

# Assistive Technology/Equipment in Supporting the Education of Children with Special Educational Needs – What Works Best?

Richard Wynne, Donal McAnaney, Trish MacKeogh, Philomena Stapleton,  
Sarah Delaney, Noeleen Dowling, Isabelle Jeffares

RESEARCH REPORT NO. 22



Education



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# Foreword

The NCSE commissioned this report to try to identify the types of technology which work best for students with special educational needs. However, the increasing volume of technologies available and the pace of technology change mean that there is no easy identification of what works best. The wide variety of needs of users and the variabilities in the training and support available in the use of technology also influence the effectiveness of equipment and technology.

The focus of this study was on assistive technology (AT) granted under the Department of Education and Skills scheme. This scheme provides grant-aid to schools to allow them to purchase specialist equipment considered essential for students with a wide variety of SEN such as voice activated software, soundfield systems, predictive text software etc. The NCSE processes on average around 3,000 applications for such AT each year.

The study examines the views of 100 students and their parents in terms of their experiences of acquiring and using AT as well as their perceived impact of the AT on their education. Overall impressions were generally positive – as many as 70% of pupils reported that their educational needs had been met by their AT. Some examples of the positive impact included students engaging better in class as they could hear instruction and see text more clearly with the use of visual and hearing technology. For others, the use of software allowed them to keep up with the class by easily taking down notes, while for others, doing tests were easier using a laptop as their hands weren't sore from writing.

While these findings are positive and indicate that the majority of students consider that their AT works well for them, it must be noted that 20-30% of pupils overall did not report a positive impact of the AT. Users, their parents and teachers consulted in the study, consistently identified the need for support and training in the use of technology.

The researchers conclude with a number of implications arising at school and system level to be looked at in the context of these findings.

**Teresa Griffin**  
*Chief Executive Officer*

July 2016

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# List of Acronyms

<b>Acronym</b>	<b>Description</b>
ADL	Activities of daily living
ADHD	Attention deficit hyperactivity disorder
ASD	Autism spectrum disorder
AT	Assistive technology
CAT	Computer-assisted technologies
CEUD	Centre for Excellence in Universal Design
DAI	Dyslexia Association of Ireland
DeafHear	National organisation for people who are deaf or hard of hearing
DES	Department of Education and Skills (formerly Science)
DEIS	Delivering Equality of Opportunity in Schools
EPSEN	Education of Persons with Special Educational Needs
ICT	Information communication technology
IEP	Individual education plan
IMPT	Irish Matching Person and Technology assessment instrument
IPSE	Inclusive post-secondary education
ISCED	International Standard Classification of Education
ISS	Inclusion Support Service
LVA's	Low vision aids
NCCA	National Council for Curriculum and Assessment
NCSE	National Council for Special Education
NDA	National Disability Authority
NCBI	National Council for the Blind in Ireland
OCR	Optical character recognition
PDST	Professional Development Service for Teachers
SEN	Special educational needs

<b>Acronym</b>	<b>Description</b>
<b>SENO</b>	Special educational needs organiser
<b>SESS</b>	Special Education Support Service
<b>SETT</b>	Student, environment, tasks and tools
<b>SNA</b>	Special needs assistant
<b>SLT</b>	Speech and language therapist
<b>SR</b>	Speech recognition
<b>TAII</b>	Technology-aided instruction and intervention
<b>TES</b>	Teacher education section
<b>UD</b>	Universal design
<b>UDL</b>	Universal design for learning
<b>VR</b>	Virtual reality applications
<b>WRC</b>	Work Research Centre



## Executive Summary

This study of the effectiveness of assistive technology (AT) in supporting the needs of children with special educational needs took a multi-dimensional approach to its investigations. Five main lines of investigation were used:

- analysis of the policy context;
- review of the international literature;
- study of pupils using at in schools;
- survey of teachers with experience of AT;
- study of the opinions of assessment and other professionals involved in the AT process.

Underlying the five elements of the study is a socio-technical model of how AT is introduced. This model acknowledges the importance of three main dimensions to the success or otherwise of implementing AT – the technology itself, the social environment and the individual. Each dimension can play a defining role in the process and the conclusions made reflect the importance of each of these elements.

The summary of study findings are organised in relation to each of the lines of investigation. There is a considerable level of synergy in the findings and this provides a sound basis for drawing conclusions from the study.

### Aims and Objectives

The six research questions (RQ) addressed by the study were:

- RQ 1: What does research evidence tell us about what is the most effective AT/equipment to support children with special educational needs to access the curriculum, engage in learning and enhance their educational experience?
- RQ 2: What does research evidence tell us about the training and support needs of users and practitioners in this regard?
- RQ 3: What evidence is available from best practice guidelines documents in Ireland and internationally?
- RQ 4: What are the views of users, practitioners responsible for supporting the users in the classroom and the assessment professionals recommending the technology about what AT is most effective and requirements in relation to assessment, training and support?
- RQ 5: What lessons can be identified from this evidence?
- RQ 6: What are the implications arising from this review for the provision of assistive technology/equipment for children with special educational needs in Ireland including issues relating to maintenance and repair?

This study investigated using quantitative and qualitative methods in the use of AT devices and applications by students with special educational needs in Ireland. It also entailed an in-depth literature review of the latest international research. The research focuses on students who have devices sanctioned through the Department of Education's grant scheme for purchase of essential AT.

The Department of Education and Skills (DES) characterises AT as any technology that enhances the performance of a learner with special educational needs by overcoming barriers in terms of presence, participation (engagement) and learning. The study acknowledges the importance of this functionality of AT. However, it contends that it is important to situate AT usage in the broader context of its selection, provision and implementation within the classroom. In essence, this view brings together the essential elements of assessment of needs for AT, the person, the technology and the environment, i.e. a 'sociotechnical' view of the entire process. The study therefore investigated student, parent and teacher experiences of AT use and impact and the processes whereby students with special educational needs were identified and their specific needs assessed. It also examined the AT identification process, matching AT to the needs of the individual and how AT was implemented and supported within the classroom.

## Policy Context

The main findings that can be drawn from this element of the work are:

**Legislation adequacy:** in the absence of the full implementation of the EPSEN and Disability Acts, the Education Act and Equality Acts provide a strong basis for deployment of AT to promote full participation in education for learners with special educational needs and/or disabilities.

**International AT policy context:** the main international policy of relevance is the UN Convention on the Rights of Persons with Disabilities (UNCPRD), which the Irish Government is committed to ratifying, and which specifies access to AT for an affordable cost as being a right and an important component in inclusive education. Effective deployment of AT in education is also supported by a range of international organisations.

An overview of delivery systems for AT in education in other jurisdictions highlighted the essential role of expert advice and support services. Other common themes included viewing AT from an inclusive education and universal design<sup>1</sup> perspective, the usefulness of a code of practice/guidelines for the deployment of AT, the importance of collaboration of health and education services in AT assessment, the need for the learner's active involvement, AT as a core component of individual educational planning and the need to monitor impact.

**National AT policy context:** issues have been raised about the operation of the DES AT scheme in terms of fairness, adequacy, the use of diagnosis as a criterion for eligibility and lack of transparency in the appeals procedure. The NCSE has raised concerns about current procedures

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<sup>1</sup> UDL is essentially a framework that attempts to address the barriers that inflexible curricula can represent to atypical learners. UDL is intended to respond to diverse learning styles and abilities through flexibility in goal setting, methodologies, resources and assessments.

for allocating AT including delays in the system, lack of continuity during transition, level of teacher AT knowledge, need for AT supports, up-to-date information about AT and standards for its assessment.

The NCSE has recommended a working group be established to develop a national AT policy that specifies its purpose in education; the standards for professionals involved in making recommendations; the type of AT that should be made available; the basis for grant aid to schools; the roles and responsibilities of those involved in the identification and allocation process; and training requirements.

**Finances for AT:** current spending on AT is about €1.26m per annum. This is less than one tenth of 1 per cent of the financial resources assigned to SEN personnel supports (€1.3bn). No evidence-based benchmark for national educational spending on AT was found, but the relatively small proportion of SEN funding allocated to it calls into question the financial and logistical rationale for splitting the operation of the scheme between the NCSE and sections in the DES.

**System administration:** eligibility for the scheme requires evidence of a diagnosed disability and that the AT is essential to education. Currently, these are evaluated on the basis of a report from a clinical assessment. Concerns with the current system administration were raised during the research. First, the risk that the absence of the word 'essential' in an expert report is sufficient to exclude a student from the scheme – such decisions should not be based on the syntax or lexical content of a report. Second, both eligibility and appropriate technology are assessed at the same time. Third, the system does not allow for a trial period in using the AT. Fourth, the NCSE has recommended that the basis for allocating additional teaching supports for students with special educational needs should move away from individual diagnosis to a school profiling system – which calls into question the rationale for retaining disability as an entry criterion for the AT scheme.

Within the scheme, assessment is usually a once-off procedure that takes place outside the school context in which the AT is to be used. Assessment professionals are infrequently involved in implementation, except in the case of sensory impairments. Teachers and parents are generally not actively involved in assessment of AT needs. There are no guidelines for assessment methods or tools most useful in identifying user needs and matching these to the most appropriate technology.

Fundamentally, the DES scheme adopts a reactive approach to providing AT, i.e. it waits until applications are received rather than having a proactive screening process. It is also truncated in that it does not initiate until an application is received and terminates after an AT application has been approved or rejected apart from administrative or appeal processes.

Good quality information on AT was said by respondents to be difficult to find – none of the AT information resources recommended by the DES in its circular on the AT grant scheme was felt to offer up-to-date evidence-supported information on AT practices.

Transferring AT between schools was also noted to be problematic. The NCSE has noted that the DES needed to clarify for schools that essential AT could be transferred with a pupil particularly in the transition from primary to post-primary education.

Other areas for improvement indicated by NCSE in its policy advice to date include the requirements for:

- measures to be put in place to support the timely and consistent access to AT for students who require it;
- professionals involved in AT assessment to be up-to-date in their knowledge about its functionality and potential educational impact;
- teachers to be supported to gain familiarity with AT;
- standards to be developed to guide AT assessment and recommendation.

**National and international guidelines:** the policy review also addressed the issue of best practice guidelines. Many of these were identified in Ireland and internationally. The main messages from these guidelines centre on common themes such as the need to involve parents and pupils; the need to provide access to relevant information; the need for training and support for all stakeholders; the need for an effective phased matching processes; and the need to integrate AT into a universally designed, inclusive education process.

## Literature Review

The literature review revealed that many commentators viewed much of the research in the field as being of low scientific quality. Chief among the reasons for this is that AT is evolving and diverging more rapidly than can be captured through one-off studies, no matter how well they are designed. This is especially true in the case of apps. In addition, there are definitional issues in relation to AT. One consequence of this is that it is often difficult to distinguish between assistive (access) and instructional technology. Both are relevant to supporting effective education for learners with SEN. Similarly, standards based on previous evidence will often be out of date before they are published. A more dynamic approach to evidence is required.

Other issues identified were methodological issues in terms of research design, small sample sizes and the multiplicity of outcome measurement strategies. Many arise from the heterogeneity of populations in terms of needs and abilities, low prevalence of many conditions, diversity of devices and contexts for AT use and difficulties in establishing high levels of experimental control. Single subject designs in which participants acted as their own controls and longitudinal studies were recommended.

Notwithstanding these difficulties there was still a relatively high level of agreement in the literature on many issues. Despite the low number of well-designed studies, it was generally accepted that AT had a positive impact on education. Some key findings include:

- AT positive impacts are not explicable in terms of type of application or brand;
- It is unwise to assume that AT applications will be accessible to an individual user.

There was common agreement that collaborative assessment based on a biopsychosocial model is essential to ensuring the best fit between the individual's needs, the AT and the environment in which education takes place. An AT expert is an important member of the assessment team. AT experts are not always clinical experts.

There was also widespread agreement that assessment must include a trial period in which performance with and without AT is measured systematically in alternating conditions. This reflected findings from the empirical part of the study where parents and teachers commented negatively on the lack of trial period for AT within the Irish system.

The literature pointed to teacher cooperation as an important intervening factor with teachers needing access to expert advice and to training and support. This was also a finding within the empirical part of this study. Continuing professional development and initial teacher education are essential to create the conditions for effective use of AT in education but training and support specific to an AT device may well be required at individual level.

The literature pointed to parents as a significant factor in determining whether a potential AT user gets the technology they need. Within the Irish system it is clear that although parents are heavily involved in this process they have no formal role.

The literature pointed to the need for AT training for new users to be empowering and participative. It is not sufficient merely to provide the specific skills needed to operate a given piece of AT. Personal factors, familiarity with AT and formal and informal supports are significantly related to empowered AT use in the transition to post-secondary education.

## **AT User Survey**

The survey was carried out with 96 students and reflects only the views of respondents granted AT under the DES scheme. The views of students deemed ineligible for the scheme or potential users who had not been identified as needing AT were not gathered.

## **Educational participation**

In general, respondents viewed the AT they received in a positive light. The AT granted under the DES scheme was valued by most of those interviewed. The AT helped pupils meet the educational challenges they faced – though there are no benchmarks available for this question, satisfaction with the AT received was considerable:

- The AT was considered to meet about 80 per cent of curriculum access, subjective wellbeing, academic attainment and educational engagement challenges. The majority of respondents faced challenges in these areas.
- Challenges in attaining life skills relevant to education and to school involvement were met less frequently. These challenges were specified by a lower number of respondents.

- The level of positive impact reported did not differ in terms of the type of AT used.
- The level of positive impact reported was significantly related to personal factors such as self-assessed capabilities and quality of life.
- Respondents with lower self-assessed capabilities rated the educational participation impact of AT as meeting fewer of their challenges.
- Respondents who had abandoned the AT reported significantly fewer positive impacts than those who continued to use their AT. However, the abandonment rate was lower than international estimates.
- Self-esteem and educational motivation differed according to age but not in terms of educational participation.
- The length of time respondents had been using their AT was significantly related to perceptions of the process but not to ratings of AT's positive impact.

### **Perception of process**

A considerable amount of qualitative data was gathered in this part of the study on perceptions of students and their parents of the process of acquiring and implementing AT. The summary of results presented below is organised by the various stages of this process. It should be noted that although a majority of respondents were positive in their perceptions of the process, the comments for the most part pointed to areas for improvement – respondents did not generally feel moved to make positive comments. Also, it should be noted that many parents did not feel able to comment on various stages of the process – in many cases this was due to their not being aware that these stages existed, reflecting a quite low level of involvement with, and awareness of, the process as a whole.

### **People involved in the process and type of AT**

The number and types of people reported by parents to have been involved in the identification of AT needs varied considerably with the type of AT the person received – parents and class teachers were most often involved for all types of AT. However, visiting teachers were almost exclusively involved with visual aids and audio systems, while OTs were not involved at all with these systems. Psychologists were not involved either, but were exclusively involved with software and computer systems and with control devices.

### **Identification of potential AT needs**

Most respondents rated this part of the process positively (82 per cent) although the comments made pointed to some problematic issues. The most common was that schools could be slow to pick up or acknowledge that a child might have a special educational need. Most often, external services identify potential needs earlier than schools (often at the pre-school stage). It was also reported that needs were often not identified in a timely manner and that relying on parents alone for identifying potential needs is problematic.

### **Assessment of needs**

Respondents were less positive about the needs assessment process (65 per cent were positive) and most comments related to areas for improvement. The main problems here were that assessment was perceived to have taken place too late, the views of parents were not always taken into account and the transfer of AT between schools (primary to secondary) was very difficult. However, respondents did point to the positive role played by external services.

### **Matching of needs to technology**

Sixty-seven per cent of respondents were positive about the process of matching needs to technology. However, most comments pointed to issues with this process, the most common of which was that there was no choice of AT offered and no trial period for trying it out. Some respondents stated that the AT they did receive was inadequate for their needs. However, a small number of respondents stated there was a good match between their needs and AT functionality.

### **Application process**

Most respondents had had positive experience of the application process (66.7 per cent). Positive comments, which were fewer, related to good approaches by the school and by assessment professionals (especially visiting teachers). Areas for improvement related to school inefficiencies, delays in the process and transfer of AT between first and second level schools.

### **Allocation process**

The process of allocating AT was viewed less favourably by respondents – only 50 per cent rated it positively. There were relatively few comments here and these were almost all relating to areas for improvement. Poor communications and delays were most commonly cited.

### **AT procurement process**

The majority of respondents held negative views of the procurement process – only 48 per cent rated it positively. Most comments related to areas for improvement and included the lack of a trial period with the AT, delays in the process and the practice of having separate awards for hardware and software.

### **Training for stakeholders**

A small majority of respondents (51 per cent) had positive ratings of training and mainly related to well-received initial training. Positive comments were relatively few but related to well-received initial training. Lack of training for parents, or teachers or pupils was the most common area for improvement raised.

### **Support following AT installation**

A small majority of respondents (51 per cent) had positive ratings of support provision following AT installation. Very few positive comments were made on this part of the process. Areas for improvement included lack of follow-up of pupils who received AT, AT maintenance programmes and monitoring of progress of individual using the AT.

## Teacher Survey

Of the 46 respondents to the teacher survey (which was not representative), the majority were teachers from schools in which the AT user sample had been drawn. They came from a wide range of school types at first and second level. Respondents felt the policy and practice of AT's introduction and management left something to be desired. Policy and practice were seen to be disorganised – two-thirds of schools had no AT policy, while 60 per cent had no designated teacher responsible for AT. Many did not monitor usage and only half provided training to pupils, while two thirds did not provide training to staff.

## Sources of knowledge

A wide range of information sources was used, though no single source predominated, and there was relatively little satisfaction with these. To improve this situation, it was suggested there should be some type of central knowledge resource, guidelines on the AT applications and more training and support for teachers involved in the process.

The most commonly used information resources were the SESS, NCSE and DES websites. However, the quality ratings of these websites were moderate. There was no single source of information which could be used, nor was there a source of information used by the majority of teachers. Furthermore, no guidance was provided on the best or the most appropriate sources of information. In this context, it is no surprise that many respondents preferred face-to-face advice.

## AT acquisition process

Teachers were asked to comment on the entire acquisition process based on their experience. From these comments three predominant approaches to the process were apparent. The first involved situations where pupils had already been diagnosed with an impairment before coming to school; the second involved schools being proactive in trying to identify pupils with special educational needs who could benefit from AT; while the third and most common was a reactive approach where schools waited to be approached by others on the potential AT needs of pupils.

Teachers rated the earliest stages of the acquisition process most highly while the latter stages, i.e. the process of providing training for staff, pupils and parents as well as the ongoing support provided, were seen as areas for improvement.

System strengths included the role of visiting teachers, positive attitudes of school principals and SENOs' actions. However, improvements were also suggested. These related to providing more and better training for all, providing more AT, having access to appropriate expertise when needed, reducing the administrative load of applying for AT, reducing delays, having a more coherent approach to the awarding of AT and the difficulties of finding appropriate assessment professionals.

Barriers to AT implementation in schools were also identified. These included lack of training for all, negative attitudes towards AT by some teachers, trying to find the appropriate or right equipment, criteria used for awarding AT, system inconsistencies, keeping up to date on AT and a general lack of resources within the system.

## **Impact of AT on educational participation**

Respondents were also asked to rate AT impact on the educational participation of their pupils. In general, ratings were very positive with the exception of overall school involvement. In relation to curriculum access, teachers pointed to improved participation and interaction by pupils, better preparation of materials, improved reading and writing, and better educational outcomes for their pupils. Teachers also noted improvements in the educational engagement of their pupils. Specifically, they cited improved interest in educational issues, improved participation and interaction in class, better preparation of materials, and lower levels of stress and higher levels of confidence among their pupils. AT also influenced academic progress in terms of improved literacy and numeracy, better overall educational outcomes and an improvement in homework quality.

Finally, teachers were asked to suggest advice to colleagues. By far the most common suggestions related to the need for better communications particularly with the professionals involved in the acquisition process (visiting teachers, occupational therapists, SENOs, psychologists and others). They also identified a need to look at pupil needs as well as the type of AT that might be awarded.

## **Expert Focus Groups**

The final element of the study involved two focus groups with selected AT experts. The first question of interest concerned referral pathways for pupils who might benefit from AT. Multiple referral sources were apparent including parents, health professionals, teachers, visiting teachers, OTs, ophthalmologists, and audiologists. It was notable that these professionals came from both the public and private sectors. It was also noted that early life stage and later life stage referrals differed considerably. The role of assessment professionals varied with the type of organisation they worked for and with their specialty.

Pre-school assessment tends to be a smoother process and different assessment professionals are involved in the assessment of school age children. It was noted that the role of the Central Remedial Clinic had diminished in recent times – it had less involvement in direct assessment and was more active in terms of supporting assessment by other professionals.

Participants were asked about the types of information sources used to keep up to date with AT developments. Similar sources were used by different professionals and these included the internet, AT suppliers, peer networks, YouTube and continuing professional development. However, they also pointed to the difficulties of keeping up with developments in apps. Often, the sources of information about apps were not reliable and the general pace of development in apps caused problems. It was also noted that training in how to carry out assessments was not widely available.

The CRC and Dublin Institute of Technology do provide some training and support in this area.

Generally assessment professionals provide no ongoing support to pupils or schools. Exceptions include the CRC, DeafHear and Enable Ireland.

Finally, participants were asked to identify the most important problems with and any solutions they might have for the entire process of awarding AT. They pointed to AT transfer between first and second level schools; having to demonstrate eligibility; problems associated with late onset diagnosis of certain conditions; getting access to expertise that is needed; how to integrate AT acquired by parents into the system and lack of finance for AT. They also pointed to problems with AT being less than optimal; a lack of knowledge of how the system works among many stakeholders; less than optimal communications between stakeholders in the system; too little training being available and delays in the system.

