



ENTEELIS

**“European Network for Technology Enhanced
learning in an inclusive Society”**

State of the Art Report

Author: Katerina Mavrou (EUC)

Co-authors: Maria Meletiou-Mavrotheris (EUC)

Merja Sallinen (SAMK)

Anne Karke (SAMK)

Evert-Jan Hoogerwerf (AIAS)



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Executive Summary

This deliverable is produced within Work Package 3 of the ENTELIS project (**WP3 - State of Art Analysis on innovation in ICT and ICT-AT education and learning**). It contains a State of the Art study regarding ICT and ICT-AT learning and education, in its broadest sense, for persons with disabilities of all ages. Data of different nature were collected from different sources and using different methodologies, including a literature review of scientific articles and conference papers, interviews with persons with disabilities and other stakeholders, the collection of innovative experiences.

In a first section the conceptual framework of the project (D.3.2) is briefly presented. It was developed to facilitate awareness of the elements involved and their relationships. In the framework the end-user with disabilities has the most central position as furthering his/her digital skills acquisition and development is the key objective of this project. It further includes different significant actors and other parameters (learning environment, needs & aspirations, policies & practices and experiences), functioning and interacting in a person surrounding “ecosystem”.

In section 2 some interesting statistical and other data from Europe and internationally are presented, indicating that the digital divide is a fact and that it affects the life of PwD of all ages, including the elderly. Data from previous projects, as well as reports by international and European organizations, call for the need of reinforcing the development of digital competencies of vulnerable groups, including PwD and older adults.

Further, the main outcomes of the literature review (D.3.1) are presented. An overall of 150 scientific articles and 13 relevant and recent projects have been studied and analysed under the following analytical themes: ICT & ICT-AT in education, ICT & ICT-AT and older adults, ICT & ICT-AT and daily life (communication, health & wellbeing, independence, environment and factors, hobbies, activities), ICT & ICT-AT in employment, resources for ICT & ICT-AT, barriers to ICT & ICT-AT, best practices in ICT & ICT-AT.

The report also presents the analysis of interview data collected by six members of the consortium, including the third country partner for the United States (AIAS, EUC, SAMK, OtW, Hft and IMPT) from end-users, service & product providers and trainers/educators. These data were analysed under the same themes as the literature review.

In general, outcomes of the literature review and interview data analysis indicated the following: ICT and ICT-AT can be effective in all domains (education, communication, daily life, health, community etc) of the lives of PwD of all ages; both literature and interview participants emphasize the vital role of ICT-AT for independence, so-

cial integration, educational success, employment opportunities, and overall quality of life of PwD; there seems to be heterogeneity in the way technology is considered and utilized among various groups of PwD, and there seem to be groups of individuals less included in processes relevant to them, such as people with intellectual disabilities; a number of challenges and barriers for ICT-AT competence development are identified, such as financial issues, lack of awareness, lack of ICT-AT technology adoption skills, failure to appreciate use and functionality of AT, high learning curve in technology skills that the adoption of ICT-AT may require from some individuals, lack of training for trainers, insufficient and inconsistent supportive policies, etc.

The report concludes discussing the results and providing suggestions for further research, for policy and practice and for the continuity of the project itself. It seems that there is need for further investigation into the reasons for the adoption/abandonment of ICT-AT, into the ways to respond to user's heterogeneous needs for ICT-AT skills, on mechanisms to reduce the impact of barriers and to strengthen facilitating factors for the acquisition of digital competencies according each individual's personal and/or career needs and aspirations, on the effects of popular mainstream and mobile technology on digital skills acquisition and on more consistent and comparable statistical data in Europe and internationally. For policy and practice, the following needs are identified: the need for increasing awareness, the need for specific professional development among teachers and parent training, the need to reduce the gap in the transition from secondary to higher education, the need to improve access to appropriate technology, the need for more inclusively designed & accessible technology, and the need to involve all relevant stakeholders representing various perspectives. Finally, it is suggested that through the project as well as after its completion, the network could explore further possibilities for the development ICT-AT learning programmes customized to needs and users in various groups and also develop position papers and dissemination material that will target the general public, but also specific groups of policy makers, the industry, the academia, the practitioners/professionals and the end-users.

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Introduction

Various projects implemented in Europe report that people with disabilities of all ages and their carers (personal assistants, carers, educators, etc.) have personal experience with ICT and ICT-AT, but lack sufficient skills and knowledge to effectively participate in the digital society and to contribute to the reduction of the socio-economic digital divide (KPT Project, ImPact, ATLEC, ATVET, ViPi). The same evidence emerges exploring the scientific international literature (literature review overview and deliverable). The current digital divide scenario is further challenged by the wide and fast process of development of Information and Communication Technologies (ICT) and Assistive Technology based on ICT (ICT-AT), and the opportunities these offer in lifelong learning, employment and care. Turning these opportunities into a reality, makes the acquisition and reinforcing of digital competences by groups at risk of exclusion as needed as ever before. As a matter of fact specific groups such as people with disabilities (PwD) of all ages, vulnerable due to their functional limitations, encounter most of the time barriers - instead of being facilitated on their path to self fulfilment and empowerment - as well as participation restrictions in accessing services in the health, education, employment, technology and media domain. As the socio economic digital divide persists (see statistics and literature review sections later in this report), and is further challenged by the economic crisis, specific initiatives and policies in formal, non formal and informal education are needed to reduce the gap.

Much has been done by different actors in European, national and local projects, to advance ICT and ICT-AT skills development of people with disabilities, and innovative pedagogical approaches fostering access to lifelong learning and the acquisition of key competences in ICT and AT have been developed and validated. This includes the interest that some organizations have showed in systems to certificate training pathways in ICT and ICT-AT (such as the ECDL for persons with disability) and projects that aim equipping the community of end users with information and informal learning and exchange tools (such as the ETNA project and the ATis4All project) (see section on previous project in literature review). Nevertheless much more could and should be done.

Therefore, ENTELIS has been established with the intent to investigate and to offer knowledge on ways to reduce the digital divide by addressing the following problems:

- the fragmentation in the responses to the requests and needs for ICT and ICT-AT training;

- the lack of policies at local, national and international level that invest in the development of digital competence and technology-aided independence of people with disabilities.

The consortium believes that the variety of answers provided so far, often the result of different cultural and pedagogical approaches involving a variety of social actors (education, employment, social care, etc.) in different countries, is a resource, but that a stable network could contribute to the development of a more effective strategy based on a model of thinking that places the person and his/her life project at the centre of attention. Too often the lack of a more holistic approach, not based on the view of institutions, but based on the perception of the individual and his/her needs in a unique life, has led to outcomes that are only partial answers, restricted as they are by barriers between institutions, educational systems, policy areas. This view is considered relevant by the project at all policy levels, including the international level. Hence, the Matching Person and Technology Institute (US) was invited to join this project as a third country partner, represented by the global leading expert on AT and ICT-AT research, Dr. Marcia Scherer. Both literature and experiences for the US partner are exploited in the research and outcomes presented in this report, providing an international perspectives of the considerations explored.

The UN Convention on the Rights of Persons with Disabilities and the very same idea of Lifelong Learning, challenge these limitations and require us to be proactive in developing and promoting a view that will help organisations to prioritise the development of digital skills of their students/clients/employees with disabilities and to gear resources towards shared goals. To this end, the ENTELIS consortium employed methodologies of social science¹ research in order to collect, assess and present experiences in ICT-AT education and skills development of PwD, in various learning environments. Through the exchange of good practice, the development of a common framework of reference, and the development of foresight scenarios and roadmaps for the future, the network anticipates to help ideas and policies grow towards a common strategy in Europe for the ICT-AT based lifelong learning of PwD.

¹ Here we are using the definition of “The main branches of science (also referred to as "sciences", "scientific fields", or "scientific disciplines") are commonly divided into three major groups: natural sciences, which study natural phenomena (including fundamental forces and biological life), formal sciences (such as mathematics and logic, which use an a priori, as opposed to factual methodology) and social sciences, which study human behavior and societies”

1. Theoretical and Conceptual Framework

ENTELIS activities are built on the basis of a theoretical and conceptual framework that aims to facilitate the collection, description and assessment of experiences in ICT and ICT-AT education and skills development for PwD of all ages. From a theoretical background perspective, the project mostly relies on the results of the literature review and on previous relevant projects' outcomes (analyzed in the literature review deliverable 3.1., an overview of which is presented in the next section of this report). In terms of the conceptualization of the methodological framework in which the project is situated, a conceptual framework has been developed (deliverable 3.2) focussing on the learning perspective of ICT-AT, as this is the ENTELIS project's emphasis. For the design of this conceptual framework, Engeström's activity theory model has been borrowed and adapted accordingly. As a result, the framework map (Figure 1) takes as a starting and central point the person's (end-user) learning experiences, his/her wish to self-determination and fulfilment and the related needs (needs and aspiration). It includes a map of different groups functioning in a person's surrounding "ecosystem", and it helps us to understand roles, expectations and barriers. Thus, it can assist us in devising solutions in order to tackle the digital divide, and consequently promote quality of life (i.e. human life goals) and access to human rights and equal opportunities by the use of ICT-AT.

More specifically, the conceptual framework takes into consideration the following constituents, as these are considered elements of the ICT-AT learning experiences for PwD of all ages, and they synthesize the theoretical basis of the research work of ENTELIS: Human life goals (identified as good quality of life, participation and fulfilment) as well as access to human rights and equal opportunities; bridging the digital divide through the development of ICT-AT competencies (as the driver to human life goals); end-users of ICT-AT (learning) experiences, needs and aspirations; barriers and opportunities; views and perceptions of other actors (trainers / educators and service / product providers); learning environments in formal, non-formal and informal education; and policy and practice. The main principle of the theoretical part of the framework, which is reflected in the internal triangle of the framework (see Figure 1), is the user-centred perspective and his/her learning parameters (other actors and setting), that require the identification of needs in terms of analysis, acquisition and reinforcing of digital competences. To that end, a methodological part of the framework, which is reflected in the external triangle, takes into consideration other external parameters/concepts (i.e. stakeholders & experiences) that need to be involved in the process for identification of needs and barriers, as well as in the process of reaching the ultimate goal.

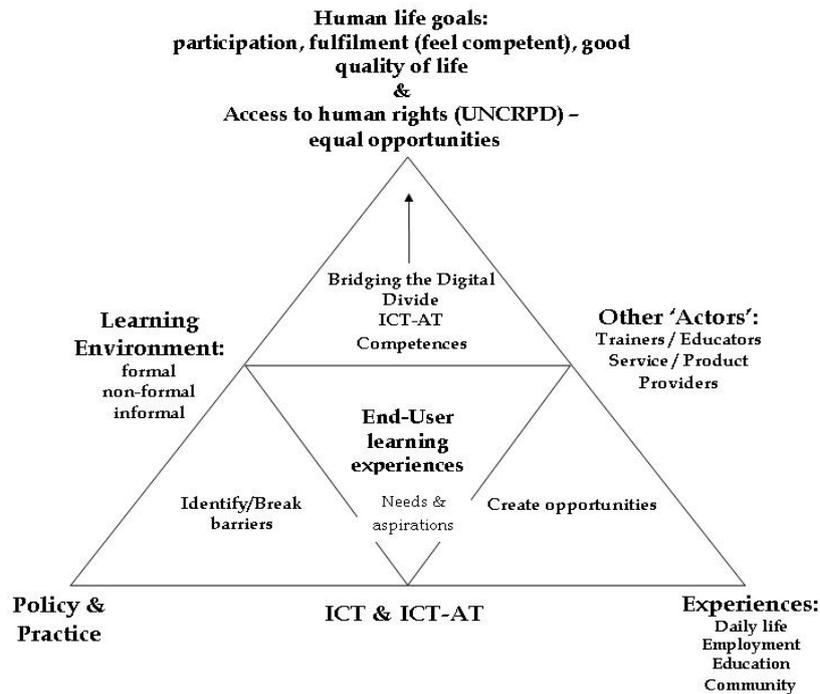


Figure 1: Conceptual Framework Map

2. Assessing the state of the art

As mentioned earlier, ICT/ICT-AT can provide many opportunities for the improvement of the quality of life of PwD. However, findings from current research show that many people with disabilities have a lack of even basic training in the use of ICT (Van Isacker et al, 2009; Van Isacker, 2010; ViPi, 2010; ATLEC, 2012), and consequently also on how to use ICT-AT effectively. Digital competence is further fundamental for participation in social, cultural and political life: to “stay in touch”, to access public services as well as to take part in culture, entertainment, leisure and political dialogues”². A society that expects its members to be “informed citizens” cannot ignore problems related to access and unequal opportunities.

It is clear that with the term “ICT” we are no longer referring to access and use of PCs only. The digital revolution has made devices for information processing, remote interaction and learning smaller, lighter and quicker, introducing also different human machine interaction paradigms, such as “touch” and “voice control”. This revolution is likely to continue in the future. Whereas these technologies on the one hand provide important new opportunities for “closing the digital gap”, they tend to be taken up much quicker by the young and healthy population (with only few exceptions such as eye gazing), thus leaving people with disabilities (and the elderly) behind.

² e-Inclusion, http://ec.europa.eu/information_society/activities/einclusion/index_en.htm

2.1. Statistical evidence

At European level people with disability are becoming an increasing significant group: 5% -10% of the total population; 50 to 75 million people in EU 27. There is a strong correlation between disability and ageing, numbers increase with demographic change³. There is evidence that providing people with carefully selected appropriate assistive solutions independence and skills development are enhanced, while important reductions in social costs might be obtained in almost all cases (Bensi, Bitelli & Hoogerwerf, 2010).

At policy level, the issue is further pushed by the UN Convention on the Rights of Persons with Disabilities that in various articles refers to the role of technology to support participation, access and equal opportunities⁴. Also the European Union (Commission and Parliament) has come to the conclusion that action is needed. The first Area of Action of the EU Disability Strategy 2010-2020 addresses Accessibility and reads: “EU action will support and supplement national activities for implementing accessibility and removing existing barriers, and improving the availability and choice of assistive technologies.”⁵

Also in education the situation is rapidly changing. The presence of technology in the classroom and in people’s homes make different forms of teaching possible, while learners are connected via mainstream or specifically designed e-learning platforms. Virtual reality and educational games further enhance the opportunities, not to speak about tablets and smart phones in learning. These changes require coping skills at all levels: policy level, pedagogical level, learning programme level, teacher-learner interaction level.

According to the new Digital Economy and Society Index developed in 2015 by the European Commission, the degree of how digital countries are varies across the EU⁶. In general, the index shows that a majority of Europeans use the Internet on a regular basis: (75% in 2014 (72% in 2013), ranging from 93% in Luxembourg to 48% in Romania). Also it seems that Europeans are eager to access audiovisual content online (49% of Europeans who go online have played or downloaded games, images, films or music. 39% of households that have a TV watch video on demand). Small and medium sized businesses (SMEs) face barriers with e-commerce (only 15% of SMEs sell online - and of that 15%, fewer than half do so across borders) and digital public services are an everyday reality in some countries but almost non-existent in

³ Web accessibility, http://ec.europa.eu/ipg/standards/accessibility/index_en.htm

⁴ Article 9 in particular.

⁵ European Disability Strategy 2010-2020: A Renewed Commitment to a Barrier-Free Europe. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. COM(2010) 636.

⁶ http://europa.eu/rapid/press-release_IP-15-4475_en.htm

others (33% of European Internet users have used online forms to send information to public authorities, ranging from 69% in Denmark to 6% in Romania. 26% of general practitioners in Europe use e-prescriptions to transfer prescriptions to pharmacists over the Internet, but this varies from 100% in Estonia to 0% in Malta). Hence, it is obvious that a person's country of residence is one of the factors affecting his/her digital experience. This gap is even larger for particular groups of population including PwD and older people (ATLEC, 2012). Even though there is no collective data available on the use of ICT/ICT-AT and the development of digital skills for PwD, data from various projects indicate the urgent need for bridging the digital divide.

For example, data from ANED (2012)⁷ on accessibility and technology issues in Europe, verify that a number of countries had adopted specific accessibility and universal design strategies, that take into consideration the development of ICT/ICT-AT competencies of PwD (i.e. e-Inclusion, Digital Strategy) in order to reinforce participation of PwD in the social, educational and economic life in the technology era. However, there is no available evidence for the monitoring of these strategies and their effectiveness in relation to the use and access to ICT by PwD. On the contrary, country specific reports of ANED (www.disability-europe.net) highlight the limited effective participation of PwD in citizenship, social, economic and political life, which is highly related to issues of technology access and use, as well as to technology literacy and experience. This is also supported by international data on e-Accessibility and the use of ICT/ICT-AT by PwD, which direct to the need of forming relevant policies and toolkits for intervention (Narasimhan, 2011). In addition, according to the Pew Internet Research (2012) the 27% of adults living with disability in the U.S. are significantly less likely than adults without a disability to go online (54% vs. 81%). Furthermore, for 2% of this population it is very difficult or impossible to use the internet at all. Based on the same set of studies, similar results have been found for adults aged 65 and over in the US and UK (Zaphiris, 2014). More specifically, based on data available from the Malcom Project (2015), take-up of digital communication technologies for older people is increasing, and currently 67% of 65-74s and 32% of over-75s have Internet access at home (up from 56% and 31% in 2013, respectively). Based on the same data, the percentage of people aged over 65 using a mobile phone to access the internet increased from 2% in 2010 to 9% in 2013 (whereas the general increase is noted from 24% in 2010 to 53% in 2013). With regard to the Internet specifically, 53% of people aged 65+ in the UK report that they do not have basic skills. This percentage is expected to fall rapidly in the next decade as the equivalent percentage for the 55-64 years age bracket is only 16%. Finally, the same project indicates that other than lack of digital skills and the associated anxieties towards technology, a common finding in studies aiming to understand behaviours to-

⁷ ANED 2012. Unpublished Interim Synthesis Report on Accessibility.

wards technology is that lack of interest / awareness is a major barrier for the elderly to adopt technology. This is evidenced by the fact that 41% of people over 55 years old have never heard of 4G mobile technology, and 28% have never heard of smart-phone / tablet applications.

