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The right to freedom to express and to seek, receive and impart information and ideas through any media and regardless of frontiers, is a legal entitlement under human rights legislation (see the Universal Declaration of Human Rights, [http://www.un.org/en/documents/udhr/index.shtml\\_article\\_19](http://www.un.org/en/documents/udhr/index.shtml_article_19), and the European Convention on Human Rights [http://www.echr.coe.int/Pages/home.aspx?p=basictexts&c=article\\_10](http://www.echr.coe.int/Pages/home.aspx?p=basictexts&c=article_10)). The right to an education is also enshrined in the same legislation and many charities and advocacy groups argue that technology to enable that right should be provided by the state, in line with the UN Convention on the Rights of People with Disabilities (UN, 2006). However, that does not necessarily mean it is provided, as research from charities such as Scope, a disability charity that supports disabled people and their families in England and Wales, demonstrates. Scope, which campaigns for the rights of people with disabilities, identified the barriers to the provision of Augmentative and Alternative Communication (AAC) as including a lack of training and development needs of professionals, few co-ordinated, cross-sectoral policies, fragmented and inconsistent coverage of services, and especially the lack of funding for equipment, support and services (Bush et al., 2008).

### **2.3 E-safety and vulnerable learners**

Recent reports highlight the extent of the use of the internet by young people in general, and in particular for those who can be considered *vulnerable*. Coupled with this is the growing issue of bullying of these young people in social networks. Research stresses the need for research and advice to teachers and learners in this area (Aston and Brzyska, 2012; Carrick-Davies, 2011).

Children and young people with learning disabilities are much more likely to be bullied than their peers. For example research in the United Kingdom (Mencap, 2007) indicated that 82% of children with learning disabilities were bullied. With the increase in availability of technology this is found to be an issue for vulnerable young people and adults on-line and is often referred to as *cyber-bullying*.

National strategies, advice, guidance and schemes have been developed in many countries across Europe, both for teachers to help them educate learners and their parents, and for the children themselves (see for example the EC Safer Internet Programme ([http://ec.europa.eu/information\\_society/activities/sip/policy/programme/index\\_en.htm](http://ec.europa.eu/information_society/activities/sip/policy/programme/index_en.htm)) and INSAFE, co-ordinated by the European Schoolnet <http://www.saferinternet.org>).

Children of parents who were less educated or do not use the Internet are potentially a significant group that experience higher risk to disturbing online material (Livingstone et al., 2011a and 2011b). However, there is a lack of specific research and advice relating to learners with disabilities (Livingstone and Palmer, 2012). An example of where the digital divide has a compound effect can be seen as occurring when the groups most vulnerable to cyber-bullying are also those most likely to find it difficult to access help in the form of support, guidance or resources.

Cyber-bullying has a severe impact on vulnerable young people and can interrupt their education, with research indicating that for some groups the impact and risk is significantly increased. Socio-economic or educational disadvantaged, disability, minority ethnic origin





(of some groups) and lesbian, gay, bi-sexual or transgender are groups considered by some researchers as being potentially of a high risk for cyber-bullying (Cross et al., 2012).

Carrick-Davies (2011) researched young people excluded from mainstream schools and who attend alternative education settings. He found that their off-line behaviours often translated to the on-line environment. He also discovered that most of this group of young disaffected people accessed the internet, in particular social networks via mobile phones. This technology was viewed as essential to them to give them identity, connection and a sense of community. Carrick-Davies recommends that e-safety is embedded into the wider teaching of emotional, social and digital literacy in all schools from an early age.

A report outlining the discussions of an expert group seminar on e-safety and vulnerable learners found that 'It should be clear that there is no single or simple definition of vulnerability to be obtained. Rather, many factors combine to render some children vulnerable to online risk, under particular circumstances, and with diverse consequences. ... we still lack a thorough understanding of when, why and how children become vulnerable.' (Livingstone and Palmer, 2012, p. 9–10). They also noted that despite there being some e-safety guidelines aimed at learners with special educational needs (see for example Childnet International, Know IT All for Teachers – SEN (<http://www.childnet.com/resources/know-it-all-for-teachers-sen>), there is very little published research on e-safety for children with special educational needs and the report calls for this to be urgently addressed.

## 2.4 Summary

The research evidence points to a continuing challenge in the provision of appropriate technologies for learners with special educational needs and disabilities.

There is variable access to support and expertise in the use of assistive technologies, or an understanding of appropriate teaching and learning strategies that incorporate ICT in order to meet the needs of learners with special educational needs. In addition, the provision of assistive technologies for learners with disabilities is variable.

There has been progress in the provision of accessible information and learning content for learners with disabilities. However, there is still much that needs to be done in this area, ranging from the education of developers and providers, including teachers, and the awareness and encouragement of the adoption of standards and good practice. Although there is a wealth of information on providing information in accessible formats, there is little evidence this is being applied or is translating into a better learning experience for those that require access to it.

There is a continuing digital divide, which significantly affects learners with special educational needs. It is now recognised less about access and affordability, and more about the skills required to get the most from online technologies for social, economic and learning purposes. Many young people access information and advice (sometimes through engagement with others) via the Internet and social media, but little research exists on the implications for learners with disabilities and SEN, with the e-safety implications for vulnerable learners not being fully addressed.



### 3. TRAINING OF EDUCATIONAL STAFF IN THE USE OF GENERAL AND SPECIALIST ICT

Teachers are essential in ensuring the successful exploitation of ICT in inclusive education and require education and training to equip them to succeed. Experience of ICT initiatives generally, and in the area of technologies for young people and adults with learning difficulties and disabilities specifically, demonstrate that providing the technology itself is not enough. The European Agency for Development in Special Needs Education and UNESCO IITE (2011) recommends that teachers are required to be educated/trained in: education and pedagogy; working in inclusive education settings supporting learners with diverse needs; using ICT for education, and using ICT for learners with disabilities and special needs.

Schleicher's (2012) report indicates that in the 18 OECD countries participating in TALIS (the OECD Teaching and Learning International Survey) the aspects of teachers' work with greatest need for development is 'teaching special-needs students', followed by 'information and communication technology teaching skills' and 'student discipline and behaviour'. The need for professional development in supporting learners with special needs can be especially challenging for schools in disadvantaged areas, as schools in these areas often have a wider range of abilities and needs. The combination of these factors is potentially a major challenge for teachers.