## **Assessment of Findings in Relation to Research Questions**

RQ 1: What does research evidence tell us about what is the most effective AT/equipment to support children with special educational needs to access the curriculum, engage in learning and enhance their educational experience?

International research evidence is not conclusive in relation to 'what works'. In part this is because of the nature of both the technology itself, which is rapidly changing and proliferating (especially in the case of apps) and the difficulties of setting up robust experimental designs in the area. As a result, the research evidence is relatively weak on the specifics of any technology's efficacy. Nevertheless, consensus is quite widespread that AT is beneficial in the educational process, even if this statement is made about relatively small-scale studies of specific AT types for specific impairments.

RQ 2: What does research evidence tell us about the training and support needs of users and practitioners in this regard?

The literature is far more conclusive on training needs: there is a strong conclusion that training is essential, it should be part of training for assessment professionals and teachers, it should be updated regularly as technology changes and it should reach down to school level, where it should be available to class teachers and others as well as users and their parents.

RQ 3: What evidence is available from best practice guidelines documents in Ireland and internationally?

Evidence from best practice guidelines supports the need for training and information to be made widely available. It also points to the need for inclusive AT acquisition procedures, i.e. involving parents and users, and the need for effective inclusion into the educational curriculum. In essence, they point to the need for a structured, inclusive and well-informed process of AT acquisition and implementation.

RQ 4: What are the views of users, practitioners responsible for supporting the users in the classroom and the assessment professionals recommending the technology about what AT is most effective and requirements in relation to assessment, training and support?

The user survey found no evidence that any single type of technology was necessarily better than another. Instead of pointing to the need to adopt specific technologies, it generally pointed to process issues, i.e. to the need to improve the entire process of obtaining and using AT.

RQ 5: What lessons can be identified from this evidence?

The general lessons to be drawn from the evidence collected point to the need to adopt a sociotechnical approach to the AT acquisition process, whereby social and technical issues need to be simultaneously addressed and to the need to improve information, training and support activities.

RQ 6: What are the implications arising from this review for provision of assistive technology/equipment for children with special educational needs in Ireland including issues relating to maintenance and repair?

This is a substantive issue and the key implications are outlined below.

## Implications for Policy and Practice

The implications for policy and practice arising from the study are based on a sociotechnical perspective on AT in education in which the AT itself and the delivery system are included. In specifying these implications, areas for improvement at policy, system level and school levels were considered.

**Universal design for learning (UDL):** a UDL approach is appropriate in responding to the increasing overlap between mainstream ICT, ICT for learning and AT. The current pace of deployment of ICT for education should be acknowledged in developing UDL guidelines for AT deployment. An audit of the current AT identification and acquisition process using a UDL framework could form the basis for a more user-friendly, proactive transparent and administratively efficient approach to AT provision. A UDL checklist might be useful for schools in reviewing their AT practices.

**Implementation and funding of the current system:** a systematic benchmark for the appropriate level of spending on AT could be developed in collaboration with jurisdictions of similar size and level of development. Ease of access to AT funding for schools could be enhanced by streamlining procedures to make it easier to determine eligibility, structuring funding so resources are available for proper assessment of need for all pupils and putting in place procedures for accessing AT training and support. A complementary budget should be considered for the training, support and follow-up of learners and teachers, in addition to funding for AT devices and equipment.

**Common and standardised approach to AT acquisition:** if national standards in AT provision are to be developed, the scope of the proposed AT working group could include a review of the AT identification and acquisition process, procedures to support evidence-informed practice and information resources. The system for AT identification and acquisition could include a follow-up stage so that AT outcomes and impacts can be measured and used to generate evidence to inform future decisions.

**Proactive system to identify the potential to benefit from AT:** the AT implementation system needs to be more dynamic and proactive in nature. System design should be based on a more proactive approach to identifying pupils with needs that can be addressed by AT and supported by active screening and assessment processes. Communications between actors within the education and health systems should ensure that children identified with an AT need in one system are brought to the attention of actors in the other system. This could be supported by adopting a common framework and terminology for describing AT needs and user strengths. Ongoing communication between HSE multidisciplinary and educational teams could avoid costly duplication and ensure the access needs of each student are fully met. The level of awareness of AT's potential needs to be high among principals, teachers and professionals. This could be supported by requiring the proactive identification of students with a potential to benefit from AT in the school plan.

**Assessment of needs and matching the person and technology:** the findings support the need for a robust, reliable and effective process for identifying needs and matching technology to needs in an optimal way. This could be supported by including the development of an AT assessment and matching process policy in the terms of reference of the proposed AT working group. The focus in the assessment process could be reoriented towards the learner's abilities rather than requiring a focus on deficits. The assessment should reflect the child's view on their aspirations and needs and include a greater role for parents. A biopsychosocial assessment tool could support schools in facilitating provision of choice and a trial period for AT as part of the acquisition process. This would benefit not only the child, but also teachers and parents.

The potential of the IMPT (Irish Matching Person and Technology assessment instrument) to form the basis for a standard approach to AT assessment and matching could be reviewed. Literature on the IMPT documented the benefits of its person-centred, biopsychosocial characteristics and it provided important insights into AT users and their needs in the current study. The AT assessment and matching process should be developed on the basis of principles of universal design with a particular emphasis on pupils with severe and more complex needs.

**Application, allocation and procurement:** eligibility criteria for the DES AT scheme could focus more clearly on learners' functional requirements and the person-activity-environment interaction. This could be supported by a biopsychosocial based eligibility assessment and a graduated approach to judging eligibility, selecting the most appropriate AT solutions and providing training and support. In practical terms a more efficient approach could be put in place which eliminates unnecessary delays within the system. Quality support for principals and teachers (similar to the visiting teachers service) and enhanced communications between schools, assessment professionals and SENOs would be important. Useful mechanisms could include a more direct application procedure with fewer steps and provision of a biopsychosocial template for making applications that documents strengths and needs, environmental barriers, interventions and supports applied and the outcomes of these interventions.

**Support and follow-up:** strategies to enhance support to all actors in the AT implementation process could be improved. An AT advice and support service with a role similar to that played by the visiting teacher service could be incorporated into the proposed inclusion support service. The awareness of all actors in the system that AT can transfer from school to school with the user when this is required needs to be raised. This should be supported by the transfer of know-how. System guidelines should address how AT use is managed during transition periods at all levels of the system including from pre-school to primary education, between schools and in particular between primary and secondary schools. The inclusion of AT provision in individual educational plans should be considered when this component of the EPSEN Act is commenced as a means of increasing a successful transition and ensuring the appropriate technology is in situ.

**Training and information:** AT training and support were identified as essential in the AT implementation process. In reviewing the current approach several issues could be considered including requesting the Teaching Council and the proposed AT working group to consider the issue. A properly managed central information resource to ensure access to up-to-date information on evidence-based AT practices for parents, teachers, assessment professionals and potential users would add significant value to the system. This could be designed so that access to national and international AT expertise is available online. It could support networking between professionals, AT experts, experienced and novice teachers, the collection of evidence of effectiveness from users and teachers and provide access to one-to-one advice and guidance from people with AT experience and expertise.

Initial and continuing professional development in ICT and AT in education would provide a good baseline for AT use in the classroom. Such training could include an understanding of disability, diversity and the application of ICT and AT within a universally designed learning environment. This would need to be complemented by training in the use of specific AT being available at school level for teachers, parents and pupils and the monitoring of ongoing training needs.

## 1. Introduction

### 1.1 Study Brief

This project investigates the question: Assistive technology/equipment in supporting the education of children with special educational needs – What works best?

It is deceptively simple, seeming to imply that the utility of AT is solely a function of the technology itself. The study acknowledges the importance of the functionality of AT. However, it is essential to situate this functionality within personal, social, policy and institutional contexts, including its selection and implementation within the classroom. In essence, it is necessary to adopt a sociotechnical view of the entire process, as various parts of such systems may function more or less well, giving rise ultimately to an answer to the question of what works best. This view brings together the essential elements of the AT assessment process: the person, the technology and the environment (Craddock, 2002).

What does this mean in practical terms for undertaking a study such as this? In this case it leads to investigating areas beyond the functionality, utility, acceptance of and satisfaction with AT. This perspective entails investigating the processes whereby students with special educational needs are identified and their specific needs assessed; it requires the examination of the AT identification process; the matching of AT to the needs of the individual and the process whereby AT is used and supported within the classroom.

This study examines all of these issues as well as taking a multi-stakeholder perspective on data collection – information was collected from the pupils themselves as well as from the parents, the teachers, the assessment professionals. In addition, a review of the literature was undertaken so that the latest research could be brought to bear on the overall research question and a review of national and international good practice guidelines was carried out to support the study's conclusions.

A good deal of evidence in the literature supports the view that technology can assist students with disabilities to overcome barriers within their environment. In line with technology advances, an exceptionally wide range of technology and equipment is available to support children with special educational needs in their education. The AT field is constantly undergoing developments and improvements. But what works best for children with special needs? Through use of quantitative and qualitative methods, this study investigates how student needs are identified, how these devices are acquired and how they are used in schools. In particular, the research covers devices currently sanctioned through the Department of Education.

### 1.2 What is AT?

Many definitions of AT are in use in the educational setting. Two come from international organisations (the ISO 9999 definition of 2011 and the WHO International Classification of Functioning Health and Disability of 2001). However, these definitions are not widely used

in the research literature on AT in education. Much of the literature relies on definitions that derive from the Individuals with Disabilities Education Improvement Act (IDEA) in the US which involves AT devices and services. All definitions in use contain elements that define AT in terms of technologies that either increase access to education and/or increase competence in carrying out educational tasks. A full discussion of the definitional issues relating to AT is presented in Chapter 2.

The domain of AT devices of interest in the present study was limited to those approved by the NCSE for funding under the DES scheme for allocating AT for learners with disabilities in primary, post-primary and special schools. Key characteristics of the AT focused on included the functionality of the AT intended to facilitate access to effective education and/or any item of equipment that could be used to improve the functional capability for a pupil with special educational needs that is of direct educational benefit to them (NCSE, 2013 p121).

This study adopts a sociotechnical perspective which viewed AT within the social, policy and institutional contexts that influenced its selection and implementation within the classroom. This included an exploration of the impact of AT devices on educational participation as well as the entire process from identification, through assessment of need, to procurement, installation, training and support.

### 1.3 Research Questions

The call for tender for this project specified six research questions to be addressed:

- What does the international research evidence tell us about what is the most effective assistive technology/equipment to support children with special educational needs in schools to access the curriculum, engage in learning and enhance their educational experience?
- What does the international research evidence tell us about the training and support needs of users and practitioners in this regard?
- What evidence is available from best practice guidelines documents in Ireland and internationally?
- What are the views of the users, practitioners responsible for supporting the users in the classroom and the assessment professionals recommending the equipment/technology about what assistive technology/equipment is most effective and requirements in relation to assessment, training and support?
- What lessons can be identified from this evidence?
- What are the implications arising from this review for the provision of assistive technology/equipment for children with special educational needs in Ireland including issues relating to maintenance and repair?

These questions are addressed through five main strands within the study. Information was collected from the pupils themselves as well as from parents, teachers and assessment professionals. In summary, the five strands included:

- review of the Irish and international policy context;
- systematic and comprehensive review of the national and international literature and good practice guidelines;
- interviews with students with special educational needs who had obtained AT under the current DES scheme (and their parents where appropriate);
- survey of the views of a sample of teachers, principals and classroom support professionals;
- two focus groups with professionals involved in the assessment process.

## 1.4 Ethical Approach

As the research involved collecting data from a vulnerable group, it was essential that procedures and instrumentation used in the study conformed to best ethical principles and practice. Accordingly, ethical opinions were obtained on the procedures and instrumentation to be used from two sources: an international expert in ethics and a third level college in Ireland. (It was not possible to obtain formal ethical approval from these sources as the researchers were not employed by an organisation with a recognised ethical committee). However, the same documentation was prepared and the same procedures followed as would have been done had access to an ethical committee been possible.

In drawing up an ethical approach to the project, the following documents were taken into account:

- National Disability Authority's Guidance for Ethics in Disability Research (2009)<sup>2</sup>;
- Children First: National Guidance for the Protection and Welfare of Children (DCYA, 2011)<sup>3</sup>;
- Department of Children and Youth Affairs' Guidance for Developing Ethical Research Projects involving Children (2012)<sup>4</sup>;
- Child Protection Procedures for Primary and Post-Primary Schools (DES, 2011)<sup>5</sup>;
- National Standards for the Protection and Welfare of Children for Health Service Executive Children and Family Services (HIQA, 2012)<sup>6</sup>;
- Health Services Executive Child Protection and Welfare Practice Handbook (2011)<sup>7</sup>.

<sup>2</sup> Good, A. (2009) Ethical Guidance for Research with People with Disabilities, Dublin: National Disability Authority.

<sup>3</sup> DCYA. (2011). Children First: National Guidance for the Protection and Welfare of Children. Dublin: Government Publications.

<sup>4</sup> DCYA (2012). Guidance for Developing Ethical Research Projects involving Children, Dublin: Department of Children and Youth Affairs.

<sup>5</sup> DES (2011). Child Protection Procedures for Primary and Post-Primary Schools. Dublin: Department of Education and Science.

<sup>6</sup> HIQA (2012). National Standards for the Protection and Welfare of Children for Health Service Executive Children and Family Services. Dublin: Health Information and Quality Authority.

<sup>7</sup> HSE (2011). Child Protection and Welfare Practice Handbook. Dublin: Health Services Executive.

Main elements of the ethical approach concerned:

- obtaining parental approval for pupil participation in the study – this involved developing an information sheet about the project and a parental consent form (see Appendix 7);
- ensuring participant safety – pupils could terminate their interview at any stage and they could have a parent/guardian or teacher present if they wished;
- protection of data confidentiality and anonymity – all data collected were kept securely and all reporting of data was done in an anonymous way.

## 1.5 Report Structure

The study structure, as indicated earlier, consisted of a literature and policy review; a survey of AT users; a survey of teachers; and focus groups with support professionals in the field of AT. These elements represent a challenge to reporting as they need to be reported on separately as well as being integrated onto an overall view of the study's results. In addition, this was a large-scale study with much detail needing to be reported on.

The report begins with a brief introduction. This is followed by an integrated methodology chapter presenting an overview of the methods and instruments used for each investigation. Further details on methods and instruments used in the study are available in the appendices. The next two chapters report on the policy and literature reviews undertaken while the subsequent three report on findings from the project's empirical work: user survey, teacher survey and focus groups. These five chapters contain considerable detail and, to aid the reader, each section of the project results chapters is introduced with a short summary of the findings. The intention here is to help track the project narrative. The final two chapters present a synthesis of the findings from the study's various elements and a set of implications for policy in the area.

A set of appendices, at the end of report, contains more details on a range of methodological issues as well as some background analyses that support the main results chapters.

## 2. Study Design and Methodology

There were five main strands to the study – the policy review, review of the literature and good practice guidelines, the AT user interviews, the teacher survey and the support professionals strands. These were designed to provide complementary perspectives on the main research question concerning what works in AT for students with special needs.

The literature, good practice and policy reviews provided a broad context for the other three strands. They reviewed the international literature in relation to studies on the effectiveness of specific types of AT; they also sought to identify literature on systems of assessment and provision of AT from which lessons could be learned for the Irish context; and they examined the Irish policy context. In addition, they sought to identify examples of good practice and practical guidelines.

The user interviews constituted the main part of the study. This strand aimed to interview approximately 100 representatively selected users of AT about their views on its effectiveness and on the processes related to the acquisition of AT.

The teacher survey looked to gather data from staff in schools from which the AT users had been drawn (though not in relation to the pupils taking part in the survey). The aim here was to obtain information that would complement the views of AT users. In practice, however, school staff surveyed came from other schools as well.

The final strand of the study consisted of two focus groups held with support and assessment professionals to obtain their perspectives on assessing children for AT and the subsequent processes of providing and using the AT.

Taken together these strands provide a structured and systematic approach to addressing the sociotechnical issues associated with provision of AT to students with special educational needs.

### 2.1 Overall Approach to the Study

A significant feature of the methodology is its aim to produce complementary perspectives on the processes and outcomes associated with acquiring and using AT. In this regard, it was important to obtain information from those with most knowledge of these processes: users, because they are the main beneficiaries of the process; school staff, because they are close to the acquisition and implementation of AT in the classroom; and support and assessment professionals, because they are involved in assessing and supporting the acquisition process. In addition, parents were interviewed on their perceptions of the entire process. Obtaining information from these sources has enabled a rich picture of how the process works from the vantage points of the main stakeholders and participants in the process.

The first stage of the process of approaching these three groups was to draw a sample of schools based on an anonymised database of AT recommendations for pupils by school provided by the NCSE. Participating pupils were identified and approached through their schools, usually through the principal. Those selected were then invited to take part in the study (with parental permission and pupil assent).

The next stage in the process was to invite teachers to take part in the teacher survey. These were approached through the schools which had pupils taking part in the user survey. However, the response rate to these invitations was somewhat disappointing, and the sample was augmented through the resources of the project team in order to ensure that sufficient numbers of teacher responses were obtained.

The final stage in the process involved obtaining participants for two focus groups to be held with support and assessment professionals. These were identified from several sources: the project team's own contacts, NCSE contacts and those of the project advisory group. The aim here was to include representatives of the range of professionals and organisations involved either in the assessment of eligibility of pupils for AT, or who were knowledgeable of or involved in the AT process.

These strategies proved largely successful in obtaining the requisite participant numbers for the study.

It should be noted that in drawing the samples for each of these three empirical strands, no effort was made to link respondents from these strands in terms of producing a dataset on pupils from multiple sources. This meant that pupils using the AT were not directly linked with school staff that responded to the survey, nor were the support and assessment professionals linked to either users or the school staff. Though this might have been desirable from a design point of view, it would not have been feasible in practice.

The process of conducting the research was supported by a range of organisations that provided useful input at various times throughout the process. These supports were:

- Association for Higher Education Access and Disability (AHEAD) which facilitated a consultation with a panel of post-school experienced AT users to inform the interview design;
- Dún Laoghaire Institute of Art, Design and Technology (DIADT) which advised on ethical practice in research with human subjects and which provided an ethical opinion on the research;
- group of international experts<sup>8</sup> from Australia, The Netherlands, North America, Italy, Sweden and Ireland who provided guidance in relation current research, including research in other languages, who contributed to a rating scheme for the strength of evidence in the literature and who reviewed the research instruments selected for the study;
- advice and feedback from the NCSE on the research process and development of an appropriate ethical process, including the development of a fieldwork child protection protocol;
- an advisory group of experts organised by the NCSE that provided feedback to the research team and the NCSE on the development of the research process, the data collection instruments, on data analysis and on draft reports to the NCSE.

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<sup>8</sup> See Appendix 1.

## 2.2 Literature Review Methodology

The review of the literature carried out for this study was based on a systematic search of publications in English spanning 2000 to 2013. The search and selection process is illustrated in Figure 2.1 and details of the approach to the literature review, key words used and data sources searched are presented in Appendix 2.

The literature search examined the international and national literature for potentially relevant articles. These were defined in terms of a range of keywords that covered educational technologies and assistive technologies in primary and secondary education for the target groups in question, i.e. children of school age with generic and specific disabilities. In addition, the websites of relevant organisations such as the Department of Education, specialist disability providers and suppliers were also searched.

The literature search was confined to specific types of studies, the aim being to review only studies of the highest possible quality and those addressing issues of specific concern to the project. The relevance criteria included<sup>9</sup>:

- type of study;
- type of participant;
- type of intervention;
- type of educational outcome;
- time period: published 2000-13;
- English language.

The search was undertaken in stages which are illustrated in Figure 2.1. In the first stage the search revealed 20,239 titles of potential interest. Of these, 11,614 were dissertations and 1,186 were duplicates, which were excluded from the review. In all, 7,439 unique records relating to AT in education were identified. In the second stage, records that did not relate to primary, secondary, special, middle or high school education were excluded, leaving 3,910 records which went on to the next stage. These were screened for relevance in terms of the types of interventions, participants involved and outcomes described. This screening further reduced the records to 680.