2.2. European projects

Various European projects (listed and described in ENTELIS Deliverable 3.1. Literature review) highlight the need to put emphasis on the reduction of the digital divide based on evidence of limitations in ICT/ICT-AT competencies development of PwD of all ages.

The ALLIANCE2 project (<http://www.aalliance2.eu/>), which focuses on the Ambient Assisted Living (AAL) solutions based on advanced ICT technologies for healthy and active ageing and wellbeing of elderly people in Europe, identified the actual needs of older people and caregivers to maintain independency, autonomy and dignity without being excluded from society. To this end, technological components and innovation were identified, pointing to the need of further digital literacy for the effective use of such solutions. On the same track, the DISCIT (<http://discit.eu/>) project aimed to produce new knowledge enabling Member States, affiliated European countries and the European Union to achieve full and effective participation of persons with disabilities in society and the economy. The project's analytical framework discusses the interrelation between accessible technology and 'active citizenship', through the comparison of data obtained from eight European countries. Results indicated that each national system determines the conditions in which sources of public international law (including international treaties) interact with the domestic legal system. With regard to AT, the situation in the DISCIT countries appears to be quite patchy, data that conforms with the findings of the aforementioned Digital Economy and Society Index developed in 2015 by the European Commission. Along the same lines of policy issues, the CARDIAC project (<http://www.cardiac-eu.org/>) developed a roadmap which identified three main research lines as a priority that indicate the growing need to support the development of ICT/ICT-AT competences for PwD: "Innovative user interfaces", "Holistic approach to human computer interaction" and "Advanced design and development methodologies and tools".

In addition, recent EU projects (ATLEC, ViPi) that specifically focused on issues of ICT/ICT-AT education and training for PwD, determined the persistence of the need to develop strategies, curricula and policies for the enhancement of PwD's education on ICT/ICT-AT competencies and their implementation towards the improvement of quality of life. The ATLEC project (<http://atlec-project.eu/>) provided evidence on this consideration, showing that a little less than half of the project's research participants (PwD) consider their ICT-AT skills to be poor to average, confirming the need

for better training both in basic ICT skills and subsequently also in ICT-AT use. Other evidence of the ATLEC research showed that there was a consensus among all respondents that improved training in ICT can increase the employability of PwD and also that PwD fully understand the importance of ICT/ICT-AT for the quality of life. The ViPi (<http://www.vipi-project.eu/>) project, has built upon ATLEC outcomes, and produced a curriculum on the development of ICT skills, which was embedded as a module in the ATLEC curriculum. Similarly to ENTELIS, ViPi investigated the needs of PwD in relation to ICT competences acquisition, and identified end-user requirements and pedagogical approaches in relation to ICT training and education.

Moreover, other recent EU projects focussing on ICT/ICT-AT and education have also provided some evidence on the need to address the issue of the digital divide. The ENABLE European project (<http://www.i-enable.eu/>) developed an EU wide platform to gather information and investigate how ICT is currently used to support lifelong learning by disabled adults and how it could best be used to overcome barriers and increase opportunities. Among others, the project's outcomes involve a report on fundamental principles of good practice, end-user requirements, methodological and pedagogical issues in relation to the use of ICT to support learning by PwD.

The iCT4i (<https://www.european-agency.org/agency-projects/ict4i>) and the ICT4IAL (<https://www.european-agency.org/agency-projects/ict4ial>) projects, which are both projects of the European Agency for Special Needs and Inclusive Education, recognize the potential impact of ICT on education, but also investigate issues related to social inclusion opportunities, and the broader role of ICT in supporting learners with different needs in their wider societal inclusion. Hence, they indirectly highlight the important role of education in the promotion of ICT/ICT-AT competences for learners with disabilities.

Another group of EU projects exploring and organizing ICT/AT solutions (AEGIS, ETNA, EASTIN, ATIS4All) define barriers in the effectiveness of ICT/ICT-AT use and development, and suggest solutions for removing some of those barriers. Hence, AEGIS (<http://www.aegis-project.eu/>) aimed at determining whether 3rd generation access techniques will provide a more accessible, more exploitable and deeply embeddable approach in mainstream ICT (desktop, rich Internet and mobile applications). This approach is developed and explored using the Open Accessibility Framework (OAF), through which aspects of the design, development and deployment of accessible mainstream ICT are addressed. ETNA (<http://www.etna-project.eu/>), EASTIN (<http://www.eastin.eu/>) and ATIS4All (<http://www.atis4all.eu/>) all identified access to technology and relevant knowledge and information, as one of the main barriers in developing ICT/ICT-AT competencies for PwD. Hence the three projects collaborated in order to comprise a set of features of a portal including a search engine, a community and the projects' websites in order to open the door to several

national databases at the same time, so one can look up the information required on ICT/ICT-AT.

3. Overview of Literature Review of Scientific Papers

The study of literature and academic work provided a very good insight of previous research relevant to the aims of ENTELIS. This served the project in the following: (a) to form the theoretical foundation of the project and especially the research tasks (Deliverable 3.2); (b) to identify, define and re-think terminology, a task that led to the formation of the Taxonomy and Glossary (Deliverable 3.3.); (c) to investigate and identify current trends in the field of ICT and ICT-AT education, that were then targeted in interview protocols (Deliverable 3.4). Data and information were collected from scientific journals and books, conference proceedings from European and world conferences about innovation in ICT and ICT-AT supported learning (tools for learning) and education in ICT and ICT-AT (digital competences), including also collection of case studies, best practices, new strategies, barriers, factors for success and failure.

The review of the literature provided seven (7) analytical categories, which were also used to structure the interview protocols and to guide the interviews' data analysis process. Hence, current literature of the last decade (2004-2014) identify the following issues in relation to ICT/ICT-AT training and education for PwD:

- ICT & ICT-AT in Education
- ICT & ICT-AT and older adults
- ICT & ICT-AT and Daily life (communication, health & wellbeing, independence, environment and factors, hobbies, activities)
- ICT & ICT-AT in Employment
- Resources for ICT & ICT-AT
- Barriers and ICT & ICT-AT
- Best practices in ICT & ICT-AT

Detailed results on literature review analysis are fully reported in Deliverable 3.1 Literature Review Report. In the following paragraphs of the present report (Deliverable 3.5 State-of-the-art), a summary of the review of the analysed literature is presented, for each analytical category. The aim of this is to briefly provide an insight into the background literature and theoretical framework that support the projects state-of-the-art, reported in this deliverable, and to help readers make the relevant

connections. Hence, for further details on literature review, one should refer to deliverable 3.1.

3.1. ICT & ICT-AT in Education

Literature approaches the issue of education in relation to ICT/ICT-AT from many different aspects; ICT/ICT-AT in the education of learners with particular disabilities, ICT/ICT-AT in different educational settings (e.g. primary, secondary, higher), strategies and curricular developments, perception and conceptualizations of educators and users in relation to ICT/ICT-AT in education, promotion of other skills (eg. literacy, maths) though ICT/ICT-AT, and overview of relevant services. Several papers highlight the positive effects of the use of ICT/ICT-AT in the education of various groups of learners with disabilities, and the way ICT/ICT-AT competences can develop though an inter-disciplinary approach in the curriculum (e.g. Parette, et al, 2006; Mechling, 2007; Mavrou et al. 2007; Parette, & Stoner, 2008; Seo & Bryant, 2009; Standen, et al, 2011; O'Malley et al, 2013). Nevertheless, the presence of ICT and ICT-AT in different educational settings (e.g. primary, secondary, tertiary education and formal, informal and non-formal settings) holds different opportunities as well as different challenges for learners with disabilities (Mull & Sitlington, 2003; Fichten, et al, 2007; Ari, et al, 2010; Mavrou, 2011; Michaelidou et al, 2012). In primary and secondary education, AT support of learners is highly dependent on the system and its legislative provisions, as well as on parental involvement (Mavrou, 2011). In higher and postsecondary education, ICT/ICT-AT competences seem to be much more essential for the effective use of technology for helping learners with disabilities to succeed (Mull & Sitlington, 2003; Ari et al, 2010; Michaelidou et al, 2012) In addition, in formal education settings, ICT /ICT-AT skills development is highly related to educators' views and stances (Hasselbring & Bausch, 2005; McLaren et al, 2007; O'Malley et al, 2013) as well as the benefits it provides for educators themselves (Wojcik, et al. 2004; Parette, & Stoner, 2008; Mavrou, 2011a). Furthermore, the literature indicates the need to incorporate technological advances in the curriculum, to design the most effective and innovative educational interventions (Morrison, 2007; Floyd, et al; 2008; Lee & Templeton, 2008). Education agencies must develop or restructure curriculum and education service delivery systems in order to ensure optimal access to ICT /ICT-AT services, training and devices.

3.2. ICT & ICT-AT and older adults

Scientific publications approached the use of ICT/ICT-AT for older adults, from many different aspects; usefulness and usability of technology versus the daily needs, quality of life, attitudes towards new technology, timing, ethical concerns, as well as teaching and learning to use ICT/ICT-AT. Articles addressing technological solutions

as such were not included in this review. Several articles (Hernandez-Encuentra et al., 2009; Agree & Freedman, 2011; Greenhalgh et al., 2013; Harrefors et al., 2010) point out that the technologies and services have to be based on the experienced needs of the older adults. If they expect to benefit from the devices or solutions, they are likely to have more positive attitudes, and thereby higher motivation to learn to use the technology in question. When an older adult does not see a need for technology, it is unlikely that she/he will be inclined to use it (Peek et al, 2014). However, it is highlighted that the usability of the technology is crucial and solutions that were perceived as complex or difficult to learn were easily abandoned soon, whereas devices that were simple were used more often and even after several months (Cahill et al, 2007). From the Quality of Life aspect, technology may serve several purposes among older adults. It can satisfy the elderly's wish to maintain independence and autonomy, to have social contacts with family and friends, to ensure security and safety and more importantly to maintain dignity to the end of life. If technological solutions can help to achieve these goals, they are more or less accepted. However, according to Greenhalgh et al. (2013), many technologies serve the health care or social service providers, but do not actually improve the lived experience of impairment of the older adults. Timing of the implementation of ICT/ICT-AT was also discussed, pointing out the need for pro-active training and preparation (Wilson et al., 2009; Harrefors et al, 2010; Greenhalgh et al, 2013; Peek et al., 2014). In addition, the literature discusses ethical concerns that were in most cases linked to privacy issues, autonomy and social interaction (Chan et al. 2009; Harrefors et al, 2010; Hamilton, 2011; Boström et al., 2013; Peek 2014;). This is also relevant not only for the EU, but internationally. Additional research in the US by Scherer (2004, 2005, 2012) (also involved as a third party in ENTELIS) indicates a continuum of use and non-use, including partial/reluctant use and avoidance of use, resulting from the confluence of personal, environmental and technology factors.

In regard to learning to use ICT (including basic use of a computer, introduction to the internet etc.), older adults seem to have different learning styles and strategies than the younger generations (Cahill et al 2007; Trentin 2009; Gonzales et al.2012; Greenhalgh et al 2013), and might benefit from simple adaptations in their computer work station, (Mann et al, 2005), as well from affordability and availability of technology at home (Mann 2005; Malanowski et al 2008; Gonzales et al 2012; Magnusson & Hansson 2012; KÄKÄTE, 2014;).

3.3. ICT & ICT-AT and Daily life

Literature on ICT & ICT-AT and daily life was analysed based on the definition of daily life in terms of communication, health and wellbeing, independence, environment and factors, hobbies, activities (based on ICF and other classification schemes – for

the purposes of ENTELIS). Thus, some findings relevant to daily life are reported in other sections of this report, and hence not largely discussed here in order to avoid repetition.

The literature unequivocally attests to the power and potential of ICT-AT for improvement of learning, communication, and daily living of PwD. A number of studies (e.g. Alper & Raharinirina, 2006; Moisey & van de Keere, 2007; Schlieder, Schmid, Munz, & Stein, 2013), showed that access to AT has an important role in making provision for the needs of disabled individuals, and in securing their fuller participation in modern, knowledge based society. Furthermore, studies highlight the use of ICT & ICT-AT as a moderating element that reduces the number of stress factors linked to care (Demers, Fuhre, Jutai, Lenker, Depa & De Ruyter, 2009) and screening processes (Davis, Smith, Ferguson, Stephens & Gianopoulos, 2007). In addition, in the education arena, ICT-AT acts as an enabler in the lives of disabled students of all ages through the provision of compensatory technological tools that motivate learners, build on their strengths, and allow them to complete academic tasks independently, to learn better, to achieve more, become more independent, experience greater feelings of security, social integration, and autonomy, and have higher social and economic aspirations as a result (Alper & Raharinirina, 2006; Dawe, 2006). Thus, enhancing disabled students' understanding and proficiency with technology allows them to improve their quality of life and to enjoy the benefits of e-inclusion (Lee & Templeton, 2008).

Communication is also discussed as an important aspect of daily life, especially focussing on Augmentative and Alternative Communication (AAC). Literature review of AAATE 2013 conference proceedings seems to place great emphasis on the emerging impact of mobile technology on AAC. Smartphones and tablets have been taking an increasingly important role in the field of assistive technology, and there are now many applications to use for people with communication difficulties (Buchholz et al., 2013; Mendes & Correia, 2013). In addition, daily life needs and communication are also associated with the use of the internet. For example, the study of Steinert et al. (2013) on the use of the Internet among older adults showed that daily telephone use influences the use of the internet for communication. Using the internet for communication can be a possible solution to some of the problems many older people have to face, such as loneliness and isolation.

However, despite the acknowledgment of the positive impact of the use of ICT & ICT-AT as well as the development of digital skills in modern society, the literature also indicates some difficulties and barriers. For example, Seymour (2005) explored the physical and functional factors that may impede usage of AT and cause under-utilization or abandonment by PwD, even after considerable investment of time and

material resources, and found accessibility issues to be a major barrier. Similarly, the study of Dawe (2006) shows that simplicity not only in AT function but also in configuration, documentation, maintenance, and upgrading or replacement, affect the development of digital competencies and effective use of AT. Other barriers identified in the literature are presented later in this report (Barriers in ICT & ICT-AT Education).

3.4. ICT & ICT-AT in Employment

Literature on ICT/ICT-AT and employment approached the problems of the employment of people with disability and how ICT or ICT-AT could help to get a job or to return to work or maintain work status from different viewpoints: effects of the use of ICT/ICT-AT on employment, work outcomes and productivity, selection of technologies, support and education and inclusive employment policy.

With respect to effects of the use of ICT/ICT-AT on employment, productivity and work outcomes, studies show that while technology offers many effective options to assist a person with job tasks, it cannot complete a job for a person with a disability (Strobela & Todd, 2003). Rather, the employee must be qualified for a position and be able to perform the essential functions of the job duties with or without accommodation. According to Gamble et al. (2006), the technological development has had both positive and negative consequences. On the positive side, it has increased the accommodation options for workers with disabilities, but on the negative side, it has created a dilemma in identification of a specific technology for use in a particular employment setting. Nevertheless, a number of studies support the beneficial effects of AT tools in the workplace (Strobela & Todd, 2003; Wehrmeyer et al, 2006; Sauer et al, 2010) not only from the advantage point of PwD, but also from health care workers', employment office workers' and co-workers 'perspective (Gamble et al, 2006; Yeagera et al, 2006), even though not all of them are familiar or acknowledge issues of accessibility and safety in technology use (Bruy  r   et al, 2005; Keijer & Breeding, 2012).

As far as policy issues are concerned, several articles suggest that even though there seems to be a significant body of equality legislation to underpin social inclusion of disabled people through employment, there is no dedicated funding for supported employment (Beyer, 2012), and attitudes to disability still remain mixed and often are reluctantly shared in society as a whole (Keijer & Breeding, 2012).

3.5. Resources for ICT & ICT-AT Education

Literature on resources for ICT and ICT-AT Education mostly focuses on: matters on design and design related considerations, resources to meet the challenges faced by

PwD and their families, and resources in educational settings, generally from the perspective of their availability and barriers to their deployment. It seems that design and accessibility issues of ICT & ICT-AT resources affect the development of PwDs' digital skills and use of technology. For example Baker and Bellordre (2004) noted that many of the wireless technologies routinely used by the general population are frequently inaccessible to a significant array of stakeholder groups of people with disabilities. Additionally, the need for AT developers to adopt user-centered designs which adjust the prototype to the user rather than imposing a predefined protocol is also being emphasized in the literature (Zickler et al., 2011; Kübler et al., 2014). Furthermore, resources are very often connected to financial issues. PwD are, according to Batavia and Beaulaurier (2001), among the most financially vulnerable citizens, since as a group, they have among the lowest educational levels, lowest average incomes, and highest out-of-pocket expenses of all population groups. Reichman, Corman, and Noonan (2008), reviewing the effects of child disability on the family, provide a vivid description of the multiple ways in which disability "is a unique shared experience for families and can affect all aspects of family functioning" (p. 680), highlighting financial strains. More recent research (e.g. Burton et al, 2013) identifies the European Union policy on disability as built on an explicit commitment to the social model of disability, requiring all partner countries to move towards a common European policy agenda. However, policies instigated at European level take time to be adopted across the whole of the European Union, and constraints in resources are still a reality. In addition, Thompson et al (2009) focus on resources relevant to supports and support needs, as they pertain to persons with intellectual disability, and closely related developmental disabilities. Hence their study indicates the differences in resources and education among various groups of PwD.