However, research shows that teachers widely recognise that ICT can enhance access and support the inclusive learning of children and young people with special educational needs, but continue to highlight the need for more information on how to choose and use them to achieve this goal (Benigno et al., 2007). Responses observed through country and European Commission level funded projects have often included the development of databases of hardware and software products that describe the capabilities of products, including their suitability or issues they may have for learners with SEN (Grant, 2006; Benigno, 2007). Some have also included case studies of practice or lesson delivery, but again focusing primarily on access to learning. This highlights the constant and on-going challenge faced by teachers wishing to provide an inclusive learning environment: ICT has the potential to support engage learners in ways not previously considered, but at the same time new technologies can become a barrier for some learners and may result in them being excluded.

Starcic (2009) reports on the use of a virtual learning environment (SEVERI) developed originally for learners with special educational needs in Slovenian schools, but later localised for six other European countries. This e-learning environment was designed to support young people by providing a bold, clear, well designed interface and personalised tools for learning and interaction. He researched the use of this environment by pre-service teacher education learners in an educational technology curriculum as a means of developing enquiry based planning and incorporating innovative use of ICT into their lessons to develop their competencies. Although noting that research indicates that inclusive practice and ICT skills are a recognised area of weakness by many teachers, Starcic found that this approach focusing on autonomy, inquiry, creativity and innovation was successful.

Lack of training for professionals working with young people who need Augmentative and Alternative Communication (AAC) is reported in various reports (Gross, 2010). In England for example, funded initiatives have been put in place to provide advice, guidance and



training materials as well as investment for the sustainability of centres which provide training due to the required high level of expertise in this field.

At a more fundamental level, Ribera et al. (2009) call for the need to include basic ICT skills training in initial teacher training before moving on to more complex aspects such as supporting inclusive learning. They highlight the need to focus on the features of the operating system and productivity tools, especially accessibility features that provide a 'no cost' solution before moving on to more expensive options.

The concerns about teacher training is not new. Nearly 10 years ago *eLearning: Designing Tomorrow's Education* (European Commission, 2003), a staff working paper examining research under Framework Programmes 4 and 5 concluded that: 'besides access to technology, a number of other factors determine the success or failure of ICT-related educational innovation. Teacher training appears to be a critical factor. ... Research demonstrates that educational institutions are social organisations that both influence the ways in which an innovation will be adopted and are influenced by that innovation' (p. 9).

Recent research (Innovative Teaching and (ITL) Learning Research, 2013) suggests that the following is required for innovative teaching identified to flourish:

- Teacher collaboration that focuses on peer support and the sharing of teaching practices;
- Professional development that involves the active and direct engagement of teachers, particularly in practicing and researching new teaching methods;
- A school culture that offers a common vision of innovation as well as consistent support that encourages new types of teaching.

Fullan, in the same research report (ITL, 2013), looks at the available research findings from the perspective of whole system change and notes that although there is a clear empirical framework for how technology and pedagogy can be effectively integrated, the available research also demonstrates that there is a long way to go for this to be achieved. He highlights the need for a focus on concrete, describable and innovative teaching practices, achieved through developing collaborative, focused cultures at the school level, a new role for the principal as lead learner and supporter, and the identification of lead teachers to play a supportive and collaborative role among peers. Fullan also suggests that at national level having a small number of ambitious goals, and developing a corresponding set of coherent, integrated actions to pursue the goals is necessary.

### **3.1 Initial teacher education**

Underlying the process of inclusion is the assumption that the general classroom teacher has certain knowledge and understanding about the needs of different learners, teaching techniques and curriculum strategies. The need for 'high quality' teachers equipped to meet the needs of all learners becomes evident to provide not only equal opportunities for all, but also education for an inclusive society (European Agency for Development in Special Needs Education, 2012c). Reynolds (2009) says that it is the knowledge, beliefs and values of the teacher that are brought to bear in creating an effective learning environment for pupils, making the teacher a critical influence in education for inclusion and the development of the inclusive school.

Cardona (2009) notes that concentration on initial teacher education '... would seem to provide the best means to create a new generation of teachers who will ensure the successful implementation of inclusive policies and practices' (p. 35).



The OECD Report *Teachers Matter* recognises that the demands on schools and teachers are becoming more complex as society now expects schools to deal effectively with different languages and student backgrounds, to be sensitive to culture and gender issues, to promote tolerance and social cohesion, to respond effectively to disadvantaged students and students with learning or behavioural problems, to use new technologies, and to keep pace with rapidly developing fields of knowledge and approaches to student assessment (OECD, 2005).

It has been argued (European Agency for Development in Special Needs Education, 2013b) that although definitions relating to inclusion have broadened, which is reflected in legislation, researchers have questioned how much practice has actually changed. Often teachers may not feel well equipped for dealing with diversity within the classroom. Attitudes, beliefs, skills and knowledge are an important part of teacher education (Beacham and Rouse, 2012). The European Agency for Development in Special Needs Education and UNESCO IITE (2011) recommends that teacher education for all teachers should take a developmental, *competency* approach, as:

*competences have the components of attitudes and beliefs, as well as knowledge and skills. Teacher competences need to cover general skills in education and pedagogy, as well as inclusive education approaches. Embedded within such training, there needs to be a consideration of the use of ICT in education generally, as well as the use of ICT for learners with disabilities specifically' (p. 89).*

A Scottish University adopted a 'learning without limits' element, when investigating practice in initial teacher education. Researchers found that the pro-inclusive attitude was sustained once the teachers were in the school environment (counter to some other research findings). The authors suggest there is a need for inclusion specialists to support the process in much the same way as special needs co-ordinators are required (Beacham and Rouse, 2012). However, Beacham and McIntosh (2013) found that although there were strongly positive attitudes towards ICT and towards inclusive education, the impact of ICT as part of inclusive practice is not well understood by student teachers and their attitudes towards digital equality do not feature highly in inclusive practices. The authors go on to suggest that this seems to 'result in ICT being used less in terms of inclusive education and more from the perspective of accessibility to the curriculum' (Beacham and McIntosh, 2013, p. 1) and that 'it is the attitudes of many teachers that take precedence over the choices and preferences of a learner. Furthermore, in the case of inclusive e-pedagogies, digital technology is more likely to be used based on a teacher's attitudes towards ICT and not on inclusive practices' (p. 9).

