained assistive technologies
- Using printed mainstream (information, education) materials
- Getting a quick overview on locations, rooms, people present

Looking at symptoms and impacts, one needs to make a clear distinction between Blindness and low vision – or better Braille Users and Screen Users (both evenly combined with additional audio output).

Low Vision:

Depending on the cause of the vision loss individuals report of central or peripheral vision loss, nystagmus, and tunnel vision or e.g. blurred vision through severe short-sightedness and photosensitivity.

A (central) vision loss brings problems in getting an overview – also in using a screen. Bigger letters are not beneficial in all use cases, e.g. in terms of getting an overview on the displayed information or for quick browsing while people with peripheral vision loss often report that magnification leads to better performance for them.

People with low vision and combined photosensitivity benefit from inverted screens and different color schemes (yellow on blue, blue on yellow or broken white on black).

People with low vision might use screen magnification combined with audio output

Some people with severe forms of low vision tend to use the remaining vision (as low as it might be) to read information from screens, use mainstream keyboards instead of adapted ones with larger letters and in most cases refuse to use Braille. Others – especially people with diabetes reported insensitivity of their fingertips and a connected inability to read Braille.

Additionally, audio representation of the information (e.g. with speech to text technologies) is a possible beneficial solution in such cases.

Blindness:

Blind people cannot read with their eyes sufficiently (some over a longer period, but most cannot read at all). Therefore they use Braille (tactile information) combined with audio output (TTS or text to speech) when using a computer (Fellbaum & Koutoupetroglou, 2008; Freitas & Kouroupetroglou, 2008).

People affected from a visual disability can – in educational contexts – not handle mainstream materials that are not designed for or adapted to their individual needs.

However, the most convenient and effective approach to support people with visual disabilities does not only depend on the individual abilities and prerequisites but also on how the person was trained and what adaptations were used so far – and what learning style this person prefers.

Complex content like diagrams, maps, tables, pictures, charts, music scores and information that is not accessibly created (e.g. only to be discriminated via its color) need additional action and effort to be adapted to the needs of people with visual impairments.

4.2. Hearing Disability

4.2.1. Key Facts

- Around 466 million people worldwide have disabling hearing loss (1), and 34 million of these are children (World Health Organization, 2019).
- It is estimated that by 2050 over 900 million people will have disabling hearing loss.
- Hearing loss may result from genetic causes, complications at birth, certain infectious diseases, chronic ear infections, the use of particular drugs, exposure to excessive noise, and ageing.
- 60% of childhood hearing loss is due to preventable causes.
- 1.1 billion of young people (aged between 12–35 years) are at risk of hearing loss due to exposure to noise in recreational settings.

- Unaddressed hearing loss poses an annual global cost of US$ 750 billion. Interventions to prevent, identify and address hearing loss are cost-effective and can bring great benefit to individuals.
- People with hearing loss benefit from early identification; use of hearing aids, cochlear implants and other assistive devices; captioning and sign language; and other forms of educational and social support.

4.2.2. Description

Hearing loss, also known as hearing impairment, is a partial or total inability to hear. A deaf person has little to no hearing. Hearing loss may occur in one or both ears, with congenital occurrence or acquired over the years. Most deaf people communicate via sign language. Hard of hearing people also use

Congenital causes

Congenital causes may lead to hearing loss being present at or acquired soon after birth. Hearing loss can be caused by hereditary and non-hereditary genetic factors or by certain complications during pregnancy and childbirth, including:

- maternal rubella, syphilis or certain other infections during pregnancy;
- low birth weight;
- birth asphyxia (a lack of oxygen at the time of birth);
- inappropriate use of particular drugs during pregnancy, such as aminoglycosides, cytotoxic drugs, antimalarial drugs, and diuretics;
- severe jaundice in the neonatal period, which can damage the hearing nerve in a new-born infant.

Acquired causes

Acquired causes may lead to hearing loss at any age, such as:

- infectious diseases including meningitis, measles and mumps;
- chronic ear infections;
- collection of fluid in the ear (otitis media);
- use of certain medicines, such as those used in the treatment of neonatal infections, malaria, drug-resistant tuberculosis, and cancers;
- injury to the head or ear;
- excessive noise, including occupational noise such as that from machinery and explosions;

- recreational exposure to loud sounds such as that from use of personal audio devices at high volumes and for prolonged periods of time and regular attendance at concerts, nightclubs, bars and sporting events;
- ageing, in particular due to degeneration of sensory cells; and
- wax or foreign bodies blocking the ear canal.