Finally, ICT and ICT-AT use as a resource in learning is largely discussed in relation to the various educational settings. Assistive technology can be used to increase equitable access of disabled students to academic, social, and extracurricular activities (Dyal, Carpenter & Wright, 2009), while at the same time providing opportunities for digital competencies' development and practice, especially under the provisions of the United Nations Convention on the Rights of the Child (United Nations [ND], 1989), the UN Convention on the Rights of Persons with Disabilities (2006) and the Salamanca Statements and Framework for Action on Special Needs Education (UNESCO, 1994) (Trohanis, 2008). In addition, the literature also raises issues of students' with disabilities readiness and competence in the use of ICT & ICT-AT for their transition through the various levels of education, especially from secondary to tertiary education (Madaus, 2005; Hadjidakou & Hartas, 2008). Other issues on ICT and ICT-AT in Education were discussed in an earlier section of this literature review overview.

3.6. Barriers in ICT & ICT-AT Education

Almost all of the original articles identify the same barriers approaching the issue from various aspects; barriers related to policy issues, barriers related to financial issues, barriers related to professionals' and users' awareness and training, barriers related to conceptualization of disability and discourse, barriers related to service delivery (eg. assessments, support), and barriers related to accessibility and technology design.

The majority of the articles (Baker & Bellorde, 2004; Copley & Ziviani, 2004; Lazar & Jaeger, 2011; Mavrou, 2011; Layton, 2012) consider policy and decision making as one of the major barriers in the development and use of ICT/ICT-AT for PwD of all ages. More specifically, barriers in relation to governmental regulatory interventions are highlighted, together with the need of re-prioritizing national disability rehabilitation research agenda (Baker & Bellorde, 2004; Mavrou, 2011; Wong & Cohen, 2011). In addition, the literature points at barriers related to legislative provisions and the failure of a number of them to effectively cover essential aspects of ICT/ICT-AT for PwD (Lazar & Jaeger, 2011). Financial constraints are identified as barriers, resulting to limited resources and technology availability (Baker & Bellorde, 2004; Copley & Ziviani, 2004; Gustafson & Penton, 2014). Insufficient funding does not seem to be a barrier only for the acquisition of technology (Almekhalh & Tibi, 2012) but also for the maintenance, technical, and educational support of users (Gustafson & Penton, 2014). The availability of technology is another challenge discussed in literature, even when funding is not the issue, linked to limitations in additional resources (e.g. training, add-ons, equipped computer labs) (Wilcox, 2010; Wong & Cohen 2011), the available time of educators/trainers and service providers, technology awareness and skills of other professionals and family members (Messinger-Willman & Marino, 2010) as well as the availability of resources outside educational settings (e.g. family training, home use of ICT/ICT-AT) (Alper & Raharinirina, 2006; Mavrou, 2011). The professional development of stakeholders is another barrier identified in the literature, as appropriate ICT/ICT-AT training seems to be absent or problematic in pre-service and in-service professionals' training (Copley & Ziviani, 2004; Wilcox, 2010; Mavrou, 2011; Wong & Cohen, 2011; Almekhalh & Tibi, 2012; Gustafson & Penton, 2014). The same studies also argue that another barrier is the divergent range of understanding and use of assistive technology, not only by professionals but also learners.

Along the same lines, the literature also indicates issues of service delivery systems as barriers to ICT/ICT-AT use and competencies development. These include: inadequate assessment and planning processes (Copley & Ziviani, 2004; Scherer et al, 2005); lack of qualified staff to conduct assessments and lack of multidisciplinary

and teamwork (Copley & Ziviani, 2004; Wilcox, 2010; Mavrou, 2011; Gustafson & Penton, 2014; Desideri et al., 2014); insufficient administration with difficulties in procuring and managing equipment and services (Almekhalfh & Tibi, 2012); inconsistency in the follow-up of technology acquisition (i.e. inconsistency with how assistive technology is delivered and incorporated as a means of accessing information as well as a tool to complement teaching and learning (Wong & Cohen, 2011). In addition, accessibility and the design of technology per se, is considered a barrier, while in-accessible mainstream technology, complex and challenging interfaces, limited access to assistive technology, lack of awareness and understanding of PwD's needs, as well as (in)compatibility of technologies are indicated as enhancers of the digital divide (Baker & Bellorde, 2004; Lazar & Jaeger, 2011). Last but not least, the current literature also emphasizes on the conceptualization and construction of disability as an additional barrier to ICT/ICT-AT education and use. These include terminology incompatibilities and discrepancy in awareness and proficiency levels in relation to ICT/ICT-AT policy and practice (Baker & Bellorde, 2004; Lazar & Jaeger, 2011), and social meanings of (assistive) technology (Foley & Ferri, 2012). Disability is still very much tied to charity and medical model discourses, even within electronic spaces. Although virtual worlds offer much potential for disability-based consciousness raising and politicisation (Ellis & Kent, 2011), they also pose navigational and accessibility challenges for many users with disabilities, with the danger of turning to medical model approaches (Foley & Ferri, 2012).

3.7. Best Practices for ICT & ICT-AT Education

Advances in information and communication technologies have positively impacted the potential for learning and information access for billions of people worldwide, including those with disabilities. The research literature supports the belief that use of AT plays a vital role in enabling PwD to complete daily activities and more fully participate in society (e.g. Braddock, Rizzolo, Thompson & Bell, 2004; Scherer & Glueckauf, 2005). In general, literature review on best practices identified four main arenas of technology advancement that have helped people with disabilities, rather than practices of ICT-AT learning situations. These areas are: personal support technologies, assisted care systems technologies, virtual technologies, and robotics.

Personal support technologies can facilitate social communication, learning, employment activities, and promote healthy behaviors (Braddock et al., 2004; Davies, Stock & Wehmeyer, 2003; Poobrasert & Gestubtim, 2014). Along the same lines, the literature indicates that proper use of assisted care systems (ACS) has several potential benefits for the disabled and their caregivers, including an increased sense of independence and task-efficacy for the disabled person, and decreased workload for the caregiver (Darragh et al., 2013; Scherer & Gleukauf, 2005). In addition, virtual

technologies, i.e. technologies that attempt to create an experience that simulates an actual experience, have the potential to promote the participation of persons with disabilities in educational and community activities. They can range from virtual environments operating on a personal PC or a tablet, to full-immersion, three-dimensional situations. Various studies have documented the benefits of providing instruction to students with cognitive disabilities using virtual technologies and computer-based simulations (e.g. Akhuitina et al., 2003; Braddock et al, 2004; Braddock et al, 2013). Finally, one of the best practices outlined in the recent literature is related to the latest advances of AT, that is assistive robotics. Ten studies appearing in the AAATE2013 conference proceedings focused on assistive robotics from different perspectives, indicating that assistive robotics may offer many possibilities in the future. Nonetheless, the literature also indicates the need for further development of the robots in terms of user-friendliness and usability, as well as in terms of reliability and safety of the robots.

4. Policies and Policy Drivers: Experiences & Suggestions

In order to gain deeper insight on policy and practice in various EU countries, the consortium (additionally to the review of literature and projects) has collected experiences from partners and associate partners. These include case studies, projects, user experiences, policies and examples of best practices, which are briefly reported here, and are also available as fact sheets on the ENTELIS website⁸. Hence, it should be noted that the collection of experiences and suggestions is an ongoing process and the online repository is often updated with new materials. A summary of the experiences collected to date is presented in the following table:

Collection of experiences in ICT and ICT-AT education for disabled and elderly people

Country	Experience	Type
Belgium & France	AT education for end-users: The GIPH and ANLH cases	Practice
France	Digital Art For All	Practice
France	Digital school for pupils with mental disabilities	Practice
Qatar	MADA Assistive Technology Portal	Practice
Qatar	Development of Arabic Symbol Vocabulary	Project
Qatar	National e-accessibility policy	Policy
Qatar	Localisation framework for Assistive Technologies	Project
Qatar	Bookshare Arabic	Practice
Portugal	UMIC - Action Programme Connecting Portugal	Practice
Portugal	National Strategy for Disability	Policy
Portugal	INOVATELL (Innovative Touch less Technologies in Lifelong Learn-	Project

⁸ ENTELIS website – Experiences: <http://www.entelis.net/en/node/54>

	ing for people with severe disabilities)	
Portugal	Digital Agenda	Policy
Portugal	GOLD (Goldilocks-based learning Overcomes Learning Disabilities)	Project
Italy	Empowering through assistive technology: methods and tools developed by the European EUSTAT Study	Project
Italy	Participatory approach for the development of a service of “Smart homes for independent living experiences”	Practice
Italy	AT education for end-users: The PRISMA case	Practice
Sweden	Teaching children with disabilities using eye-controlled computer	Project
UK	More Independent (Mi) project	Practice
UK	Personalised Technology and Hft	Practice
UK	Lincus: self-reporting tools to improve health and wellbeing outcomes	Practice
UK	Lucille’s Medication Dispenser	Practice
UK	Andrew and Gillian strive for independence	Practice
EU	Towards an ICT-AT competence framework	Project
EU	Towards a job profile of an ICT-AT trainer	Project

Experiences on Policies

Collection of experiences of policies come from Portugal and Qatar, and present national accessibility and disability policies and policy drivers, recently designed and developed in order to promote equal access to technology and participation in digital society. More specifically, the Portuguese National Strategy for Disability (Resolution of the Council of Ministers, nº 97/2010, 14th December), promotes the rights and quality of life of people with disabilities. It continues the planning of the public policies that combat discrimination and assure active participation of people with disabilities in the several areas of social life. In relation to ICT, it contains measures on Accessibilities and Design for all (Axis 4 - deadline 2011: to develop version 2.0 of the validation programme of the WC3 guidelines for the accessibility of the web content) and Administrative Modernization and Information Systems (Axis 5 - deadline 2013: to consolidate the accessibility of the electronic sites concerning informative and transactional services with public entities). Along the same lines, the Digital Agenda of the country (Resolution of the Council of Ministers, nº 112/2012, 31st December) is a policy driver which aims at developing the Digital Economy and the Knowledge Society, preparing Portugal for a new model of economic activity, centred on innovation and knowledge. From the various measures of the Digital Agenda, two measures are considered relevant for people with disabilities (within chapter 3.3 – To improve digital literacy, qualifications and inclusion). The measures are 3.3.2 (to promote the availability and utilization of e-books) and 3.3.4 (to define a policy for the accessibility of the Portuguese digital contents and platforms in Internet). It is expected to prepare the economic, education and social entities, and their services and products, to assure development and improve qualifications in order to empower people with disabilities and assure their social and economic inclusion.

In Qatar, the national e-Accessibility policy aims to ensure people with disabilities in Qatar have equal access to the technologies that can enrich their lives, and covers a range of e-Accessibility issues, including websites, telecommunications services, handsets, ATMs, government services, access to assistive technologies and digital content. The policy is effective immediately and ictQATAR will oversee the implementation of the policy across sectors and monitor progress. It lays down a framework for the implementation of accessible technology in Qatar, mandating Mada as the national centre to provide assessment and training as well as funding the provision of equipment.

Projects

In addition to EU projects studied during the literature review of ENTELIS, a number of other national, EU and cross-country projects have been collected as experiences by consortium partners and associate partners. Up to date, projects from Qatar, Portugal, Italy, Sweden and ATLEC (which has been previously discussed) have been reported.

The Mada Assistive Technology Centre in Qatar has undertaken a project funded by Qatar National Research Fund that seeks to create a dictionary of symbols based upon the Arabic language. The graphic symbol set will be released under Creative Commons licence and made available for commercial use to those developing literacy and communication solutions that can be applied to Arabic users. This three year project is approaching the end of the first year. Arabic symbols will have the impact of reducing the cost of creating and maintaining solutions for Arabic speakers. Developed within the Gulf, the symbols will provide a valuable resource throughout Europe with communities of Arabic Speakers. In addition, Mada is involved in another project that seeks to outline key issues in localising AT from both a language/cultural and technical perspective. The associated website is available to support AT developers, considering a move into Arabic or other languages to ensure that a range of issues are taken into account to create more effective localised products, and hence to help build emergent markets. The framework offers a holistic approach to the creation of technologies to meet the needs of users living in different settings and with a different language. It is a valuable resource to guide development of AT in emerging markets.

The GOLD, a Leonardo EU project, reported by the Portuguese partner aimed at testing whether students with learning disabilities, such as autism and dyslexia, can benefit from the individual tailor-made method 'SlimStampen': a tool to help students to learn facts, words, topography etc. The method was already scientifically tested in mainstream education with good results. It is based on scientific models that take into account the individual knowledge the student already obtained and

the way each individual remembers facts. It makes studying more efficient, more effective and more encouraging. The project has proved the relevance of ICT as an effective tool for facilitating the learning of persons with disabilities. INOVATELL is another EU funded project reported by the Portuguese partner in which partners will develop and implement a technological solution that will help people with limited hands functionality to participate in lifelong learning process by remotely controlling specialised software using only hand or head functions; transfer and localize integrated INOVATELL technological solution as the touchless hand and head gesture controlled learning tool; transfer and supplement learning content to match the practical needs of the target group; create all the necessary documentation describing transfer methodologies and technology and make these materials readily available on the web. The project promotes the acquisition of digital skills and abilities to make effective use of assistive technology for the independence and resulting empowerment of people with disabilities.

The Swedish project reported is a local research work that aimed at investigating how people with disabilities actually use eye-tracking in a real day-to-day context. The study explores the meaning of teaching children with severe disabilities using eye-tracking. Fourteen teachers were interviewed about their reflections and experience of teaching and supporting pupils with an eye-controlled computer. The essence, of teaching pupils how to use an eye control computer using eye controlling is both to understand what the pupil does with the computer, and also what the pupil wants to express through the computer. With the introduction of eye gaze technology there are opportunities to express the pupil's wishes and emotions to some extent. The learning situation therefore involves more than learning the eye-control technique and acquiring knowledge of different subjects; it is also an existential situation.

In addition, the EU-funded EUSTAT project (Empowering Users through Assistive Technology), carried out in 1997-1999 by an international consortium including organisations of people with disabilities, academic institutions and rehabilitation centres, is reported here by the Italian partner. Although it was a pioneering study and assistive technology (AT) has significantly advanced since that time, the relational approach and the methodologies developed by the EUSTAT study are still fully valid today. The project consortium produced a set of handbooks for end-users and trainers that can be used in many different kinds of educational activities addressed to PwD of all ages.

Examples of Best Practices

All partners and Associate partners included in the table above also provided some examples of good practice from various perspectives. These include:

- (a) *Examples of material/product development and/or localization:* Such experiences have been reported by Qatar and UK. The Mada Assistive Technology Centre in Qatar has developed and maintains a portal that aims at providing a core resource of information and advice on accessible technology for Arabic speaking people with a disability. The approach addressed the need to deliver this information in a range of media and through creative commons licence to maximise disseminations and impact. In addition to that, Mada is involved in developing an online repository of accessible Arabic e-books, including the development of tools to aid conversion. The aim is to distribute accessible digital content to Arabic speakers with a print impairment, which in turn will support education and quality of life for users. Within this effort significant issues were addressed in dealing with the conversion process from scanned text to accessible text. An outstanding issue to address the need for improved OCR of Arabic text was identified and will provide the basis of future research initiatives.

In UK, Lincus is an easy-to-use picture and simple word-based software application for recording health and wellbeing information. Developed by Rescon Technologies, Lincus has been tailored for, and tested with, people with learning disabilities allowing them to record their feelings using an intuitive touchscreen interface. It aims to help users to engage in conversation and express how they are feeling, as well as engaging with their own health and wellbeing. This helps to promote choice for the people we support. It also enables the evaluation and visualisation on the person's wellbeing, as well as the effect of interventions and life events on their health. By using Lincus, the supported individuals have been given the opportunity to express how they feel. This has been particularly valuable for those with limited communication skills or who are non-verbal. Individuals have also been able to take control of their own health and wellbeing and be a part of their own recordings. Support-staff have also had the opportunity to take the time to talk with the individuals they are supporting and gain an increased understanding of their health and wellbeing issues.

- (b) *Examples of actions and approaches:* Such examples have been provided by France, Portugal, Italy and UK. The school of the Centre de la Gabrielle in France works at the project "A school in the digital age for people with intellectual disabilities". Thirteen teachers provide special education to 130 children and teenagers aged 6 to 20, with cognitive impairments associated with disorders. In 2009, an ICT-dedicated classroom, equipped with 10 laptops, a video projector, a digital camera, a colour printer, and Internet. This classroom became a place of resources, work and fun where pupils are applicants

and stakeholders, develop mutual help, share knowledge and respect for the equipment. Each pupil has access to this classroom, and can use a computer as most children, teenagers or adults do. The introduction of ICT at the school is based on fairness for the sake of equality with the general population. In fact, digital skills are now part of the range of key skills that every citizen shall have at its disposal to adapt a rapidly changing world. In addition the Centre de la Gabrielle maintains a studio, namely “Couleurs et Création”, which welcomes elder intellectual disabilities persons. The artistic creation is in the centre of all activities. The process of artistic creation becomes the main vector of the preservation and the development of the physical, intellectual and relational abilities. The activities of the workshop focus on digital art in order to develop computer appetite of the users.