Beacham (2011) recently observed this in new qualified teachers, all of whom had undertaken specific inclusive education training. He found that although they were well versed in inclusive education pedagogy and had a good understanding of e-learning principles, there were often significant barriers to putting this into practice. All seemed aware of how this could impact on access, but less so of how this can affect learner achievement and belonging. He also found limited understanding of the potential impact of digital exclusion (limited access to technology outside of school and poorer digital literacy skills). This limited the opportunities for inclusive processes within the classroom such as trust and working with or through others.

Research suggests that many student teachers in initial teacher education have not formed clear opinions about inclusive teaching and this stage provides an opportunity for influencing attitudes through provision of a carefully designed learning programme (European Agency for Development in Special Needs Education, 2010). A postgraduate



course for special needs and inclusive education developed by a university in Northern Ireland identified that online conferencing fostered professional dialogue and students reported positively on the blended approach which included interviewing experts online as well as meeting them in person. It was also reported as having potential for the development of communities of practice (Lambe, 2007).

A blended learning approach integrated into teacher training on learning disabilities in the Apulia region of Italy used an e-learning environment and reported real benefits for the learners in terms of motivation, independence and responsibility for their learning (Limone and Dipace, 2012). Albanese et al. (2011) also report positive outcomes from the collaborative use by student teachers of a support wiki and forum.

Teachers' positive attitudes towards inclusion depend strongly on their education, experience with learners having special educational needs and the availability of support (Benigno et al., 2007). Experts in accessible ICTs recommended that skills, attitudes and knowledge of this area is required by all teachers and should be provided during pre-service and in-service education and training. They state that teachers need training in accessible ICTs and need to know how specialised AT and mainstream accessibility features can support learners of all abilities as well as be able to produce adapted digital materials. As the technology is constantly developing, training teachers also needs to investigate and explore the use of technology both for the learners they teach and as part of their own lifelong learning (UNESCO, 2012b).

There are benefits of including challenging and engaging practical experience in real settings so that student teachers can then apply their knowledge and theoretical understanding, with responsibilities for every child (Mavrou, 2011a). As Hagger and Macintyre (2006) state: 'whatever student teachers need to learn to do as teachers in schools for their future careers, it is in schools that they need to learn to do these things' (p. 65). Although quality inclusive placements may be difficult to organise, the country reports show many examples of innovative practice where carefully planned experiences and quality support for student teachers address the theory to practice gap and provide them with an opportunity to examine their own beliefs and values and begin to develop the skills necessary to meet diverse needs in the classroom. The importance of larger scale, systemic change to develop more inclusive schools and the need for education and professional development for mentors and school-based supervisors of school practice, as well as teacher educators, are also raised (European Agency for Development in Special Needs Education, 2011d).

### **3.2 Continuing professional development**

Governments are in an ideal position to promote national level training that can influence attitudes and practice to inclusive education. Lindsay et al. (2011) recently evaluated a number of overlapping national level English initiatives that ran from 2008–2011 that were designed to improve teacher workforce skills in relation to SEN and disabilities. The Special Educational Needs and Disabilities Training Toolkit and on-going professional development for teachers, the Inclusion Development Programme (IDP) both focused on meeting the needs of young people with SEN in an inclusive way. The research indicated that IDP-related continuous professional development (CPD) was effective in raising the knowledge, understanding and confidence to teach learners with SEN for the majority of teachers involved. The work suggests that measurable improvements in learners academic progress can be expected as a result of improved teaching and learning prompted or reinforced by CPD around inclusion.



A number of factors were identified as important, including developing inclusive education as a school improvement issue (reducing the likelihood of it being solely about learners with special needs) and also engaging school leaders in embedding SEN in whole school development. The programme also provided opportunities for those involved to share resources and ideas through websites and provided a forum for educational professionals to learn from each other.

Working in England, Male (2011) reports that far fewer teachers are accessing CPD relevant to the needs of learners with SEN and that the Salt Review (DCSF, 2010) respondents expressed concern that they were inadequately prepared to teach learners with more complex needs. Her research indicated that teachers feel a need for training to meet the needs of this group and also those learners with social emotional and behaviour difficulties.

The challenge of accessing appropriate training due to lack of time or distance of the training centre is addressed in a number of countries through the use of technologies for remote learning. One such example is 'Tailored Continuing Professional Development' in Portugal (see <http://nonio.es.ipsantarem.pt/crticsantarem/>).

Online open training materials commissioned by the Department for Education in England included some aspects of ICT to support learners with complex needs. However, use of these materials was voluntary and not linked to formal qualifications (see <http://www.education.gov.uk/lamb/> and <http://www.education.gov.uk/complexneeds/>).

The challenge faced by teachers in exploiting ICT for the achievement of all learners is reinforced by the expectations highlighted in the UNESCO *ICT Competency Standards for Teachers* (UNESCO, 2008 and 2011):

*The use of new technologies in education implies new teacher roles, new pedagogies and new approaches to teacher education. The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in new ways, to merge new technology with a new pedagogy, to develop socially active classrooms, encouraging co-operative interaction, collaborative learning and group work. This requires a different set of classroom management skills (p. 8).*

The UNESCO *ICT Competency Standards for Teachers* set out six components and three increasing levels of competency, as well as detailing 18 study modules with curricular goals and the skills that teachers should demonstrate. The development/improvement model starts with digital literacy, with progression to knowledge deepening and culminates in knowledge creation and applies these to the main aspects of teachers work: understanding ICT in education, curriculum and assessment, pedagogy, ICT, organisation and administration and teacher professional learning.

The expectations and increasing complexity of teaching and learning, including the use of ICT and the diversity of learner needs, highlights the need for high quality professional development. Schleicher (2012) indicates this is necessary to:

*...ensure that all teachers are able to meet the needs of diverse learner populations, effectively use data to guide reform, engage parents, and become active agents of their own professional growth. The development of teachers beyond their initial education can serve a range of purposes, including to:*

*- update individuals' knowledge of a subject in light of recent advances in the area;*



- *update individuals' skills and approaches in light of the development of new teaching techniques and objectives, new circumstances, and new educational research;*
- *enable individuals to apply changes made to curricula or other aspects of teaching practice;*
- *enable schools to develop and apply new strategies concerning the curriculum and other aspects of teaching practice;*
- *exchange information and expertise among teachers and others, e.g. academics and industrialists; and/or*
- *help weaker teachers become more effective (p. 73).*

Mavrou (2011a) when reporting on the design and implementation of an assistive technology course for a Masters degree on special/inclusive education, suggests that the design and development of a course related to technology and disability is not only challenging because of the rapid changes of technology, but is more challenging because of all the of historical, social, political, cultural and economic determinants that have already influenced the participants' state of mind.