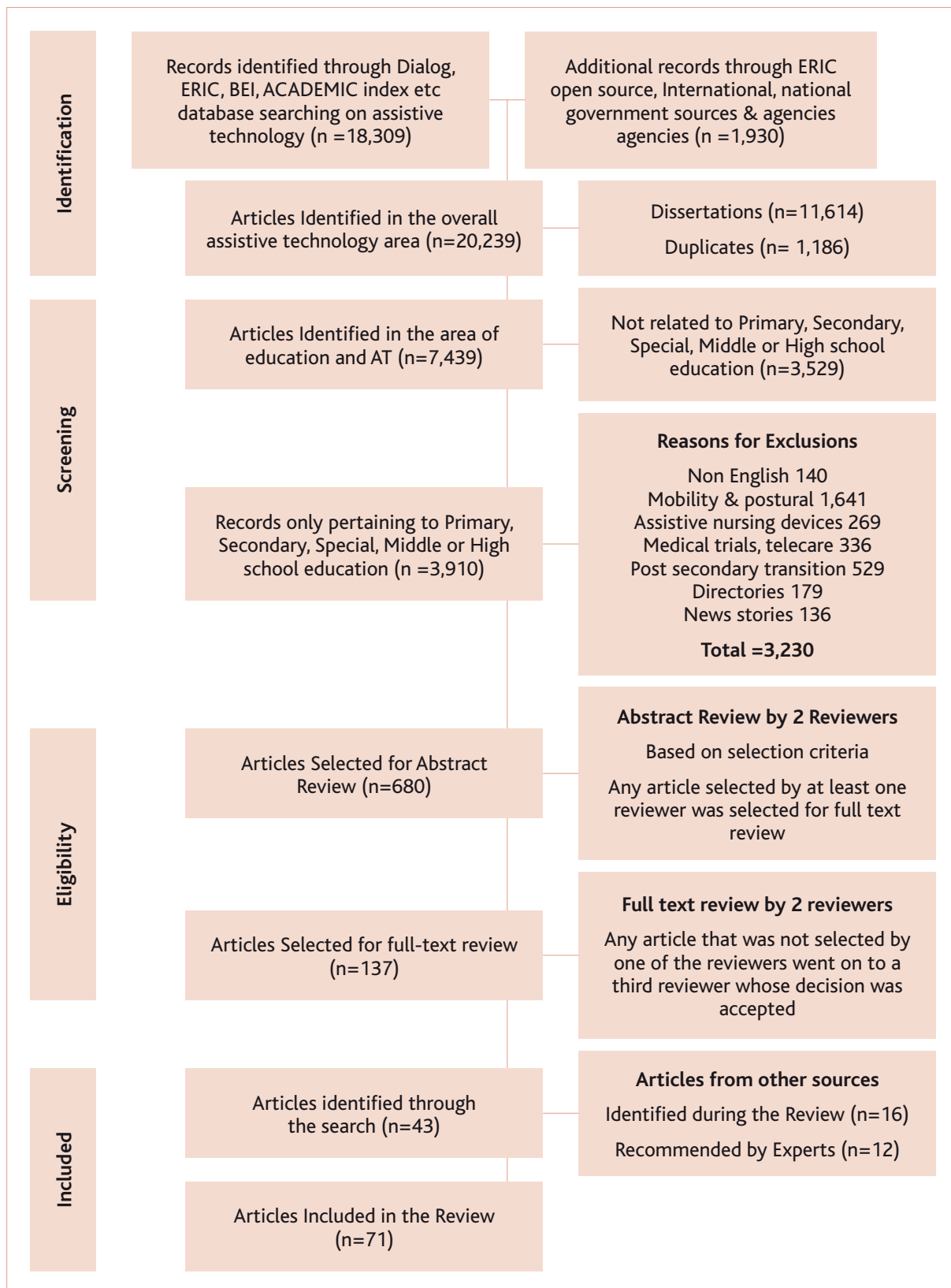
Abstracts were obtained for each of these 680 records which were reviewed by two reviewers on the basis of their potential relevance and quality in terms of:

- characteristics of study participants;
- educational or learning context;
- AT evaluated;
- methodology implemented;
- outcome measures used;
- study conclusions/recommendations.

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<sup>9</sup> A full listing is contained in Appendix 2.

**Figure 1.1: Overview of literature search and selection process**



Reviewers were provided with a set of evaluation criteria and a response template that allowed them to feed back the reasons for their decision to include or exclude an abstract. Following this process, 71 articles were read, summarised and included in the final literature review. Summaries of the final articles reviewed are included in Tables A1, A2 and A3 in Appendix 2. These provide a synopsis of the type of AT used; disabilities covered; type of article (e.g. meta-analysis, literature review, comparison group design, single subject studies etc); methodology used and findings. Additional articles were recommended by the NCSE, members of the project advisory group and the international experts who supported the project which have been incorporated into the review. These are not consistently included in the tables in Appendix 2.

## 2.3 AT User Survey Methodology

### 2.3.1 Sampling procedures

The population of interest for the study was pupils with disabilities who had been allocated AT by the Department of Education and Skills. The first step was to sample schools from an anonymised data set of positive AT recommendations provided by the NCSE. Survey participants were pupils attending these schools for whom positive recommendations had been made. The variables in the data set provided the basis for sampling.

It should be noted that this database did not include pupils who had made unsuccessful applications for AT, nor did it include pupils who may have had a need for AT but had not applied to NCSE for its provision. Moreover, the database related only to AT supplied through the NCSE scheme and took no account of pupils possibly using AT acquired through other means (for example, parents or disability NGOs).

A stratified replacement random sampling procedure was used to identify study participants. The unit of sampling used was the school rather than the individual. This was because database records referred to AT applications rather than individuals (individuals sometimes had more than one application). The sample was stratified on the basis of:

- Type of AT<sup>10</sup>:
  - Visual aids and devices;
  - Audio systems;
  - Communication devices;
  - Software;
  - Control devices/accessories;
  - Laptops and computers;

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<sup>10</sup> This categorisation was drawn up in consultation with NCSE and the project advisory group. It was based on ISO9999:2011 Assistive products for persons with disability – Classification and terminology.

- Gender;
- Type of School:
  - Primary;
  - Secondary;
  - Special;
- County:
  - Co Dublin;
  - Dublin City;
  - Cork;
  - Galway;
  - Kildare;
  - Urban/rural;
  - Disability category under which the AT was granted.

The study's main question of interest concerns AT efficacy. Therefore the experimental variable in the study is the type of AT obtained by the pupils. The other characteristics were treated as control variables and in the sampling process were counterbalanced across the design. This meant that impact of gender, type of school, county, urban/rural and disability category could be controlled for in the data analysis, but only for the whole sample. Interactions between them could not be explored.

The sample was drawn from four counties rather than from the entire country. These were Dublin, Cork, Galway and Kildare. These were selected on the basis that they would provide access to urban and rural schools as well as to schools from towns. It was not intended that this would be a nationally representative sample.

Procedurally, the sample was drawn as follows. Firstly, an anonymised dataset of the ATs recommended by NCSE was provided. Each school in the dataset was assigned a number in sequence. A random number generator was then used to select schools within the designated counties. The anonymised details of each pupil and type of AT recommended in each selected school were transferred into a sampling frame and the distribution of participants across the stratification variables was calculated. Sampling of schools continued until 200 potential participants distributed proportionately across the stratification variables were included in the sampling frame.

Invitations to participate in the study were issued to the principals of the selected schools. If a school opted out of the study, it was replaced by a randomly selected school of the same type. Where a school agreed to participate, the principal was provided with information about the research and consent forms, which were to be sent out to parents and pupils. Once a consent form was received the AT user was recorded in the final sampling frame.

### 2.3.2 Sample structure

Distribution of participants across the independent and the stratification variables are presented in Tables 2.1 and 2.2 below. These compare the proportions of the sample on these variables with those in the overall database to show how representative the sample is of the population.

The final sample consisted of 96 participants. The fact that the records in the database relate to recommendations for technology made it difficult to achieve full agreement between 'Actual' and 'Expected' numbers of pupils in the various categories shown in the two tables.

**Table 2.1: Distribution of respondents by type of technology and type of school (%)**

Type of AT	Proportion	Type of School			
		Primary	Post-Primary	Special	Total
Visual aids	Expected	13	13	15	14
	Actual	13	7	18	13
Audio systems	Expected	25	16	6	16
	Actual	30	14	5	16
Communication devices	Expected	16	0	13	10
	Actual	13	0	5	6
Software	Expected	21	17	13	17
	Actual	15	25	5	15
Control devices/ accessories	Expected	12	10	45	22
	Actual	13	7	41	20
Laptops and computers	Expected	14	43	8	22
	Actual	15	46	27	29
<b>Total</b>	<b>Expected</b>	<b>52</b>	<b>30</b>	<b>18</b>	
	<b>Actual</b>	<b>48</b>	<b>29</b>	<b>23</b>	

Table 2.1 shows the percentage of users of each type of technology (the independent variable in the study) in each type of school in comparison to the percentage that would be expected on the basis of the overall NCSE database. The distribution for type of AT and type of school in the sample corresponded closely to the NCSE database. However, there were relatively fewer users of visual aids at post-primary level than expected and there were fewer users of communication devices and software in special schools and more users of laptops and computers.

Table 2.2 presents the distribution in the sample across each of the stratification (counterbalanced) variables compared to the distribution in the NCSE database. The distribution agrees closely to what would be expected on all variables apart from gender, where the proportion of females is lower than expected, and disability category, where the proportion of

pupils within the moderate and severe general learning disabilities (GLD) categories was lower than expected. The proportion of participants within the multiple disabilities was somewhat higher than expected. One implication for interpreting data analyses is that for groups where there is a relative under-representation (such as females or pupils with visual aids at post-primary level) any differences associated with that group will need to be larger to be statistically significant.

**Table 2.2: Distribution of respondents across the stratification variables**

School Code	Expected	Actual
Primary	52	48
Post-primary	30	29
Special	18	23
County	Expected	Actual
Co Dublin	24	29
Dublin City	22	26
Cork	27	22
Galway	16	16
Kildare	11	8
Location	Expected	Actual
Urban	83	77
Rural	17	23
NCSE AT Code	Expected	Actual
Visual aids	13	13
Audio systems	17	20
Communication devices	10	7
Software	18	16
Control devices/accessories	19	18
Laptops and computers	23	27
Age	Expected	Actual
6-9 years	16	18
10-13 years	41	38
14-16 years	17	20
17-19 years	26	24
Gender	Expected	Actual
Female	39	26
Male	61	74

Disability	Expected	Actual
Assessed syndrome	4	4
ASD	11	9
GLD (moderate/severe)	11	5
Emotional behavioural	2	1
Hearing impairment	14	14
Multiple disabilities	22	30
Physical	21	19
Specific learning disability	6	7
Speech and language	2	4
Visual impairment	7	6

In all, 96<sup>11</sup> pupils (or their proxies) were interviewed in this part of the study. These included 11 students interviewed on their own, 28 parents or school staff interviewed instead of the pupil, and a further 57 students interviewed while accompanied by parents, SNAs or teachers.

Table 2.3 below provides a breakdown of the final sample of 96 pupils in terms of the types of AT for which they had received approval and the types of disabilities they had. The most common types of AT approved were laptops and computers (26 pupils) followed by audio systems (19 pupils) and control devices/accessories (17 pupils). The least common type of AT were communication devices, for which there were approvals for seven pupils.

As might be expected, pupils with sensory deficits tended to receive approval for AT that was specific to that deficit, i.e. visual aids and audio systems. However, a far wider range of types of disability was associated with the more generic AT types. Software and laptops/computers were awarded to pupils with seven different types of disability.

<sup>11</sup> The overall sample size was 96. However, for some analyses, only 95 were included, due to missing data.

**Table 2.3: Characteristics of the sample**

Type of AT	Type of disability	N
Visual aids (12)	Multiple disabilities	6
	Visual impairment	6
Audio systems (19)	Hearing impairment	13
	Multiple disabilities	4
	Specific speech and language disorder	2
Communication Devices (7)	Multiple disabilities	5
	Autism/ASD	1
	Emotional behavioural	1
Software (15)	Multiple disabilities	4
	Specific learning disability	4
	Physical	3
	Autism/ASD	1
	Emotional behavioural	1
	Moderate GLD	1
	Specific speech and language disorder	1
Control devices/accessories (17)	Physical	8
	Multiple disabilities	4
	Assessed syndrome	2
	Autism/ASD	1
	Moderate GLD	1
	Severe and profound GLD	1
Laptops and computers (26)	Physical	7
	Autism/ASD	6
	Multiple disabilities	6
	Specific learning disability	3
	Assessed syndrome	2
	Moderate GLD	1
	Specific speech and language disorder	1
<b>Total</b>		<b>96</b>

The specific devices to be included in each category was agreed through a consultative procedure with NCSE SENOs and a wide range of specific types of AT are covered by the six overall categories (see Table 2.4). Examples of visual aids included Flex CCTV with a distance camera, tripod and foot switch, print magnifiers and braille primers. By far the most common AT examples of audio systems were Soundfield systems, which accounted for 11 of the 19 awards in this category. There were few awards for communication devices, but four of them related to Boardmaker.

Typical examples of software awards included Read and Write Gold, laptops and voice recognition software and Alphasmart Neo. There was a wide range of control devices/accessories awarded, examples of which included move and sit cushions, switches of various kinds and keyboard and peripherals. Examples from the final category – laptops and computers included desktops, laptops, iPads and tablets.

**Table 2.4: Technologies included in the type of technology variable**

AT Type	Specific technologies
Visual aids and devices	CCTV and magnifiers
	Computer with camera
	Computer with magnifier or wide screen
	Other hardware and software e.g. Duxbury Brailnote
Audio systems	Hearing aids
	Radio systems
	Soundfield systems
	Sound amplifications systems (SAS)
	Pass around microphone
	Computer with radio aid
	Unspecified audio systems
Communication devices	Augmentative and alternative communication
	Computer with augmentative and alternative communication
	Sign language software
	Other software, e.g. Boardmaker

AT Type	Specific technologies
<b>Software with and without computer</b>	Predictive text software, Word processors and spellcheckers
	Voice activated software
	Text to speech software, audio and screen readers
	Educational, keyboard skills and games software
	Literacy
	Numeracy
	Keyboard skills
	Cognitive skills, memory, attention
	e-Books & e-Readers
	Unspecified software
<b>Control devices/accessories</b>	Adapted control and input devices with or without computer
	Dictaphone with and without computer
	CD player, headphones with or without computer
	Calculator with or without computer
	Printers with or without computer
	Scanners with or without computer
	Computer sundries
	Sundry equipment
<b>Laptops and computers</b>	Desktop
	Laptop/Notebook
	iPad
	Other

### 2.3.3 Development and administration of research materials

Two interview tools were used to collect information from AT users. The first was an interview schedule developed specifically for the study and the second was an internationally accepted instrument for matching a person's needs to appropriate AT, the Matching Person and Technology assessment instrument. The Irish MPT (IMPT) was selected as the most appropriate instrument on the basis of a review of AT needs assessment tools and feedback from international advisors and the NCSE advisory group. The procedures used to identify the most appropriate tool are described in Appendix 9.

The purpose of the interview was twofold. Firstly, it was intended to allow pupils to describe the extent to which, and in what ways, their AT had impacted on their educational participation (Section 1 of the interview). The pupils ranged in age from younger primary students to older

post primary students and were using a diversity of equipment to meet a range of special educational needs. In consequence, it was necessary in some cases to elicit this information not from pupils themselves but from proxy interviewees, i.e. parents or guardians, a school staff member or other professional, who provided their impression of AT's impact.

Secondly, the interview gathered perspectives on the process through which the AT was acquired (Section 2 of the interview). Pilot testing of the interview revealed that AT users were generally unaware of the application and acquisition process. For this reason, this section of the interview was completed with the parent or guardian of each pupil either directly following the interview on a face-to-face basis, or afterwards by phone, if the parent was not present or if the interview exceeded the set 60-minute limit.

Section 1 of the interview aimed to elicit information on the educational participation challenges pupils faced before obtaining AT and its impact after acquisition. It used a story-based inquiry initially and followed this with a prompted procedure to ensure all potentially relevant issues were covered.

The story-based inquiry served a dual purpose in that it elicited respondent views on what educational issues arose spontaneously for them that required AT provision and, at the same time, oriented them to the purpose and scope of the interview and prepared them to respond to the prompts. The narrative was tracked by the interviewer in terms of the challenges the pupils faced and the positive impacts they experienced. After they had completed their stories, the interviewer used a set of structured probes to explore the aspects of educational participation not raised spontaneously by respondents. The interviewer then requested respondents to judge whether AT had positively affected any of the challenges they had specified.

The essence of the story-based inquiry approach is to ask respondents to tell their story in their own words. The information gathered can then be categorised and analysed, either through pre-defined categories or through a qualitative analysis procedure (both approaches were used in this study – see Appendix 8). However, using pre-defined response categories did not alter the simplicity of the questions asked of the respondent, as the exhibit below shows. This is extracted from the interview schedule, the full version of which can be found in Appendix 4.

## Exhibit 1: Questions asked in the story-based interviews

### Introduction:

What I would like you do is to tell me the story about you and the AT you got to help you with learning, your education and the life of the school. You should tell your story in your own words and then your mother/father can add anything else that might be useful or important. I may/will phone your mother/father later to get his/her opinions.

I am interested in things like:

- The way you got the AT;
- The types of AT that you use;
- The things that are easy for you to do using the AT;
- The type of training you got in how to use the AT;
- The kinds of support you have in getting the most out of your AT;
- The differences that the AT makes in taking part in the life of the school;
- Other types of technology that you find useful;
- Whether there are other assistive devices that you think would benefit you in your education and in taking part in school life.

### Question 1 – Pre-AT Experiences:

We can get started by you telling me about what it was like before you got the AT and what happened then.

### Question 2 – Positive Impact of the AT:

Moving on to the present, I would like to ask some questions about how useful you find the AT. I am interested in particular in the differences that it has had on your school work, not in other areas of your life. For example, you tell about the way it helps you to cope with your school work, your level of interest school and learning, your experience of education, doing test and exams, getting on with your teachers and other pupils. It would be great if you could describe the best things about having the AT and any problems you are having.

### Question 3 – The Identification, Procurement, Training and Support Process:

That was excellent. Now I would like you to talk about how you came to get the AT you were given to help you with learning and school. For example, tell me about who suggested that you could get AT and how it was decided what was the right AT for you. You could also describe the kinds of training or help you got in how to use the technology.

The answers obtained from part 1 of the interview (questions 1 and 2) were categorised in terms of the concept of educational participation. This was operationalised based on the work of Douglas *et al* (2012) for the NCSE who proposed that educational participation had a number of dimensions including attainment, attendance, happiness, independence and engagement and school participation, each of which could be subdivided into a number of sub-elements. The five domains of educational participation generated for the current study reflected these domains. They were: curriculum access, educational engagement, school involvement, attainment in academic and life skills and subjective wellbeing. School process engagement referred to being engaged in all aspects of school life both within and outside the classroom, taking an interest in school life and activities and being aware of what was going on in the school. Participation in school-related activities related specifically to the formal aspects of school such as breaks, library time, recreation or assemblies and access to school facilities. Academic attainment was viewed from three perspectives, overall academic attainment, attainments in literacy and numeracy and attainments in specific subjects. These distinctions were made on the basis that a pupil can have difficulty with literacy or numeracy but perform well academically or be achieving well overall apart from one or two specific subjects e.g. history or languages. Each construct was operationalised in terms of a number of sub-categories. The advisory group and international expert panel were consulted on the appropriateness of these categories and the final version of the concept is outlined in Table 2.5 below and full details are provided in Appendix 8.

**Table 2.5: Elements of educational participation**

Element	Sub-element
Curriculum access	Classroom participation
	Participation in assessment
	Access to learning materials and resources
Educational engagement	School process
	Cognitive engagement
	Behavioural engagement
	Affective engagement
School involvement	Participation in school-related activities
	Extra-curricular school activities
	Relationships with peers and teachers
Attainment	Academic achievement
	Literacy and numeracy
	Subject specific
	Skills for life
	Mobility
	Daily living skills
	Independence
	Socialisation
Subjective wellbeing	Academic orientation
	Enjoyment
	Self-esteem
	Confidence
	Optimism

The researchers identified educational challenges that pupils might face in relation to these elements of educational participation (question 1) as well identifying any positive impacts that the AT might have had on these challenges (question 2).

Researchers were trained to interpret the narratives produced by respondents. During and after the training they applied the criteria to a sample of responses. Concordance ranged between 0.85 and 0.65. Where ratings differed these were addressed and the criteria were refined. In addition, the researchers confirmed their interpretation during the interview when querying the extent to which AT had impacted positively on the challenges described.

Two versions of section 1 were produced – an independent version for AT users and their parents or guardian, in the cases where they were accompanied, and a proxy version to be completed by a parent, guardian or other informant (usually a teacher or SNA) in the case where the parent or guardian deemed this was most appropriate. The proxy version was administered in the presence of the AT user except where this was difficult to accommodate.

Section 2 of the interview comprised a series of open-ended questions about the AT identification, allocation and procurement process that were intended to be answered by a parent or guardian either in person or in a telephone interview subsequently. These are presented in Table 2.6.

**Table 2.6: Stages of the AT acquisition process and related questions**

<b>Identification of the potential for AT</b>	How was it decided that you could benefit from AT and if this could have been done better?
<b>Assessment of AT needs</b>	Tell me about any assessments that were done to decide on your needs before you got your AT and whether these could be improved?
<b>Person-technology matching process</b>	How was the AT that you got matched to your needs?
<b>Application process</b>	Tell me how your application for AT was made and if it could have been done differently?
<b>Allocation process</b>	Describe how it was decided that you should get the AT and whether there is a better way for this to happen?
<b>Procurement process</b>	Tell me about how the AT was bought and delivered and whether you would change the way this was done?
<b>Training process</b>	Tell me about the training you, and other people such as your teacher or parents/guardian, got to make sure that you could use the AT well?
<b>Support process</b>	Tell me about the types of help you get to make sure that you get the most out of your AT?

This part of the interview was administered for all participants. Responses to each question probe were categorised as being either primarily negative, neutral or positive and the content of each response was analysed to extract the basis for the perception of the respondent and the other people involved in the process.

Where section 2 was administered face to face, responses were audio recorded and notes were made by the researchers. In cases where a phone interview was undertaken, the researchers made contemporaneous notes. In a small number of cases where the interview exceeded the time allotted, section 2 was also administered by phone.

The third section of the interview consisted of the IMPT questionnaire. The IMPT, which consists of six sections presented in Table 2.7, produces more variables than those described in the table. The seven used below, however, were all that was needed for purposes of this study.

Two versions of the IMPT were used. The decision on which version was used was based on the age of the respondent and his or her capacity to understand abstract concepts. If a user was not capable of completing the IMPT on his or her own behalf, a proxy respondent was organised. This was frequently the parent or guardian but in some cases a teacher or SNA.