Among children, chronic otitis media is a common cause of hearing loss.

4.2.3. Symptoms & Impact

Functional impact

One of the main impacts of hearing loss is on the individual's ability to communicate with others. Spoken language development is often delayed in children with unaddressed hearing loss.

Unaddressed hearing loss and ear diseases such as otitis media can have a significantly adverse effect on the academic performance of children. They often have increased rates of grade failure and greater need for education assistance. Access to suitable accommodations is important for optimal learning experiences but are not always available.

Social and emotional impact

Exclusion from communication can have a significant impact on everyday life, causing feelings of loneliness, isolation, and frustration, particularly among older people with hearing loss. Communication with sign langue and personal assistance via sign language interpretation, relay service and speech to text reporters (STTRs) or even automated speech recognition – ASR) as well as other offers like simplified language or easy to read and basic accessibility prerequisites concerning readability and legibility of texts are the main facilitators for inclusion of deaf and hard of hearing persons.

4.3. Motor Disability

4.3.1. Description

Motor capabilities of a person include dexterity, reaching, and stretching, as well as locomotion. A significant number of individuals of all ages confront permanent, occasionally or transiently functional motor limitations (Kouroupetroglou 2013a). The number of persons with motor disabilities is not inconsiderable. For example, studies in Europe show that 0.4% of the general population are wheelchair users, 5% cannot walk without an aid, 0.3% cannot use fingers, 0.1% cannot use the arm, 2.8% have reduced strength and 1.4% have reduced coordination. Moreover, 0.3% of the general population are speech impaired due mainly to a motor limitation of their articulators. The range of

these disabilities expands from mild or moderate to severe loss of capability. The variation by age indicates that 50% of those over 75 years old experience some loss of motor capability. Some of them have multiple disabilities (Kouroupetroglou 2013b).

Motor impairment is the partial or total loss of function of a body part, usually a limb or limbs. This may result in muscle weakness, poor stamina, lack of muscle control, or total paralysis. Motor impairment is often evident in neurological conditions such a cerebral palsy, Parkinson's disease, stroke and multiple sclerosis.

An extreme form of motor impairment is locked-in syndrome, in which voluntary control of almost all muscles is lost, sometimes including the eyes, in an individual who retains cognitive function. The syndrome is caused by damage to portions of the lower brain and brainstem, from a stroke or other insult.

Tetraplegia, or paraplegia, is loss of the use of the arms, legs and torso, usually caused by spinal cord injury, especially in the area of the fifth to the seventh vertebrae. This level of paralysis is also associated with loss of sensation from the neck down.

Neural interfaces have been explored to restore functionality for severely motor-impaired individuals. Implanted devices in the area of the brain's motor cortex sense brain states, and the interpreted signals are transmitted to a computer. With training, users develop some command over objects in the environment, which could be applied to such basic efforts as communicating or moving a motorized wheelchair.

As with other impairments, motor impairments might occur congenitally or be acquired later on (e.g. accidents, illness or simply age).

One special (and fast growing) aspect of Motor impairment occurrence are musculoskeletal conditions:

- Musculoskeletal conditions are the second largest contributor to disability worldwide, with low back pain being the single leading cause of disability globally.
- Musculoskeletal conditions and injuries are not just conditions of older age – they are relevant across the life-course. Between one in three and one in five people live with a painful and disabling musculoskeletal condition.
- Musculoskeletal conditions significantly limit mobility and dexterity, leading to early retirement from work, reduced accumulated wealth and reduced ability to participate in social roles.

- The greatest proportion of persistent pain conditions is accounted for by musculoskeletal conditions.
- Highly prevalent among multi-morbidity health states, musculoskeletal conditions are prevalent in one third to one half of multi-morbidity presentations, and very commonly linked with depression.

4.3.2. Symptoms & Impact

A motor disability in most cases also affects dexterity and agility and leads to functional, social and economic impacts and leads – especially but not only in emerging markets and developing countries – to exclusion, segregation and poverty as well as loneliness and depression.