Reporting on a survey of the use ICT in education of schools in Europe, Wastiau et al. (2013) observed that around 70% of learners at all grades are taught by teachers who have engaged in personal learning about ICT in their own time. They noted however, that although online resources and networks are widely available in Europe, they are a relatively new way for teachers to engage in professional development, and only a minority of these opportunities are used by schools.

A real challenge for many educators is the diversity and volume of advice now available on supporting learners with special educational needs. Although there was advice on using IT a decade ago, this has now increased significantly. Academics, software and hardware companies, parents, people with disabilities, charities and other groups, as well as teachers are providing information, advice and guidance more than ever before, both in print and online, through websites, blogs and online communities of practice. Some of the advice focuses on specific individual needs and touches on the use of ICT, while others sources examine assistive technology applications linked to a particular disability or impairment, while relatively few sources bring these together to focus on technology for inclusive learning (Abbott et al., 2011; McKnight and Davies, 2012).

This was also borne out by literature abstracts provided by countries involved in the ICT for Inclusion project (<http://www.european-agency.org/agency-projects/ict4i>). While nearly one hundred abstracts were provided, less than 10% focused explicitly on ICT for inclusive education, with the majority reporting on specific aspects of technology support for a disability or special educational need.

The interactive whiteboard, which has been widely adopted across Europe (European Commission, 2013) and internationally, and has been reported as a tool for inclusive learning, although some have concerns that it may not being used fully to meet individual needs (Cecchini et al., 2009; Bonaiuti, 2010) and that more on-going training is needed by teachers.

The *Four in Balance* report from Kennisnet (2012) for example reports that teaching using interactive whiteboard can provide a richer form of instruction with the multimedia principle, an effect which occurs when combining text, images and audio, shown to improve learners' motivation and help them grasp complex concepts more rapidly.



However, the report authors caution that the information structure should correspond to the way learners absorb information, and they should be stimulated to focus on the relevant information presented through the various media. When the right conditions are in place, however, learners receiving instruction in this way perform better (Kennisset, 2012; reporting Heemskerk et al., 2012).

In a small scale qualitative study the challenge for teachers in matching appropriate use of technology with the needs of some learners is again highlighted; Gauci (2011) in a small scale study found that positive intentions regarding ICT use with early years learners with ASD are not necessarily reflected in the most appropriate use, as educators also need to have appropriate skills and knowledge about the technologies use and application. Gauci found for example that the use of ICT with these pupils was often perceived as an isolating experience and that classroom assistants often used the technology rather than the learners themselves. She reported that teachers expressed the desire to receive more training to develop appropriate skills in using ICT.

Borg (2010), examining what makes an effective multidisciplinary team that can assess the assistive technology needs of individuals with cerebral palsy, highlights the need for reliable up to date information on the range of products to be available to all parties. This raises the issue of how to ensure experts in assistive learning technologies access and maintain high levels of professional knowledge. Bush et al. (2008) also highlighted that how professionals accessed professional development opportunities to ensure they exploited technology to meet the needs of learners with AAC needs was variable not only across England but also across different professions. This view is reinforced by other research (Atkins, 2009) highlighting the need for a more systematic approach to encourage both mainstream teachers and specialist teachers to access on-going CPD in technology for inclusion.

Most teachers are positive about the value and impact of ICT on teaching and learning and while convincing teachers and school heads is no longer a priority (Becta, 2010), equipping teaching staff with the digitally based teaching competences and experience they need for effective and efficient practice in the classroom is clearly a priority. Support at EU level could usefully look at capacity building, specifically in the area of new patterns of teacher professional development through online learning communities and other schemes closely integrated into teacher daily practice (European Commission, 2013).

### **3.3 Teachers' use of ICT to support their classroom practice**

The value of ICT to support teaching and learning was reinforced by Sutton Trust-Education Endowment Foundation, who produced a summary of educational research on resources to improve the attainment of disadvantaged learners. It identified a wide range of interventions (33 and growing) with the toolkit summarising each in terms of impact on attainment, the strength of the evidence supporting them and their cost. Digital Technology was rated as having moderate impact for high cost, based on extensive evidence (Sutton Trust-Educational Endowment Foundation, 2013).

Mitchell (2012) also references a range of evidence based teaching strategies that he identified from the literature (Mitchell, 2008). He makes the point that although there are approaches that benefit learners with special educational needs, almost all have a general applicability. No single approach is advocated, rather that teachers develop a repertoire of best practice that is sympathetic with their context. It is interesting to note that although there is not always a direct match between those suggested Mitchell and those of the Sutton Trust-EFF Toolkit (2013), at the time of writing there were seven overlapping areas,





based on the Sutton Trust descriptors, with the majority having moderate to very high impact for low to moderate cost. There were:

- peer tutoring
- meta-cognition and self-regulation
- behaviour interventions
- social and emotional aspects of learning
- digital technology
- parental involvement
- phonics.

There was also agreement on the negative impact of ability group as a strategy, with the Sutton Trust-EEF indicating that although this has little cost implication, it has a negative impact (based on moderate evidence), with feedback, meta-cognition and self-regulation, and peer tutoring having high impact.

Reports into the use of ICT highlight the need to focus on these strategies along deep learning (Groff, 2013) and there is some evidence that ICT can support this along with helping to make hard to teach subjects more accessible using technology (National Association for the Teaching of English, 2008).

Meijer (2003) identifies key factors in transforming classroom practice to support inclusion:

- Co-operative teaching (support and cooperation of professional colleagues within and beyond the school);
- Co-operative learning (peer mentoring and flexible pupil grouping);
- Collaborative problem solving (focus on addressing behaviour issues);
- Heterogeneous grouping (but more differentiated when required to meet diversity of need);
- Effective teaching (high expectations and individualised learning plans, with systematic monitoring, assessment, planning and evaluation of learners work);
- Home Area system (with fixed learning areas supported by a team of teachers);
- Alternative ways of learning (learning to learn and problem solving).