In Portugal, the programme Connecting Portugal is an action that aims at including the integration of ICT across the education system with the focus on: improving the quality of education, motivation and the pleasure of learning and technological skills of young people essential to the modern labour market; the use of the motivating power of ICT to make learning engaging the youth who left school; the recognition and accreditation of skills acquired; and developing new audiences ensuring that all citizens can obtain skills for use of ICT services. The action anticipates modernizing and opening the school environment, training and developing basic ICT skills.

In UK, Liverpool Community Health (LCH) has led one of the programme objectives to enable people to be supported in their community by a tailored package of health technology and monitoring and/or social/medical care, to reduce hospital admissions and visits to the GP. They have set up a central ‘hub’ in Liverpool, which is staffed by nurses and offers telehealth services to local residents. Once individuals have been referred to the ‘hub’ by their GP, they have telehealth equipment installed in their homes allowing them to monitor health conditions such as blood pressure, glucose levels or weight. Recordings are then monitored by hub staff, who can make referrals to the GP should intervention be required. In addition, Hft is involved in the project “dallas”, which is an attempt to encourage communities to look at new ways and methodologies to enhance its overall health and economic sustainability at scale. The ‘assisted living’ part in “dallas” is very much supported by Hft’s development of Personalised Technologies (PT). Essentially the way Hft approaches the use of PT with the issue first can be transferred to other groups, including vulnerable groups and the general public. This has required Hft to develop generic mobile and virtual smart houses and modify its training for

the different stakeholders (volunteers, carers, social workers, front line clinicians).

- (c) *Examples of case studies:* Good practices have also been reported through the experience of particular case studies, either of individual end-users or organizations and service providers. The GIPH and ANLH cases are about two user organisations, based in France and Belgium respectively, which organised for several years, short courses on education to independent living for people with disabilities, with special focus on assistive technology. In GIPH Aquitaine (Groupement pour l'Insertion des Personnes Handicapées Physiques), in order to ensure that these services were properly run, the association hired a team of skilled professionals in social and employment integration. Thanks to the impetus of the founding members, these professionals (an occupational therapist, a social worker, a psychologist, an educationalist, and an instructor in locomotion, Braille and daily living) developed considerable experience in supporting people in their daily life environment. Similarly, ANLH (Association Nationale pour le Logement des personnes handicapées) in Brussels also undertook the organisation of a new educational initiative for end-users in Belgium. The main mission of ANLH (the National Association for the Lodging of People with Disability) is to promote the social integration of people with physical disability by providing lodging and a living environment adapted to their needs. With this aim in view, ANLH established a set of services called AVJ (Daily Life Activities), whereby persons with severe physical can opt for an autonomous lifestyle in their private lodging, supported by a personal assistance service that is on call round the clock seven days a week.

Along the same lines with the above experiences, in Italy from 1985 to 2000 Centro Studi Prisma, an Italian non-governmental organisation in the disability field, organised every year a residential course on education to independent living for people with disabilities, with special focus on assistive technology. Based on an interdisciplinary approach, Centro Studi Prisma works to promote culture, information and knowledge concerning all aspects of rehabilitation, social integration and independent living. The underlying idea is that knowledge is the fundamental basis for helping to remove social, cultural and technical barriers that hinder full participation of disabled persons in society. Another experience from Italy focuses on the case study realized by the USL Bologna and Emilia-Romagna's Center for Assistive Technology of Corte Roncati, aimed at developing and implementing a service of "Smart homes for independent living experiences" through a participatory approach. It was aimed at promoting living experiences in apartments through innovative activities for the development of personal autonomy in young adults and adults

with disabilities. The Living Lab approach influenced the outcomes of the experimentation in a positive way, as reported by the interviews and the focus groups.

Finally, three case studies on individual PwD have been reported from the UK. The first one refers to Lucille, a lively outgoing 32 year old who was living with her mum until August 2009 when she moved into an Hft supported shared house in Oxfordshire. Lucille lives with four other individuals and her boyfriend Tom. Her confidence has really grown since living at Hft and she likes to try new things. Lucille's support-staff asked about introducing a PivoTell medication dispenser to Lucille as it was one of her goals to learn how to take her own medication so she didn't have to rely on staff. Lucille has bought herself a PivoTell medication dispenser and disposable refill trays so that the pharmacist can fill them. She also bought herself a spare dispenser, as she broke her original one and was upset when she was without it for a short while. With a total cost of £350 Lucille has increased independence and a sense of empowerment now that she is able to take her own medication. She has completed one of her goals and she is very proud of her achievement. The second and third case studies are about Andrew, a 47 year old man with Down's syndrome and Gillian, a 58 year old lady, whose goal was to have their own front door and garden for the last couple of years. Becky, Hft service manager and Verity, Gillian's key worker, worked closely with the couple to find an appropriate flat and to prepare them for moving on. A two bedroom flat was found and a Personalised Technology (PT) assessment was carried out. A selection of PT was chosen to support their needs and it was installed, with the aim that Andrew and Gillian would only need support in sleep for a short while. As a result Andrew and Gillian now have more independence and have their "own front door" – something they have wanted for a while.

5. User experiences: Research Results from Interviews

Findings of the ENTELIS research study are presented here. Based on extensive review of the existing literature, and on careful analysis of material collected from other sources (e.g. partners' experiences, previous relevant project reports etc), three interview protocols were created: one addressed to ICT/AT end-users, one to trainers and one to service/technology providers and professionals. The aim was to reflect primarily on the impact of current technological, social and economic changes on the participation of PwD in the educational realm of life and on their perceived level of confidence, efficiency and adequateness (quality of life). To this end, the in-

interview protocols were developed on the basis of Semi-Structured Interview Themes conveying the main dimensions of life and quality of life. The interviews are structured around five categories plus two themes; general barriers and examples of good practices. The five categories (and sub-categories) are as follows:

- (1) Participants' profile (especially in relation to ICT-AT background and experience);
- (2) Daily life (including learning and applying new knowledge, communication and interpersonal relationships);
- (3) Education (formal, informal and non-formal);
- (4) Employment (including work and economic life);
- (5) Community, social and civic life (including recreation, human rights and political life and citizenship).

Categories and subcategories have taken into consideration some of the life areas listed in the International Classification of Functioning, Disability and Health (ICF), as an established framework, which however, have been expanded and restructured in a way that serves the scope of the project.

Based on the interviews protocols, consortium partners have engaged in the collection and analysis of information regarding relevant experiences in ICT and ICT-AT education for PwD, what needs they try to tackle (meta language) and how they could be labelled (taxonomy).

This report summarizes the results of semi-structured interviews completed with the three stakeholder groups by European University Cyprus (EUC, Cyprus), Satakunta University (SAMK, Finland), AIAS Provincia di Bologna Onlus (AIAS, Italy), Open the Windows (OtW, Macedonia), and HF Trust Limited (HFT, UK):

- (1) End-users with disabilities (Cyprus: 3; Finland: 8; Italy: 5; Macedonia: 5; UK: 5)
- (2) Educators/support staff (Cyprus: 2; Finland: 5; Italy: 3; Macedonia: 3; UK: 3)
- (3) AT providers (Cyprus: 4; Finland: 2; Italy: 2; UK: 3)

In addition, the experiences and results from ongoing research in the US from the third country partner are also included in this report.

Interviews, which were conducted face-to-face, via skype, or through an online questionnaire (based on interviewees' preferences especially for PwD), were completed between July – November 2014.

The report provides useful insights into the profiles, conceptions and beliefs of end-users, trainers/support staff, and service/technology providers and professionals in the five participating countries, on the multifaceted relation between ICT / ICT-AT education and learning. It also highlights some of the main current trends, barriers, and emergent and future needs and innovations in the field.

Interviewees' profiles

I. End-users (PwD)

Cyprus

Three end-users were interviewed. Below is a short description of their profile:

- Nick is a 37 year-old male with visual impairment. He has a Bachelor's degree in Public administration and a Master's degree in History. He is single and resides with his mother. He works as Coordination and Communication Officer at the Pancyprian Organization of the Blind. He has excellent ICT skills, and has been using AT and ICT for the past 25 years. He currently owns a PC, an i-phone and an i-pad. On the PC, he *uses screen* magnification software. He mainly uses his PC at work to conduct various surveys, create databases in Access, and to handle the Organization's social media sites. He uses his i-pad particularly for reading purposes, taking advantage of the built-in Voice Over accessibility feature. He also uses his i-phone for making phone calls, and again for accessing text material with Voice Over.
- Chris is a 53 year-old male with visual impairment. He is a university graduate who has studied computer science. He is single and lives alone. He works at the public sector as an administrative officer (Ministry of Finance). He has excellent ICT-AT skills, and uses various types of ICT-AT on a daily basis: Synthesized speech, Braille display, Braille notebook, Reading devices (text-to-speech), audio player (ie. daisy readers), everything for work and business, entertainment and education purposes. He's been using assistive technologies since he was a little boy (e.g. Braille type-writer, octagone, etc.). He had his first computer around 1985, while in 1990 he acquired OMNIPAGE
- George is a 31 year-old male who also has visual impairment. He is a university graduate who has studied Music Technology. He is married and works at the Pancyprian Organization of the Blind in the audio books department. He started learning about computers 23 years ago (at the age of 8-9) and is now using ICT-AT on a daily basis for both work and leisure purposes. The main AT he uses is a screen reader that he employs on both on his PC and his mobile device.

It should be pointed out that the fact that these 3 individuals (end-users) have excellent technology skills is not always the case for PwDs in Cyprus. The reason for selecting the specific end-users to participate in the study was twofold: (a) the aim of this research is to investigate PwD's views and participation in the development of ICT and ICT-AT competencies. Hence, people with experience in the use of technology were more likely to be interested to participate in the study and also to provide an insight of both their experience and concerns on the issue; (b) EUC investigated the views of participants with visual impairment, a group of PwD that holds a stronger presence in both activism and social and educational life in the country. According to literature, there is often a differentiation in legislative and other documents and processes which is considered a result of the lack of collective activism in Cyprus and an absence of collective identity (Symeonidou, 2009). As a result, very often people with visual impairment have easier access to funding schemes and training programmes than other groups of disability.

Finland

Eight older adults were interviewed for the project. They all lived independently at home. All interviewees said that they have a vivid social life. They all were active participants and voluntary workers in the local elderly care organisation (Satakunnan vanhustentyön tuki ry). Only one of the older adults who were interviewed used assisted technology for hearing. None of the others used any AT. The group can be divided into two parts. Some respondents did not use ICT and some of them used ICT very actively.

- Aili is a retired lady in her 70s. She used to work as a housekeeper and has no-formal education after a comprehensive school. She lives independently alone
- Brita is an 81 year old retired cook. She is a widow and lives independently. She uses a computer occasionally and has found it rather difficult to learn to use it in older age
- Sisko, 70, used to work as a store manager. She has no formal education after comprehensive school. She is retired and lives alone independently. She uses ICT every now and then but is not very interested in using it for e.g social contacts.
- Hilikka is a 76 years old lady and lives independently. She used to work as a salesperson but is now retired. She has no formal education after comprehensive school. She is not interested in using ICT at all, rather than that she resists it

- Iris is retired woman living independently. She is 73 years old. Iris has Bachelor's degree from social sciences and used to work as a head of department. She is comfortable with using a computer but finds it challenging to keep up with the development.
- Kaisa is a former head of a nursing home for the older people. She has a Bachelor's degree in social sciences. She is 75 years old, retired and lives independently. She is an active user of ICT; she follows news, uses social media and keeps contact with her family and friends via skype and whatsApp.
- Mirja is a 66 year-old woman who was recently retired. She has high formal education- licenciante in social sciences- and she used to work as a senior lecturer in social work. She lives independently. She has good ICT- skills and uses computer on a daily basis to follow news, to run her finances, to search information etc.
- Kaarina 81, lives independently alone (no other personal details were documented). She does not use ICT because she does not find it necessary.

Italy

In Italy, five persons were recruited by AIAS and accepted to participate. Interviews with them were conducted face-to-face. Table 1 provides an overview of their demographic characteristics:

Table 1: Profile of Italian end-users interviewed by AIAS

Participant	Age	Gender	Education	Health status	Type of AT	Time of experience	Self-perceived mastery in ICT-AT
Claudio	51	M	High school	Spinal cord injury	PC, mobile devices, domotic adaptations at home	20 years	Good
Brunella	50	F	Medical degree	Cerebral palsy	mobile devices, PC	10 years	good
Alberto	47	M	High school	Cerebral palsy	PC, mobile devices, domotic adaptations at home	15 years	Good
Daniela	47	F	High school	Cerebral palsy	PC, mobile devices, domotic adaptations at home	20 years	Good
Ivan	21	M	University student	Visual impairment	PC, screen reader, braille	11 years	Good

As seen in Table 1, all end-users from Italy use AT and ICT technologies. Two of the end-users (Alberto and Daniela) live together and were interviewed together.

Macedonia

Open the Windows (OtW) conducted interviews with 5 end-users with physical disabilities. The interviewees were of different age, education level and gender. Below are the short descriptions. All end users are or were attending regular mainstream schools.

- Igor is a 25 year old unemployed male, and is a high school graduate. He lives with his parents and his younger brother who goes to the university. His disability is a result of an injury when he was 6. He has moderate to severe impairment of body functions which disrupts his everyday activities to the extent that he depends on others for assistance. He has no visual, hearing, speech or cognitive impairment. He can walk with walker assistive device, but he has difficulties using his arms due to a spasm and tremor. He has been using ICT-AT on a daily basis for the past eight years. The types of ICT-AT he uses include standard computer with large button keyboard and adapted joystick, and accessibility options in Windows (adaptation of cursor movement, filter keys).
- Veronika is a 19 year old girl who is attending fourth year of secondary (high) school. She lives with her mother and her twin sister who has no impairments. Her disability is result of problems during her birth (Athetoid cerebral palsy). She has severe impairment of body functions which disrupts her everyday activities and she needs assistance. She has no visual, hearing or cognitive impairments. She has unrecognizable speech and she answers the interview questions using ICT-AT. She has been using ICT for more than fifteen years, and in the past two years she uses AT. The types of ICT-AT she uses include: standard computer with onscreen keyboard and adapted joystick, accessibility options in Windows and Ubuntu Linux (adaptation of cursor movement, sticky keys).
- Viktorija is a 16 year old girl who is in second grade of high school. She lives with her parents and younger brother and sister. Her disability is the result of an extremely rare progressive disease of the connective tissue (Fibrodysplasia ossificans progressiva -FOP). She has severe impairment of body functions and needs everyday assistance. She has no visual, hearing or cognitive impairments. She has been using ICT-AT for the past 4 years. Specifically, she uses the following types of ICT-AT: standard computer with on-screen keyboard and trackball, accessibility options in Windows and Ubuntu Linux (adaptation of cursor movement, sticky keys).
- Vera is 14 year girl who is in seventh grade of primary school. She lives with her parents and older sister. Her disability (cerebral palsy) is the result of perinatal problems. She has mild to moderate impairment, but she is very independent

and needs assistance only in more complex (demanding) activities. She has no visual, hearing or cognitive impairments. She has been using ICT-AT since the age of 5. She uses a standard computer with large button keyboard. In the past, she used adapted joystick, but now she uses trackball, accessibility options in Windows and Ubuntu Linux (adaptation of cursor movement, filter keys).

- Elena is a 26 year old woman. She lives with her grandparents most of the time, although she has parents and brother and sister as well. Her disability is a result of high fever at an early age (according to her words, not quite clear what kind of illness). Due to her illness she has visual and hearing impairments; she is in a wheelchair and can use her arms. She needs assistance in some of her daily activities. She recently graduated from the Social works and social politics Institute at the Faculty of Philosophy. She uses ICT-AT for the past seven years, and specifically a standard computer with a large button keyboard and mouse, and accessibility options in Windows (magnifier and high contrast).

UK

Five end users were interviewed by HFT across an age range of 32-59. All were living in supported/assisted accommodation shared with others. There was a range of abilities which impacted on the way in which they were able to interact with technology.

Four of the five were using computers with internet access. Two individuals were using the computer for email communication, as well as being able to conduct searches for information online. Usage by the other two was more limited - looking at pictures, listening to music etc. Examples of comments showing the variation in usage are given below:

“I use the computer to send emails and research things on the internet. I am also a member of our parliament group, and I receive information from the local PO and Neighborhood watch, which I send on to others” (Supported Female, 51 years)

“I like to look at pictures of lorries -this is my hobby - and I like to listen to music on the computer. Doing this makes me happy” (Supported Male, 59 years)

Three of the individuals had panic alarms in their house, to enable them to call for help if needed. Three individuals also commented that they had a mobile phone. One individual had a medication dispenser.

II. Educators

Cyprus

Both trainers interviewed in Cyprus were special educators:

- Dina 1 is a special educator with focus on ICT-AT (first degree in Greek Language-Secondary Education). She has been working with children and adults with various disabilities for the past five years. She offers ICT-AT training on an individual basis for people with disabilities, using different types of AT devices and software. She gained her knowledge and skills in ICT-AT through attending a Master's program in Special/Inclusive Education, as well as various seminars, conferences, and workshops.
- Anna 2 is a special educator with focus on ICT-AT. She has a Bachelor's degree in Primary Education, a Master's degree in Special (Inclusive) Education and Inclusion, and a second Master's degree in Technologies of Learning and Communication. The knowledge and competences in ICT-AT that she gained through her formal studies, was supplemented and further enhanced through participation in workshops, seminars and conferences. She currently works as a private one-to-one tutor for children with disabilities. She has been using AT in her work for the past three years.

Finland

Five members of supporting staff/ educators/trainers were interviewed. Tuula, 54, worked as a rehabilitation counsellor in a health care centre and had experience in planning and implementing accessibility improvements in housing conditions for people with decreased functioning, as well as long work experience concerning assistive devices and technologies. Four participants (Maija 44, Mirka 32, Anneli 47 and Niina 35) were working in different settings in elderly care; in home-care, supported housing or a special unit for people with moderate to severe memory deficit.