Motor impairments caused by age and illness and musculoskeletal conditions include conditions that affect:

- joints, such as osteoarthritis, rheumatoid arthritis, psoriatic arthritis, gout, ankylosing spondylitis;
- bones, such as osteoporosis, osteopenia and associated fragility fractures, traumatic fractures;
- muscles, such as sarcopenia;
- the spine, such as back and neck pain;
- multiple body areas or systems, such as regional and widespread pain disorders and inflammatory diseases such as connective tissue diseases and vasculitis that have musculoskeletal manifestations, for example systemic lupus erythematosus.
- Musculoskeletal conditions are prevalent across the life-course and most commonly affect people from adolescence through to older age. The prevalence and impact of musculoskeletal conditions is predicted to rise as the global population ages and the prevalence of risk factors for no-communicable diseases increases, particularly in low- and middle-income settings.

People with motor and dexterity impairments or musculoskeletal conditions have problems in moving, getting around (especially in non – accessible surroundings), and face problems in using standard computer equipment like point and click devices and keyboards.

Due to dexterity issues, people with motor and dexterity impairments and musculoskeletal conditions benefit from accessible information and website navigation elements that are fully reachable with keyboard shortcuts (instead of “mouse movements” that are way harder to be carried out sufficiently) and without too complex use paradigms. In order to facilitate easiest possible and most universal manipulation, computer systems and software should foresee multimodal use

paradigms for input and output (e.g. Buttons, Joysticks, Headtracker, Suck/puff devices like Integra-Mouse).

5. Requirements for accessible educational environment

5.1. Assistive technology

Access to Assistive Technologies are the primary facilitator of successful integration into (higher) education.

For face 2 face courses, the equipment has to be brought to the learning facility and needs either a well-equipped, maintained classroom with latest technology and software for the most diverse user group (what is in effect expensive and somehow inefficient and asks the students to know how to handle and use the infrastructure on site) or a mobile and light equipment brought, tweaked and maintained by the learner what asks for a personal budget for Assistive Technologies as well as for the necessary adaptations and training on how to handle the mobile infrastructure.

Additionally, the learners must reach school and what asks for accessible transport means as well as accessible classrooms learning facilities (seen from accessible architecture).

In Distance Learning, not only the learners stay in their known surrounding, but also the Assistive Technology stays with the learner the facility used for learning. The infrastructure is known and there is no need to choose the most mobile tools as the devices do not need to be moved. The main issue in this case is the accessibility of the used tools and frameworks for Distance Education, sufficient and stable access to the internet and the accessibility of the content provided. Therefore, Distance Education seems to be most feasible to most learners with disabilities – independently from perceived or known accessibility issues concerning system and first of all content. Studies show, that accessibility is not implemented in most cases and it becomes clear that not being accessible from scratch additionally “poses a serious problem to its foundation principles of being open to all. Accessibility in open online learning is particularly important since distance education in general attracts more disabled students than traditional education, and this trend is emphasized further in open education.” (Coughlan, Rodriguez-Ascaso, Iniesto & Jelfs, 2016).

Furthermore, individuals with disability state that "... Accessibility is important to me but I never take it into account. I take for granted that courses are not accessible, but in case a course is attractive, I will enrol in it, and fend for myself, even if I needed to ask for help to people I live with..." and [...] the student reported stress when using the website and the eLearning platform of an on-line

institution, because of the accessibility problems that affected key activities, such as the registration process and the navigation through the course's contents. In some cases he needed to rely on someone else to sort these problems. However, successful distance education that satisfies students' expectations involves all departments and staff of an institution and depends on their views towards Distance Education, from librarian over teachers to management board. Additionally, it is determined by the level of tangibility, reliability and how the institution deals (and even knows) about the needs of their students and the awareness for accessibility and disability that should have a critical place in designing and improving educational activities.

5.1.1. Knowledge on using AT

Not only the Assistive Technology or stable access to AT and internet facilitate successful Distance Education for people with disabilities, but also the level of proficiency in using the devices – no matter if low or high-tech and without any difference between disability forms – and to be able to making the most out of the technology´s existing features by adaptations, maintaining and using it. Understanding technology's existing features and capabilities in order to customize for individual requirements is essential. Without this knowledge, AT users struggle to complete tasks that could otherwise be completed effortlessly.