Examples of both collaborative teaching and co-operative learning to support inclusive education facilitated through ICT are provided in a handbook on using digital technologies to promote inclusive practices in education (Walker and Logan, 2009). These include the use of video and digital cameras, school radio stations. Collaborative problem solving can foster both academic and key skills, including: working as a team player, active listening, assertion, managing conflict through group resolution, critical thinking – forming a fluid argument, negotiating and fostering mutually respectful relationships. It can be argued that many of these strategies can be facilitated and enhanced through the use of ICT, and that at scale, technology greatly increases the opportunity and capacity for these outcomes (Groff, 2013).

The majority of teachers realise they have a significant role to play to promote and realise inclusion, but many indicate that they need specific information and guidance on how to choose and use ICT to achieve that aim (Benigno et al., 2007).



Loveless (2009) in her review of literature on pedagogy and ICT observes that things have moved on from Shulman's (1987) characteristics of teacher knowledge, and proposes that it now 'incorporate[s] understandings of the construction of knowledge through distributed cognition, design, interaction, integration, context, complexity, dialogue, conversation, concepts and relationships' (p. 7). ICT as well as being a valuable tool for instruction (Kennisnet, 2011), is also ideal to support constructivist, knowledge construction, teaching and learning approaches that can help to deliver these new understandings of pedagogy.

Becta, in a research informed publication that matched ICT competencies to national professional standards for teachers, highlighted what this means for a teacher demonstrating effective practice with ICT (Becta, 2010b) in terms of skills and practice, knowledge and understanding, and values and attributes. This resource provided teachers with an easy way of evaluating their practice and planning development activities and included the prompt for teachers to consider whether they provide adaptive solutions for learners with special needs have appropriate specialist knowledge of ICT and manages learners' use of technology appropriately to promote engagement and learning.

A publication that focused specifically on special needs and inclusive ICT approaches based on this self-assessment approach was also produced (Becta, 2010c). This checklist approach, along with school improvement tools such as the ICT Self Review Framework (Naace, 2012) are examples of nationally developed resources to help schools reflect on how they integrate technology into all aspects of running a school. The Self-Review Framework, which provides schools with a means of assessing and accrediting their whole school use of ICT, has inclusion and diversity considerations integrated into the framework and examples.

To ensure that young people with additional learning needs are included within the teaching and learning environment with appropriate access to, or use of, mainstream technologies, adaptations are necessary or the provision of personal assistive technologies are required. Beningo et al. (2007) found that teachers need support in identifying and evaluating software and hardware suitable to meet this need. Advice for teachers on assessing the quality and appropriateness of digital learning resources has been developed and often include principles of accessibility and inclusion (Becta, 2007a). This guidance included a core principle that digital learning resources should, in most circumstances, support inclusive practices in their design and in the supporting materials they offer practitioners and learners. It suggested that teachers can do this by offering the flexibility to adapt resources to different learning preferences, or by suggesting alternative ways of addressing the intended learning objectives, where the digital learning resources are limited in relevance.

In addition, a core design principle of accessibility should be followed; accessible design of digital learning resources concerns ensuring that no user, practitioner or learner is unreasonably prevented from benefiting from a resource simply because of their access requirements or preferences. The report acknowledged that there is still debate around the best approaches to accessibility, but core aspects that all designers must address are that:

- accessibility issues must be considered from the earliest point of the development process;
- accessibility is not simply a technical issue and all aspects of design must be considered, for example the user interface and the layout of information and support materials;



- resources must offer relevant information on the accessibility features that are included and/or relevant technical specifications (Becta, 2007a).

Heemskerk et al. (2005) reviewed the literature to identify to what extent the characteristics of educational ICT tools enhance or inhibit learning for different groups of learners. This was carried out to test the assumption, validated by previous researchers, which found that the design of software can have built in assumptions, for example of typical users' attitudes or interests. Where learners are not able to identify with the supposed user, this may inhibit their learning. Ultimately, this can result in differences in participation, attitudes and learning outcomes in both ICT itself and subjects in which ICT is used as an educational tool.

Heemskerk and colleagues acknowledge the inherent difficulties of trying to design software to meet the potential interests, gender specific, cultural, social and other aspects, but argue that teachers (maybe working with learners themselves) should be aware of these and where possible provide a mix of materials across the teaching and learning offered by the institution. The authors go on to argue that the multisensory, non-linear and contextual aspects of educational software or digital learning materials mean that a critical consideration of its content and how it is used is needed. The research highlights some important issues regarding independent use of ICT materials and the need for educators to consider ICT materials in possibly a more critical way than other teaching and learning resources (such as books for example).

Online communities and Web 2.0 technologies can encourage and support communicative, collaborative and community building, for example through social software which can be used to foster a learner voice culture, a more personalised approach to learning, and improved knowledge-sharing with others (Walker and Logan, 2009). Crook et al. (2008), who examined the impact, barriers and issues of implementing Web 2.0 technologies in secondary schools, noted that practitioners found it engaged many learners who were tentative contributors in class or who had special needs, and supported learners' natural curiosity by enabling expression through different media and a sense of audience, providing access to further resources and the ability to gain confidence and skill in speaking and presenting.

Walker and Logan (2009) cite an English teacher who found that learners who would not sit down and put pen to paper in their exercise book will, after midnight, put postings on a forum. ICT can essentially appeal to different learners' different learning styles. Other teachers commented that homework had been improved, that the internet introduced greater variety and removed some laborious aspects with technology generally seen to be valuable for learners with poor literacy skills.