In their working environment, the interviewees' possibilities to use ICT or ICT-AT varied a lot. In one unit, very modern technologies (such as a big table with touch screen) were used not only for entertainment, but also for educational purposes with the older adults. In another unit, the amount of ICT was next to nothing, as there was only one computer in the nurse's office and it was mainly used for documentation. In three settings, some of the older adults had devices of their own; smart phones and/ or a computer/ laptop. Nearly all clients had some kind of a safety alarm system, which in most cases was a 'safety wristband'.

Italy

Interviews were conducted through an online questionnaire. Three educators from Area Ausili of Corte Roncati (Bologna) participated in the study. All had, on average, more than 10 years of experience working with PwD. All were involved in ICT-AT training mainly concerning communication solutions for people with severe motor and intellectual disabilities (e.g., cerebral palsy). All of them declared their work would improve in case PwD would be more skilled in using ICT-AT solutions. In particular, one of the educators specified that – considering the specific needs and abilities of the people she works with – it would be important to improve the digital skills of the environment (e.g., parents, school professionals, health professionals) around the PwD. This would have a positive impact on the use of ICT-AT solutions of PwD.

Macedonia

Three special educators were interviewed in Macedonia:

- Lydia is special educator with the focus on ICT-AT. She works with people with disabilities for the past seven years. She is using AT in her work for the past three years.
- Mara is special educator with the focus on ICT-AT. She works with people with disabilities for the past four years. She is using AT in her work for the past two years.
- Sarah is special educator with the focus on ICT-AT. She works with people with disabilities for the past ten years. She is using AT in her work for the past eight years.

Due to the fact that AT is not an academic subject at the Faculty for special education and rehabilitation or any other relevant educational institution in Macedonia, all three educators gained their knowledge and skills for AT at the centre for assistive technology of Open the Windows. Participation in different workshops, seminars and conferences complemented and enhanced their competencies. In addition to that, practical work with end users allowed them to further explore and research with different types of AT and assistive software and with users with various disabilities.

UK

Three members of support staff were interviewed, with lengths of experience in their role ranging from 2 to 7 years. All had experience of a wide range of AT, as a requisite for their role in assessing individuals for AT. They also were all regular users of ICT as an integral part of their daily work. All staff were aware of the importance of staying up to date with ICT/AT, through a continuous training programme.

III. AT Providers

Cyprus

Four professionals with extensive formal technical training and/or experience in the provision of ICT-AT products or services were interviewed for the study purposes. All of them are involved in advising PwD and their families, and/or professionals (clinicians, educators) in the field on AT solutions. Their involvement in the ICT-AT field ranges from 5-15 years.

- The first AT provider, Tim has been in the ICT-AT field for more than a decade. Since 2004, he has been directing a Cyprus-based company that aims to enrich the disability field with state-of-the art AT products for children and adults. The company offers various services including: assessments and evaluations of individuals, environments and equipment, suggestions and applications of AT equipment, trainings and seminars for the most popular software and devices, and technical support for all its products. The company is collaborating very closely with local institutions, centres, schools, specialists and professionals who offer their services to people with special needs.
- The second interviewee, Mia works at the Ministry of Education, as an AT Coordinator, providing advising on AT solutions. She engages in assessments and evaluations of student needs in terms of AT and, based on these assessments, makes recommendations for the provision of AT devices to pupils in public schools. She also provides training to teachers and support staff working with disabled children (e.g. speech therapists). She has five years of experience in the field. Her academic background is in Special Education and in Educational Technology, but not specifically in AT. She first got acquainted with the field of AT while working in a special school, and has since then attended various seminars, conferences, and workshops in the field.
- The third interviewee, Peter is a university professor. He has a PhD in Computer Science and over 15 years of experience in ICT-AT. His area of specialization is Human-Computer Interaction, with focus on accessibility and usability, and he works in the Department of Multimedia and Graphic Arts of a public university in Cyprus. He teaches courses of HCI (user-centered design) and courses of Design for All (universal design).
- The fourth interviewee, Suzan is an administrative officer at the public sector and works at the Department of Social Inclusion for People with Disabilities (DSIPD), under the Ministry of Labour and Social Works. She has around 7 years of experience in the area of funding and policy on assistive technologies. Her academic background is in sociology, criminology and business (she has an M.B.A.). She has

gained her knowledge about ICT-AT mainly through her experience in working in the DSIPD. The Department where she currently works offers two alternative funding schemes related to ICT-AT to PwD. The first scheme provides funding for the purchase of AT, while the second one funds the purchase of wheelchairs. PwD can also apply to borrow AT or other equipment available in the Department and can return it when they no longer need it. The Department is the monitoring body on issues of disabilities in Cyprus, and also provides some funding for the participation of PwD in programs/seminars related to the acquisition of ICT-AT skills.

Finland

Two ICT developers and producers, Mikko and Jari, were interviewed. Both of them had substantive experience of ICT – technology development among older adults and other age-groups ranging from 5 to 10 years. Mikko works in an SME and Jari in an ICT –research centre. Both had an academic background in engineering, and a PhD in the ICT –technology area. Both providers have the end-user involvement in their work and research.

Italy

Two operators from Area Ausili of Corte Roncati (Bologna) and 1 from Centro per l'Autonomia Ausilioteca Campana (Naples) participated in the survey, which was conducted through an online questionnaire. All participants are involved in advising PwD and professionals (clinicians, educators) on AT solutions, both for children and adults. Participants are, on average, involved in the ICT-AT field for more than 20 years. Two of the interviewees are engineers, and the third one is a social educator. The contribution of AT providers involved in the study in developing ICT-AT skills of PwD are mainly regarded as allowing them to access and use digital technologies for achieving their desired goals.

UK

Three providers of AT agreed to be interviewed for the study. The areas of technology involved covered:

- Software tools enabling people with learning disabilities to communicate information about their mental and physical health and wellbeing;
- Hardware and software tools to support people with learning disabilities who suffer from long term conditions, by helping the individuals (and their family and carers) to better manage their condition;

- Mobile apps and web tools to provide people with learning disabilities and their families and carers with easily comprehensible information about telecare and telehealth services which are available to them.

Building on their extensive formal technical training and experience in ICT, participants had between 3 and 6 years' experience specifically focused on working with products and services for people with learning disabilities.

USA

Multiple vocational rehabilitation counsellors who are responsible for selecting and providing all types of ICT-AT for employment-eligible adults provided information useful to this project.

Interviewees' responses

End-users', educators', and AT providers' profiles have been described in the previous section. This section presents an overview of the participants' responses to the different questions posed during the interview. For each stakeholder group, results are presented on the basis of the following categories and themes in which the interviews were structured:

- (i) Daily Life
- (ii) Education
- (iii) Employment
- (iv) Community, Social and Civic Life
- (v) General Barriers
- (vi) Examples of Good Practice.

I. End-users' responses

Daily Life

Learning & applying knowledge

End-users from all participating countries stressed the fact that the advances in ICT-AT have been profound in recent years. They agreed that technology has revolutionized learning of PwD in several ways, providing many new tools for "improving the learning experiences" of disabled students, which were not available in the past. Most participants stressed that while for the general population IT skills have an important role in the acquisition of new knowledge and skills, from an aspect of PwD they are even more essential for learning since for *"PwD the keyboard might replace pencil, or a screen reader might substitute or complement their visual impairment"*

(End-user, Macedonia). ICT-AT skills help PwD in the area of education, self-education, or distance learning. Having access to ICT-AT technologies *“is a fundamental prerequisite for learning in different fields and an opportunity to learn something new every day, from a new recipe to the news from the world”* (End-user, Italy).

Most of the study participants had well developed ICT-AT skills, and were using technology on a daily basis. These individuals felt that ICT-AT is helping them to increase their skill set and plays a crucial role in facilitating their societal integration and inclusion. ICT-AT skills have helped them to become *“more confident, positive individuals who can easier fit in the surroundings”* (End-user, UK). However, there were some exceptions. Some of the elderly participants from Finland, for example, did not make much use of technology, arguing that *“they do not trust themselves as users of ICT”*.

All interviewed end-users acknowledged the significant impact of ICT-AT advances on enhancing the quality of their daily functioning, and their capacity for independent living. Everyone stressed the fact that ICT-AT *“provides faster and more secure access to information that can be manipulated by the individual the way he/she wishes”* (End-user, Cyprus). They pointed out the importance of ICT-AT technologies for improving safety of PwD, and for enabling them to maintain independence in performing many of the activities of daily living (studying, working, purchasing products and managing payments on the internet, reading e-newspapers, etc.). The supported individuals from the UK, for example, said that they value technology because it improves their own experiences, giving them access to sights, sounds or information which enhance their lives. The back-up of technology (be it a panic alarm or simply a mobile phone) that lets them contact support if they need help, makes them feel more confident to have control over their lives and to do things independently. *“My telecare has made me more independent, which has given me a lot more confidence in my overall life”* (Supported end-user, UK); *“Using AT keeps me safe. I can call staff when they are not at my house”* (Supported end-user, UK); *“Using my mobile phone helps me to travel and makes me feel safe”* (Supported end-user, UK).

Communication, Interpersonal interactions & relations

All interviewees stressed the important role of technology in facilitating their communication and interpersonal relationships. Depending on their age, familiarity with technology, and type of disability, all interviewees used one or more technological tools for communication. Everyone had access to mobile devices, while the majority noted that they also use other means of virtual communication such as e-mails, chats, social networks (Facebook and/or Twitter), and Skype on a regular basis, *“for fast and independent communication with other people”*. They all agreed that the tools provided by contemporary technologies make it easier for them to be active

members of society by facilitating their interaction with other people, at work and/or in daily life: *“ICT-AT greatly contribute to an independent, seamless, and effective communication with our fellow human beings”* (End-user, Cyprus); *“It helps keep in touch with what is going on, and to be more able to find out about local groups and activities”* (End-user, UK); *“Technology makes life more meaningful because it is easier to follow news, politics, public figure birthdays and it also relieves loneliness”* (End-user, Finland). For some of the respondents, using IT was the only means for expressing themselves and this possibility brought them satisfaction, since they were not excluded from the modern trends of communication. Respondents from Finland and the UK also noted that the possibilities offered by technology have increased their self-confidence, and have helped them improve their relationships with other people.

Despite the undoubtedly positive impact of ICT-AT on their interpersonal interactions and relations, end-users still pointed to some constraints to social inclusion. Some of them stated that PwD continue to be stigmatized, encountering attitudinal and physical barriers both in work and in daily life: *“Many people feel uncomfortable around individuals with disabilities. Much of this discomfort stems from lack of personal contact with people with disabilities, and a sense of awkwardness and uncertainty as to how to speak and act in their presence”* (End-user, Macedonia). Others referred to technological barriers limiting their e-inclusion. One of the interviewees from Italy, for example, who is blind since the age of 8, said that although he has lots of friends, he cannot use WhatsApp to communicate with them because he cannot keep up with the speed of interaction required by the application (for example during conversations involving many participants). This makes him feel excluded from an important part of his interpersonal relationships.

Education (formal, informal, non-formal)

The younger end-users in our study had received some formal instruction about ICT-AT while at school or at college. The majority, however, had gained their ICT-AT skills through either formal or non-formal education.

Several of the participants, including those with studies in ICT-related fields, noted that they continue to get informed about advances in digital technologies in general and assistive technologies in particular, and to further develop and update their ICT-AT skills, through informal education. The internet, in particular, has proved extremely useful for them: *“While in the past I was constrained to the very limited training opportunities offered in Cyprus, now I can learn independently. There are many podcasts which act like user guides...listening to someone describing how he uses an app for example, computer software, or an assistive device, we also learn how it*

works” (End-user, Cyprus). One of the interviewees stressed the usefulness of online communities of disabled people “providing support to other PwD belonging to their end-user group on various technical issues, and information about technological developments in AT” (End-user, Cyprus).

It is evident from the interviews that all participants agreed that technology has revolutionized learning of PwD in several ways: *“When I was in elementary school I used a Braille writing tablet. My teachers were not able to understand what I wrote, so there was the need for me to ask someone to translate from braille to the alphabetic code, and only then were the teachers able to assess my homework. When I started to use the PC, translation was not needed anymore, so I had the opportunity to send my homework directly my teachers, and this had a very positive impact on my relationship with them, and on my learning.”* (End-user, Italy)

In the opinion of the participants, people with disabilities should at least be aware of the opportunities brought about by competencies in ICT, and how ICT may increase learning opportunities. Most of the respondents stressed the need for PwD to develop their skills in using ICT-AT starting from a very young age. They considered the role of formal education as extremely important for introducing children with disabilities to ICT-AT: *“It is important for teachers to know in practice how to effectively integrate AT with instruction, catering for individual students’ needs”* (End-user, Cyprus).

Cypriot interviewees expressed the view that the educational system in Cyprus fails to cater to the needs of school children with disabilities. They consider the role of formal education to be underdeveloped, since in schools, teachers rarely help children with disabilities to use ICT and AT. They noted that although there are some exceptions, like for example the School for the Blind which offers additional training in the afternoons to help students with visual impairments cope with the demands of the computer programming classes they take at school, no similar programs are offered for most of the other groups of disabled students (e.g. students with physical and mobility impairments). Cypriot students with disabilities have to resort to the private sector to receive training and this tends to be very expensive. Italian participants also complained about the lack of formal education targeting PwD on digital technologies in general, and assistive technologies in particular. However, most of them also recognized that formal ICT learning activities may be very boring. For ICT-AT training to be effective, they pointed out, *“it would be necessary to design ICT learning activities taking into account the real needs and the peculiarities of each participant/student with disability.”*

According to the interviewees, non-formal education on ICT-AT is particularly important for older PwD who are not comfortable with technology. For young disabled adults, they do not find necessary the offering of formal or non-formal education on ICT-AT, *“since young people tend to have good technological skills”*, but also *“because it is very important to young disabled people to be independent...to learn to experiment and to find out solutions on their own”*. Formal or non-formal training targeting young PwD, according to our respondents, is required only for *“specialized topics, like learning a new programming language”*, and for people who want to study a field related to computer science (End-user, Cyprus).

Employment

Work & Employment

All end-users agreed that in modern, technology-based society, *“having good ICT skills is one of the main factors affecting employment”*. Competence in using ICT is absolutely necessary, they pointed out, and people with poor ICT skills are at a serious disadvantage: *“You need to be able to learn fast and to stay always up to date because everything changes very fast: new management software, new mobile devices, new application”* (End-user, Italy). However, although considering the development of technological skills as vital for accessing the labour market, interviewees also stressed that this is not sufficient. In all of the participating countries (with the exception of Finland where all the end-users were retired), work, employment and economic life proved to be weakest part of interviewees’ experience with ICT-AT.

The interviewees noted that PwD often experience discrimination, leading to very high rates of unemployment compared to the rest of the population: *“I think it’s easier for a disabled person with good ICT skills to get employed, however this is often not adequate since even if this is the case employers might refuse to hire a PwD to avoid the extra cost required to provide AT at the workplace”* (End-user, Cyprus). The interviewees from Cyprus, in particular, stressed the *“problem of prejudice by employers”*, and the need for the government to provide more incentives for companies to employ PwD: *“Without incentives, employers are not willing to employ PwD since the vacancies are so few due to the economic crisis... And this despite the fact that when the disabled are given AT and the opportunity to work, they can reach similar, or even higher, levels of productivity to those of people without a disability.”*

Even when securing employment, PwD most often work in low-skill, low-paying jobs that do not require ICT-AT competencies. The researchers from HfT found that only one of the supported individuals they interviewed was engaged in employment, working as a receptionist for two days a week, and also doing some part-time work in a charity shop. The minimal impact on employment opportunities they found in

this study, was also reflected in a previous research undertaken by Hft among staff who provided support (Hft Personalised Technology Impact Assessment, 2012), where personalised technology had led to an improvement in employment situation in only 3% of the cases.

In the USA, the participating vocational rehabilitation counsellors and PwD both report a lack of confidence in knowing existing options for ICT-AT and will often rely on Assistive Technology Specialists who have received a certificate in AT provision. Employers turn to their Human Resources Offices when an employee requests workplace accommodations.

Economic life

Interviewees said that training in ICT-AT facilitates the participation of PwD in economic life, and significantly impacts their independence in some economic activities. By using ICT-AT, PwD are enabled to regularly monitor their bank accounts, to pay bills and do other financial transactions, and even to buy different products via the internet, often at a much smaller cost. While, however, the younger end-users tended to be avid users of technology who took full advantage of the tools it offers, some of the older respondents refused to learn how to use ICT for doing their financial transactions (e.g. online banking).

Community, social & civic life

Communication, social life, and recreation

All respondents considered technology as an important means for improving involvement of PwD in social and political life (e.g. communicating via social networks or e-mails). As stated by the participants, many aspects of participation in community life are affected by technology use. Training in the use of ICT *“encourages e-inclusion by enabling users of ICT- AT to actively participate in society”* (End-user, Macedonia). The acquired ICT and AT skills and knowledge facilitate public involvement, as they allow a faster and easier means of getting certain information, facilitated communication, and less dependence in realizing various activities: *“The opportunity to travel around the world is now increased in comparison with some years ago thanks to the possibility to plan a trip in autonomy and to ask other people who face similar problems when travelling, to give you useful information about the destination”* (End-user, Italy).