Combined to this, the following prerequisites are beneficial to gain proper conduct over (Assistive) technology:

- Curiosity and personal view on technology and AT
- Knowing peers that use the same technology
- Access to peers for learning by watching and observing
- Timespan used for training and getting acquainted to the technology – and connected to it, the possibility to rely on trial and error and informal support systems as well as the opportunity to explore and practice
- Adapting and augmenting Assistive Technologies to the changing proficiency level and use paradigms of the individual

Additionally, people with disabilities tend to overestimate their level of proficiency when asked for it as "actual performance proved to be unrelated to self-rated competence. Moreover, the competence of both young and older participants fell far short of what active participation in society requires, especially for the more complex information and strategic skills." (Van der Geest, Van der Meij & Van Puffelen, 2013) and traditionally, issues of access, exclusion and the digital divide have been approached from the standpoint of physical access to technology. In many West-European countries, household access among the population at large is 70 % or higher; in the Netherlands,

where this study was conducted, access at home has reached 90 %. In these countries it is no longer the physical access to computers that is most important; instead, what becomes critical is what the users can do (skills) and actually do (usage) on the computers that are available to them. The most important mission by now is to move from digital divide to digital literacy (Van der Geest, Van der Meij & Van Puffelen, 2013).

It becomes obvious that providing technology without proper training and first and foremost time to get used to it and train with it, keeps persons with disabilities from equally benefitting from education (no matter if provided face 2 face or per distance education), reduces the possible success, stamina, personal satisfaction and competence level significantly and raises the probability of drop out and not finishing courses – no matter whether the content and the used system is accessible or not – last but not least endangering career and educational paths as a whole.

5.2. Accessible materials

In education, accessibility embraces a multidisciplinary combination of needed prerequisites, e.g.:

- Access in terms of architecture or technical infrastructure
- Access in terms of financial and economic framework (tuition fees, course prices, AT)
- Access in terms of transport to the venue or a stable & available internet connection
- Access in terms of time and availability of resources
- Access in terms of educational tools and systems
- Access in terms of barriers in getting to the educational activities (prerequisites for study programs and school education
- Access in terms of content, used materials and exam schemes

It becomes obvious immediately that accessibility in terms of adapted study materials and learning accessibility are important, but “only the last” step in a long chain of prerequisites that have to be checked, enabled and cleared when building up accessible offers for new groups of students and clients.

5.2.1. Alternative Materials

More and more, it becomes obvious, that inclusive offers, keeping persons as close as possible on the “mainstream” product are more successful as not only the persons:

- Develop a common understanding and mental model on what mainstream students are working including the used wording and use paradigms but also

- Are able to communicate to others where they need help and support in understandable terms including the advantage that the materials are the same throughout the whole inclusive classroom and not necessarily alternative materials for single use.

Jitngernmadan, Petz, Stöger and Miesenberger (2016) as well as Heumader, Edler, Miesenberger & Petz, 2016 (2016) a nd upcoming research literature from Matthews et al. (2019,) present findings in the same direction, emphasizing the importance of adapted mainstream materials.

5.2.2. Training on the adapted materials

As with mainstream materials, books, figures, lab environments, also people with disabilities need training on the adapted materials as well as materials that are consistent structured and made adapted.

A common standard on developed materials is necessary (as researched and published by the EU4All projec t (CEDEFOP – European Centre for the Development of Vocational Training , 2019).

5.3. Specific needs requirements

5.3.1. Visual Disabilities

AT usage takes place to reinforce or replace vision and support different use paradigms like touch and auditive display. The basic hardware in using ICT is a keyboard with headphones and a standard screen for sighted helpers, HQ screen to be used with screen magnification.

Additionally, scene description (for videos, animations and complex situations displayed) are most beneficial.

The learners benefit from: A clear structure, consistent layout giving orientation and overview on the main teaching items and how to use them as well as on where to get further info and help in using the materials.

Seen from accessibility perspective, rules and guidelines taken from WAI-w3c, PDF/UA as well as WCAG in its most up to date version always meets with the needs of learners with visual disabilities.

5.3.2. Hearing Disabilities

Individuals with Hearing Disabilities more or less use standard IT Infrastructure in terms of Hardware.

Additionally, the framework itself is of high importance (HoH persons need quiet surroundings not putting further stress on them and their understanding, most of the deaf people prefer personal assistance in terms of sign language interpretation for communication and all groups benefit from captions - e.g. for videos, animations, complex situations - and less complex language as a general

prerequisite. These services range from ASR what means automated speech recognition already built in e.g. for YouTube videos - to STTR – speech to text reporting services providing high quality transcripts in the original language level).

In terms of software, the focus is on issues with structure usability and language and alternative notification schemes (additional visuals for audio only information).

As with people with visual disabilities, rules and guidelines above mentioned are one the best ways to meet these needs.