Dudzinskienė et al. (2010) propose innovative inclusive teaching and learning methods using ICT for primary school teachers, highlighting the need for sharing between colleagues, individualisation of learning, the encouragement of learner collaboration, and family involvement. Čedavičienė and colleagues (2012), also writing about innovative teaching methods and ICT developed in Lithuania, encourage schools teachers to recognise that learning is a personal and unique process. They propose a six stage implementation process for innovative teaching methods with ICT emphasising the importance of working in a collaborative environment. The recommended stages for innovative teaching methods and ICT implementation are:

- precise definition of the desired innovations;
- formation of the innovation implementation team;



- team activity co-ordination and organisation;
- innovation implementation strategic planning;
- reflection on and evaluation of the achieved results;
- teacher motivation and in-service teacher training

### **3.4 Teachers' competences in using ICT to support learning**

In the Netherlands, an annual survey reports on the use and benefits of ICT in Dutch schools in primary, secondary and vocational education and training. The 2011 report (Kennisnet, 2011) highlights a national model to both track progress as well as support schools in improving practice. The report highlights recent research findings that support the view that for improvements to be made, they need to be driven by human factors – namely *vision* and *expertise* – supported by the technological factors of digital learning materials and ICT infrastructure. An approach to co-ordination that puts technological factors before pedagogy has only a limited chance of success. Four crucial human factors, identified by researchers as success factors, are:

- The ICT (facilities) match the teacher's views on education. The alignment of an ICT application with pedagogic principles increases the likelihood of it being used;
- The teacher is familiar with ICT and is capable of using it. Without this the use will be ineffective, but to have an impact usage needs to then be integrated into the subject or pedagogic approach of the teacher;
- The teacher is convinced of the added value of ICT. Extending this it is highlighted that a teacher's professional development should lead to an understanding of which ICT related pedagogic strategies lead to improved learner performance, and
- There is leadership that allows teachers to be involved in innovation. Research indicates this can motivate and allow a shared vision to be developed not only with trend-setters but also other teachers who are less convinced.

A report on teacher education for inclusion across Europe (European Agency for Development in Special Needs Education, 2011b) summarised the key competencies that the majority of countries identified as most relevant to inclusive practice and it is encouraging to see the degree of alignment with the OECD report cited above and the UNESCO *ICT Competency framework*. Many of these are not surprisingly attitudinal, and include:

- *Reflection on their own learning, seeking out information to overcome challenges and support innovative practice;*
- *Attending to the well-being of learners, taking responsibility for meeting all learning and support needs and ensuring a positive ethos and good relationships;*
- *Collaborating with others (professionals, parents) to assess and plan an engaging curriculum to meet the diverse needs of learners, attending to issues of equality and human rights;*
- *Using a variety of 'inclusive' teaching methods and group and independent work appropriate for the aims of learning, the learners' age, and their abilities/stage of development and evaluating learning and the effectiveness of methods used;*
- *Addressing language learning in multi-lingual contexts and valuing cultural diversity as a resource (p. 51).*



The importance of teamwork, with collaboration of professionals from initial assessment of assistive technology for learning for an individual, through implementation, follow up, feedback and re-evaluation is highlighted (Mavrou, 2011b). Mavrou also notes that training and support, consistency of approaches between different disciplines, and access to relevant assistive technology in the home are importance policy and practice issues.

Experts from education, industry, government and other stakeholders in the use of accessible ICTs (UNESCO, 2012b) recommended teachers and schools should:

- Make maximum use of the access features built into current technology, such as the operating system or productivity tool accessibility checking options;
- Assess learning and ICT access preferences at an early stage and enable learners to select their own personal preferences for their computer and store them, including assistive technology options (either on the network, on pen drives or remotely);
- Create an inclusive and positive attitude towards the use of technology for learning, where accessible ICT is viewed as a positive and equitable support for all not just those with disabilities.

### **3.5 Summary**

It is widely recognised that good quality teaching is essential to the education of all young people. It is also recognised that technology has an important role to play in the education of learners with special educational needs. The research, however, highlights the significant challenge of bringing all these aspects together – inclusive education that meets the needs of all learners, including those with special educational needs, combined with effective exploitation of ICT to achieve that aim.

There is evidence that a pro-inclusive education approach is sustained in the classroom following initial teacher education that includes that element. However, there is limited information exploring how this is translated into practice in terms of the use ICT.

Although there is growing research evidence of what works in terms of teaching and learning strategies, there appears to be a limited number of studies that focus directly on how these strategies can be enhanced through the use of ICT. Likewise, there continues to be a challenge around finding meaningful indicators of the impact of ICT on learning, beyond that of motivation, increased engagement and improved behaviour.

As a number of researchers point out, in the majority of cases there is no need for separate pedagogies for learners with special educational needs, but rather the application of the appropriate mix of existing tried and tested approaches, utilising a wide range of tools and techniques (including ICT) to maximise learning experiences.

Online communities of practice and networking are widely available across Europe, and viewed as a valuable means of real support, but are still seen as new with only a minority of teachers taking advantage of these opportunities.

The challenge for education systems appears to be how to ensure this can be supported – beginning during the initial education of teachers and ensuring appropriate CPD is available throughout their career.



## 4. MULTI-STAKEHOLDER RESEARCH AND DEVELOPMENT INTO ICT

Innovation in technology for inclusion concerns the development of new tools, and also new ways of using ICT, may come from researchers, developers or professional educators. The literature points increasingly to the recognition that it is essential to involve users in the design and implementation of inclusive educational technologies, and it is important for the different stakeholders, designers, people with disabilities and the educational staff who work with them need to network and share information (Abbott et al., 2011; European Agency for Development in Special Needs Education and UNESCO IITE, 2011; Wright et al., 2011).

### 4.1 Design for All

The Design for All (DfA) approach is increasingly promoted as a means of accommodating individual differences. Design for All is used to describe a design philosophy targeting the use of products, services and systems by as many people as possible without the need for adaptation. Design for All is design for human diversity, social inclusion and equality (EIDD Stockholm Declaration, 2004: <http://www.designforalleurope.org/Design-for-All/EIDD-Documents/Stockholm-Declaration/>).

The concept encourages manufacturers and providers of services to produce new technologies which can be accessed by nearly all potential users without modification. The approach recognises that where this is not possible, the product or services should be easily adapted to meet different needs, or use standardised interfaces so that assistive technologies will work with them. However, there is a need for independent longitudinal research that focuses more on the impact of the use of assistive technologies on learning outcomes rather than adoption rates and design (Abbott et al., with Salminen, 2008).