**Table 2.7: Irish Matching Person to Technology sections and variables**

Section	Component	Variables
1	<b>Educational goals:</b> The extent to which the respondent aspired to meet educational goals and his or her expectation that these were attainable.	Motivation
		Self-esteem
2	<b>Current capabilities:</b> The respondent's perception of their strengths and needs and the extent that these will improve or disimprove in the future.	Self-assessed capabilities
3	<b>Subjective quality of life:</b> The respondent's satisfaction with what he or she has achieved in terms of wellbeing, independence and participation.	Quality of life
4	<b>Technology utilisation:</b> The purpose of all AT being used, the duration and frequency of use and satisfaction with its impact.	Use/abandonment
5	<b>Assistive technology device predisposition:</b> The respondent's views about the extent to which each AT device fits with his or her life and temperament and contributes to attaining life goals.	Device impact
6	<b>Student self-evaluation:</b> The respondent's understanding of his or herself as a person.	Self-concept (technology preference)

### Development and piloting of instruments

Six researchers collected the data in the AT user survey. The research materials were developed initially by the research team and amended on the basis of feedback from the post-school AT users (organised by AHEAD), the international expert panel and the research project advisory group. They were piloted by a member of the team experienced in AT user research with learners from a variety of schools and of different ages. This provided a basis for generating the final materials and a researcher manual. These were provided to the researchers in advance of a three-hour training session during which the approach and methodology were presented. Subsequent to the training, each researcher shadowed an experienced research in a further pilot phase. Issues raised were addressed in a revised manual. During the interview process, each researcher had access to the principal researchers.

## Organising the interviews

Once the consent forms were received from a school, arrangements were made through the principal or his or her designate to carry out the face-to-face interview with AT users and/or their parents, guardians or other informant. Younger informants and those who needed to be accompanied (as indicated by parents) were interviewed together with an adult. Older informants had the option of carrying out the interview independently. Where neither of these options was considered appropriate, a proxy interview was carried out.

Parental consent was obtained before the interview. Signed consent forms were collected before the interview. In addition, the AT user's assent user was also obtained on the day of the interview.

Each interview lasted not more than 60 minutes and was recorded using a digital recorder. The interviewer emphasised the collaborative nature of the process and sat beside the AT user during the interview. Section 1 of the interview and the IMPT were administered during this time.

Section 2 of the interview was administered with the parent or guardian either face to face or via a telephone in cases where time did not allow for the former. Most interviews took place via telephone.

## Procedures for proxy administration

In the information pack on the study, parents and guardians were made aware that if they believed the AT user needed help with communication through an interpreter this could be arranged. If they felt the difficulties of communication were substantial, they were offered the options of being interviewed on behalf of the user or, alternatively, nominating a person to act on behalf of the AT user. A space was provided on the consent form that allowed them to indicate their wishes in this regard.

Researchers were trained to administer the interview in the case that the AT user was not in a position to respond on his or her own behalf or an interpreter was required. The proxy version of the interview involved the following procedures:

- Story-based inquiry:
  - The researcher clarified with proxy respondent that they were interpreting the question on behalf of the AT user to the best of their knowledge;
  - If the AT user was present, the researcher explained each question to the pupil;
  - The first name of the AT user was used in all questions;
  - If the proxy was a relative, parent or guardian the semi-structured interview was conducted by changing the syntax of the questions so that they referred specifically to the user;
  - The proxy was asked to describe the situation before acquisition of the AT in the first place and then the prompts were administered;

- Where the proxy was not sure the item was left blank;
- If the proxy was a teacher or SNA then any questions that could not be addressed by the proxy were covered with the parent or guardian by phone;
- In this case the prompt questions were asked directly rather than requesting a story and all answers were coded as prompted.
- IMPT:
  - An age appropriate version of the questionnaire was used;
  - The proxy was asked to provide a personal opinion about the AT user as they saw his or her reality or how they thought the user would rate themselves;
  - In each of the sections the syntax of the stem question was transformed using the user's name;
  - If the proxy was unsure about any item it was left blank;
  - Where the proxy was unsure he or she was reassured that this was an acceptable response;
  - When the proxy was a teacher or SNA, any questions that he or she could not answer were addressed to the parent or guardian by phone.

Questions about the AT acquisition process were always answered by parents in the proxy and non-proxy versions of the interview. Where the parent was not present this was administered in a phone interview.

Ninety-six participants were interviewed. However, one interview had to be dropped from the sample, because of missing data. In all, 35 interviews were undertaken with a proxy, in 27 of these the AT user was not present and in eight cases they were at the interview. The majority of AT users for whom a proxy interview was considered appropriate had a diagnosis of either multiple disabilities (17) or physical disability (seven). The diagnosis of the other participants interviewed by proxy were assessed syndrome (three), ASD (two), hearing impairment (one), moderate GLD (two), severe/profound GLD (one) and speech and language impairment (two). The person acting as proxy varied. The majority (16) were parents or guardians. Other proxies included school staff members (nine) and other professionals such as speech and language therapists (ten).

Of the 60 interviews administered directly with AT users, 11 were carried out with the pupils independently without another person present and the remainder (49) were carried out with either a parent or guardian (23) or a school staff member (26) present.

## 2.4 Teacher Survey

Respondents to the staff survey were recruited from the schools randomly selected for inclusion in the user interview study. Teachers were invited to participate from all schools from which pupils were drawn, but the number of responses was quite low, in part because the time of

year (May 2014) is for many teachers their busiest time. As a consequence, teachers were also recruited through contacts that had previous AT experience and were either known to the researchers, project advisory group or educational representative organisations. In essence, this was a convenience sample of teachers but those who took part in the survey can be characterised as being relatively familiar with the processes of AT acquisition and implementation. The survey obtained responses from a sample of 46 teachers, 25 recruited from participating schools and 21 through other channels.

No attempt was made to match staff to participants in the AT user study and survey questions were not specific to any individual with disabilities. The questionnaire was developed and piloted with a small sample of teachers. The questionnaire (see Appendix 5 for details) was administered electronically. Teachers were asked to complete the questionnaire and these were to be forwarded to the Work Research Centre (WRC) for analysis.

The questionnaire requested teachers to provide information about their schools and themselves. Questions asked included their familiarity with, and knowledge of AT, the sources of their knowledge of AT and ratings of the quality of the information they had obtained. They were asked about the AT identification process, the acquisition process and the impact that AT had on the educational participation of pupils. They were also asked for any advice they would give to a colleague with no previous experience of AT in education. Finally, they were asked what suggestions they would give to NCSE and DES on the entire AT implementation process.

Forty-six teachers responded to the questionnaire by email or by post although not all respondents completed all items.

## **2.5 Focus Groups**

The third empirical part of the study comprised focus groups with support and assessment professionals on the issues that arise in the processes of identifying pupils with needs for AT, matching technology to those needs and the role they have in the implementation and support processes that may take place. The focus group methodology was designed and implemented with the intention of obtaining qualitative information from disparate groups of people to identify key issues that might not become apparent with predefined questionnaires.

### **2.5.1 Aim of the focus groups**

The aim of the focus groups was to learn more about the process whereby AT is acquired, i.e. the decision-making processes for AT funding, the assessment which takes place, the process of matching the AT to the needs of the child, AT procurement, supports that may be offered for AT training and maintenance and any other relevant issues that arise. In addition, the focus groups sought to characterise the sources and the methods used by support and assessment professionals in keeping up with developments in their areas.

## 2.5.2 Participant selection

The initial aim here was to select a cross-section of professionals involved in the assessment process for AT eligibility. This was broadened to include people with a good knowledge of the processes involved from the wider stakeholder group as this would give multiple perspectives on the initial stages of acquiring AT not tied to the views of a single group.

A group of 28 potential participants was identified and 15 of these were able to attend both focus groups on July 18th, 2014. They were drawn from a range of stakeholders including support organisations, service providers and disability NGOs and were qualified in diverse professional fields such as occupational therapy, speech and language therapy and educational psychology. Parents, SENOs and educators were also represented.

This sampling strategy for the focus groups was not to create a truly 'representative' sample in any statistical sense, but neither was it a purposive sample. The aim was to construct two groups of professionals who could reflect the views of the main stakeholders, were knowledgeable on issues of concern and worked as support or assessment professionals.

## 2.5.3 Methods used

Before the focus group, participants were given a short questionnaire that addressed the main areas of investigation for the session. Participants could use this questionnaire to familiarise themselves with the issues to be discussed on the day. They were also asked on a voluntary basis to submit it to the research team to augment the information collected at the focus group session.

There were two senior Work Research Centre staff present at each workshop: one was chair and asked the questions, while the other ensured the main answers were recorded.

Following the session, questionnaires were collected from those who wished to submit them (it was also possible for these to be submitted offline). The information from these questionnaires was amalgamated with the questionnaires from the focus group discussions and integrated into a final report.

The main research questions asked of participants in the focus groups were:

- In your experience, how do children with AT needs come into contact with assessment professionals?
- What role does the assessment professional play in relation to the assessment and procurement process?
- Are you aware of the kinds of information resources that assessment professionals use?
- Are assessment professionals involved in the provision of training or ongoing support to children or teachers in schools?

- Are you aware of any training in relation to making AT assessments?
- How do you keep your knowledge up to date?
- How well do you think the AT support and procurement processes work?
- How well do you think the implementation and maintenance processes work?

## 2.6 Data Analysis

The study's empirical strands used quantitative and qualitative methods to collect and analyse data from:

- ninety-six self-report and proxy interviews with Irish AT users, aged six to 18 years, and parents/guardians;
- a questionnaire survey of 46 teachers;
- two focus groups with 15 assessment and support professionals.

Both qualitative and quantitative analyses were performed on the data and these included:

- a description of the findings from interview data with AT users (or their parents/proxies) on the challenges they faced, the impacts of AT granted under the DES scheme and their experiences of the AT identification and acquisition process;
- a description of results from the IMPT responses of respondents;
- an exploration of the relationships between key demographic variables and the data from the interviews and the IMPT;
- a multivariate statistical analysis of the data from the interviews and IMPT to assess relationships between a range of relevant variables and covariates;
- a description of the views of school staff on their experiences of the AT identification and acquisition process, the sources of knowledge and information they use and the impact of AT on the education of students with special educational needs. This was augmented by statistically analysing frequencies, cross tabs and means. The qualitative responses were explored using key content analysis;
- a content analysis of the focus group responses to two key probes: (1) views on the AT identification and acquisition process and (2) the impact of AT for students with special educational needs.

## 2.7 Features of the Study Design

The study has several significant and unique strengths which include:

- This is the first study of its kind in Ireland.
- It engages with a wide range of stakeholders. This gives it a legitimacy not only in terms of the range views obtained, but in terms of the depth of understanding of the issues it raises.
- It asks broadly similar questions from multiple stakeholder groups, thereby allowing for a multi-perspective approach to be taken to the main research questions of the study.
- It includes a broadly representative sample of users – this allows for solid conclusions to be drawn from the data analysis.
- It conducted a comprehensive and broad-ranging review of the literature and of best practice guidelines nationally and internationally.

The study design also has limitations that affect the generalisability of the findings. These include:

- The focus on pupils awarded AT under the scheme – pupils who had acquired AT from elsewhere or those who were unsuccessful were not included in the sample (no information was available on either of these groups).
- The relatively small numbers of respondents for the three empirical strands to the study – complex interactions between the main study variables are difficult to identify.
- Only the user survey used a representative sample of respondents. These limitations restrict the kinds of conclusions that can be drawn from the latter two strands of the study. Nevertheless, the function of these two strands was essentially to provide complementary information to that collected in the more representative User Survey. Moreover, as will become clear later, the scale and breadth of this study compares very well with the designs used in studies reviewed as part of the literature review.

## 3. Policy Background

### 3.1 Introduction

This chapter provides a context for the current study based on national and international policy in the area. It includes:

- Discussion of the definition of assistive technology;
- International policy position on AT provision;
- Overview of the current Irish legal and policy context;
- Current mechanisms for AT provision:
  - Discussion of some recent developments relevant to at and education;
  - Brief description of systems of provision in some other jurisdictions;
- Review of good practice guidelines in Ireland and internationally.

## 3.2 Defining Assistive Technology

### Section Summary

The Department of Education and Skills characterises AT as being any technology that enhances the performance of a learner with special educational needs by overcoming barriers in terms of presence, participation (engagement) and learning. The NCSE has described AT as any item of equipment that can be used to improve the functional capability of a pupil with special educational needs that is of direct educational benefit to them (NCSE, 2013: p121). To place these descriptions in context, this section overviews some of the more frequently cited definitions internationally.

The most frequent definition comes from the Individuals with Disabilities Education Act (IDEA) in the US which incorporates both AT devices and support services. This study reflects these perspectives as AT is defined not only in terms of devices or applications but also in terms of the services to help users acquire the most appropriate AT and to use it effectively. This is effectively a sociotechnical perspective that includes the entire process.

Definitions of AT in the field of education either refer to access to education or increasing educational competence or both. While this distinction between access (compensation) and instructional (remediation) technologies is conceptually clear, it is not widely used in research.

It was generally acknowledged that assistive technologies and mainstream technologies are converging and that it is more appropriate to view technologies on a continuum that spans technology for general use, through customised and adapted technologies, to specifically designed devices. In addition, applications originally developed as AT, such as speech recognition, have crossed over into the mainstream, while mainstream technologies are being used as AT. The rapidly evolving field of mobile technologies and apps, many of which are being used by people as assistive devices, is also blurring the distinction between AT and technologies for general use.

These developments were evident in the range and variety of devices and software that had been approved by the NCSE for funding.

This study focused specifically on AT to support effective education for students with special educational needs (NCSE, 2013). However, there is no single accepted definition of AT in education and so the conceptualisations of AT adopted in policy documents and the research literature were explored to obtain a sense of their relevance to the study. Some of the most frequently used definitions are presented in Table 3.1.

Some are more relevant to the education context than others. The definitions of both the International Standards Organisation (ISO, 2011) and the World Health Organisation (WHO, 2004) are frequently used as references for assistive technology in policy. However, they are less widely used in the research literature on AT in education. Much of the literature relies on definitions that come from the US Individuals with Disabilities Education Improvement Act (IDEA, 2004).

All of the definitions in the field of education contain elements that define AT in terms of technologies that either increase access to education and/or increase competence in carrying out educational tasks. No research article reviewed for this study applied the ISO definition (ISO, 2011), the definition in the International Classification of Functioning, Health and Disability (ICF) (WHO, 2001) or the broader WHO definition (WHO, 2004).

Most US studies adopted the definition included in IDEA 2004. This has two components – AT devices and AT services:

- Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customised, that is used to increase, maintain, or improve the functional capabilities of a child with a disability (Pub L No 108-446, § 602 [1]);
- Any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device (Pub L No 108-446, § 602 [2]) (AC141).

In line with the US approach, Campbell *et al* (2006) for example emphasised two components of AT: the devices and the services to identify appropriate AT and train users and families to use them (p3).

AT devices are tools for enhancing the independent functioning of students who have physical, sensory or cognitive impairments in education. AT devices can range from portable computer-based communication systems speech, speech output devices to devices to an array of sophisticated voice recognition and screen reading software packages.

**Table 3.1: Selected definitions of assistive technology**

<b>International Standards Organisation (ISO 9999) (2011)<sup>12</sup></b>
Any product (including devices, equipment, instruments and software), especially produced or generally available, used by or for persons with disability: for participation; to protect, support, train, measure or substitute for body functions/structures and activities; or to prevent impairments, activity limitations or participation restrictions.
<b>World Health Organisation (2001)<sup>13</sup></b>
Any product, instrument, equipment or technology adapted or specially designed for improving the function of a disabled person.
<b>World Health Organisation (2004)<sup>14</sup></b>
<b>Assistive technology:</b> An umbrella term for any device or system that allows individuals to perform tasks they would otherwise be unable to do or increases the ease and safety with which tasks can be performed.
<b>Assistive device:</b> Equipment that enables an individual who requires assistance to perform the daily activities essential to maintain health and autonomy and to live as full a life as possible. Such equipment may include, for example, motorised scooters, walkers, walking sticks, grab rails and tilt-and-lift chairs.
<b>Improving Access to Assistive Technology for Individuals with Disabilities Act of 2004 (118 Stat 1707 Public Law 108-364 -Oct 25, 2004 -SEC. 3. [3] –[5])<sup>15</sup></b>
The term 'assistive technology device' means any item, piece of equipment, or product system, whether acquired commercially, modified, or customised, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.
The term 'assistive technology service' means any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device.
<b>Foundation for Assistive Technology in the UK (FAST)</b>
Assistive technology (AT) is any product or service designed to enable independence for disabled and older people. (User group consultation at the King's Fund, 2001, facilitated by FAST). <sup>16</sup> It includes a broad range of equipment and services that assist older and disabled people of all ages to maximise their independence. It acknowledges the crossover between inclusively designed, mainstream products and the technology specifically made for disabled and older people.
<b>Ministry of Education Guidelines, New Zealand<sup>17</sup></b>
Assistive technology is any technology that enhances performance of students with special education needs by overcoming specific barriers in three areas: presence, participation (engagement) and learning.

<sup>12</sup> [http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=50982](http://www.iso.org/iso/catalogue_detail.htm?csnumber=50982)

<sup>13</sup> <http://apps.who.int/classifications/icfbrowser/>

<sup>14</sup> [http://www.who.int/kobe\\_centre/ageing/ahp\\_vol5\\_glossary.pdf](http://www.who.int/kobe_centre/ageing/ahp_vol5_glossary.pdf)

<sup>15</sup> <http://www.resnaprojects.org/statewide/essentialdocs/pl108-364.pdf>

<sup>16</sup> <http://www.fastuk.org/about/definitionofat.php?trm=%20Definition>

<sup>17</sup> <http://blennzonline.edublogs.org/2012/01/21/assistive-technology/>

AT services specified in IDEA 2004 include:

- Needs assessment including a functional evaluation of individual's customary environment;
- Acquisition of assistive technology devices through purchase or leasing by children with disabilities;
- Selection, design, fitting, customisation, retention, repair or replacement of devices;
- Co-ordination of other interventions or services with AT including education and rehabilitation;
- Training and technical assistance for the individual and/or family members;
- Training and technical assistance for professionals, employers, or other individuals who provide services substantially involved in the major life functions of AT user;
- Service intended to expand the availability of access to technology, including electronic and information technology.

The Foundation for Assistive Technology (FAST) in the UK consulted a user group in 2001 which agreed that AT was any product or service designed to enable independence for disabled and older people. This definition included a broad range of equipment and services. It acknowledged the overlap between inclusively designed, mainstream products and technologies designed specifically as AT devices.

In the main, definitions found in the literature reflected these concepts in part or completely. For example, Radic-Sestic *et al* (2012) referred to AT as any item, part of equipment or productive system that can be purchased, modified or made to be used to improve the functional capabilities of persons with disabilities. The authors also cited a definition for AT for cognition which described a cognitive aid as a computer system designed to assist a specific person to carry out one or more tasks related to activities of daily living including education and work (Lynch, 2002 cited in Radic-Sestic *et al* 2012: p3827).

Another conceptualisation of AT was any item, piece of equipment or teacher-made product designed to improve a student's functional capability or help a student succeed in accessing the general education curriculum (Watson & Johnston 2007: p35). This was similar to the characterisation of AT as any item, piece of equipment or product system used to improve functioning in terms of enhanced control of learning, participation in classroom activities and independence in completing assignments (Winter & O'Raw, 2010).

A report on a large EU study (Andrich & Besio, 2002) propose that AT can be classified either in terms of technical components relating to the functional role of the AT or in terms of the human, social and economic factors that influence choice. The authors recommend that organisers of AT education take account of a range of factors that can facilitate or inhibit learning. These include learner demography, readiness for AT learning, attitudes and expectations. They conclude that attitudes, supports and services, market factors and expectations within the person's social and health-related networks need to be addressed.

An important distinction in describing and evaluating AT has been proposed by Douglas and colleagues (Douglas *et al*, 2009, Douglas *et al*, 2011). They contend it is important to distinguish between educational technology, intended to enhance learning and competence, and access or assistive technology, which is about enabling a person to perform tasks or enhance functioning. An equivalent distinction has been made between the application of ICT to train and rehearse, to assist in learning and to enable learning (Abbot *et al*, 2011). Both categorisations reflect the complementarity between remediation and compensation (Ashton, 2005). Remediation refers to building capacity to perform more effectively in terms of functioning or carrying out activities such as reading or communicating. Compensation is about putting in place mechanisms to help carry out tasks and activities, such as learning from text, in the context of an impairment or activity limitation. This distinction was generally not clearly made in the literature reviewed for this study and various articles described technology applications intended to enhance capacity, for example using virtual reality to improve the communication skills of children with ASD (Parsons & Cobb, 2011). Reichle (2012) (citing Lane & Mann 1995) proposed that AT was a generic term to describe assistive, adaptive and rehabilitative devices for people with varying degrees of disability to assist or expand human function or capabilities.

In its guide to help schools and specialists provide quality AT services, the DES characterises AT as any technology that enhances performance of a learner with special educational needs by overcoming barriers in terms of presence, participation (engagement) and learning. The inference here is that usage of a technology defines it as being 'assistive' rather than any inherent characteristic. From this perspective, a piece of mainstream technology for one learner could function as an assistive device for another.