5.3.3. Motor & Manipulation Disabilities

Individuals with Mobility or Motor & Manipulation Disabilities use more or less standard software infrastructure but need alternative interfaces – nonstandard keyboards and input paradigms as well as point- and click devices to use ICT. The focus here is to enable widest possible use of interfaces, from buttons, switches over mouse and keyboard used with head- movements or tongue, mouth stick or even blink detection – all possible interaction paradigms must and can be used to interact with ICT. That means most flexible input- and output- possibilities combined with consistent, well designed and usable surroundings.

As with all other user groups, rules and guidelines taken from WAI-w3c, PDF/UA as well as WCAG in its most up to date version always meets with the needs of learners with hearing disabilities.

6. Distance education as favourable environment for accessibility

Students studying online find it more fulfilling and less difficult to get knowledge. While it is difficult for the disabled students to get admission in a conventional education institution, this is not a case when they turn to online learning platforms. As a matter of fact, many colleges and universities have started conducting online learning platforms. Today, the concept of virtual campuses is evolving rapidly, and more disabled students are getting enrolled. Technology is also playing a pivotal role in providing the perfect learning solutions to the disabled students. Nowadays, students choose their own location for schoolwork and study.

Besides, disabled students find it more comforting to study in the online environment as it gives them more time to complete assignments as well as allow them to sit, rest or walk whenever there is a necessity.

There are certain benefits of eLearning for disabled students that they can avail without having any trouble. Some of them deserve a mention here:

1. For Learning Disabilities: studying online provides the disabled students time and space to work. With eLearning, they can review materials and watch videos lectures as many times as they need. Through the IT systems and software, students who have dyslexia or visual processing disorder can manipulate digital text by changing their font style or size which help them in processing the information effectively.
2. For Physical Disabilities: the most obvious benefit for the physically-disabled students is that they stay in their comfort zone without rushing to a campus or commuting between classes to classes. There are integrated technologies for the students who cannot type such as voice-to-text and voice-activated programs.
3. For Visual Impairments: it is easier for visually-impaired students to access their computer to attend the lecture rather than traveling to the campus. The adaptive technologies like braille keyboards or voice-to-text software and audio recordings are provided for their learning.
4. For Hearing Impairments: students with hearing impairment can use technology to make their life easier. Through eLearning, they can view video lectures with subtitles, which they cannot experience in the classroom. Text being the primary mode of communication with the teachers and other fellow students can be an easier way of interacting through forums and emails.
5. For Psychiatric Disabilities: such disabled students can work and study in their own comfort zone. As it gets difficult for them to cope up with the situation and anxiety, hence their known surrounding will help them better to learn through eLearning.

For the disabled students, two main factors are beneficial at every level; convince and flexibility. Online learning provides convenient access for the distant learners and it is more flexible than traditional schooling methods.

There is no hassle of traveling because classes can be attended from home, disabled students can easily set up their home office area according to their personal preferences. Being in their own comfort zone, it will make easier for them to progress more.

Apart from convenience, eLearning provides students some flexibility that is not available in the F2F delivery format. Online courses are developed with Universal Designed Learning (UDL) standards. By this, information of the course is presented in multiple ways.

For example, a reading assignment available in regular text is also available as an audio file. This will automatically give students the flexibility to read or head the information and to review it often as they need.

Online courses depend more on interactive studies like visuals, graphics, and closed-captioned videos. They are known as a great leveller. Such studies allow students to choose and share what they want to show. Such programs and studies maintain the anonymity about their disability as well. This way all the learners work together towards a common goal of learning and pursuing careers in different fields.

Wrapping up, as technology is in everyone's hand in the form of computers, laptop, phone or tablet, attending classes online is far better than commuting to college or universities. The technology that is used for eLearning allows auditory and visual aspects to be accessible to all learners.

It is also noted that adult disabled students prefer online environment better than the traditional format. Being convenient, flexible and accessible to all the disabled students, eLearning is the most appealing way of encouraging and persuading such students to develop and polish their skills.

7. Inclusion vs special education for IwI

Among the major outcomes of the Decade of Disabled Persons was the - UNESCO "Salamanca Statement" and adoption of the UNESCO Standard Rules on the Equalization of Opportunities for Persons with Disabilities by the General Assembly of UN (United Nations, 1994).

Although not a legally binding instrument, the Standard Rules represent a strong moral and political commitment of Governments to take action to attain equalization of opportunities for persons with disabilities. The rules serve as an instrument for policy-making and as a basis for technical and economic cooperation. One of the most important aspects assuring equal rights and possibilities of IwI is connected to (basic and further) education.