The Global Assistive Technology Encyclopedia initiative (<http://abilitynet.wetpaint.com/>), which provided a collaborative environment for assistive technology professionals, was also found to be effective in enhancing knowledge about Design for All principles. This assistive technology resource was established to promote knowledge exchange in this subject domain and involved mainly professionals, developers, vendors as well as people with disabilities. The platform provides an easy way of providing up to date information, advice and views on emerging products as well as over 500 videos, at the time of writing, which provide examples of use by practitioners (Redecker, 2009).

Rather than requiring special accommodations, increasingly people with and without disabilities are taking advantage of access features built into mainstream technology and systems (Abbott et al., 2011). Some technologies with such access features have been used for some considerable time, but there has often been little or no research into their effectiveness (Abbott et al. cite voice output communication aids and speech recognition software as examples here). However, they point out that users are starting to be asked what they want from products, particularly in the area of augmentative and additional communication (AAC), rather than development just focussing upon professional input.

Abbott et al. (2011) acknowledge that there has been a shift since Salminen (2008), albeit restricted, in terms of the scope/definition of the research, literature review of European research literature on assistive technologies for children with disabilities, which at the time highlighted a dearth of findings. Definitions of assistive technologies, as highlighted earlier, continue to be debated, however, it is clear from recent reviews that there has now been wider research in more wide ranging areas. Much is in line with the UN Declaration on the Rights of Persons with Disabilities focus on *inclusive* rather than *special* education, and



there has been some shift in focus of research to issues of rights and entitlements to inclusive education and appropriate support. Abbott acknowledges that there is still a relatively small number of research papers and projects, but goes on to highlight 5 key themes (Abbott et al., 2011):

- increased user involvement, using participant design approaches;
- the mainstreaming of mobile devices with the development of assistive technologies that work with these being built into their design rather than added afterwards;
- assistive technologies usage increasingly visible and used by many people, including those without disabilities, such as speech (voice recognition to create text or to search, and speech synthesis as well as symbol support for text);
- wider interaction and collaboration afforded by technology between people with and without disabilities due to the increasing diversity of mainstream multimodal literacy;
- development of new technologies and interfaces, such as eye gaze and neural control of devices, games interfaces that exploit motion sensing technologies, and robotics.

A related concept to Design for All is Universal Design for Learning (see CAST <http://www.cast.org/udl/index.html>). This is based on research from learning science and provides an educational framework to guide the design and development of flexible learning environments. The principles are widely recognised with guidelines (CAST, 2012) on using ICTs translated into several languages. The three main principles, each with accompanying guidelines, are:

Principle 1: Provide multiple means of representation – with guidelines to provide options for perception; language, mathematical expressions, and symbols; and comprehension;

Principle 2: Provide multiple means of action and expression – with guidelines to provide options for physical action; expression and communication; and executive functions;

Principle 3: Provide multiple means of engagement – with guidelines for recruiting interest; sustaining effort and persistence; and self-regulation.

Reid et al. (2013) contend that the use of Universal Design for Learning and individualisation of learning tools, such as mobile technology, can support the integration of interventions that support learners with dyslexia into the curriculum. The use of apps and mobile technologies allow for easier delivery of tried and tested accommodations and encourage more independence and confidence in learning.

McKnight and Davies (2012) note that there are many sets of guidelines for educators on how to present materials for learners with special needs in an accessible way, the majority of which follow standard usability guidelines. They argue that there is a benefit for these separate guidelines as it brings the guidelines and underlying research to an audience that may be unfamiliar with them, may reveal differences for particular groups of users, and can help designers prioritise requirements for specific groups.

## **4.2 Involving users in the design of technology for learning**

The need for more participant research design approaches that involve other key stakeholders can have a significant impact on the effectiveness and impact of assistive



technologies such as teachers, carers, therapists and other learning support professionals is highlighted by researchers (Abbott et al., 2011; Wright et al., 2011).

An example of a multi-disciplinary approach to participatory design to include learners with complex needs and promote inclusive practice can be found in the work of Keay-Bright (2007) whose research focuses on games and exploratory play for early years and early development, and in particular the use of touch based technologies such as the interactive whiteboard and tablet computers. This research highlights the importance of involving end-users, in this case children with autistic spectrum disorders (ASD), and argues the importance of participatory design process and the design of play to provide a resource that meet the needs of all involved. The challenge for designers includes firstly the idiosyncratic behaviours of the young people who, she reports, take ownership of the play environment the software and interactive whiteboards offers, and secondly, how this ownership can be built into the design process. The research highlights the benefits of this type of interface on enhancing the learning of young people with ASD (Keay-Bright, 2007).

There are growing numbers of research projects that involve users with learning difficulties in both the design and evaluation of new technologies for education, for example between developers and educationalists to develop software and virtual learning environments for young adults with cognitive and physical disabilities (Maquire et al., 2006). Mazzone and colleagues (2011) highlight the multimedia advocacy approach which adopts a participative approach to the design of websites particularly designed for adults with learning difficulties. They believe their approach has relevance for Design for All and recommend that contact with the users has to be supported by a psycho-educational professional; features that could be considered usable according to commonly applied principles need to be adjusted and tested in each specific context of use; that the Web Accessibility Initiative Guidelines (W3C, <http://www.w3.org/WAI/>) and personalization standards implementation is essential to achieving the necessary flexibility and adaptability; users' engagement is important to increase users' motivation in completing the task and their familiarisation and satisfaction with using the product, and the system's adaptability and flexibility is crucial as the specific user requirements are changeable and very dependent both on unpredictable external and internal factors – more than with most users.

In addition to web accessibility guidelines, advice and guidance for developers of digital content for e-learning have been produced and include accessibility and inclusion features as well as other technical, usability and curriculum relevant criteria (Becta, 2007b).

One challenge highlighted in the Agency report into the use of ICT and SEN in 2001 (European Agency for Development in Special Needs Education, 2001), still seems relevant today, as does the possible means of addressing it. There continues to be a dearth of commercially available materials for young people with learning difficulties that provide age appropriate content (matching literacy level, cognitive ability and life experience) that support the development of daily living skills or life skills (Røddevand and Hellman, 2011). Their research identified eight areas where Instrumental Activities of Daily Living training are required and the lack of products appropriate to the needs of these young people. They found that most commercial products were aimed at beginner's level and material targeted at their age group containing more complex language and with less motivating elements. This raises the issues of universal design of educational products, user involvement in the design and of teachers having time or expertise to provide personalised multimedia materials.