The National Council for Curriculum and Assessment (NCCA, 2004a) guidelines for primary school teachers on ICT in the curriculum adopt a broad definition of AT which refers to:

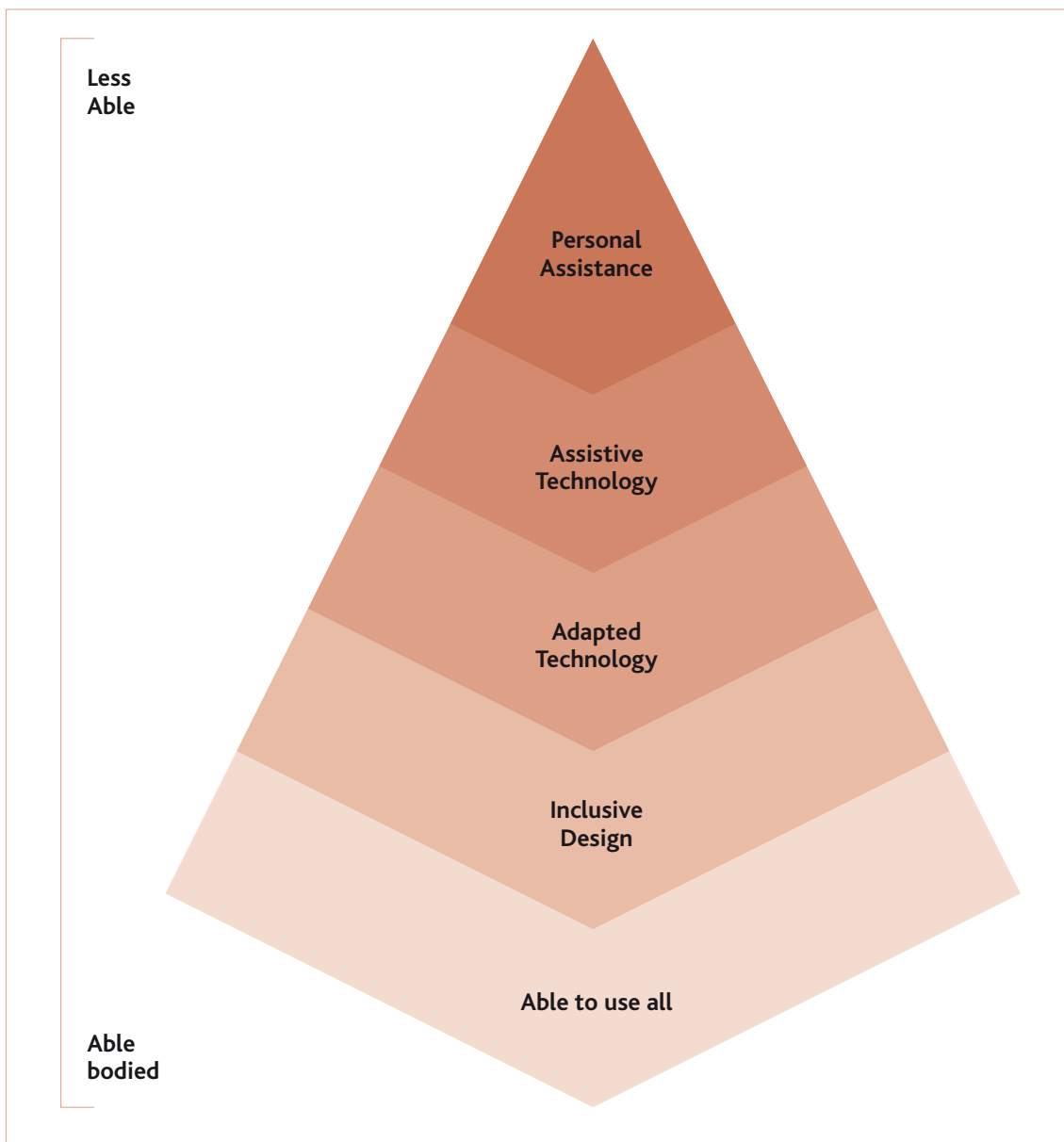
*A range of technological devices or systems designed to improve the functional capabilities of individuals with disabilities and maximise their quality of life. Some children of primary school age will need such technology in order to lead fuller lives as children and to assist them in their learning (p13).*

More recently the boundaries between assistive technology and everyday technologies have become blurred (Scherer 2012). Scherer points to the advantages of everyday technologies in terms of not singling users out as being different and because they are cheaper. They can function as an effective backup or secondary device for people. A major disadvantage arises in relation to funding as everyday technologies are often not considered to be eligible by funding bodies. In contrast, the specialised technologies that are covered by funding bodies, tend to be very durable, have strong support services and warranties and work better for persons with complex needs.

One way of characterising the distinction between mainstream and assistive technologies proposed by Nordby (2004) is presented in Figure 3.1. The usability pyramid shows all users of ICT equipment and services in terms of abilities and technology options. A broad span of people can use all technologies with smaller groups of people requiring inclusive design, adaptations to technologies or assistive technologies. At the apex of the pyramid are people who can only access services and devices with the assistance of another person.

There is a convergence of assistive and mainstream technologies such that devices designed to support people with disabilities are now used by individuals of all ages, while tools designed for the average user can be adapted to support people with disabilities (Stockall, Dennis & Miller, 2012; US Office of Educational Technology, 2013). For example, speech-to-text software is being used for hands-free dictation by a wide range of people and text font and size adjusters are standard for all e-book readers and for web surfing. In contrast, text-to-speech systems are also being used as augmentative communication devices and global positioning systems as navigation aids.

**Figure 3.1: Usability pyramid**



Adapted from Nordby (2004, p6)

Given the rapid rate of development and deployment of mobile technologies, for example over 30 billion mobile apps were downloaded worldwide in 2011 (World Bank 2012), the overlap between the objective of AT focused on enabling an individual to overcome challenges in his or her environment and universal design's (UD) vision of eliminating disability through a focus on continual improvement of the products, services, technologies and the physical environment is increasing (Craddock, 2015). There are over 65,000 educational apps on the Appstore website and they can be easily customised to learner needs and personalised around individual interests and circumstances. Moreover they can promote independent learning and offer immediate feedback and reinforcement.

While the population for this study was limited to a subset of AT users within the education sector (students in primary, post-primary and special schools using Department of Education and Skills funded AT) these developments were evident in the range and variety of DES approved devices and software. In this context, important characteristics are AT functionality and, specifically, any item of equipment that can be used to improve the functional capability of a pupil with special educational needs that is of direct educational benefit to them (NCSE, 2013) (p121).

In addition, the study was situated within the social, policy and institutional contexts that influenced AT selection and implementation in the classroom. This is effectively a sociotechnical perspective that includes the entire process of bringing together the essential elements of the AT assessment, the person, the technology and the environment (Craddock, 2002). This entailed not only an exploration of the impact of AT devices on educational participation but also an investigation of the processes whereby students with special educational needs are identified, their specific needs assessed; the matching of AT to their needs; and the processes whereby AT is implemented and supported in the classroom.

### 3.3 International Context

#### Section Summary

Access to AT for an affordable cost is a right under the UN Convention on the Rights of Persons with Disabilities and is considered an important component in inclusive education. In addition, the right to AT as a reasonable accommodation is implicit in the convention. The World Health Organisation acknowledges AT as an important environmental facilitator for the acquisition of knowledge, expertise and skills.

AT is deployed in educational systems to support learners with special educational needs in most developed economies. A brief overview of some systems identifies the following features:

- Code of practice/guidelines governing the deployment of AT (UK, NZ);
- Collaboration of health and education services in assessment (UK, IT);
- Biopsychosocial assessment (UK);
- Active involvement of the learner in the assessment and acquisition process (UK);
- AT for homework and for school (NL, DK);
- Incorporating AT into an inclusive education process (NL);
- Provision of expert advice and support services (NL, DK, NO, US, NZ);
- Acquisition of a standard computer is subsidised and is the property of the student (NO);
- Specialised equipment is provided on loan and maintained or repaired without charge (NO);
- AT as part of an individual education plan (IT, US);
- Monitoring of AT's impact (US, NZ);
- Increasing emphasis on universal design (US);
- Access to online AT supports and resources (NZ);
- AT no longer required is redeployed (NO, NZ).

Access to AT is a right under the UN Convention on the Rights of Persons with Disabilities<sup>18</sup> (UNCRPD, 2006). Article 4 specifies information and communications technologies (ICT), mobility aids, devices and AT as technologies that member-states must make available to persons with disabilities at an affordable cost. Moreover, there is an onus on states to carry out or support research into AT (UN, 2006). The convention acknowledges AT as an important element of inclusive education environments. It recognises its potential to reduce the isolation of learners with communication difficulties and its role in facilitating the participation in mainstream classrooms of learners with substantial physical or sensory impairments. Under Article 24 (on education) member-states must make reasonable accommodation so pupils can participate freely in mainstream general education at primary, post-primary, higher education and vocational training. The article is specific about arrangements to be made for people with sensory impairments.

<sup>18</sup> Ireland has not yet ratified this convention.

Borg, Larsson and Östergren (2011) explored the extent to which the general principles and specific articles of the UN Convention on the Rights of Persons with Disabilities (CRPD) supported the right to AT. In a review of 25 convention articles, five dimensions were examined – assistive technology terms, actions, target groups, areas of life, and actors. The analysis revealed that explicit actions relating to AT were not very 'far reaching' – no single article addressed the full AT process from design and production; availability, affordability, information, training and use and assessment and follow-up were not addressed. The main action focus identified was on availability and use rather than general provision. The rights explicitly linked to AT were freedom of expression and access to information, education and participation in political and public life.

The conclusion was that a non-discriminatory approach to interpreting the CRPD was most appropriate and supported the entitlement of people with disabilities to demand available and affordable AT to ensure full participation and equal rights and freedoms.

The World Health Organisation's International Classification of Functioning, Health and Disability (ICF, 2001) acknowledges AT as an important environmental facilitator. It includes education as one of ten key domains where technology can act as a barrier or facilitator to participation. Assistive products and technologies are defined in the ICF as adapted and specially designed equipment, products, processes, methods and technology. AT in education is defined as AT for the acquisition of knowledge, expertise or skill such as special computer technologies. A review of international literature on how the ICF has been applied in non-medical domains concludes that the application of the ICF can facilitate a more accurate, systematic and globally recognised terminology for describing the design process. It can provide a consistent method for investigating core variables to inform design for accessibility and usability (McAnaney & Gilligan, 2012a; 2012b).

A review of provision of AT across the lifespan documents approaches to the provision of AT in education in various countries (Cullen *et al*, 2012). A brief summary of provision systems is given here as part of the international context for the current study. With the exception of the Netherlands, the brief descriptions below have been abstracted from the report on AT provision in Ireland published by the National Disability Authority (Cullen *et al*, 2012).

## United Kingdom

The secretary of state for education in the UK issues a code of practice which governs how local education authorities (LEAs) and schools administer provisions for students with special educational needs.<sup>19</sup> The most recent code has updated the approach to the provision of special education provision in line with the Special Educational Needs and Disability Regulations (2014, No 1530). Special education is considered to address four broad areas of need: communication and interaction; cognition and learning; social, emotional and mental health; and sensory and/or physical needs. The active participation of learners and parents in decision-making is emphasised.

<sup>19</sup> Department for Education and Department of Health (2015). Special educational needs and disability code of practice: 0 to 25 years. Statutory guidance for organisations which work with and support children and young people who have special educational needs or disabilities. London, UK: Department for Education.

The previous approach to SEN identification has been incorporated into the new code and the legal test of when a child or young person requires an education, health and care plan (EHC) remains the same as that for a statement of need under previous legislation. Thus, pupils with more complex needs are entitled to a co-ordinated assessment process and an EHC plan rather than a statement of need and learning difficulty assessment. The SEN regulation requires that an EHC assessment takes into account information from the child's parent or the young person, educators and medical, psychological, social care professionals.

At its core, the process is a joint planning and commissioning procedure in which education, health and social care agencies must work together. Assistive technology and specialist equipment requirements must be included in the joint commissioning process for children and young people with special educational needs or disabilities, both with and without EHC plans. Schools and educational authorities must publish information on SEN services and supports. This must include information about how equipment and facilities to support children and young people with special educational needs are provided.

### **The Netherlands**

In August 2014, responsibility for special education in the Netherlands transferred from regional centres to regional alliances of mainstream and special school at primary and secondary level. In the previous system, AT provision in education was funded under two main statutory provisions that provided AT be used solely for homework and AT for pupils participating in mainstream primary, secondary and further education rather than special schools (Cullen *et al*, 2005). The types of AT devices eligible for funding in education were specified in Article 11 of the Ministry of Education regulation of educational supports and administered by the Employees Insurance Administration Office. Subsidies were available to schools and to parents through student-related subsidies which provided a budget for parents (the 'backpack') to support participation in mainstream education. Once eligibility was established parents had a role in deciding how the finance could be spent in collaboration with the school. Specialist advice was available from regional expertise centres covering all major impairments.

This system is in the process of being replaced by providing the alliances with their own budgets for educational support based on procedures developed by each alliance with participation from parents and teachers. The transition to the new system is scheduled to be completed by 2021 (Bosscher, 2013). In addition to establishing alliances, independent experts (educational consultants) are being put in place to provide advice on the placement and support for learners with special educational needs. At such an early stage, it is difficult to gain a perspective on the impact of these changes on AT provision to learners with special educational needs.

### **Denmark**

In Denmark, primary and lower secondary education is mainly provided by municipalities (Cullen *et al*, 2012). The Departmental Order of Special Education covers AT provision for school and homework. The school owns the AT which it provides to students free of charge. Municipalities must also provide support for children who have yet to start school. In primary and lower secondary education not provided by municipalities, AT is covered by a departmental order for

public and private primary schools and is funded by the state service at the Ministry of Education up to age 15. After this, the procedure depends on the type of school the student attends. The extra costs for SEN, including AT, are covered based on Ministry of Education approval. The municipal office for pedagogical and psychological counselling (PPR Office) provides the main support for AT acquisition. Arising from a teacher referral, a PPR-consultant then carries out an assessment and decides the type of SEN support including AT that is needed. While AT procurement, installation and training vary depending on the type of school, in general the special needs teacher is responsible with the support of the PPR-consultant. The office for special pedagogical support (SPS-office) provides for upper secondary school students. The process is similar in that a teacher or a special student adviser refers to the SPS-office. A specialist or therapist assesses and makes a recommendation for relevant AT and often assists with the customisation, installation and training of the student. In 2012, the Folkeskolen Act was amended to create a greater focus on inclusive schools. It provided specific direction addressing educational challenges and promoting differentiated and individual education.<sup>20</sup> While schools can access external specialised advice from pedagogical and psychological services, the principal has overall responsibility for developing inclusive education and applying supports.

## Norway

The Work and Welfare Administration in Norway is responsible for AT provision for education, at home and at school, in primary and lower secondary level education. In cases where a standard computer is required, a fixed subsidy is provided to the student and the equipment becomes his or her property (Cullen *et al.*, 2012). More specialised equipment is provided on loan under national insurance which also covers maintenance and repairs. Although a standard computer is not free of charge, the specialised software is. The distinction between specialised and mainstream software can be problematic. Pedagogical and psychological services are provided by local communities which can access support from national centres specialising in different disabilities. The health sector covers pupils with motor impairments with no learning problems. Local centres carry out the assessment and an application is sent to the work and welfare administration. Follow-up is the school's responsibility.<sup>21</sup>

## Italy

Italy has no special schools and mainstream education is provided to all students.<sup>22</sup> Students with disabilities are supported by special social and psycho-pedagogical services. AT provision in educational settings is the joint responsibility of schools and the local health agency with the schools taking the lead in identifying AT needs and ensuring provision. There is wide variability depending on the budgets available to schools. Within two months of starting school a student with a disability is provided with an individualised educational programme by a team of teachers,

<sup>20</sup> European Agency for Special Needs and Inclusive Education. Denmark – Special needs education within the education system. Accessed (20/09/2015) at: <https://www.european-agency.org/country-information/denmark/national-overview/special-needs-education-within-the-education-system>

<sup>21</sup> Sund, T. (2015). Assistive technology: The Norwegian experience. Presented at: Assistive Products for Children with Disabilities (APCD) Forum, July 6-7th, 2015, Copenhagen. Accessed (21/09/2015) at: [http://www.unicef.org/supply/index\\_82298.html](http://www.unicef.org/supply/index_82298.html)

<sup>22</sup> European Agency for Special Needs and Inclusive Education. Italy – Special needs education within the education system. Accessed (20/09/2015) at: <https://www.european-agency.org/country-information/italy/national-overview/special-needs-education-within-the-education-system>

health and social professionals working with the family. If AT is required within the school structure, the school provides, then owns, it. AT for personal use is provided by the national health system (Cullen *et al*, 2015).

## United States

Funding for setting up AT facilities including demonstration and information centres, equipment loan facilities and referral services are provided under the Technology-Related Assistance for Individuals with Disabilities Act (1988) at federal level in the US. Advocacy services to assist access to services, low interest loans and alternative financing are also provided. A requirement to consider AT needs for each pupil with an individual education plan (IEP) is set out in the Individuals with Disabilities Education Improvement Act (2004). Each US state implements the federal legislation in its own way.

An interesting approach was adopted in Ohio under the AT Infusion Project (Fennema-Jansen *et al*, 2007) which distributed AT grants to schools and measured its educational impact. AT is considered to operate in parallel with other interventions to enhance educational participation, quality of life and academic performance. The project gathered both pre and post AT information using web-based tools. AT allocation was based on the nature of the challenges to be addressed by AT, current levels of performance, previous and existing interventions and supports, potential solutions, evaluation of potential options, the solution eventually selected and the type AT requested. Applications which did not demonstrate that other options had been tried were not funded. Six performance areas were monitored: academic content; accessing and manipulating instructional materials/tools; work habits/study skills; communication, mobility; and personal care. Results showed general acknowledgement that the online application and management system required significant effort from schools. Nevertheless, 91 per cent of respondents to a survey strongly agreed it was worth the effort (Fennema-Jansen *et al*, 2007).

In parallel with AT provision emphasis on universal design is increasing in the US. For example, in 2006 Congress mandated a new and more universally designed approach by establishing regulations for the National Instructional Materials Accessibility Standard (US Department of Education, 2006) which stipulated that all US textbooks be available as a digital source file (i.e. a fully marked up XML source file based on the Daisy international standard). Digital source files can be easily transformed into many different student-ready versions, including a Braille book, a digital talking book and a large-text version. As a result the content is generated only once by a publisher but can be displayed in many different ways to match the different needs of diverse students.

## New Zealand

The special education section of the New Zealand Ministry of Education is responsible for supporting AT services.<sup>23</sup> It provides support and guidance to school staff and specialists, promotes access to learning environments and assigns AT to pupils. Guidelines to support

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<sup>23</sup> New Zealand Ministry for Education. Assistive technology. Accessed (20/09/2015) at: <http://www.education.govt.nz/school/student-support/special-education/assistive-technology/>

the provision of AT services have been published. A range of factsheets addressing the main challenges facing parents and teachers and templates and forms are available on the ministry website. Operational protocols to facilitate joint action by the Ministries of Education and Health are in place. A Centre for Assistive Technology has been established to provide AT support and advice to staff of the special education section, teachers and parents and early childhood education personnel.

The guidelines clearly specify the elements that should be included in the AT assessment and include the learner's personal characteristics, academic abilities and functional capacities, the physical and social environment at school and at home.<sup>24</sup> A well signposted services pathway that includes evidence of consideration of all other options for intervention and support; checking the eligibility and gaining informed consent; engagement of a multi-disciplinary team with an AT lead worker; assessment of needs and establishing baseline data; development of a community support plan for AT use; ongoing monitoring and support and closure. When AT is no longer required it is returned to the Ministry of Education for re-assignment to another student (Cullen *et al*, 2012).

### Lessons for the Irish Context

Several areas in which AT provision in Irish education could be strengthened have been identified through the international review (Cullen *et al*, 2012), including:

- Enhanced guidelines for primary and secondary schools and professionals on eligibility criteria and school responsibilities;
- A clear description of the service pathway for acquiring AT for schools and specifically for assessing professionals;
- A more formal approach to follow-up, monitoring of AT usage and impact including the use of previously granted AT;
- An effective mechanism to provide students with the necessary training to make sure they can get the best out of it;
- A review of the rationale underpinning the exclusion of certain high incidence disabilities from the AT grant scheme such as mild general learning disabilities which require technology support in education;
- Networking and knowledge sharing between educators and professionals with an expertise in AT to keep the personnel involved up to date and improve the standard of AT assessments and applications;
- Expertise at a local or regional level to support schools and parents in understanding the potential of appropriate AT and to contribute to continuing teacher education.

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<sup>24</sup> New Zealand Ministry for Education. Make an assessment and apply for assistive technology. Accessed (20/09/2015) at: <http://www.education.govt.nz/school/student-support/special-education/assistive-technology/make-an-assessment-and-apply-for-assistive-technology/>

### 3.4 Irish Legal and Policy Context for AT in Education

#### Section Summary

In the absence of the full commencement of EPSEN and Disability Acts, the Education Act and the Equal Status Acts currently provide the basis for AT provision in education.

It is important to view current Irish AT policy within the broader field of ICT in education, given the overlap between the domains of technologies for general use and AT. AT provision for learners with special educational needs must be viewed in the context of the underdeveloped deployment of ICT for general use in education in Ireland. A more unified approach to ICT provision in education and an integrated system of special needs and welfare supports has been recommended by the Post-Primary Education Forum (PPEF).

Despite a clear policy commitment to deploying ICT in education and providing ICT equipment, broadband and technical support to schools, concerns have been raised about the follow through on these commitments by agencies including the National Disability Authority (NDA), the Special Education Support Services (SESS), the National Council for Curriculum and Assessment (NCCA) and the Education Research Centre. Challenges identified include the need to enhance teachers' expertise, increased investment in infrastructure and equipment, greater support for schools and insufficient resources.

The system for providing AT to learners with special educational needs is different from the system of delivery for other SEN resources and supports. It is, however, important to take account of the recommendations of the NCSE working group on a new model for allocating additional special educational teaching resources to mainstream schools. Of particular relevance to the current AT provision scheme are the adoption of a biopsychosocial approach to assessment, the involvement of parents and student and moving away from diagnosis as a basis for the allocation of resources.

The NCSE has addressed AT in education in a number of policy documents and has highlighted its importance for learners with a range of special educational needs including hearing and visual impairments, emotional and behavioural difficulties, literacy and numeracy difficulties. Concerns have been raised about current procedures for allocating AT to students including delays in gaining access to AT, the need to ensure continuity during transitions between schools, enhancing teachers' AT knowledge, the provision of support in its implementation and ensuring that assessment professionals are aware of the latest developments in the field of AT in education. Issues have also been raised about the operation of the scheme in terms of fairness, adequacy, the use of diagnosis as a criterion for eligibility and lack of transparency in the appeals procedure.