The development and history of inclusive education goes (at least) back to the early 19th century, starting with institutionalised, separated residential schools providing services and care primarily for visible handicapped students.

From this starting point - and in parallel to the development of public school systems - special schools and classes were formed (first half of the 20th century) and residential schools became larger - leading from institutionalisation over segregation to a state best described as categorization: High incidence exceptional learners were taught in more and more diverse special classes. Extensive testing, measuring and labelling resulted from this need to "qualify for quality education" - leaving low incidence students remaining in residential schools.

In the 1970s, a philosophical shift to promote education for handicapped students in the least restrictive environment lead to first integrative classes - and placement alternatives also within the public school system emerged.

During the 1980s, integration developed for a small group of high incidence learners to a system called “mainstreaming” - these exceptional, high incidence students became part of regular classes; social, physical and instructional needs were met at the least restrictive environment - in neighbourhood schools in general classes.

Finally, in the 1990s, the process to merge special and regular education into a unified (inclusive) education system started. The focus was changed on the individual learners´ needs.

Currently, the terms mainstreaming and integration have been replaced by the term inclusion. Integration aims towards an inclusive learning environment. Schools that use such strategies focus on the movement of including students with special needs in the regular classroom with accommodations and/or modifications to the curricula based on their needs to help them be successful. Students may spend some time in the classroom and some time in an alternative placement, which is the most supportive learning environment (Pickl, Holzinger & Kopp-Sixt, 2015).

Inclusion is a “philosophy that states all individuals, regardless of ability, should participate within the same environment with necessary support and individualized attention. Inclusion is more than simply placing individuals together, it’s a belief that all individuals belong and are valued” (Kasser & Lytle, 2005). In other words, inclusion is a principle thus making integration a strategy that supports inclusion. Inclusion argues that students with special needs should not be segregated; in this case, progress is not a main concern but adaptation and not being excluded is key in the classroom environment and society. This may be different in some schools, but emphasis is usually on social gains and life skills than academic gains.

In DACH - region (German-speaking countries, Germany, Austria and Switzerland), integrative education historically means educating children with and without disabilities within a clustered framework, where all individuals are taught within the same setting/classroom, while within that setting the children may be grouped according to their abilities and educated following different curricula (according to their - also special - educational needs).

Also in DACH-region, Integration followed segregation, where children with disabilities were educated in special settings, apart from children with typical development and in teacher education there are no more dedicated study courses to become special teacher at primary or secondary level anymore, but only the topic special education or inclusive pedagogy as focus, comprising of

strategies and schemes like team teaching, or different aspects of disability and inclusion, assistive technologies and SEN education / inclusive education. Inclusive education, however recognises that each child is unique and therefore deserves individualised pedagogical approaches; consequently, differentiating between children with and without disabilities within the same setting becomes irrelevant (Feuser, 2003).

In most cases, the term inclusive education is used almost synonymously with integrative education, comparable to the development in Great Britain, where in the 1990s the term integration was substituted by the term inclusion, without the change in terminology necessarily leading to a change in paradigm (Sander, 2004).

After formal endorsement of inclusive education by Austrian school laws in 1993, 20 years later the rate of children in inclusive education, independent of the degree of their impairment, was around 80% in the federal states Burgenland, Styria, and Carinthia, while the rate was only around 30% in the federal states Lower Austria or Tyrol (Bruneforth & Lassnigg, 2012).

Scandinavian school systems (especially the Swedish) is most often showcased as best practice example to be met - as a true one-track- school for all children independently from a possible disability. Today's reading show a slightly different picture: Analyses trace "three themes at the national and municipal levels: (1) values and goals; (2) organisation and placement of pupils; and (3) importance of categories in obtaining support. A rather complex picture emerges from this analysis" (Göransson, Nilholm & Karlsson, 2011).

In this article, several conclusions are made: (1) state policies leave a lot of room for interpretation at the municipal and school levels, and this results in an extensive variation; (2) Swedish state policy is not as inclusive as is often stated; (3) celebration of difference seems to be hard to achieve; (4) learning goals can be a double-edged sword with regard to inclusion; and (5) most pupils appear to enjoy participation in school, and in an international perspective, Swedish classrooms seem to be largely democratic - with all possible advantages and drawbacks.