McKnight and Davies (2012) highlight some of the practical and ethical issues in involving users with special educational needs in research. They cite the research of Davis et al. (2010) into interactive software use by young people with autism, which indicates that for some groups of learners, user centred or participatory design may not be appropriate. There is also the real challenge of ensuring informed and valid consent to be involved in research, particularly with young people with complex special educational needs (McKnight and Davies, 2012; Lewis and Porter, 2007).

Andreou and Mavrou (2012) in their qualitative research into the design and development of instructional materials in the subject of Greek Language applied the principles of Universal Design for Learning. They found students' use of symbols to facilitate written instruction enabled them to undertake work that would otherwise not have been possible and to complete it faster. User involvement also led to increased use of coloured worksheets as students found them more motivating, highlighting the importance of designing learning resources in response to learners' requirements. The move from textbook to the use in schools of new media and digital tools for trans-media storytelling also offers opportunities for participatory design and inclusive personalised learning paths (Limone, 2012).

Luckin et al. (2012) highlight the disconnection between industry, research and practice and the need for these to work together to test ideas and evaluate potential innovations before they go to market. Such an approach would develop an evidence base that is consistent and can be applied to practice. Some researchers and advocacy groups recommend including learners in all aspects of the design, development, implementation and marketing of technologies in order to develop technology that is both accessible and responsive, and an accessible and inclusive approach should also be applied to specialised technologies (Foley and Ferri, 2012). A notable example of this is the recommendations by One Voice for Accessible ICT on producing accessible apps (<http://www.onevoiceict.org/node/86>).

### **4.3 Universally accessible technology**

Some researchers – such as Foley and Ferri (2012) – suggest that currently technology is designed in a way that is deeply embedded in social, economic and cultural practice. These have an impact on the whole process of design, marketing and implementation of technology. Foley and Ferri argue for the need for all technology to be accessible and inclusive with a shift from the current focus on assistive technology, which they argue creates subtle forms of exclusion. They highlight many AT devices are not used due to their often unattractive or stigmatising design.

Hodkinson (2011) found in his study of electronic media in primary schools that the representation of disability is limited, with images being infrequent and where they were presented often showing or described in terms of a medical deficit.

Foley and Ferri (2012) argue that technology is designed in ways that reflect taken for granted ideas about what constitutes normal. They cite examples of exclusive practice, such as formal mechanistic processes around assistive technology provision in schools that matches technology to a student's impairment. They found more subtle examples, for example the way in which search engines may display results when a term related to a physical or sensory impairment is entered: the results typically focusing on rehabilitation or remediation, while other terms relating to race or sexuality provided a wider variety of results, often relating to social interaction (rather than medical ones). They highlight online learning environments as an example of a teaching and learning technology not typically



designed with people who have a disability in mind, and the subsequent need to provide accommodations is costly and time consuming.

Developers and providers of AT should also consider the impact on learner's self-identity when designing and recommending provision, as even small design errors or incompatible technologies and the use of assistive ICT may result in a focus on the impairment and reinforce negative stereotypes of disability (Söderström, 2013).

The inflexibility and high cost of many dedicated assistive technology devices compared to the relative affordability of mass market products such as the iPad, and the fact that investing in a dedicated device often commits the user to a technology that has been 'designed with very particular ideas about who disabled users are and what they want in a device' is highlighted in research (Foley and Ferri, 2012, p. 7).

Foley and Ferri (2012) state that assistive technology too often follows a reactive model rather than building in access from the beginning, noting that with the rapid pace of development of technology it is difficult for accessible standards to remain current. This is not to say that some products do not cross over between mainstream and disability specific solutions, and in some cases there are good examples of products that were designed specifically for people with disabilities in mind that provide a better experience for all users. These include predictive spellchecking software, computer touch-screens, synthetic speech and graphic symbols. The authors argue the need for accessible and inclusive technology which builds in accessibility from the start, includes disabled people in all aspects of the process from design to marketing of products with the aim of creating accessible and responsive products, by '... creating multiple points of access for users. This approach would consider the needs of those with cognitive, sensory and physical disabilities as important sources of diversity and complexity necessary to inform the design of technology to increase accessibility and usability for all users' (p. 8). They go on to suggest this approach could also be extended to the design of specialised technology, which would also be more acceptable to the user and is designed with social inclusion in mind.

#### **4.4 Summary**

Much of the research literature highlights the need for more multi-stakeholder approaches research into the design of assistive and accessible technologies. This section has highlighted, however, the intrinsic challenges this presents, ranging from the practical and ethical issues of participatory research design methodologies that involve learners with special educational needs, to the moral issues when using an intervention with one group of learners and not another.

There are signs of increased interaction between different disciplines in research that focuses on specific disabilities such as autism spectrum disorders, but there is still a lack of longitudinal studies on the effectiveness and impact of technology on learning.

In terms of multi-stakeholder involvement in providing accessible information, there seems to have been only slow progress in the adoption of standards and good practice at all levels. Although some governments are taking the lead in producing accessible websites, and in some countries procurement regulations encourage companies to provide products and services with built in accessibility, this does not necessarily translate to providers of education at all levels.

There continues to be a need for on-going education on all fronts for all the different professional that support the education of learners with special educational needs, in the

















peers. There is also evidence of learners rejecting these in favour of less accessible but socially acceptable technologies, both in school and at home. Technologies such as mobile phones are increasingly an intrinsic part of the lives of learners with special educational needs. Often they are not allowed to use these in schools and have limited access to shared devices, which do not necessarily provide the accessible features they are used to at home or on their mobile, or the immediacy of internet access they expect outside of school. There are also economic pressures that are continuing to restrict access for learners to assistive technologies, assessments, and services that provide training and support.

Looking forward, the rapid adoption by institutions of mobile devices, especially tablets with built in accessibility features, along with low cost assistive technology apps, is opening up many new opportunities for inclusive teaching and learning. There are emerging indications that teachers are more comfortable with these devices and willing to take a more experimental approach to using low cost apps, as well as being more willingness to learn from the learners themselves.

Across Europe as well as at the global level there is an on-going need to identify centres of excellence in the use of ICT for inclusion and for practical ways to be developed for the sharing knowledge on how this has been achieved. Research into inclusive practice supported by ICT is needed, as is baseline data gathering and on-going monitoring of ICT for inclusion.





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