The NCSE has recommended a working group be established to develop a national policy on AT.

## Legal Context

The use of AT to support students with special educational needs in primary and post-primary education is supported by the Education Act 1998, the Education for Persons with Special Educational Needs Act 2004 (EPSEN, 2004) and the Equal Status Act 2000-04. The Disability Act 2005 is also relevant where the need for AT to support access to education is identified by a health and social care assessment of need. The impact of the EPSEN Act is limited given that it had not been fully commenced when the current study was implemented and there was no indication when this might occur. The NCSE continues to recommend the full implementation of EPSEN in its policy advice, resources permitting (NCSE, 2013).

The Education Act provides a basis for the constitutional right to education of all children including those with disabilities or special educational needs (Section 6[a]). According to the Act, the Minister can produce regulations relating to technical aids and equipment and to reasonable accommodations to facilitate access to the schools (Section 33[i]). It requires that a school's plan includes a statement of the objectives and the actions it will implement to enable equality of access for student with disabilities or special educational needs and support their participation (Section 21[2]). Technical aids and equipment are specified in the Act in addition to support services, adaptations to buildings to enable access and transport as means to support participation of students with special educational needs and their families in education (Section 2).

The requirement to provide reasonable accommodations to persons with disabilities under the Equal Status Acts 2000-04 is the responsibility of the Department of Education and Skills (DES) and primary and post-primary schools. In the sphere of education, reasonable accommodations include special treatment, facilities or adjustments to meet the needs of learners with disabilities where it is not possible or extremely problematic for them to participate in school without such accommodations.

The requirement for schools to make reasonable accommodations can be waived if the costs involved are more than nominal. In the view of the Equality Authority in 2005, the nominal cost exemption may not be significant for State-funded schools and schools may have a responsibility to access statutory grants and resources to fund the required accommodation. The determination of an appropriate reasonable accommodation requires an assessment of the needs of the person and the context. This should take into account the views of the learner and family member (Equality Authority, 2005).

The Equal Status Acts provide an option for schools to give preferential treatment or take positive measures towards learners needing additional or alternative arrangements to students in general. The mainstreaming of students with disabilities is a presumption in the Equal Status Acts.

Inclusive education is at the heart of the EPSEN Act. Inclusive education involves students with special educational needs participating in education alongside those without such needs in an inclusive environment. This requirement is moderated by the proviso that it is not consistent with the effective provision of education to other children or the best interests of the student (Section 2).

The assessment of needs for young people is covered by both the EPSEN Act and the Disability Act 2005. Although neither specifies AT, references to supports and services undoubtedly include technical aids and equipment. Under the Disability Act (Part 2), an independent assessment of need which covers health and education needs is stipulated as an entitlement for children under school age and adults with substantial impairments. The assessment must specify the nature and extent of the disability, the person's health and educational needs and a statement of the services required to meet them (Section 8[7]). The SEN identified in this assessment are forwarded to the NCSE for action, specifying the suitable service (Section 11 [8]).

An education plan developed by the school is required under Sections 3 and 8 of the EPSEN Act<sup>25</sup> using guidelines issued by the NCSE or by the HSE in cases where the child is not a student. The assessment must include an evaluation of the nature and extent of the child's disability and the services the child needs to participate in, benefit from, education and to develop his or her potential (Section 4 [6]). The roles of those who could be involved in the assessment are indicated in the EPSEN Act and include psychologists, medical practitioners, the school principal or designated teacher or qualified therapists (Section 5[1]).

The outline content of educational plans specified in the EPSEN Act includes the special education and support services needed to enable the student to benefit from education and participate in school life. Special education and related services to enable a child to transition from pre-school to primary school education or from primary to post-primary should be provided (Sections 9[2] [e][f][g]). The transfer of information between schools to support transition is also indicated in the Act (Section 9[8]).

Cullen *et al* (2012) reviewed systems for AT provision across the lifespan. They concluded that a legal basis for an effective national system of provision in Ireland was provided by the link between the Education Act 1998, which defined support services to include technical aids and equipment, and the integrated approach to health and educational needs and service planning contained in the EPSEN and Disability Acts. The limiting factor was that the key component of both Acts have not yet been implemented, specifically the sections in the EPSEN Act addressing assessment of needs, statements and individual plans for students with special educational needs, has not been commenced, i.e. implemented by the relevant Minister, while the implementation of Part 2 of the Disability Act 2005 for children aged five and over has been deferred. This precludes a strong statutory basis for AT in inclusive education.

Currently, the Equal Status Acts 2000-04 provide the most solid basis for using AT for reasonable accommodations. In this regard, a statement from the Office of the Ombudsman for Children (2011)<sup>26</sup> raised concerns about the fairness and adequacy of the operation of the DES scheme for grant-aiding AT. In particular, use of diagnosis to determine eligibility, lack of clarity of guidance on eligibility, responsibility for determining eligibility and lack of a transparent appeals procedure were of concern. Diagnostic categories remain key criteria for allocating grant aid to schools for AT even though some of these issues have been addressed in Circular Letter 0010/2013.

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<sup>25</sup> These sections of the EPSEN Act have yet to be commenced.

<sup>26</sup> A statement based on an investigation into the refusal to provide an assistive technology grant to a child by the Department of Education and Skills.

## Policy Context for AT

Effectively, AT in education policy overlaps, on the one hand, with the ICT in education policy given the continuum of use and application of both domains (Nordby, 2004) and, on the other hand, with the broader sphere of the allocation of SEN teaching resources. Specifically, within an educational system in which ICT in education has been fully and effectively deployed, the role of AT would be to augment the access provided through ICT resources in the classroom. In the absence of effective deployment of ICT in schools, AT may be required to play a more central role in the inclusive education process. Equally, although allocation of SEN teaching resources in Ireland operates separately from AT allocation, there is no clear theoretical rationale for this approach and it is important to locate AT within the broader SEN context. Thus, this section places AT within the broader context by reviewing policy development in ICT in education and allocation of AT resources before addressing AT policy directly.

### ICT in education – policy and deployment

ICT's importance in education is recognised internationally (Watkins, Tokareva, & Turner, 2011) and nationally (DES, 2008). The DES publication *Investing Effectively in Information and Communications Technology in Schools 2008-2013* (2008) reports on a comprehensive evaluation of ICT's impact on teaching and learning. It was the first report of its kind. Indicative findings at primary and post-primary included the conclusion that teachers were positively disposed to using ICT but were impeded by the lack of access to equipment, broadband and technical support. It identified a need for greater clarity and understanding in using ICT effectively in teaching and learning and for greater support and guidance on ICT planning in schools.

The DES report characterised ICT as integral to all people's lives and proposed it should be a requirement that all citizens were capable of full participation in the digital world and that schools be provided with new ICT equipment, adequate broadband, technical support services and pedagogical guidance. It recommended teacher education and professional development; the ready availability of appropriate digital content and content tools; sufficient computers and supporting ICT equipment; adequate and robust broadband provision; technical support and maintenance of a high standard; structures to implement and support the investment; and support for effect-focused, leading-edge ICT research.

In *Smart Schools = Smart Economy* (DES, 2012), the report of ICT in Joint Advisory Group Schools, recommendations were made for an educational technology vision led from the top by the DES to ensure ICT use is financed, assisted and encouraged, and that a high standard of reliable technology is used effectively in all primary and post-primary schools.

The Post-Primary Education Forum is an umbrella organisation that includes the main stakeholders in secondary education in Ireland<sup>27</sup>. In its shared vision for the future (PPEF, 2013) it recommended that all special needs and welfare supports currently available be reviewed to develop a properly resourced, wide-ranging and integrated support service to support schools

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<sup>27</sup> The National Parents Council – Post-Primary, the teaching unions and the representative organisations of school management.

and students. It also recommended a unified approach to providing ICT in education including a programme of professional development to ensure that teachers make meaningful use of ICT; have adequate and appropriate ICT; and access to high quality and Irish curriculum-related digital teaching and learning materials and technical support.

ICT in education in Ireland has frequently been addressed in research and publications of the DES and other agencies, including NDA, NCSE, SESS, NCCA, and the Educational Research Centre. A key issue raised in many reports is implementation and follow through on policy commitments and particularly the need to enhance teachers' knowledge and use of technology in Irish classrooms.

A range of commentators has drawn attention to lack of effective deployment of ICT in education in Ireland.

Craddock (2005) identified teacher knowledge as an important factor in students' effective use of AT at post-primary level. The NCCA in its ICT framework final report (2007), piloted in 12 schools, concluded that teachers welcomed the framework, but lacked the infrastructure to implement it successfully. There was a view that ICT was undervalued in the classroom which was evidenced by out-of-date and inadequate equipment. The report recommended significant investment in ICT infrastructure, that ICT be embedded in the curriculum, assessment and State examinations and that teacher training in ICT be made available.

In 2009, the OECD (2009) noted that over 50 per cent of teachers in Ireland reported a lack of instructional materials, computers for instruction, library materials and other equipment. They considered this hindered their teaching. It also drew attention to the need to develop teachers' ICT teaching skills.

Many reports acknowledge the need for more resources to facilitate ICT in classroom practice (NCCA, 2007; PricewaterhouseCoopers, 2010; DES, 2011,) and to address the gap between ICT research and policy and its implementation in the classroom. Sheil (2011) reported that during 2004-09 computer use in classrooms and the level of IT usage by children in Irish schools was static and recommended greater access to ICT resources and courses.

Although computers are widely available in Irish classrooms, technology use is often relatively basic such as looking up information or reading a story onscreen and a minority of pupils rarely or never use a computer in class at all (Clerkin, 2013). The author concluded that ICT integration in teaching appeared to remain an area where professional development was key.

McCarthy & Murphy (2014) found a significant gap in research and classroom practice in a small scale study of teachers and their use of technology and teaching digital literacy in schools in Ireland. They highlighted a continued overemphasis on teaching traditional print literacy skills, a lack of understanding of digital print literacy and an increasing gap between use of technology at home and at school. Respondents referred to the pressure to integrate technology into the classroom in the context of insufficient of resources. Most teachers surveyed believed digital literacy development was the same as using technology as a tool to support the teaching of traditional print reading skills.

The allocation of AT resources needs to take account of the ICT resources available within a school setting. Given the general concern evident about the current level of deployment of ICT resources in the Irish education system, there are no grounds for assuming learners who require standard or generic equipment are likely to have access to such resources.

### **Proposed policy for equitable allocation of SEN teaching resources**

The NCSE working group report on Delivery for Students with Special Educational Needs: A Better and More Equitable Way proposed an improved model for delivering additional teaching support to students with special educational needs (2014b). Though the report does not directly address the allocation of grants for AT, it is important in the context of its strong view that diagnosis is not an appropriate mechanism for allocating additional teaching supports. This view is also supported by the conclusions of an international review of procedures to assess SEN carried out on behalf of the NCSE (Desforges & Lindsay 2010). This review recommended a framework for SEN assessment which reflected an interactionist/ecological (biopsychosocial) model based on a broad range of assessment methods and tools. In addition, it emphasised parents and students should have an active role in assessing and developing interventions. These findings are relevant to the AT grant scheme since diagnostic category is a key eligibility criterion in this scheme (DES 2013).

The NCSE working group concluded that need for a diagnosis to access additional teaching supports created pressure for professionals to label students. Using it as a basis for allocating resources did not properly reflect student level of need and also the requirement for professional assessment of diagnosis was inequitable as ability to pay for an assessment was a factor in gaining resources. An additional concern was the lack of indicators on the educational impact of these resources.

The guiding principles adopted by the working group were reflected in the NCSE advice on supporting students with special educational needs in schools (2013). The working group recommendations were intended to facilitate:

- Timely allocation of SEN resources;
- Balance between stability and flexibility;
- Resources for prevention and early intervention;
- Equitable and transparent basis for allocating resources;
- School capacity to identify and respond to SEN efficiently and to measure outcomes (p4).

The new model proposed that educational needs at school level would be the basis for allocating additional resources. All schools would receive a common allocation and further resources would be allocated on the basis of a school's profile in terms of the number of students with complex needs, the percentage below a specified attainment threshold on standardised tests and the school's social context including its location and pupil gender. The model's relevance to allocation of AT resources needs to be explored.

The deployment strategy proposed involves support from the National Education Psychological Service (NEPS) psychologists using a problem-solving framework to identify students with special educational needs and generating appropriate interventions. It also proposed a system to advise schools on goal development and collection of outcome indicators for students using SEN resources and guidelines on how to identify such students and assign resources. Moreover, the working group recommended setting up a NCSE inclusion support service (ISS) to bring together the disparate support services currently available in order to build schools' capacity and to support them in responding to exceptional circumstances. There is a case to be made for an AT advice and support service to be incorporated into the proposed ISS.

The NCSE published advice on supporting students with special educational needs in schools (NCSE, 2013) informed by six principles, including the view that all children should be welcome and be able to enrol in local schools regardless of the role of special classes and schools for pupils with complex needs. Other principles support equitable allocation of resources to schools and individuals in line with needs, individualised assessment which informs the teaching and learning cycle, effective use of resources and respect for the role of parents as primary educators.

The policy advice paper (NCSE, 2013) acknowledged that using diagnosis for allocating SEN resources had limitations including the tenuous relationship between diagnosis and level of need. It noted that delays in gaining a diagnosis can inhibit prevention and early intervention while access to assessment for diagnosis is easier for those who can afford to pay. In response to these and other concerns, the NCSE proposed a new allocation model to address these issues. This is framed within a national assessment system. The extent to which the new model can be applied to AT allocation needs further consideration.

### **AT in education – policy and deployment**

Apart from Circular Letter 0010/2013 from the DES, which sets out the procedures through which AT resources are allocated, no single formal AT policy document was identified. Nevertheless, studies and policy advice documents produced by the NCSE have addressed AT in the educational setting. For example, its policy advice for deaf and hard of hearing students referred to the role that technology and acoustic treatment can play in delivering appropriate education in all classrooms (NCSE 2011). It also recommended that the role of AT should be addressed in continuing professional development for teachers and in post-graduate education. The role of the visiting teacher service and voluntary organisations in providing advice was also highlighted. Other sources of support specified included having professionals provide assistance to parents. The NCSE policy advice on emotional and behavioural disorders specified the link to literacy and numeracy difficulties which could be resolved through use of appropriate technologies (NCSE 2012).

The NCSE policy advice on supporting students with special educational needs (NCSE 2013) addressed the current procedures for allocating AT to students with special educational needs. It raised concerns about how the scheme for grants towards the purchase of essential AT operates. These included delays in gaining access to AT, inadequate procedures to ensure that essential AT transitions with the student when changing schools, the level of familiarity of teachers with allocated AT and lack of support for teachers to learn how to use AT.

For these concerns the NCSE recommended that:

- DES clarifies with schools that essential AT can be transferred, particularly in the transition from primary to post-primary education;
- Measures are put in place to support timely and consistent access to AT for students;
- Professionals involved in assessment be up to date in their knowledge of the functionality and potential educational impact of AT;
- Teachers are supported to gain familiarity with AT;
- Standards to guide the assessment and recommendation of AT are developed.

The NCSE advised that a national policy on AT was required. Such a policy should specify the purpose of AT in education; the standards for professionals involved in making recommendations; the type of AT that should be made available; the basis for grant aid to schools; the roles and responsibilities of those involved in the identification and allocation process and the training requirements for teachers.

A specific recommendation in relation to AT was made (Recommendation 10) that included a proposal to 'establish a working group, with AT expertise, to develop a national policy on standards for professional recommendations and to determine the supports required in an educational context and the best ongoing utilisation of these resources' (p167). It also proposed that the potential for Education and Training Boards to provide expertise on AT schools be explored.

### 3.5 Current Systems for AT Provision in Irish Education

#### Section Summary

The main mechanism for allocating AT to learners with special educational needs is the DES scheme to support acquisition of essential AT for pupils with physical or communicative disabilities. Generic technologies and group applications are ineligible. Spending under the DES grant scheme was €1.26m in the year 2012-13 and 4,766 students benefited from this.

Applications must demonstrate that all other interventions, supports and equipment have been tried, that other funding sources have been explored and the learner has been permitted to use his or her own equipment. Evidence of a diagnosed condition is a criterion for eligibility although allocation of an interim award of AT while awaiting diagnosis is an option.

The application for AT is made by the school, equipment is procured by the school (or ETB) and the equipment is owned by the school which is responsible for its maintenance and repair. Equipment not being used can be re-allocated to another school. There is a facility for transferring equipment from one school to another where the AT is deemed essential.

The application is made to the NCSE SENO who makes a recommendation to the DES. If this is approved the school is reimbursed on the basis of receipts. It is possible for a school to appeal to the DES in the case that an application is rejected.

The primary source of AT funding within primary, post-primary and special education is the scheme of grants towards the purchase of essential assistive technology equipment for pupils with physical or communicative disabilities.

The procedures for AT purchase and repair through this scheme are detailed in Circular Letter 0010/2013 from the DES. The scheme is not relevant to generic technologies or to group applications. Smart phones, TVs and AT not essential to education are not covered. Before this scheme, no formal policy governed provision of technical aids and equipment in primary schools. However, in its absence the NCSE applied the guidelines issued by the DES for second level schools (Circular M14/05) to primary and post-primary<sup>28</sup>.

In preparing this report a search was carried out to identify other sources of funding for AT within the Irish primary, post-primary and special schools systems. In addition, information was gathered from informed respondents in special education and from the Education and Training Boards. Apart from individual initiatives on the part of schools or parents through fundraising, no other sources of funds were identified. In the past, some schools have acquired AT using core funding but there has been less flexibility for this in recent years.

<sup>28</sup> Revised scheme of grants towards the purchase of equipment for pupils with a disability in second level schools <http://www.education.ie/en/Advanced-Search/?q=Grants%20equipment%20disability&t=all&f=all>

The DES circular proposes a staged approach requiring that:

- All possible interventions and accommodations have been implemented;
- Existing equipment within the school has been tried;
- The possibility of procuring the AT out of school funds has been explored;
- The student had been allowed to use his or her own equipment in school;
- On the basis that the preceding options are not adequate, an application can be made to the NCSE.

The primary disability categories for which AT is intended relate to hearing and visual, physical and severe or profound general learning disabilities. In certain circumstances applications for students with moderate general learning disabilities, autism spectrum disorder (ASD), speech and language disorders, multiple disabilities and specific learning disabilities can be approved. In these cases, the school must provide evidence that it has used existing technology without success, it knows how the AT will be used in class and the student needs it will address.

Students with mild and borderline general learning disabilities and emotional behavioural disorders and without an additional disability are excluded from the scheme (Circular No 0010/2013; Section 4[c]). Students with a medical condition yet to be clearly diagnosed can be given an interim AT award. The DES reserves the right to substitute generic equipment where a particular brand of equipment is recommended.

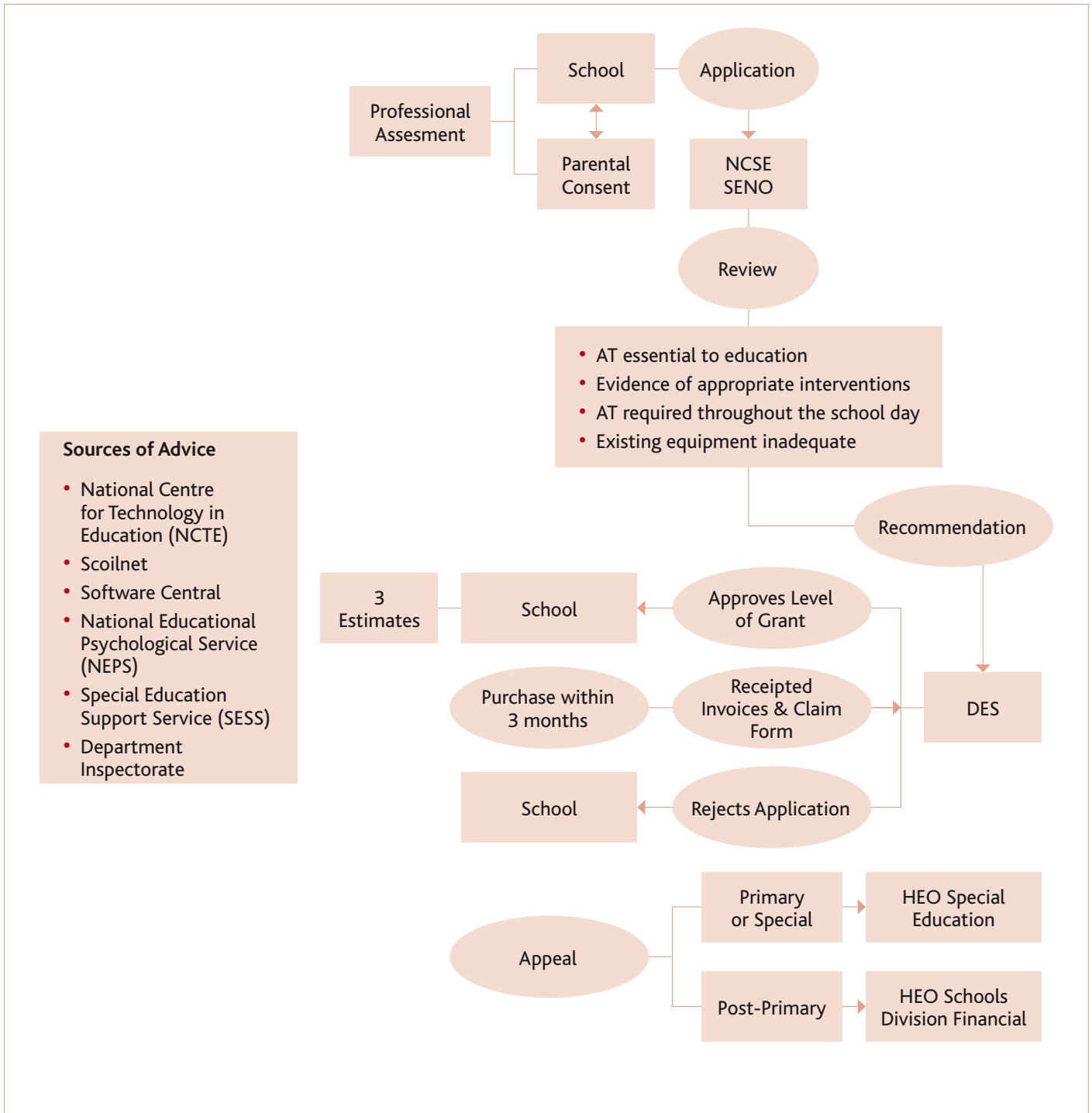
The school owns the AT and is responsible for maintenance and repair. The circular specifies that where the AT is specialist equipment not relevant to any other students in the school, the SENO may allocate it to another school. This could be the school to which the student is transferring, e.g. from primary to post-primary education.