As a possible conclusion, inclusive educational settings should and can be seen as a necessary and important next step and not as "end of the road" - additionally to all systematic shortcomings, inclusion has a major impact also on the IwI themselves, most of them connected to the fact that (in the actual situation) these individuals need to organise their needed support measures themselves (or with their parents / teachers) and way more self-dependent. Additionally, their proficiency of e.g. blind specific techniques and coping strategies as well as typical "blind cultural techniques" like reading Braille depend - to a certain level - on the competence level, education and commitment of the team teacher or special pedagogue (available for some hours per week / month). Finally, the

small target group leads to students with e.g. visual disability that did not get in touch with other peers until they take part in designated activities, e.g. summer camps for blind and partially sighted and miss the opportunity to learn from each other in everyday situations (coping strategies, networking, communication about their disability and barriers / problems they face), whereas pupils from one of the last special educational institutions (like BBI in Vienna, Austria) stay, learn (and sometimes also live) with peers in small groups - reporting from other drawbacks resulting from being segregated from their peers without visual impairment - related to parallel structures in a somehow "sheltered environment" facing problems when it comes to self-dependence and self-organising abilities or "survival in mainstream / inclusive higher education".

8. DE programs for people with special needs

Here are analysed some educational programs that are mainly delivered using IT. For each one it is shown its description, syllabus and outcomes that has. All of them are intended for people with special needs and the focus of the analysis is on this feature.

8.1. Digi.komp (eEducation Austria - Digital competencies for all!)

The main objective of this initiative is to advance digital and ICT-based competencies throughout all schools and education institutions in Austria. The author of this program is BKZ eEducation Austria and copyright owner and founder is BMBWF of Austria (digi.komp – Digitale Kompetenzen Informatische Bildung, 2016). The program is both public and restricted because, it is public Austrian education institutions who first have to join to the program. Then students are provided by the courses which the program contains. There are 4 courses in the program. Three intended for a different level of digital literacy and one for teachers. It meet the accessibility requirements of PwSN and follows the main accessibility guidelines for web W3C's WCAG 2.0. However, it designed following the principles of UDL which promotes inclusion over education for PwSN.

8.1.1. Links:

- Main page: https://digikomp.at/
- Description of the project: https://bildung.bmbwf.gv.at/schulen/schule40/digikomp/digikomp.html

8.1.2. Impact

- More than 1665 Austrian education institutions have applied for membership (eEducation, 2019).

- More than 772 schools have been certified (meeting all requirements that this program set) for more than one academic year.as eLearning expert.
- More than 33248 activities have been done since the program was launched.

8.1.3. Main courses in the program:

digi.Komp4: Digital Course on IT for Elementary School Level

Further details: https://digikomp.at/index.php?id=542&L=0

Unit	# Lesson	Lesson name
1. Information technology, people and society	1.1	Importance of IT in the life-world of children
	1.2	Responsibility for the use of IT
	1.3	Privacy and Data Security
2. Computer systems	2.1	Technical components and their use
	2.2	Design and use of personal computer systems
	2.3	Data exchange in networks
	2.4	human-machine interface
3. Applications	3.1	Documentation, publication and presentation;
	3.2	Calculation and visualization
	3.3	Search, selection and organization of information
	3.4	Communication and cooperation
4. Concepts	4.1	Presentation of information
	4.2	Structuring of data
	4.3	Automation of instructions
	4.4	Coordination and control of processes

Table 1: Competence model of digi.Komp4

digi.Komp8: Digital Course on IT for Middle School Level

Further detail: https://digikomp.at/index.php?id=557&L=0

Unit	# Lesson	Lesson name
1. Information technology, people and society	1.1	Importance of IT in society
	1.2	Responsibility, privacy and data security
	1.3	History of Computer Science
	1.4	Professional perspectives
2. Computer systems	2.1	Technical basics and functionalities
	2.2	Operating Systems and Software
	2.3	Networks
	2.4	human-machine interface
3. Applied Computer Sciences	3.1	Production of digital media
	3.2	Calculation Models and Visualization

	3.3	Search, selection and organization of information
	3.4	Communication and cooperation
4. Practical Computer Science	4.1	Concepts of information processing
	4.2	Algorithms, Data Structures and Programming
	4.3	Data Models and Database Systems
	4.4	Intelligent Systems