All of the five supported individuals interviewed in the UK felt that IC-AT had created more opportunities for them both through the functional benefits of being able to identify options and to make initial contact, and also through the improved confi-

dence which ICT-AT provided. Generally, supported individuals saw ICT-AT as a positive thing, which could make them feel more included in society: *“It makes me feel the same as everybody else”* (End-user, UK). Similarly, all of the elderly participants from Finland that used ICT-AT, agreed that technology relieves the feeling of loneliness and gives them more possibilities to keep in contact with others and to engage in leisure activities. They used smartphone applications like Whatsapp for communication purposes, and also maintained contacts with their friends and family by phone, skype or, in some rare cases, by social media. These senior citizens also engaged in recreation by playing solitaire, doing online gaming, and watching TV-series from the computer.

At the same time, interviewees from Cyprus pointed to several barriers facing disabled people when it comes to entertainment and recreation, including *“the still limited number of accessible books, magazines, videos, or movies – especially in Greek...there are no theatrical productions accessible to PwD in Greek.”*

The interviewees considered ICT-AT skills a question of citizens’ rights, since such skills increase the life quality of PwD. They stressed that lack of technological skills by some PwD complicates their participation in political and civic life. Thus, they consider it a responsibility for the state to ensure that PwD acquire ICT-AT skills, but also that electronic sites and physical sites become accessible to enable participation by PwD on equal terms with people without disabilities. As a participant from Cyprus pointed out, *“when it comes to recreation, it is not adequate to be comfortable using AT, but it also depends on whether the websites or physical locations that one visits for recreation are accessible or not.”*

Political life & citizenship

The end-users stressed that ICT-AT skills play a significant role in terms of providing information, easier and more immediate communication and help to PwD in expressing their political views (using social networks, blogs, forums etc.). They considered knowledge of ICT-AT essential for participation in political life and citizenship, *“first of all because AT provides information, but also because interaction within social networks makes it very easy for someone to raise questions or issues”*. However, the interviewees felt that PwD are not adequately encouraged to participate in civic life, but on the contrary, as pointed out by an educator in Cyprus, *“political parties often try to take advantage of some PwD. This educator gave the example of parliamentary elections in Cyprus, where “some political parties include people with disabilities in their list of candidates for members of parliament...although they know that these persons have a very limited chance of being elected...they include them to get more votes from persons with disabilities and their families”*.

General Barriers/Opportunities

The main barriers towards developing ICT-AT competences cited by the participants are related to the accessibility of digital technology. They pointed out that although *“such technologies should be made accessible to everyone without any modification”* (End-user, Italy), *“up until now advances in technology have often introduced more barriers rather than facilitating their use by people with disabilities”* (End-user, Cyprus). However, interviewees were hopeful that the situation would improve in the near future, since as cited by an end-user from Cyprus, *“it seems that the dimension of accessibility for all is finally gaining momentum... these days we are talking about accessible design, not universal design. The emphasis is now on accessible design so that ICT companies can develop products that are accessible to everyone.”* A couple of end-users gave Apple’s solutions, integrated in iOS, as a very good example of accessible design.

Another serious barrier mentioned only by Cypriot interviewees is that of language. Since *“most devices are developed for widely-spoken languages...English, French, Italian ... they have to be adapted for Greek speakers and this causes lots of problems, e.g. when scanning text”*. Cypriot interviewees also referred to financial constraints, which have now worsened due to the economic crisis facing Cyprus.

End-users referred to the lack of adequate opportunities for training PwD, especially older people who tend to know very little about how to use it ICT-AT in their daily life. They pointed out that ICT-AT is often introduced without proper support and guidance on how to use them: “The biggest challenge is knowing what there is, how to get it, and how to use it” (Supported Female, UK); *“If people aren’t shown how to use it properly, it could be dangerous”* (Supported Female, UK). End-users also mentioned the need for specialized training targeting younger people that can provide them with technical and vocational skills that can improve their position in the labour market.

Another issue brought up by the respondents is the need for trainers to respect the wishes and interests of the persons they train, as well as their aspiration to work with a specific device: *“There is no need to force the use of certain AT, if the person you work with does not accept it”* (End-user, Macedonia). Also, it is very important for educators and AT providers to know the abilities of the person they are working with, so as to be able to recommend an appropriate device. Besides the recommendation for assistive computer device, it is also important for them to be able to do some software adaptations to meet the unique needs of each person with disabilities.

End-users referred not only to barriers between technology and user, but also to barriers in the relationships between seniors and younger people. All interviewed seniors from Finland (living independently without AT) stated that the elderly tend to be afraid of technology and especially of services such as online banking and “*need a spark to start*”, but are not provided with appropriate encouragement and support since the attitude of younger adults towards them (about using ICT in daily life) is discouraging.

Finally, the interviewees stressed the importance of laws enforcing accessible design: “*I think that it should become mandatory by Law for web developers to follow WC3C accessibility guidelines when designing websites. Unfortunately, if something is not mandatory in Cyprus, people tend not to abide to it*” (End-user, Cyprus). At the same time, they noted that enforcing the need for accessibility depends on PwD themselves to some extent, who need to become more proactive and demanding with regards to their human rights, adopting a similar approach to that of PwD in more advanced countries like the US, where “*if a company develops a device which is not accessible to the blind, people resort to courts and seek compensation*” (End-user, Cyprus).

Best Practices

Although the interviewees from Cyprus believed that the country “*lags behind other European countries in terms of supporting PwD*”, and that “*much more needs to be done*”, they did cite a few examples of “*best practices*” in ICT-AT:

- An app for indoors orientation targeting people with visual impairment;
- A training program targeting individuals with autism;
- A training program for individuals with mental retardation;
- A program offered in the past by the Department for Social Inclusion of Persons with Disabilities which provided funding to people with disabilities to travel abroad to attend short-term training courses and workshops;
- Funding by the government of up to 80% of the cost of companies acquiring AT in the workplace for social inclusion of persons with Disabilities;
- Recently voted legislation, according to which Cypriot schools should provide AT to all students who need it.

The end-users from Finland gave as an example of good practice programs which encourage train elderly people in ICT-AT through “*slow and individual guidance*”. The end-users from Italy cited only one example of “*best practices*” - formal learning activities on ICT and ICT-AT offered for free for people with disabilities. No examples of best practices were provided by end-users in the UK and in Macedonia. Finally, in the

USA, the use of skilled peer mentors has been found to be very effective in showing new users methods and strategies for maximizing benefit from ICT-AT.

II. Educators'/Support Staff's Responses

Daily Life

Learning & applying knowledge

Access to and familiarity with ICT-AT solutions is considered by educators as a fundamental means for PwD to achieve important learning and developmental goals. They stressed the fact that technology makes disabled people's life "much easier, but also much more active and interesting". People with disabilities acquiring ICT-AT knowledge and skills "become much more independent, self-confident, and proactive", since "they can perform on their own activities for which they would otherwise have to rely on others" (Educator, Cyprus), and thus fully participate in society. Using ICT-AT can facilitate the fulfilment of a person's needs by "empowering them, helping them to gain independence, supporting them to communicate more effectively, and giving them more choice and control" (Educator, UK). The acquired knowledge and skills in using ICT, but also the improvement in attitudes significantly influence and facilitate disabled people's further education and learning:

"The students I work with like it more when they write on the computer themselves, rather than dictating to others what to write. Thus, they become more independent and able to cope when their attendant or parent is not around...this will help them later to cope with the demands of college-level education." (Educator, Cyprus)

"ICT-AT skills help PwD in the area of self-education or distance learning, because there are always in a particular state educational institutions offering education for different profiles. This supports education, which further offers more employment opportunities. These effects have already been observed in some of our beneficiaries." (Educator, Macedonia)

Educators and support staff working with the elderly stated that they do use ICT-AT with their clients (e.g. using it as a tool of memory rehabilitation by showing pictures of old times). However, they pointed out that learning new skills at an older age and with memory difficulties can be very demanding. Older adults are often a bit slow, and feel frustrated with ICT, because "for example, their family members of the younger generation tend to show them things too fast" (Educator, Finland). Respondents also emphasized that "for the older generation the terminology that is used in the ICT world is a "foreign language": (what is 'enter')?" (Educator, Finland). However, the respondents felt that these people in the 75+ age group may be the last cohorts of elderly people without any ICT-skills coming into their services and that in

a few years' time the majority of the older adults will have at least basic skills upon retiring from working life.

Educators and support staff stressed the need to be comfortable themselves with ICT-AT, in order to be able to effectively train supported individuals in how to use it. They are personally also using ICT as a tool to get informed about advances in ICT-AT, and to find the right technology for PwD: *"Using ICT helps me to find a new piece of technology to enable an individual to lead a more independent life. It may enable an individual to carry out tasks that they couldn't do before – for example, to be able to tell a member of staff what they would like for tea, or it may enable them to have more home alone time"* (Support staff, UK).

Communication, Interpersonal interactions & relations

According to these educators, ICT-AT skills and knowledge facilitate communication, enabling PwD to effectively interact with other people. This, in turn, helps PwD to develop socialization skills and self-esteem, while at the same time having a positive impact on their learning: *"The children and adults I train learn how to use ICT-AT to improve communication with those around them. Through use of technology, PwD can interact, play games, participate in learning, develop socialization skills and improve their self-esteem"* (Educator, Cyprus). Educators from Italy, who worked with people with severe motor and intellectual disabilities, noted that for these individuals ICT-AT solutions are a fundamental means for achieving activities of daily life and that *"communication, in particular, would be impossible without any assistive solution"*. Another educator, from Macedonia gave the example of *"a student in a wheelchair electronically communicating with his professor instead of going to a meeting and facing many physical barriers"*, to stress the fact that use of AT, allows PwD to more easily interact with other people, and to *"equally participate in social life"*.

Interviewees also stressed that ICT-AT has made communication much easier, both for the staff members themselves and for the people they support. They feel that the ability of supported individuals to develop new relationships and to maintain existing relationships (especially with family) have both improved: *"Many of our clients explicated the need of being in contact with others and when you can no longer be physically active or visit your friends due to the physical limitations, the contacts are maintained by phone, skype or in some rare cases also by social media"* (Educator, Finland). Educators also stated that computers and smartphones have promoted their own communication with other colleagues and with their clients, making it easier to keep in touch with work contacts: *"I use face-to-face, verbal, non-verbal (hand gestures and can use Makaton), formal, informal, emails, phone calls, text messages and social media"*(Educator, UK).

A few of the educators pointed out that the extent of optimal ICT-AT use in the field of communication depends on factors such as the PwD's academic background, type of disability, and age: *"The benefits of assisted communication, however, vary from child to child, depending on the severity of the disability and the responsiveness of the environment"* (Educator, Italy). As mentioned by an educator from Macedonia, a person with autism that has difficulty in establishing communication and interaction, should often be encouraged to communicate in the real world than in the virtual world. Also, as pointed by Finnish educators, many older adults might feel hesitant to use computers and smartphones for communication, being *"afraid that the computers and smartphones etc. might replace human contact"*.

Education (formal, informal, non-formal)

Based on their experience, the interviewed educators have come to realize that while ICT skills are very important for the general population in the acquisition of new knowledge, from the perspective of PwD they are vital. ICT-AT helps to improve the quality of PwD's lives, and can have a very huge impact on their participation in education (formal, informal and non-formal), allowing them to more actively participate in the learning process.

In Cyprus, the two interviewed special educators' job revolves around training of children of children or adults in ICT-AT technologies. They perceive their role (as trainers/educators) in this context to be extremely important: *"I basically feel that I hold a young person's learning in my hands. It's not that this person cannot learn on their own, it's just that they need some device for support to do so...So, this means that, as their trainer, I should help them get acquainted with AT and come to appreciate how important they will be for their lives. Basically, it is like teaching a small child how to write using their pencil...how to hold the pencil in their hand, etc."* The two interviewed educators consider the role of formal education as being very important in terms of the development of ICT-AT skills both for the people who need it and for those around them. Although both of them have excellent knowledge of assistive technologies, they pointed out the fact that many other special educators in Cyprus have little or no background in AT at all. Thus, they believe that the Ministry of Education should offer training on AT to special educators and other support staff working with PwD, but also to their family members.

The educators from Macedonia explained that in their country, there are 31 primary and 2 secondary schools equipped with sets of assistive computer devices. Teachers working in these schools are trained in the use of ICT-AT in the classroom. This enables students who need AT to be identified and to be supported in the acquisition of skills and knowledge in using ICT- AT in the teaching and learning process. How-

ever, the educators pointed out, the rest of the schools and universities in Macedonia are not at all equipped with AT, despite being very well equipped with standard IT equipment, computers, internet connectivity, smart boards, etc. Similarly to their Cypriot counterparts, they also explained that only a small number of teaching staff are trained (educated) in the use of AT, as well as in the process of assessing the needs of students with disabilities for AT. They stressed the need for more specialists that can provide consultative and advisory work regarding ICT-AT, i.e. support in making the assessment of AT needs, adjusting workspace, and tracking achievements.

In Italy, the educators noted that formal education in ICT-AT is considered important, but that it is difficult to propose due to differences between different groups of PwD. For individuals with severe disabilities, they consider it very important for people in their environment to also receive adequate education on ICT-AT use and its potentials.

The support staff from Finland indicated that they had gained their own ICT-AT skills as part of their vocational education. According to them, courses for the elderly users are rare, if any. A few of their clients had participated in an evening class or similar provided by the local library or voluntary organisation. Some had earlier experience with ICT in their working life. The respondents explicated strongly that the education in ICT or ICT should be based on the needs of the users and not on technical details or very generic ideas. This means that the educator should know the person quite well to be able to concentrate on her/his individual needs and desires.

In the UK, all the interviewed members of the support staff were aware of basic ICT training courses being available through colleges. Two of the staff had themselves attended such college courses, with this being complemented by self-teaching and on the job training.

Employment

Work & Employment

Similarly to the interviewed end-users, educators also stressed the need for PwD to develop ICT-AT skills in order to effectively participate in the labour market, since *“modern trends in one society are in need for IT skills for almost any job or position”* (Educator, Macedonia). Possession of ICT-AT skills strengthens disabled individuals’ competencies and provides them with the opportunity for equal participation in the labour market. Using ICT-AT, persons with disabilities have the opportunity to look for job advertisements on their own, to prepare their applications and CVs, and to

apply independently. Also, they can meet the jobs' criteria that require knowledge of technology and computer skills.

At the same time, educators acknowledged that although possession of technological skills strengthens PwD's competencies and employment prospects, there are serious barriers to their employment which ICT-AT training and experience would not overcome, including the very limited number of paid job opportunities and the negative attitudes of employers towards PwD: *"There still seems to be a stigma attached, as employers feel that they may need to support the individual"* (Educator, UK). Also, many PwD tend to be employed in low skill jobs that do not require ICT skills: *"Most of the jobs that the people we support have (paid and unpaid) don't require ICT skills, as they are in shops, cafes etc."* (Educator, UK)

Educators also pointed out the need for companies to *"adapt their job descriptions and working spaces according to the needs of persons with disabilities"* (Educator, Macedonia), and to introduce AT tools and ergonomic aids. In addition to stressing the need for improving employers' attitudes and practices towards employees with disabilities, educators noted that *"it is important for employers to gain themselves knowledge about ICT-AT, in order to support the development of their disabled employees' skills, but also in order to satisfy the needs of their disabled customers"*. (Educator, Cyprus).

Economic life

The interviewees also referred to the positive impact of training in ICT-AT on disabled people's participation in economic life. They pointed out that by using AT, persons with disabilities are enabled to regularly engage in economic activities like monitoring their bank accounts, buying different products and grocery via the internet, arranging for travel, and paying bills using e-banking. This, they stressed, makes the life of PwD easier and allows them autonomy and independence in the decision making process. However, some of the educators also pointed out that the internet should become more accessible, for PwD to be able to use it more efficiently.

Community, social & civic life

Communication, Social life, and Recreation

The participating educators noted that training in the use of ICT enables and encourages e-inclusion of persons with disabilities. It provides significant opportunities for them to independently participate in society. The acquired ICT and AT skills and knowledge facilitate public involvement, as they allow a faster and easier way of getting certain information, facilitated communication and less dependence in realizing various activities. Recreation and leisure activities, in particular, were recognized by

the participants as areas in which PwD could benefit the most from ICT-AT use. ICT-AT is felt to be having a positive effect in allowing people to identify and get more actively involved in recreational opportunities of personal interest, and to often do so without the presence of another person for assistance: *“It makes the organization of time for recreation and leisure easier, with less necessity for the presence of another person (assistance)”* (Educator, Macedonia); *“It could enable an individual who struggles to communicate to make everyday choices”* (Educator, UK). Even the educators working with the elderly in Finland said that some of their clients use computer games (e.g. solitaire) and simulations for recreation: *“An old man living in supported housing had an application on his computer where you could plan and simulate a train trip through Europe. This old man used this application several times a week just to fill his days with something interesting and fun”* (Educator, Finland).

At the same time, the educators drew attention to the fact that there are still several issues related to accessibility that limit PwD opportunities for entertainment. As an educator from Cyprus pointed out, development of ICT –AT skills, affects PwD’s participation in social life in positive ways only in cases where the virtual and/or physical environment offering the entertainment is accessible for them: *“In movie theatres, if the screen used does not suit a person with visual and/or hearing impairment, then this person won’t be able to watch a movie.”*

Finally, there were a couple of educators (from Macedonia and the UK) who, despite being very enthusiastic overall regarding the benefits of ICT-AT, did raise a caveat over a possible negative impact – the possibility of excessive attachment to ICT-AT and its use that might lead individuals to spend less time engaging with people on a face-to-face basis.