The procedure begins with the school applying for AT to the SENO on a form developed by the NCSE. The application, which must be accompanied by evidence that the AT is essential for effective education, requires the school to specify:

- Teaching key skills and reasonable accommodations and adaptation already tried;
- Description of the need for AT throughout the school day;
- Explanation of why existing equipment does not suffice;
- How the AT will be used in class.

Procedures and processes specified in the circular are summarised in Figure 3.2. The SENO then makes a recommendation to the DES. If the recommendation is approved, the DES informs the school of the level of grant approved. The school must obtain three cost estimates before purchasing the equipment. The purchase must be made within three months of receiving approval. Cost of the AT is reimbursed on submission of receipted invoices and a claim form. Within the ETB system, support for procurement is provided by procurement services which can advise on the availability of a range of technologies during the application process and which acquire the AT for the school once DES approval has been obtained. Should an application not be approved, schools can appeal the decision.

**Figure 3.2: AT Acquisition process for primary, secondary and special schools<sup>29</sup>**



<sup>29</sup> In the case of ETB schools acquisition is carried out by central procurement services on behalf of individual schools.

According to the NCSE (2013), SEN resource expenditure rose by over 170 per cent in the seven years from 2004 to 2011 at a time when Governmental tax receipts had reduced in real terms. The expenditure in 2012 was about €1.3bn. Spending on AT under the DES grant scheme was €1.26m during 2012-13 and 4,766 students benefited from this. AT resources were allocated on the basis of the disability categories used by the NCSE and DES for the of SEN resources using the criteria above). The number of new applications approved is presented in Table 3.2, broken down by disability category.

The circular (Circular No 0010/2013) refers schools to a range of sources for AT advice including the visiting teacher service for students with visual or hearing impairments, the National Centre for Technology in Education (NCTE) (now PDST – Technology in Education), Scoilnet, Software Central, NEPS, the Special Education Support Service (SESS) and the Department Inspectorate. In addition, the DES specified learning support and resource teachers as a source of advice on augmentative and assistive technologies in its guidelines for the inclusion of students with special educational needs in post-primary schools (2007). The SESS website also provides lists of AT suppliers and useful websites.

**Table 3.2: Numbers of new approvals for AT in 2012-13 by disability category**

Type of disability <sup>30</sup>	Primary No of students	Post-primary No of students	Special No of students	Sum
Assessed syndrome	53	14	9	76
Autism/ASD	247	220	32	499
Borderline mild GLD	10	23	0	33
EBD	55	77	1	133
Hearing impairment	838	163	12	1,013
Mild GLD	16	26	15	57
Moderate GLD	60	16	20	96
Multiple disabilities	488	158	93	739
Physical disability	446	681	21	1,148
Severe EBD	17	10	4	31
Severe and profound GLD	14	0	45	59
Specific learning disability	210	260	15	485
Specific speech and language disorder	81	43	0	124
Visual impairment	175	89	9	273
Total	2,710	1,780	276	4,766

Source: NCSE (2013) (p121)

<sup>30</sup> An explanation of each of the disability categories is included in Appendix 3.

An evaluation of the SESS was undertaken by PricewaterhouseCoopers (2012). The SESS was established in 2003 to enhance learning and teaching for students with special educational needs, to develop and offer continuing professional development (CPD) initiatives and supports and to consolidate and co-ordinate CPD mechanisms already in place. The report found participants particularly valued the skills and experience of SESS and highlighted areas where it was thought it could develop new provisions relevant to AT. These included offering additional CPD opportunities relating to ICT, inclusion and teaching students with special educational needs and raising the awareness of classroom teachers about the potential contribution of AT to the educational participation of learners with SEN.

### 3.6 Evidence from Best Practice Guidelines in Ireland and Internationally

#### Section Summary

A review of Irish and international guidelines and principles concluded that:

- AT should be viewed from an inclusive education perspective;
- AT can play an important role in a Universal Design for Learning strategy;
- AT provision must be augmented by support to use the tool effectively in the physical environment and in accessing the curriculum;
- It is essential that instructional technologies and curricula do not create barriers to the use of AT by learners with disabilities;
- AT use should be closely linked to learning and teaching programmes and coordinated with staff;
- Parents and pupils must be engaged and communicated with during the needs assessment process and be made aware of all AT options;
- Assessment professionals have a key role to play in determining the most appropriate AT for learners;
- A phased approach to matching technology to the needs of the learner is essential;
- It is important to ensure the potential user has the cognitive ability to use the AT independently and that it is ergonomically appropriate;
- The pupil's home circumstances must be incorporated into the needs assessment;
- AT provision is essential to individual educational planning;
- Positive attitudes to AT should be promoted among professionals, educators, parents and learners;
- Efficient procedures for maintenance and repair are important elements of an AT process.

Publications from Ireland and elsewhere provide guidelines and recommendations on implementing AT within an educational context. For example, guidelines from the DES (Inclusion of Students with Special Educational Needs, Post-Primary Guidelines, DES, 2007) highlighted the role ICT could play in facilitating learning and teaching. The DES contended that IT could be most effective in facilitating students' learning when closely linked to existing learning and teaching programmes and suggested that learners with special educational needs learnt best when provided with opportunities to use concrete, structured and practical learning materials, including low- and high-technology support tools.

The National Council for Curriculum and Assessment (NCCA, 2004) published ICT guidelines for primary school teachers on ICT in the curriculum. These described the role of AT in supporting children and how it could be used to facilitate access to the curriculum. It recommended that ICT be included in the school plan. The main topics to be addressed were availability of finance and grants; coordinating staff and devices; communicating with parents and professionals; incorporating AT into individual planning; promoting positive attitudes to AT; and procedures for equipment maintenance and repair. Guidelines emphasised that it was crucial to match technology to learner needs and provided details of a variety of ICT AT devices. They also reviewed ICT which can be used to support the teaching and learning environment in general, access to software and access to the internet. The NCCA Guidelines for Teachers of Students with General Learning Disabilities (2007) provided useful advice and guidance about how ICT can support the learning environment.

The SESS has published useful guidelines on its website and made available the policy and practice recommendations generated by the SOLAS project which operated under the Schools Integration Project<sup>31</sup>. SOLAS operated from 1997 to 2001 and piloted an AT support service to meet the educational needs of pupils with physical and sensory impairments in primary and post-primary education (O'Mahoney, 2001). It was a comprehensive project that undertook a range of activities including investigating the existing system of AT provision from pupil and school perspectives; piloting a regionally-based approach to assessment and provision; raising awareness of the technology; identifying pupils who would benefit from technology; providing training to schools with pupils with AT needs; operating a flexible regional programme of supply, maintenance and re-use; exploring how a regional and central support structure could improve provision; liaising with other education structures and service providers in developing an integrated service; taking responsibility for making applications and maintaining equipment on behalf of schools; and considering the potential for an integrated service for AT and learning software.

The SESS AT overview described the factors that needed to be taken into account when making decisions about AT. These included:

- Engaging pupil and family in the process of AT needs assessment and acquisition;
- Adopting a phased approach to matching the pupil with an appropriate AT solution;
- Taking into account the pupil's home circumstances;

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<sup>31</sup> <http://www.sess.ie/resources/assistive-technology-overview>

- Making sure the device selected is compatible with the pupil's cognitive ability in terms of learning and independent use;
- Attending to the ergonomic dimensions of the context in which the device is to be used to ensure that inappropriate positioning is minimised;
- Considering AT from the perspective of an inclusive curriculum and use in the mainstream classroom.

The Inclusive Learning through Technology (ILT) project (Craddock, 2005) explored the concept of ubiquitous technology (combining specialised and mainstream software). It integrated a range of technologies including laptop computers for each student, interactive whiteboards and AT for students to produce an integrated approach to ICT in education. The project also provided blended learning courses in ICT and AT teaching. The MPT (matching people with technology) was used in assessing needs. The study evaluation revealed that the methodologies applied had a significant impact on teaching styles used and on student learning. Furthermore, the Keeping Pace with Technology (KPT) project produced Guidelines for Lifelong Learning in AT targeting professionals delivering training courses in AT assessment (Craddock, 2005). These included a range of operational and structural recommendations. Structural recommendations included:

- AT to be included in the planning and assessment of individual education plans and the statement of need;
- Determining the most appropriate Department(s) to manage and resource the AT sector so all mainstream services incorporate accessible measures;
- Establishing a single agency for providing AT services, expert support for AT assessment, information on technology advancements, research and development and technical assistance and training;
- Eliminating gaps in funding procedures for AT and creating transparent and simple practices to avoid misinterpretation or inappropriate implementation;
- More comprehensive, consumer-responsive and better coordinated funding policies including direct payment options;
- Establishing a user group of expert users to ensure that AT assessment, provision, research and development meet the needs of people with disabilities;
- Developing AT standards and definitions to ensure that only effective and safe assistive devices are provided;
- Developing a charter on AT in Ireland to establish a strategy for inclusion and make recommendations for action to all stakeholders in order to reduce barriers to, and achieve greater, participation in Irish society;
- The production of mainstream technology with accessibility built in, using the principles of universal design and the potential to adapt where necessary.

Operational recommendations included:

- Improving ongoing communication between health and education teams to avoid duplication and to ensure a comprehensive assessment of access needs;
- Implementing awareness initiatives to inform potential beneficiaries of AT, their families and friends, service providers and the public;
- Training in the field of AT for health and education staff;
- Cultivating and expanding AT competence of individuals as part of consumer empowerment activities.

In 2010, UNESCO published international recommendations which included good practice guidelines on using and applying ICT and AT (2010). Some relevant recommendations included:

- Considering ICT as integral to inclusion rather than separate from the normal work of educational professionals;
- Viewing ICT for people with disabilities along a continuum of educational intervention and across the spectrum of lifelong learning so that ICT is available to learning in formal and informal learning contexts;
- Systematically addressing the range of factors affecting the use of ICT in education at the level of the individual, the organisation and at system level including training of professionals, developing new approaches and tools and a policy framework;
- The promotion of positive attitudes to and awareness of the potential for ICT to provide learners. A number of stakeholder groups and in particular teachers need to be addressed;
- Creating access to appropriate ICTs in different learning contexts including the home by ensuring input from professionals from different fields and their effective, cooperation and interdisciplinary working;
- The importance of autonomy in using ICT for learners with disabilities and providing the means to be involved in and to influence decisions made on their access to ICT;
- The inclusion of information about the theory and rationale for using ICTs to support learning of people with disabilities;
- Adopting user involvement and user centred development to support end users of technology to be involved in the design and development processes.

In 2014, Skills for Health, the Sector Skills Council for the UK health sector, produced a standard covering identification and selection of assistive devices.<sup>32</sup> While specific to health, there are a number of standards of relevance to the assessment and selection of AT in education. The standard includes a requirement for facilitating agreement with individuals and carers in selecting and deploying a device or intervention and for working with others to plan or modify interventions. It specifies knowledge and performance requirements for professionals.

AT in education can be viewed within a Universal Design for Learning context (UDL). UDL is essentially a framework that attempts to address the barriers that inflexible curricula and a one-size-fits-all approach in education can represent to atypical learners. The UDL Guidelines – Version 2.0 were published by the Center for Applied Special Technology (2011). UDL is intended to respond to diverse learning styles and abilities through flexibility in goal setting, methodologies, resources and assessments.

A benefit of UDL is that it enables educational professionals to plan and create learning environments that are inclusive of all students. The pedagogical, neuro-scientific, and practical underpinnings of UDL are now well documented in the literature on teaching and learning (Rose, Meyer & Hitchcock, 2005; Meyer, Rose, & Gordon 2013; Rose 2015). In the US it has been officially recognised that designing assessments and materials to operate effectively with AT is much more cost-effective than trying to 'retrofit' these after they have been developed (US Office of Educational Technology, 2010). A national UDL Task Force has been established by the National Center on Universal Design for Learning to persuade the Administration and Congress to adopt UDL principles in federal legislation and policy and to integrate UDL into all learning settings and practice initiatives.

Rose (2015) contended that UDL was a way of thinking about learning that made it easier for the teacher to engage the learner and improve teaching practice by using all methods available. Rose advocated the importance of moving the disability label and emphasis from the student to the school environment. The UDL perspective views the problem as an environmental problem. This view fosters solutions targeting limitations in the curriculum rather than limitations in the student.

The starting point for UDL is the design of curricula to respond to the needs of all learners, thereby eliminating the needs for post-facto adaptations that can be expensive in terms of time and money (CAST, 2011). A UDL designed curriculum uses a variety of customisable options based on three primary principles:

- Use multiple means of representation – present content in a variety of formats so the different ways in which learners perceive and understand information are accommodated;
- Use multiple means of action and expression – allow learners to navigate through a learning environment and to express their knowledge and skills in ways suitable to individual needs and strengths;

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<sup>32</sup> National Occupational Standards (NOS) for Assistive Technology. Accessed (21/09/2015) at: <http://nos.ukces.org.uk/Pages/results.aspx?u=http%3A%2F%2Fnos.ukces.org.uk&k=assistive%20technology>

- Use multiple means of engagement – cater for individual differences in motivation and aspirations so that learners with diverse learning backgrounds and priorities can be engaged in the learning process.

The guidelines acknowledge an important role for AT in a UDL environment particularly for students needing personal AT to access learning environments. This can be the case even in the context of a well-designed and equipped UDL learning environment. However, AT does not exclude or substitute for UDL overall.

Under principle II (multiple means of action and expression), guideline 4 states that curricular materials need to interface seamlessly with common AT devices and technologies. Specifically, checkpoint 4.2 (Optimising access to tools and assistive technologies) contends that provision of tools is not sufficient in itself and must be augmented by support to use the tool effectively to navigate through the environment in the physical context and the curriculum itself. All learners must be allowed to use the tools that could assist them to participate fully but for learners with disabilities who have to use AT regularly it is essential that instructional technologies and curricula do not create barriers to its use. Examples of this provided in the guidelines include:

- Providing alternate keyboard commands for mouse action;
- Building switch and scanning options for increased independent access and keyboard alternatives;
- Providing access to alternative keyboards;
- Customising overlays for touch screens and keyboards;
- Selecting software that works seamlessly with keyboard alternatives and alt keys (CAST, 2011: p23).

## 4. Literature Review

### 4.1 Scope of the Literature

As indicated in Chapter 2, the literature review had a wide scope in terms of domains of learning, types of AT and disabilities. In all, 71 articles were reviewed for the study and these are summarised in Table 4.1.

The categories of Table 4.1 are not mutually exclusive – some articles addressed more than one disability and most included more than one specific AT device. In general, the literature covers disability categories used as a basis for determining eligibility for DES-funded AT and the types of AT used by the respondents in the study. The focus most frequently addressed by the articles was AT for literacy, i.e. reading, spelling and writing.

Because of the nature of the area (see section 4.3 below), few highest quality level articles were found. For example, only one carried out a well-designed meta-analysis – this was concerned with a selection of single subject case studies<sup>33</sup> which assessed the impact of the universal design characteristics of AT. There were five separate systematic reviews and 16 literature reviews. Experimental designs were used in 10 intervention studies: one included a comparison group of participants not using AT, one carried out a secondary analysis on the data of a longitudinal data set and the remainder were single subject designs, of which six used alternating conditions and one a multiple baseline design. Four studies carried out an analysis of the characteristics of AT applications without reference to users. There were two surveys of the perceptions of educators. Ten studies used qualitative observation methods and non-experimental case study formats. Twelve articles were opinion pieces or commentaries often based on extensive experience in AT application and deployment.

Summaries of the articles reviewed are included in Appendix 1 (Tables A1, A2 and A3).

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<sup>33</sup> Studies using alternating conditions where performance in an AT condition was compared with performance without AT over several alternating trials.

**Table 4.1: Summary of articles reviewed for the study**

Disabilities Addressed	Number of Articles	Types of Methodologies	Number of Articles
Special educational needs	6	Meta-analysis	1
Disability	3	Systematic review	5
Intellectual impairment	5	Literature review	16
Physical	12	Single subject design alternating conditions	6
Visual	8	Single subject design multiple baseline	1
Hearing	3	Comparison group – non randomised control	2
Specific learning disability	16	Longitudinal analysis	1
Autism spectrum disorder	10	Systematic case studies	5
Speech and language	2	Informal case studies	5
Cognitive	2	AT device/programme review	4
Emotional behavioural	1	Qualitative and observation studies	3
Multiple disability	3	Commentary	6
		Descriptive	8
		Educator survey	2

**Table 4.1: Summary of articles reviewed for the study (continued)**

Type of Assistive Technology	Number of Articles	Focus of Assistive Technology	Number of Articles
Assistive technology	21	Reading	11
Visual aids	6	Spelling	15
Auditory aids	2	Writing	16
Augmentative and assistive communications	10	Maths	9
Software	14	Social skills	3
Devices, switches, alternative input devices	9	Behaviour	3
Laptops and computers	13	Mobility	4
Ebooks	2	Speech	8
Virtual reality	4	Organisation	5
Computer-assisted instruction	8	Voice rec	7
Universal Design for Learning	2	Music	2

## 4.2 Categories of AT

The question of what precisely constitutes AT is of concern to practitioners, policy makers and the scientific community alike and was investigated as part of the literature review. Many definitions are in use, but no consistent taxonomy of AT emerged from the review. In some cases AT was specified in terms of the function or activity for which it was intended to compensate, e.g. AT for reading and writing. In other cases it was addressed in term of the type of disability to which it was relevant, e.g. AT for students with physical disabilities.

Various authors highlighted the distinction between low, moderate and higher tech AT (Edyburn, 2005; Watson & Johnston, 2007; VanWeelden, 2011; Courtad & Bouck, 2013). Low tech AT referred to a range of devices or equipment that did not involve ICT such as tactile rulers, advance organisers, graphic representations, wheelchair lapboards and Velcro® to enhance grip. Moderate tech included audio recorders, enlarged print and braille texts. High tech covered a wide range of computer applications both standalone and web-based including text to speech software, voice activated word processors, personal digital assistants (PDAs) and laptop-based augmentative and alternative communications systems.

Opinion is diverse on what constitutes AT, but may be summarised in terms of two perspectives, one viewing AT from the perspective of its intended impact on functioning and activity and the other which considers it from a disability perspective. In addition, other themes were extracted from the literature including assessment of needs and matching the person and AT, AT training and support, educators' perceptions of AT, the AT identification and acquisition process and Universal Design for Learning (UDL) and AT.

### 4.3 AT Research – Challenges to Interpretation

#### Section Summary

There were frequent references in literature reviews and commentaries on the absence of robust research evidence and a need for greater clarity on the nature of such evidence. Challenges faced in interpreting the findings from the literature included:

- Heterogeneity of populations in terms of needs and abilities;
- Low prevalence of many conditions;
- Demographics;
- Difficulty in establishing high levels of experimental control;
- Diversity of devices;
- Range of contexts in which at was applied;
- Rapid rate at which at was evolving;
- Methodological issues in terms of research design, small sample sizes, characterisation of outcomes and measurement tools.

Single subject designs in which participants acted as their own controls and longitudinal studies were recommended, in part because randomised control trials are so difficult to organise in the AT field.

Even in the context of these challenges, it is still possible to draw conclusions on key lessons arising and on the positive impact of AT (See section 4.4).

The need for more high quality research in the domain of AT and education is as essential today as it was in 2007 when Edyburn produced a major review of the area (2007). A recurring theme in many literature reviews was the rapid growth in technology use to support the learning and education of learners with special educational needs even without robust research evidence of its impact and a lack of solid underpinning theories (Shamir & Margalit, 2011). Furthermore, AT is evolving rapidly (Horn & Kang, 2012) and research has not kept pace with the proliferation of ICT-based support tools over the last decade at least in writing (Peterson-Karlan, 2011). There is general agreement on AT's potential to influence the educational performance of learners with special educational needs in a range of areas. What is lacking is data from experimental research either involving control groups or repeated measures pre-post studies with adequate sample sizes to support this contention (Maor *et al*, 2011).

Peterson-Karlan & Parette (2007) pointed out that although AT could be implicitly linked to enhanced educational outcomes, producing an evidence base to inform practice was no simple matter. There was no definitive specification of what constituted acceptable evidence in the field of AT and AT research was inherently complex given that randomisation and stratification were

almost impossible, participants varied widely in type and severity of disabilities, educational contexts were diverse and the prevalence of many conditions for which AT was suitable was low (ibid).

A review of 60 articles published in 1998-2003 noted challenges in synthesising results due to the variety of devices studied; the different age groups involved; the different settings in which the studies were implemented; the range of skills addressed and the diversity and complexity of participant needs (Alper & Raharinirina, 2006 cited in Maor *et al*, 2011).

A review of 82 intervention studies during 1980-2001 evaluated the adequacy of the outcome evidence reported in these (Lenker *et al*, 2005). It was concluded that challenges faced researchers studying AT effectiveness including the diversity of AT devices, user characteristics and environments. Major barriers identified included diversity in age, disability and AT; lack of distinctive sub-groups; study specific measures of user perceptions; insufficient information about reliability and validity; and requirements for staff learning.