Table 2: Competence Model of digi.Komp8

digi.Komp 12: Digital Course on IT for Diploma Level

Further detail: https://digikomp.at/index.php?id=585&L=0

Unit	# Lesson	Lesson name
1. Information technology, people and society	1.1	Importance of IT in society
	1.2	Responsibility for the use of IT
	1.3	Privacy and Data Security
2. Computer systems	2.1	Technical components and their use
	2.2	Design and use of personal computer systems
	2.3	Data exchange in networks
	2.4	human-machine interface
3. Applications	3.1	Documentation, publication and presentation;
	3.2	calculation and visualization
	3.3	Search, selection and organization of information
	3.4	Communication and cooperation
4. Concepts	4.1	Presentation of information
	4.2	Structuring of data
	4.3	Automation of instructions
	4.4	Coordination and control of processes

Table 3: Competence Model of digi.Komp 12

digi.Komp P: Digital Course on IT for Teachers

Further detail: https://digikomp.at/?id=592

The acquisition of IT teaching skills are structured in three development phases which are showed below:

- Phase 0: Digi.komp12
- Phase 1: teacher's training course
  - Digital life
  - Creation of learning material
  - Digital teaching and learning
  - Digital teaching and learning in classroom

- IT management
- Digital society

- Phase 2: continuous professional development
  - Inclusive IT

8.2. AWCAT (Applications and Web Content Accessibility Training)

This implements a DE program for the acquisition of required competencies in design accessible both web application and web content. But, the main goal is to transfer IT accessibility and inclusion knowledge to other universities in order to fill the education gap of the different European regions. This is a program founded by Erasmus+ which involve between others Vistula University (Poland), Varna Free University (Bulgaria) and Johannes Kepler University of Linz (Austria). The developed online course is fully accessible and follows UDL guidelines. Currently, it is available for the target universities (VU & VFU). But, the developed material will be released in following months as OER. Due, it is very close its release, measures of its impact are not ready however, estimations of it point to a good repercussion.

8.2.1. Links:

Main page: http://awcat.vfu.bg/

8.2.2. Estimated Impact

- Great expectation by the student community of target universities.
- With the release of the content in OER is expected that it will reach the most of European countries. Since, it is a curated content and is translated into English, Bulgarian, and Polish

8.2.3. Sylabus

Unit	# Lesson	Lesson name
A. Fundamentals of Web Accessibility	A.1	Introduction to the course and to Web Accessibility
	A.2	Why: Societal Impact and Effects of Accessible Web Design and How: Overview
	A.3	Technical Foundations: Accessibility APIs
B. Assistive Technology	B.1	Users and Assistive Technology: Requirements for Accessibility
C. Guidelines and Legal Requirements	C.1	Web Accessibility Standards and Guidelines: WCAG, UAAG, ATAG, ARIA
	C.2	National and International Legal Frameworks

D. Accessible Web	D.1	Techniques for Accessible Web Design
	D.2	Accessibility of Responsive Design
	D.3	Rich Internet Applications and Multimedia Accessibility
	D.4	Evaluation and Repair Methodology and Tools
	D.5	Selected Aspects of Accessibility: Video and Documents, Responsive Design, Personalisation
E. Design and Usability	E.1	User Centred Design & Usability Engineering

Table 4: AWCAT course syllabus

9. Improvements in current status of DE programs

In the 21st century, the acceptance of disabilities needs to be promoted among teaching and IT professional. Also, accessibility guidelines need to be developed according to the needs of students, based upon their real-life experiences. Disability is no more a problem as there are many tools, teaching methods and design standards that make everything accessible to the disabled. However, awareness has to be increased and more know-how must be developed in all people involved in the delivery of distance education.

Accessibility guidelines, best practices, and norms must be promoted and people involved in DE in order to make a proper use of this. Technology is being improved in a good pace but the right teaching methodologies and processes should be implemented in all the width of the education industry, DE included.

Programs described above could be good examples of a well implemented accessible DE. However, the final goal to which experts agree to be followed is inclusion and a proper use of tools that nowadays we have available. The awareness of people involved in those described programs is high but, this must be too for the upcoming DE programs. Also, for those programs not related to the matter of inclusion, accessibility, life skills, lifelong learning, etc.

10. Conclusion

DE is growing in size, social importance and usefulness. Technology has changed completely the landscape of this method of teaching. In the last times also, it has been improved more the accessibility and inclusion of people making easy for all the access to the knowledge.

However, the human part of the DE besides technological one needs improvements. It is the inclusion and for that, the key is awareness and the requirement of following the accessibility standards, procedures and guidelines of accessibility and inclusion.

DE is affected by this need of awareness, training and regulation like traditional education. But, the increasingly importance, in society and between PwSN, of DE makes it especially affected and the great improvements should be made on it.

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