Political life & citizenship

The respondents considered the provision of opportunities to build knowledge and skills in ICT-AT as a human right of PwD, since all humans should have the right to access and take advantage of the tools and information offered by technology: *“Access to information and accessibility are rights defined in the Convention on the Rights of Persons with Disabilities. One of the conditions that define the accessibility and availability of information is the use of ICT- AT”* (Educator, Macedonia). Training of PwD in ICT-AT, they pointed out, promotes equal access to education and opportunities: *“Training in ICT-AT enables PwD to fully participate in modern society, and to coexist with people that do not have a disability... instead of a person holding a pencil to write, he/she uses AT, or instead of using his mouth to speak, she uses her AT. “* (Educator, Cyprus).

Training in ICT-AT also facilitates communication for PwD, and promotes their political life and citizenship by providing them with information (e.g. by reading electronic newspapers, watching documents etc.). According to the Finnish respondents, for example, ICT was used by the senior PwD they worked with for following the news, reading newspapers, and watching documents from Areena (a service by the broadcasting company where TV and radio programs are saved and can be watched later for a certain period of time). ICT-AT also provides tools for PwD to express their political views (using social networks, blogs, forums etc.), to contact or become members of political and/or civic organizations, and to exercise their electoral rights.

General Barriers/Opportunities

The interviewees in Cyprus, the UK, and Macedonia stressed the need for more training programs targeting PwD: *“The biggest challenge is to empower people who have not had the opportunity to use a computer to do so and to ensure they become confident in using it”* (Educator, Macedonia). Support staff in the UK, for example, felt that the main barrier for the use of ICT/AT is training and encouragement to allow people to acquire the basic skills to get started: *“Everything is on the internet, but you need to have basic IT skills just to get on there”*. Suggestions for improvement included having more training opportunities (and in particular for people with learning disabilities, use of face-to face-training and specialized training courses for people with learning disabilities).

Participating educators emphasized the need for the provision of training targeting not only PwD, but also other people in their environment, including trainers, support staff, and family members: *“If a student can use the AT, but if his teacher is not familiar with this technology, then it will not be used at school. So it depends ... the person can have the skills to use AT but if people in their environment do not know how to use it, this is a barrier for the disabled person to use the device effectively”* (Educator, Cyprus). The lack of qualified educators who can provide targeted ICT-AT training based on the individual needs of disabled people were mentioned as a barrier by the Cypriot and Macedonian interviewees.

In all participating countries, interviewees also mentioned the lack of AT devices and the high cost of acquiring them as major obstacles to the promotion of the education of PwD in ICT-AT: *“Even when you have the skills, but cannot afford to buy a computer or smart phone makes keeping up the skills difficult.”* (Educator, Finland). Participants stressed the need for *“more funding to help overcome this constraint”* (Educator, UK).

The fear of some end-users towards technology in general, and their resistance towards the use of ICT-AT in particular, was also indicated as a barrier. What was pointed out, however, is that *“it is important to respect the wishes and interests of the person you train (educate), as well as his/her aspiration to work with a specific device”*, and that *“there is no need to force use of certain AT, if the person you work with does not accept it”* (Educator, Macedonia). Finnish participants, for example, who provided support to the elderly, explained that *“the older generation do not seem to be interested in using the technology but are happy as they are”*. As they explicated, their clients *“do not feel excluded from society, and definitely not excluded because of not being able to use ICT; they simply have no need for using ICT-AT.”*

General Best practices

There were no examples of best practice mentioned by the interviewed educators in Cyprus, Finland, and Italy. On the contrary, Macedonian educators gave several examples of good practices:

- Example 1: Preschool kid with hemiparesis works uses trackball and switches while using educational software. At the beginning he used touch screen only.
- Example 2: Girl with cerebral palsy became literate with the help of ICT-AT. She does her homework on a computer.
- Example 3: High school girl with severe physical impairment works on development of educational software with the use of assistive device. She successfully passed her final exams last year using assistive devices.

Examples of good best practice were also described by support staff in the UK:

- Personalised technology awareness training (from Hft)
- Training on use of technology (from Tunstall)
- Computer sessions arranged for supported individuals
- Staff making informed choices on suitable IT equipment, to best meet the needs and capabilities of supported individuals.

III. AT Providers' Responses

Daily Life

Learning & applying knowledge

All of the providers stressed that *“use of ICT-AT is necessary in modern life.”* They all felt that ICT-AT was able to have a massive impact on the lives of individuals with disabilities, helping them to independently manage and organize several aspects of daily living from relationships to health services, and to more successfully participate

in education and in the labour market. They pointed out that when PwD are proficient in ICT-AT use, *“they can more easily survive on their own, go to universities, live more independently, move around etc....the more ICT skills they have, the better access they have to happenings in society.”* (AT-Provider, Cyprus).

Use of internet technologies was hailed as *“opening access to new information, support, communication with other people with similar problems, involvement in online communities for the exchange of information, ideas and support”* (AT-Provider, Cyprus). Mobile apps and web tools were mentioned as playing *“a key role in helping to explain products and services to individuals with disability and/or their families and other carers in a way which helps them to make an informed choice about what is best for their needs»* (AT Provider, UK).

The AT providers noted that availability of assistive technological products and services is critical for the development of ICT-AT competencies in people with learning disabilities. At the same time, however, they pointed out that ICT-AT availability is not a panacea, and that PwD need to learn how to properly use these technological tools, *“otherwise they might use them in a wrong way and get very little out of it. Getting educated in the proper use of technology is necessary”* (AT-Provider, Cyprus). Motivation was also indicated as a fundamental prerequisite for learning. It was stressed that, in some instances, technology might actually have a negative impact on learners’ motivation. This was considered particularly true in cases when technology is difficult to use or does not meet the real needs of PwD. To avoid this, respondents stated that AT providers’ focus and commitment should be on ensuring that *“technologies are designed in such a way that they can be used by all populations”* (AT-Provider, Cyprus). The key, according to the respondents, is the adoption of a *“user-centric design”* (AT-Provider, Finland). ICT or ICT-AT should be developed based on user-needs and requirements, and should demand as little technical knowledge as possible from users (e.g. they should not assume that the elderly persons using them have ICT skills). ICT-AT should guide the user and help him/her to adapt to the surroundings of technology without even knowing that it is there. According to Finnish interviewees, if ICT or ICT-AT demands a lot of know-how from end-users then *“this is a flaw of technology”*.

Cypriot AT providers again reiterated the serious accessibility issues currently limiting e-inclusion of PwD: *“There have been some issues, for example teaching about accessibility and universal design, and the class you teach not being accessible ... I think it's a bit insulting to a University to do this... or to teach Web accessibility, but your website not being accessible”*.

Communication, Interpersonal interactions & relations

All the AT-providers stressed the important role of technology as a means for facilitating communication and interpersonal relationships with other PwD, but also with support staff: *“Communication is one of the basic needs of humans. By assisting communication through our ICT/AT, we are fulfilling a basic human daily life need”* (AT Provider, UK). Communication solutions offered span from special input devices (e.g., switch) to more high tech devices (e.g., eye trackers). The impact of these technologies on communication activities is high, especially *“considering the fact that in many cases ICT-AT represents the only means for communication”* (AT Provider, Italy). As the communication between supported individuals and their carers improves, so are the relationships between them able to develop. By enabling communication between supported individuals and carers, the needs of supported individuals are better met. Being able to see benefits for the individuals they support *“can be a powerful boost for staff morale”* (AT Provider, UK).

Two AT providers from Cyprus referred to the benefits of PwD becoming members of online communities of disabled people with similar problems, at the national or international level: *“PwD can find other people with similar problems, discuss with them freely, have the ability to get support from people who understand their problem”*. Participation in such online communities was considered especially useful for people who might not be able to get local support due to the fact that their disability is not very common: *“Given that we live in a very small country, for some rare types of disabilities there might only be a few cases in Cyprus. These individuals can get support from people abroad that have similar disabilities, thus becoming members of a larger family.”*

Despite the benefits of social media for PwD, AT providers again mentioned that there are still some issues of accessibility limiting the participation of PwD in communication and collaboration networks and that more effort should be made so that social networks, and other communication media become more accessible: *“Twitter or Facebook, for example, are not accessible by PwD that use a switch, so the developers of these websites, but also websites such as governmental portals should become accessible”*(AT Provider, Cyprus); *“If the technology is demanding new skills and e.g. physical abilities from elderly that do not have these skills or abilities – this leads to restriction of participation in society”* (AT Provider, Finland).

Education (formal, informal, non-formal)

Although acknowledging that *“technology is not a panacea that will solve all the problems of a student with disabilities”* (AT-Provider, Cyprus), the AT providers

stressed that the acquisition of digital skills is extremely important for PwD, and particularly for children and young adults: *“Technology will definitely give the child access to adequate academic resources, and will help them develop skills that will allow them to successfully proceed from elementary to high school, and then to higher education.”* (AT-Provider, Cyprus). The AT providers stated that there seems to be a direct link between the availability of technology (products and services) and the development of ICT-AT competencies: *“Increasing availability will surely improve take-up and involvement, if appropriately used”* (AT Provider, UK).

In defining their role in the development of ICT-AT skills in formal and non-formal education, the AT providers portrayed themselves as facilitators and partners, working on co-design and supportive training. For example, one of the British providers (working on communication tools) explained that their product had very specific benefits in helping the educational development of individuals: *“It enhances health literacy, communication and vocabulary skills (pictures matched with words). Easier access to technology enhances digital inclusion”*.

Participants noted that AT providers should not be involved in the provision of training, unless they have specialized knowledge: *“We, as a company, specialize in another aspect. We will not get involved in training. Although we’ve been approached to offer training, we refused because this should be the responsibility of schools, training centres, or universities or colleges, who have the resources and expertise to provide training”* (AT Provider, Cyprus); *“The manufacturers or ICT producers should not be the ones educating elderly alone, the education should be planned and carried out together in multidisciplinary teams. The professionals that are involved with elderly are more qualified educators than the ICT producers”*. (AT Provider, Finland)

One of the Cypriot interviewees discussed the role of government in the education of people with disabilities in ICT-AT. He stated that the government’s role should be coordinating, at the policy level, to ensure that all the stakeholders involved in the provision of ICT-AT training do it properly, and that all PwD have access to high quality education in ICT-AT. According to this respondent, *“the government can fund training, can fund programs, but it should not necessarily offer them on its own”* (AT Provider, Cyprus).

Respondents also stressed that offered training activities should be *“tailored to the needs of PwD in so far they group together competences in both technology and disability”* (AT Provider, Italy). They also pointed out the need for training opportunities for the educators and other individuals in the disabled person’s environment: *“Individuals involved with ICT education of elderly should be educated in the organisations that work with elderly”* (AT Provider, Finland).

Employment

Work & Employment

According to the AT providers, the labour market requests the same competences from PwD to those requested for people without disabilities: *“It requires skills in using digital devices and electronic content, software for improving productivity (e.g., Office) and organizing activities (e.g., calendars, email)”* (AT Provider, Italy). Thus, knowledge of technology improves the employment prospects of PwD: *“Knowledge of technology allows PwD to run, for example, an online shop or to offer services. If you’re a graphic designer and have impaired mobility, you can do most of your work at home”* (AT Provider, Cyprus).

AT providers stressed that the development of ICT-AT skills does not suffice for PwD to successfully enter the labour market, due to the discrimination that they encounter: *“Someone can acquire terrific skills, get the best education possible, learn to use computers proficiently, have the required competences, but he or she would find it extremely difficult to get a job, especially in the private sector ...”* (AT Provider, Cyprus). This seems to be an issue at an international level as well. Such considerations have been reported by Macedonian participants, as well as by experiences in the USA. More particular, the USA third party partner of ENTELIS reported that an ongoing issue in the USA remains social isolation in the workplace when perceived by peers and co-workers as being “different.” While technology skills can equalize competencies, they sometimes have the potential to further separate PwD when they use more or specialized devices.

Economic life

AT providers pointed out that the development of ICT-AT skills also facilitates the participation of disabled people in economic life and increases their autonomy. However, they again highlighted the fact that the internet should become more accessible, for PwD to be able to use it more efficiently. Moreover, as was highlighted by a respondent from Italy, while using ICT-AT solutions for bank operations may be a facilitator for young PwD, for the elderly this solution might represent a barrier that increases exclusion.

Community, social & civic life

All of the AT providers felt that ICT-AT can lead to at least some improvement in community involvement for disabled individuals through enabling greater access. ICT-AT enhances participation of PwD in societal activities such as *“going to a restaurant, going on a trip, participating in a social event, shopping from a supermarket,*

being able to read the menu to order in a restaurant” (AT Provider, Cyprus). It allows PwD “to be actively involved and able to express their own opinions and desires” (AT Provider, Italy). One AT provider from England also felt that the improvements in mental wellbeing accompanying ICT-AT use by PwD (ICT/AT making communication better and reducing anxiety levels), can make individuals more positive and more motivated, giving them greater confidence in becoming involved in community activities. In Cyprus, AT providers noted that PwD tend to be isolated at home, and thus the ability to use technology provides them a chance “to get out of that restrictive space and to engage in social activities”.

On the other hand, AT providers from Finland pointed out that the use of ICT can actually narrow the participation of PwD in community, social and civic life, if such participation requires ICT skills that an individual does not possess. Therefore, the AT providers indicated the need for creating ICT and ICT-AT that is more ambient assisting and better responds to user needs. AT providers in Cyprus stressed the fact that knowledge of ICT-AT is not adequate and that several other serious barriers, including accessibility and prejudice against the disabled, prohibit the effective participation of PwD in Cypriot society. As they pointed out, *“PwD may know how to use technology, but in practice the State’s infrastructure in terms of roads and facilities is a huge problem”* since there is lack of accessibility of sites and natural areas. According to one of the interviewees, *“Cyprus is completely inaccessible as a country”*. It lacks public transportation that is accessible, and *“even when buses are accessible, it is practically impossible for a disabled person to reach the bus stop on their own since the streets are not accessible.”* Greek websites, both private and public, are also inaccessible. According to another AT provider, *“in Cyprus disabled people have equal human rights compared to the rest of the citizens only in terms of education. From there on, you will find out that nothing is equitable... PwD not only have very limited employment opportunities, they are also at a disadvantage when it comes to social and recreational aspects.”* However, another AT provider described a positive example of promoting disabled people’s participation in recreational activities. Specifically, she explained that *“in some beaches, the authorities have put wheelchairs that disabled people can use to move in the sand, and so be able to go swimming.”*

In all participating countries, AT providers felt that access to and effective use of ICT-AT also had the potential to improve the participation and involvement of PwD in political life and citizenship by enabling them to get actively involved and to express their own opinions and desires. One British AT provider suggested that further developments in communications might be possible to convey messages, and allow more informed voting by people with learning disabilities. One felt that accessibility may be improved through mobile/web technologies. In Cyprus also, AT providers again mentioned accessibility as an obstacle to the participation of PwD in civic life.

Moreover, they noted that there is prejudice in Cypriot society against the involvement of PwD in politics: *“There is still lots of prejudice... it is extremely difficult to convince many people to vote for you because you are capable, not just because you're blind or handicapped.”*

General Barriers/Opportunities

A number of barriers to developing ICT-AT competences have been cited by interviewees, most of them related to access and accessibility of digital technology. Finnish AT providers pointed out issues related to product design: *“ICT & ICT-AT developers and producers are still too far away from real life and the users are seen as buyers. The technology should be seen as a servant!”*. In England, possible barriers highlighted by AT providers which might inhibit the development of ICT/AT competencies for people with learning disabilities were lack of a clear design framework, complexity and linguistic issues, as well as non-inclusive workflows that hamper implementation. In Italy, old infrastructures were cited as a major barrier prohibiting access of PwD to ICT-AT. In Cyprus, AT providers mentioned language issues: *“Since most devices are developed for widely-spoken languages ... English, French, Italian ... they have to be adapted for Greek speakers and this causes lots of problems, e.g. when scanning text”*. Additionally, Cypriot AT providers referred to financial constraints, which have now worsened due to the economic crisis in Cyprus, highlighting the high cost of AT acquisition, maintenance and training. They also mentioned various accessibility issues in both physical and virtual space.

Another serious barrier inhibiting the development of ICT-AT competencies for people with disabilities cited by AT providers in Italy and Cyprus, are the negative attitudes of society towards PwD, and in particular the attitudes of the people in the disabled person's immediate environment (trainers, teachers, parents, siblings, classmates), but also the negative attitudes of some of the disabled persons themselves towards technology. Providers in the USA also cite these factors as major barriers. They highlight the importance of training in social and communication skills as well as the development of technology competencies.

The lack of available opportunities for high quality training of PwD, especially *“older people who tend to know very little about technology”*, also hampers the development of ICT-AT skills of PwD according to AT providers in Cyprus. In Cyprus, as AT providers pointed out, there is also lack of qualified trainers, and lack of training opportunities in ICT-AT targeting special educators, support staff, and parents. At the same time, they again stressed the fact that knowledge of ICT-AT is not adequate since there are several other serious barriers to the participation of PwD in Cypriot society, including accessibility and prejudice. For example, the fact that many insti-

tutes in Cyprus offering ICT training are not accessible for some groups of PwD was indicated as a barrier.

Despite the abovementioned barriers, it was felt by the interviewees that these problems were not insurmountable and might be overcome. They made several suggestions as to how this could happen. British AT providers felt that design issues hampering accessibility of ICT-AT products *“could be overcome by having a clear structured process for service redesign and for product and service development”*, while implementation could be improved through better management of innovation *“so that both staff and supported individuals welcomed the ICT/AT being introduced, rather than it being forced upon them.”* In Cyprus, AT providers noted that a change in attitudes towards disability *“can be achieved through provision of information to the public, and the organization of various events in which politicians should be invited to attend since they are the ones defining new legislation and policies.”* This would help the society as a whole to become more accepting of diversity and disability, and service and product providers *“to realize that whenever they produce or develop something, they should take into account people with disabilities.”* Cypriot AT providers also stressed that schools have to play the biggest role in changing the society’s attitudes towards PwD, through educating young people to accept diversity. They also stated that for children with disabilities to be truly integrated into mainstream schooling and educational processes, schools should become capable of providing technical and practical support to these children, and effective training in ICT-AT. The lack of training opportunities for teachers, parents and other people around PwD could be resolved through the establishment of training centres and the offering of various seminars by highly qualified trainers.

General Best practices

When prompted to provide examples of best practices, Cypriot AT providers’ comments were very pessimistic, describing the grim reality facing students and other persons with disabilities in Cyprus. In particular, they described the educational system in Cyprus as being very conservative and as lacking examples of best practices and innovation. One of the interviewees noted that the most successful cases of students with disabilities in relation to technologies, is when a systemic approach to the development of their ICT-AT skills is adopted - collaboration among specialists, school, school and family, starting from a young age: *“To my mind come a few students who were given the opportunity to have access to technology from a very young age ... students who had become acquainted with technology... from kindergarten, or from very early primary school, who had support from their school and their home environment”*. However, this interviewee went on to add that this synergy is rarely witnessed in Cyprus due to the lack of resources and support systems.

By contrast, AT providers in England mentioned several examples of best practice including the following:

- Mi smarthouse (a virtual tour demonstrating products and services)
- Hft technology shop (simple website enabling carers to view and purchase products)
- Lincus (YMCA Liverpool pilot study for individuals with multiple and complex needs)

The two ICT-AT developers/providers from Finland mentioned a future idea, that of an alarming wrist band: *“If this would be linked to a wrist watch, and looks like one – user would not know the difference and education would not be needed when the ICT would be reacting to those things that would be relevant to the user’s safety and health.”* This was echoed in the USA with the addition that the community participation of some with behavioral disabilities requires adding facilitators who can build bridges to full inclusion by providing necessary and appropriate training and supports for behavioral control and that this can be provided in part by technology prompts and cues.

6. Conclusions & Suggestions

Data from European and International statistics, as well as data from various projects and empirical studies report that people with disabilities of all ages and their carers (personal assistants, carers, educators, etc.) have personal experience with ICT and ICT-AT, but at the same time face difficulties and challenges in the effective use of technology, such as lack of sufficient skills and knowledge to effectively participate in the digital society and to contribute to the reduction of the socio-economic digital divide. This fact constitutes a problem, as ICT and ICT-AT play an essential role in education and in the transition from education to employment and further career development.

Digital competence is further fundamental for participation in social, cultural and political life: to “stay in touch”, to access public services as well as to take part in culture, entertainment, leisure and political dialogues”. At policy level, the issue is further pushed by the UN Convention on the Rights of People with Disabilities that in various articles refers to the role of technology to support participation, access and equal opportunities. Also the European Union (Commission and Parliament) has come to the conclusion that action is needed. The first Area of Action of the EU Disability Strategy 2010-2020 addresses Accessibility and reads: “EU action will support and supplement national activities for implementing accessibility and removing existing barriers, and improving the availability and choice of assistive technologies.” In addition, with regards to education, new online technologies, virtual reality envi-

ronments and educational games, as well as mobile technology further enhance learning opportunities, but at the same time require coping skills at all levels: policy level, pedagogical level, learning programme level, teacher-learner interaction level.

Taking into consideration the above, the ENTELIS project aims at primarily reflecting on the impact of changes in all levels, on the participation of people with disabilities and elderly in the educational realm of life and on their perceived level of confidence, efficiency and adequateness (quality of life). Changes in the availability of technology, demographic changes, the political agenda and changes in education are incorporated in a holistic model able to describe scenarios and to outline roadmaps towards future objectives related to digital skills development of vulnerable groups.

Consequently, results of the literature review, the interview data analysis, and experiences collected at this stage of the project helped us to identify the main issues concerning the needs and views of various groups of PwD and older adults, as well as identifying the major barriers in relation to equal participation in the digital society and development of digital literacy and competencies. The main outcomes are summarized here:

Firstly, an overall theme emerging from both the literature and the interview data analysis is the vital role of AT for independence, social integration, educational success, employment opportunities, and overall quality of life of PwD. All interviewees (end users, providers and trainers) agreed that the use of ICT-AT has expanded the learning opportunities for many learners with disabilities of all ages and has the potential to help PwD fully access, participate and communicate in educational and social environments. This is largely supported by previous research and literature, indicating the positive impact of ICT-AT on disabled people's participation in life situations (Braddock et al., 2004; Alper & Raharinirina, 2006; Moisey and van de Keere, 2007).

Nevertheless, a number of challenges are also identified, which include the digital divide and the lack of ICT-AT competencies of PwD and older adults. For example, a number of studies indicate that even with the many forms of assistive technologies that are available, a great percentage of devices (some even mention a 35% of devices) (Dawe, 2006) are abandoned shortly after their introduction for use as communication aids. This is also supported by data provided by the US partners, indicating that *"for 30 years we have used a 30% ATD non-use or abandonment rate. It is unlikely that the stability of this figure is due to the lack of product options. It is likely that it is a result of the means by which products are obtained, that is the assistive technology service delivery system"* (Scherer, 2014, p. 1). Technology abandonment is also one of the barriers and considerations expressed by almost all interviewees of the research study of ENTELIS. Very often in educational settings, students with dis-

abilities and their teachers are underutilizing the AT available to them (Mavrou, 2011). Reasons for failed AT adoption often include a failed understanding of what the technology actually does, why it should be helpful and uncertainty about how to use and configure the technology (Dawe, 2006; Cahill et al., 2007), which is highly related to ICT & ICT-AT competencies and confidence to use technology. This seems to be particularly true when technology has a high learning curve that makes its adoption difficult. Nevertheless, portability as well as high cost of AT are also identified as major barriers to adoption and usage of AT, by both literature (Bigham et al., 2008) and interview participants of our research study. In addition, evidence from literature review (Boström et al., 2013; Greenhalgh et al., 2013; Peek et al., 2014) and interview data (i.e. data from Finland) indicate that failure of ICT and ICT-AT adoption is even higher in older adults, who seem to be more resistant to the acquisition of digital skills and the acknowledgment of the benefits of ICT-AT.

Nevertheless, a general heterogeneity in the way technology is accessed and utilized has been observed among the different groups of PwD. For example, individuals with visual impairment (data from Cyprus and examples from Germany⁹) seem to have more positive experiences in ICT-AT education and learning (and probably better access to resources), than other groups, such as people with cognitive and intellectual disabilities (Braddock et al., 2013; Symeonidou, 2015) or people with physical disabilities (data from Macedonia). Even though interview data across groups are not actually comparable, due to other variables such as country, policies, culture etc., these differences are often supported by the literature, and sometimes linked inconsistencies in legislative provisions and policies, even within the same countries. In some cases, such differentiations may be considered (among others) a result of the lack of collective disability activism and an absence of collective identity (Symeonidou, 2009) when it comes to influencing policies and vindicate rights. For example, as Braddock et al. (2013) point out, individuals with sensory disabilities and their advocates have promoted the benefits and adoption of ICT access for their constituencies much more intensely and effectively than other types of disabilities. Hence, there seems to be a wider range of possibilities offered for people with sensory disabilities (particularly VI), especially in the ICT area (ANED 2010-2014 reports).

Difficulties also seem to exist in learners' transition from secondary to higher education. The research available is limited and outdated, but it appears that there is a missing link when students with disabilities transit from high school to post-secondary education. Often, these students enter college "unprepared for the demands of postsecondary education" (Getzel, 2005, p. 70), and thus experience a dramatic educational transition from high school to tertiary education. The transi-

⁹ Vocational training for blind people and visually impaired, example for the German labour market, 80% placement rate (www.blista.de)

tional issues are, among others, attributed to the change in how students are accommodated in high school vs. higher education in relation to the use of ICT-AT. In higher and postsecondary education ICT and ICT-AT competencies seem to be much more essential for the effective use of technology for helping learners with disabilities to succeed (Mull & Sitlington, 2003). Such differences in the various educational settings are also highlighted in interview data from trainers/educators, in the aforementioned results in this report.

Implications for further research

The majority of research in the assistive technology community has focused on users of assistive technology - primarily on their use of technologies, but also on choices made in adopting or abandoning assistive devices. However, people with disabilities may have complex reasons for not using assistive technologies, some of which have not yet been adequately explored including lack of ICT-AT competences. Consequently, even though existing studies on AT adoption and abandonment highlight general themes on this issue, they also indicate current literature's limitations and the need for further research. Hence, the actual underlying process involved in technology adoption/abandonment should be further investigated together with the identification of potential interventions to prevent rejection, especially in relation to the digital divide and digital literacy. To more effectively succeed in this kind of research there seems to be a need to observe learners in every educational (and not) setting, i.e. formal, non-formal and in-formal learning environments. Additionally, partnerships and collaboration among teachers/trainers, families, service providers and researchers is considered important.

More research on the social consequences of assistive technologies is also needed, since overcoming these social barriers may depend on their success. Compared to traditional assistive devices, the use of mainstream technology (e.g., smartphones, tablets) has shown more acceptance and increased perception of independence in social contexts, also relevant to issues of Universal Design (Emiliani, 2006; Foley & Ferri, 2012). As the concept of disability is changing worldwide, research on ICT-AT competences can also be reinforced if it turns into determining potential benefits of bridging the digital divide for both the disabled and non-disabled communities. Such efforts must be sustained to foster the idea that assistive technologies are more than a specific product with a narrow market and financial burden for manufacturers, but a tool for supporting human rights, and enhancing communication and participation. For example, technology developments such as audio or visual aides in crowded areas – vital to sensory impaired individuals – have facilitated a very effective method of information dissemination among the non-disabled as well (Baker & Bellordre, 2004). Further to this, and based on the same argument of the increase of mobile

(mainstream) technology use by PwD, it is also suggested that future research can investigate the impact of the use of mobile technology on the development of digital skills. The accessibility features integrated in new mainstream technologies, such as mobile devices are assumed to benefit PwD (Arrigo & Cipri, 2010; Kuznekoff & Titsworth, 2013), and probably reinforce ICT-AT competencies. Nevertheless, there is not yet any specific research evidence on this, and hence further research is needed.

In addition to the above, and in relation to the use of new technologies by PwD, it is suggested that further research should look into the use of social media by PwD. For example, comparative studies on access to ICT-AT and the use of social can provide important data on the impact and need of ICT-AT competencies by PwD in the technology era, and in the new methods of communication and interaction

Furthermore, since access and utilization of technology, as well as competence development does not seem to be homogeneous among the different groups of PwD, there may be a need to specifically investigate the factors for this, as well as the needs of each particular group towards ICT and ICT-AT learning experiences. Other factors, such as societal and family systems can also be considered as influential factors for further research.

Since transition from one setting to another (e.g. secondary to higher education, education to employment) seems to be highly relevant to ICT-AT skills, future research could focus on mechanisms of reducing barriers and improving facilitators for the acquisition of digital competencies according each individual's personal and/or career needs and aspirations.

Finally, statistical information on the usage, benefits and digital skills in relation to ICT-AT by PwD of all ages do not seem to exist in a comprehensive and holistic view. In other words, there is lack of a coherent international and/or European study that would provide numeric and other experiential evidence on the dimensions and impact of the digital. Hence, it is recommended that statistical agencies as well as international research and European associations and committees should be involved in further investigating the digital divide in relation to PwD of all ages, and provide a clearer mapping of what and how, in order to help further other organizations and networks to undertake action.

Implications for policy and practice

Besides implications for further research, from the literature review, the interview data and the collection of experiences at this stage of the project, the following implications for practice and practice emerge:

The need for increasing awareness: Because of the inefficient and ineffective dissemination of information regarding available ICT and ICT-AT solutions and the opportunities offered by them for activities and participation, the lack of knowledge on products and user strategies and methodologies continue to be a barrier to the effective delivery, usage and understanding of such technology. The outreach and awareness opportunity is vital to successful utilization (Baker & Bellordre, 2004). In addition, awareness among PwD of all ages, as well as their families and caregivers will reduce resistance (especially for older people) and increase interest in the acquisition of digital skills.

The need for professional development of teachers and the training of parents and other informal caregivers: Professionals in higher education need to take responsibility for ensuring that pre-service teachers are exposed to many AT devices and are aware of the benefits afforded to students who use them. Additionally, the level of support and training teachers and the individuals using the devices receive is pivotal to the success of the individual and his or her AT goals (Day & Huefner, 2003). Educators, assistants/carers, families and learners often do not realize the true potential of assistive technology, usually because of the lack of training and inadequate digital skills. Studies suggest that lack of family involvement may lead to misuse and disuse of ICT-AT (Alper & Raharinirina, 2006; Zabala & Carl, 2005). In formal education, institutions are then responsible to provide training to all concerned in order to get PwD to use the technology effectively and enjoy its benefits (Alper & Raharinirina, 2006). There for, the need to develop strategies, curricula and policies for the enhancement of PwD's education on ICT/ICT-AT competencies is stressed beyond the education of PwD alone. The implementation of such strategies towards the improvement of quality of life of PwD is highly relevant to the involvement of other stakeholders as well. Outcomes and experiences from best practices reported here (e.g. USA skilled mentors showing new strategies), provide good evidence of how education and training of family and support staff can be effective in maximising the benefits of ICT-AT competencies and use.

The need to reduce the gap in the transition from secondary to higher education: Since modern university life requires students to be self-reliant and digitally competent, families and educators need to provide students with opportunities for independent decision-making, and self-advocacy prior to the transition to higher education, and also with opportunities for self-directed ICT-AT skills development, which can be applied in real situations and not only assessed in ICT certified programs with no practical match.

The need to improve access to technology: This issue is twofold. On one hand, disability policy on technologies needs to be reformed towards the design and availabil-

ity of both assistive and accessible mainstream technology to PwD of all ages. For example, increasing access to assistive and universally designed telecommunications (Baker & Bellordre, 2004) can affect the need of PwD and older adults to acquire ICT competencies in order to be benefited by the use of such technology. On the other hand, access to technology is absolutely necessary for learning and practicing ICT-AT, in all educational settings (formal, non-formal and in-formal). Training programmes are usually doomed to failure if learners do not have access to the technology they are trained to use. For example, Dawe (2006) noted that learning how to use ICT-AT may sometimes be hindered, in cases where the same technology might not be available at home and school, or a different interface might be present.

The need for more inclusive design: The design of the technology is known to be important for successful technology education, training and use, especially for older adults and people with cognitive disabilities (Cahill, Begley, Faulkner & Hagen, 2007). Technology is often developed and designed by younger adults and therefore it may not always meet the needs of older adults; older adults are thus at increased risk of being left behind (Eisma et al., 2004; Dawe, 2006). Studies highlight that the key element in ICT-AT products' design must be simplicity/AT configuration, and while maintenance should also embrace simplicity. Designers and engineers should improve accessibility features on current mainstream devices/mainstream technology, to ensure they have accessibility built-in, i.e. are inclusive. When this is not feasible, assistive devices should incorporate cutting edge technologies that should address function, usability, portability, and cost, as well as aesthetics. As highlighted by the experience and research in the USA very specialized technology may on one hand offer great potential in education and employment, but on the other hand it may lead to segregation in particular cases.

The need to involve all relevant stakeholders: Besides family (and family training) mentioned above, it is important to include other stakeholders (providers, trainers/educators, policy makers) in research and design processes in order to obtain a set of rich perspectives and insights about the people involved in the selection of ICT-AT, as well as in the design of ICT-AT training and education programmes (Eisma et al., 2004; Orpwood, 2009).

Implications for the ENTELIS project and the way forward

In general, the aforementioned implications for research, policy and practice provide valuable input for the future work and sustainability of ENTELIS and its established network. First of all taking into account the considerations on the heterogeneity in the opportunities for digital skills development in various groups of PwD of all ages, the network could explore further possibilities, and get involved in suggestions for training/education programmes customized to needs and users in various groups. A

more universal approach to this (e.g. a certificate cross-country programme offered in ICT-AT selection, provision, and training) with the involvement of the ENTELIS network could be a further approach/suggestion. Although other projects (e.g. ViPi, ATLEC) have been involved in ICT-AT competencies curriculum development, it seems that there are still perspectives that need to be addressed. To this end, two strategies are suggested: (a) invite trainers/educators in the network and (b) explore possibilities for less involved groups of PwD, but inviting representative in the network and involving them more in the forthcoming project activities. Living Labs of WP5 may offer a very good setting for targeting these two strategies and discuss further the main issues raised in interview data and the literature review.

In terms of implications in policy, the work and outcomes of the ENTELIS project could be developed into position papers, which can be disseminated to partners' and other countries stakeholders with specific suggestions and opportunities of open dialogue on strategies. This may help to the involvement of more relevant stakeholders and influence policy and regulations on availability of training programmes and funding, as well as inclusive design of technology *per se*.

Finally, it is important to highlight the reinforcement of the dissemination activities of ENTELIS, since awareness is one of the major issues raised in all data, experiences and literature collected. Dissemination for both public awareness and more specialized audience (e.g. stakeholders, end-user organizations, trainers etc) awareness is essential. Thus, further to the aforementioned involvement of specialized groups in the Living Labs, it is also suggested that the ENTELIS network should be involved in setting up short recommendation papers and other dissemination activities to: the general public, in order to improve awareness; to academics and research/statistical data bodies in order to improve research; to industry and designers/developers in order to improve the market; to professionals, in order to improve practice; to end-users, in order to improve skills; and to policy makers, in order to improve policies.

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