Another review concluded that many effectiveness studies lacked rigour – often there was no control non-technical condition or matching on intervening variables (Ploog *et al*, 2013). Shamir & Margalit (2011) concluded there was little doubt that technology could be an effective mediating tool during learning although it was not easy to determine which technologies were best for which educational needs. On this basis they recommended facilitating access to information and knowledge through multiple modes of communication. A similar conclusion was reached in another study which attributed the difficulty in identifying specific devices that were effective to the use of small samples and lack of controls (Maor *et al*, 2011). The authors also observed that while most studies documented positive effects for the AT involved, there was little evidence for the sustainability of effects.

Smith & Kelly (2014) undertook a review of 397 articles published in 1965-2013 that addressed AT for students with visual impairments in an educational setting. They documented an increase in the number of articles published year on year but only 98 articles over the entire period could be characterised as research studies and only four studies met rigorous standards for experimental design. Twenty-four articles were classified as qualitative (including case studies) and 24 used correlational quasi-experimental designs. Five of these were single subject designs.

Criteria adopted to represent effectiveness varied. Often, success with an assistive device was determined by how well it performed and how satisfied the user was with it (Jutai *et al*, 2005; Jutai *et al*, 2009). The authors cited a previous article that characterised effectiveness of the extent to which an intended or planned improvement was achieved in a participant's normal context (Raasch *et al*, 1997, cited in Jutai *et al*, 2009). This is not easy to measure using standard experimental designs.

Other challenges to the interpretation and synthesis of results in the literature included the small number of studies in any one area, limited sample sizes and some studies involving outdated technologies (Peterson-Karlan, 2011). Other potential intervening variables identified included paying little attention to the unintended effects of AT in terms of non-targeted behaviours,

competing schedules of reinforcement on selected behaviours and the effect of treatment intensity as opposed to targeted content (Reichle, 2011).

Some authors have made proposals to improve research into the effectiveness of AT. Goldstein *et al* (2014) suggested four criteria for evaluating findings: adequacy of research design; the measurement scheme used; the dimensions of external validity; and the strength of the results. In 2007, Peterson-Karlan & Parette proposed a template for AT research that included systematic observation or experiment; data analysis to allow generalisation; reliable measurements; the attribution of cause based on random assignment; closely matched groups or trials showing effects in more than one setting; replicability or generalisability of results; appropriate designs and methods; and a peer or expert review process. They contended that the key research questions were: what is happening (description); is there a systematic effect (cause); and why or how it is happening (process or mechanism) (Peterson-Karlan & Parette, 2007, 2011). They recommended a continuum of research approaches from preliminary ideas to testing hypotheses and from observations or descriptions through classroom demonstrations to formal research designs. In their view, the most appropriate designs involved a small number of participants acting as their own controls including multiple baselines, alternating treatments, multiple probes and concurrent time series probe designs.

Most authors who addressed methodological issues tended to favour within-subject single subject designs, for example, alternating-treatment designs replicated across participants (Reichle, 2011; Goldstein *et al*, 2014) such as that applied by Mezei & Wolff Heller (2009), which was exceptional in the single subject intervention studies reviewed for this study in which participants were exposed to two alternative conditions over a number of weeks using an ABBABAAB-BAABABBA design<sup>34</sup>.

Edyburn recommended a Time Series Concurrent Differential model to gather data on the classroom use of AT (Smith, 2000 cited in Edyburn, 2006). An illustration of this approach which assesses outcomes supported by AT and without AT was provided using web resources for teaching current affairs. Data analysis was based on interpreting graphical data for an individual AT user (Edyburn, 2006). In a meta-analysis of AT use, the most common designs were multiple base line and alternating time series (Wehmeyer *et al*, 2008).

A descriptive analysis of much of the literature in Europe 2007-11 concluded there was a scarcity of longitudinal studies of AT (Abbott *et al*, 2011; Abbott *et al*, 2014). The need for longitudinal studies to address usage context and AT impact on overall education and wellbeing across the lifespan was also emphasised in a literature review (McKnight & Davies, 2013). The authors pointed to the need for researchers to take account of user independence, anxiety and self-confidence as well as learner needs and abilities, functionality of the technology and the context for use.

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<sup>34</sup> See Appendix 6 Glossary of Terms for a definition of single subject designs such as this.

## 4.4 Does AT Work? Evidence for the Impact of AT on Learning and Education

### Section Summary

The review of literature identified a consensus among many authors and commentators that AT is a useful support for learners with special educational needs. This conclusion is based primarily on reviews and single subject intervention studies.

Some trends identified include:

- Availability of AT is increasing and costs reducing;
- AT is evolving rapidly and reliability is improving;
- User involvement and inclusive or user-centred design has become more evident in the interaction and collaboration between people with disabilities and developers;
- Use of mobile mainstream devices has become more widespread;
- AT use in mainstream settings is more visible;
- An increasing focus on alternative interface technologies can be identified.

The remainder of this section is structured into sub-sections each with its own section summary. Each sub-section summarises the literature from a different perspective.

Section 4.4.1 describes AT's impact from a functioning or activity perspective.

Section 4.4.2 describes AT's impact from a disability perspective.

Section 4.4.3 reviews the literature on assessment of need and matching the person and AT.

Section 4.4.4 reviews the literature on AT training and support.

Section 4.4.5 reviews the identification and acquisition process.

Section 4.4.6 reviews educator surveys.

Section 4.4.7 reviews the relationship between Universal Design for Learning and AT.

Many authors included in this review have concluded that AT was generally useful to support learners with special educational needs to acquire competences (capacity building and learning) and to gain access to learning resources. This general conclusion must be tempered by drawing attention to the caveats described above. This section lays out the evidence on which this general conclusion is based. Both reviews and intervention studies, many of which were single subject designs, are included with specific reference to findings on the impact of AT devices and processes. This emphasis involves somewhat more detail being provided on intervention studies to clarify the methodologies applied.

Trends in AT's application and use highlighted in a review of the literature in Europe in 2007-11 (Abbott *et al*, 2011; Abbott *et al*, 2014) were reflected in the articles reviewed for this study. These included AT's increasing availability and lower cost; the rapid evolution and improved reliability of technologies; an emerging emphasis on user involvement and inclusive or user-centred design; increasing interaction and collaboration between people with disabilities and developers; growing use of mobile mainstream devices; the visibility of AT use in mainstream settings; and a focus on alternative interface technologies.

The section is structured according to a number of themes relevant to AT devices and systems in education including the impact on functioning and activity; AT from a disability perspective; assessment of needs and matching; AT training and supports; educator perceptions; the identification and acquisition process; and AT from a Universal Design for Learning (UDL) perspective.

To aid interpretation a brief summary of each section acts as an advance organiser for reviewing detailed content.

#### 4.4.1 AT's impact from a functioning or activity perspective

##### Section Summary

Articles focusing on function or activity rather than disability tended to emphasise AT's impact on learning processes. This raised issues about the overlap between AT and ICT for learning. Thus it was difficult to separate studies involving access technologies from those that addressed instructional technologies.

Technologies addressed included video modelling and simulation, speech synthesis, speech recognition, word prediction and spell checkers, computer-aided instruction, personal digital assistants, anchored instruction, tablets and iPads, eText, WiFi networking, augmentative and alternative communication devices and switch technologies.

No specific type or brand of AT emerged as being consistently more effective. Not all studies that addressed the same type of AT were consistent in their conclusions. In some cases the effects were moderate. AT's suitability varied with user needs and the learning context. Teacher cooperation was an important intervening factor.

Positive functioning and activity effects identified included:

- Improvements over traditional paper-based learning materials;
- Support for spelling, writing and revising processes;
- Greater accuracy and legibility;
- More elaborated and better structured content;
- Increased length and speed of production of compositions;
- More effective decoding and word recognitions skills;
- Increased reading speed and efficiency;
- Improved reading comprehension;
- Enhanced conversation and communication;
- Computation and mathematical problem solving;
- Improved independence and learning behaviours;
- More effective note taking, planning and organisation;
- Easier access to reference materials.

In the US, the application of literacy technologies in the general classroom has been documented to improve performance even on traditional paper and pencil language achievement tests (Barone & Wright, 2008). Digital picture books and ebooks, in studies carried out in Israel and the Netherlands, were considered to positively influence the vocabulary of young learners (Shamir & Margalit, 2011). While these tools could be relevant to all learners, they also offer access for learners with sensory or learning disabilities.

US research provided evidence that AT has the potential to support various writing processes including planning, organising, drafting, transcribing, editing and revising (Peterson-Karlan *et al*, 2008).

In a review of 15 studies between 2004 and 2009 that showed some impact, most documented improvements in outcomes (Maor *et al*, 2011). Many of the studies reviewed could be considered to relate to educational technologies rather than access or assistive technology (Douglas *et al*, 2009; Douglas *et al*, 2011) or to technology for building a learner's capacity (remediation) rather than technology to support participation in activities (compensation) (Ashton, 2005; McKnight & Davies, 2013). However, this distinction was not clearly made in the literature and articles describing technology applications intended to enhance capacity and learning have been included in the review as long as the studies' participants had disabilities or other special educational needs.

A review of 19 studies (Wanzek *et al*, 2006 cited in Maor *et al*, 2011) concluded there was a consistent effect for spelling for AT users in comparison to controls. Despite a lack of well-designed experimental studies, the authors concluded based on their review that AT had potential. Some of the main findings were:

- Video modelling improved conversation for children with autism (n=2);
- Co:Writer and Write:Outloud:
  - Reduced misspellings and improved accuracy for most of the participants with mild learning disabilities (n=7);
  - Improved legibility, spelling and word sequences for learners with physical disabilities (n=24);
  - Equivocal results were found for learners with physical disabilities (n=4);
- Tele Web for spelling and for scaffolding helped learners with learning disabilities (n=18) and writing disabilities (n=35) to produce more text of higher quality and greater coherence;
- MultiFunk text to speech improved literacy skills for learners with reading disabilities (n=26);
- Computer-aided instruction for phonological and orthographic training improved word decoding skills for learners with reading disabilities: general improvement (n=41); improvement in skills (n=47);
- Speech recognition software improved word recognition and comprehension but not spelling for learners with reading and spelling difficulties (n=28);

- Word processing reduced spelling and reading errors and enhanced text organisation for learners with writing difficulties (n=3);
- Read and Write Gold (v6, v7.1): Microsoft Word homophone detection improved proof reading for learners with reading disabilities (n=57);
- SpeakOUT speech synthesis improved comprehension and spelling error detection for learners with reading disabilities (n=93);
- WordQ improved writing performance and enhanced user satisfaction for learners with physical and learning disabilities (n=29).

Forgrave (2002) undertook a review focusing on the impact of speech synthesis, organisational software and voice recognition software for middle and high school students with difficulties in reading and writing. It was concluded that the effects were not definitive due to the small sample sizes, the focus on specific brands of applications, lack of consistency of training and practice periods and learner characteristics and the narrow age ranges which did not reflect developmental or long-term effects. However, the author noted a range of positive effects documented in the literature including:

- Speech synthesis allowed readers to correct mistakes thereby reducing frustration and supporting better comprehension and improved decoding and word recognition skills in a longitudinal study carried out over three years;
- Bi-modal (text and speech) presentation improved comprehension to average levels for elementary students. Age and length of practice periods were influential;
- Concept mapping significantly improved quality of writing, summarising text information, assessment scores in academic subjects. Explicit instruction was required for best effect;
- Voice recognition was faster than handwriting in writing essays. Stories written using this were longer, more complex and had fewer grammatical errors and the technology was associated with significant improvements in reading comprehension, spelling and word recognition. Extraneous noise represented a challenge and extensive instruction and monitoring was required.

Edwards *et al* (2010) reviewed 39 applications intended to assist in early reading development, 21 of which were analysed in detail. This involved an expert evaluation using a four dimensional scale: interface design, instructional design, phonological awareness and alphabetic understanding. It was concluded that the quality of instructional software for beginning reading needed to be explored more deeply. Many applications did not meet research-based criteria for interface, instructional design and beginning reading content required for at-risk learners. Performance was not related to price and most did not address phonological awareness skills.

In a US case study a Grade 7 boy with SLD and limited keyboard skills worked with a team to identify the most appropriate AT for him. The final package included headphones, a talking word processor and an OCR scanner. The total cost was \$250. In a one-month trial a number of positive impacts were recorded such as the length of compositions increased by 50 per cent, the time per paragraph reduced by 50 per cent, spelling errors reduced by 66 per cent, more pages

were read, word recognition and comprehension scores improved from 65 per cent to 85 per cent and assignment were easier to grade. The author concluded that it was essential a team included someone who knew about technology (Gillette, 2006).

The effects of various word prediction programs on students' journal writing were compared to word processing in the US (Evmenova *et al*, 2010). The study involved six Grade 6 to 9 boys. An alternating conditions design was used to explore three-word prediction programmes Word Q, Co:Writer and WriteAssist. Because the design did not involve a return to baseline it was not considered adequate to demonstrate a relationship between the baseline and the experimental conditions. Nevertheless, the authors concluded that regardless of the type of word-prediction software, it increased the proportion of words spelt correctly. WriteAssist was considered the most primitive, Co:Writer was considered the most complex and WordQ the preferred option. Other less conclusive results included increases in total number of words and composition rate (which was still slower than handwriting). Another US article proposed that the 'scan-and-select' requirement in word prediction programmes might actually decrease text transcription speed (Peterson-Karlan *et al*, 2008).

A well-designed alternating conditions design (in which 'A' represented the control condition and 'B' represented the experimental condition and which were alternated using the pattern ABBABAAB-BAABABBA) was used to explore the effect of word prediction (Co:Writer 4000) and word processing on the fluency, accuracy, and passage length of four writers with physical disabilities aged 12-18 years in the US (Mezei & Wolff Heller, 2009). The study measured impact on reading comprehension, spelling, word identification, word processing skills and students' typing rate. Participants were provided with individualised instruction in Co:Writer. No gains in typing rate were identified although spelling and keyboard errors were reduced. The authors noted a previous study that found word prediction had a greater impact on users with lower typing rates and higher spelling error rates.

A well-designed US study evaluated the extent to which Listening-While-Reading (LWR) was more effective in factual and inferential comprehension than silent reading. Twenty-five readers aged 11-15 who were performing two grade levels below their expected level participated. Participants were presented with reading passages at their grade rather than their reading level and no preparatory training was provided. No significant effects were found for overall, factual or inferential comprehension. The authors noted that the underlying causes of reading difficulties were not controlled (Schmitt *et al*, 2011).

The reading comprehension impact of ClassMate Reader (a portable text to speech device) was compared to paper and pencil use on the performance of six students in post-secondary education in the US (Floyd & Judge, 2012). Participants were four males and two females with reading disabilities aged 19-22. The study involved reading 15 expository passages of 400 to 600 words at a reading level three grade levels above their reading quotients using a multiple baseline design across participants. All participants performed better, but the impact for four participants was considered to be moderate. The authors concluded that while the Kurzweil 3000 might be more effective for readers with very low comprehension scores, ClassMate Reader could benefit some students with learning disabilities and had the advantage of size and portability.

In a US study, Higgins & Raskind (2004) compared the effectiveness of a speech-recognition application, a computer- and text-based automaticity programme for 28 participants with learning disabilities aged eight to 18 years over 17 weeks. Their performance was compared to a comparison group of 16 students with similar disabilities. Nine special classes were involved, three each at elementary, middle and secondary level education. One class at each level was selected for comparison. The technology used was a speech recognition-based programme (SRBP) and recorded speech which was used to present 16 200-400 word stories. The programme resulted in improvements in word recognition and reading comprehension for the experimental group. Other significant effects included process and reading efficiency. No significant impact on spelling was identified. The authors concluded that speech recognition could be effective but was not suitable for all learners. They also noted the challenges in using the application in a classroom setting, the significant training to proficiency required and the time it took to develop speech recognition stories. The programme's critical aspects were considered to be the bimodal presentation of text, the choice list of similar 'sounding' and 'looking' words and the activity's interest-driven, self-paced nature.

Bouck and Flanagan (2009) undertook a review of 17 empirical studies (from 1996-2007) that addressed AT and mathematics for learners with high incidence disabilities between kindergarten and 12th grade. They identified three primary types of AT: anchored instruction locating mathematical problems in real life situations, computer-assisted instruction (CAI) and calculators. They concluded that only anchored instruction had a robust knowledge base. It was found that anchored instruction using video improved performance on problem solving but not computation. CAI impacted positively on the acquisition of maths facts, basic skills and problem solving. The results of studies on calculators were mixed.

O'Malley *et al* (2013) reported on the differential effect of traditional instruction compared to iPad instruction regarding independence in completing tasks and acquisition of maths skills with seven learners with ASD (two females and five males aged 10-13) in the US. An alternating conditions design was used (ABAB) in four to five sessions over four weeks. Independent task completion, teacher prompts and non-compliant behaviour were analysed and an improvement rate difference was evaluated. Results were mixed for non-compliant behaviours and there was a moderate effect for independent completion, although there was wide variability in results. Less teacher support was required and teacher ratings were positive. There was evidence of progress towards learning and enhanced learning skills.

US classroom-based studies were used to compare the maths performance of middle school pupils with specific learning disabilities using an etext application that could translate mathematical notation to speech (using MathML) with control classrooms using standard read-aloud accommodations (Noble, 2014). The SLD students in the intervention classrooms consistently outperformed controls in the short term and over the year and outpaced the Grade 7 average in progress. Practical implementation barriers included difficulties with equipment and wireless access. Dissemination challenges related to expertise availability for schools, availability of compatible maths text books and upskilling teachers to produce etext themselves.

Liu *et al* (2006) explored the use of a wireless network, tablet computers and a shared whiteboard on interactions between a teacher and seven hard-of-hearing junior high school pupils around cognitive load and progress assessment in a Taiwan mathematics classroom. Eight sessions of two conditions (WiTech/non WiTech) were implemented. An error analysis was carried out and results indicated that scaffolding tools on the tablets reduced error rates, WiTech reduced distraction behaviour and learners valued the WiTech environment.

The impact of the learning demands of a variety of layouts used in electronic augmentative and alternative communication (AAC) applications was explored in two US studies (Drager & Light, 2010). Four types of display were investigated: a taxonomic grid presenting symbols using categories, a schematic grid presenting symbols based on events or experiences, a schematic scene with symbols embedded and iconic encoding which presented symbols as they would appear in a word or phrase. Eighty participants were randomly assigned to the four conditions and received four training sessions. It was concluded that dynamic display supported better performance. The iconic prediction groups did not perform significantly better but some generalisation to other items was evident. Difficulties learning how to use AAC highlighted in a previous study were noted.

Watson & Johnston (2007), based on research carried out in the US, listed seven processes that can be impacted through the use of AT for learners with mild disabilities in the science classroom:

- Organisation;
- Note taking;
- Writing assistance;
- Productivity;
- Access to reference material;
- Cognitive assistance;
- Materials modification<sup>35</sup>.

Campbell *et al* (2006) reviewed 104 articles addressing reported practices in teaching switch use, use of computers, mobility and alternative communication published in 1980-2004. They identified 27 empirical studies including one RCT design and group, single-subject designs and case studies. Most studies reported positive learning of device use. Only 10 articles were published in 1990-2004. The conclusions reached included:

- Switch interface device use – evidence was relatively strong that children as young as 18 months can learn to use switches;
- Computer use – evidence was inconclusive due to poor design and a small number of studies;

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<sup>35</sup> Lahm and Morrissette (1994) cited in Watson and Johnston (2007).

- Power mobility – there were only a few studies but participants did acquire the competence to use powered mobility devices;
- Augmentative and alternative communication devices – there was evidence that training in the AAC devices generalised to peer-to-peer communication.

A systematic review of 60 studies from 1988-2003 explored the evidence to support the benefits of technical cognitive prostheses in accessing the general curriculum and in learning new material (Alper & Raharinirina, 2006). Participants were aged five to 21 years and disabilities addressed included learning disabilities, intellectual impairment, autism, physical disabilities and visual impairment. The authors listed a range of positive findings including:

- Inspiration software – enhanced planning and note taking;
- Video – increased appropriate behaviour and supported better achievements;
- Video modelling with prompting – resulted in skill acquisition and maintenance;
- Video simulation – increased resistance to abuse;
- Video instruction – improved word recognition;
- Multi-media anchored instruction – on task behaviours and interactions, increased accuracy;
- Multimedia/video simulation – better word recognition, shopping behaviour;
- Hypermedia (similar to hypertext but including sound and video) – self advocacy, better reading;
- Personal orientation device – supported independent travel;
- Computer-assisted study – positively affected motivation and generalised to study strategies;
- Tech assistant/personal organiser – facilitated task independence, initiation, appropriate task responses, task accuracy, performance was maintained;
- Networked note taking – maintained and generalised skills;
- CAI writing – improved spelling, revision skills, process knowledge;
- CAI leisure – information level and choices made improved and satisfaction increased;
- CAI reading – mixed impact on comprehension although skills were acquired;
- Auditory prompt system – supported skills acquisition and maintenance;
- Speech recognition – usability was demonstrated;
- Word processor with spell checker – increased spelling accuracy and user satisfaction, better editing;
- Word processor, speech synthesiser and word prediction – increased writing legibility and spelling skills;

- Spell checkers – spelling corrections depended on severity of errors;
- Touch Talker AAC – increased conversations;
- Alpha Talker AAC – resulted in the initiation of communication;
- AAC least prompts – enabled improvised performance;
- Web tech – improved independent internet use.

In a single US case study of a male aged 17 with a short-term memory deficit, use of technology-based organisational software reduced memory prompts by the guardian from 75 per cent to 8 per cent (Flannery & Rice, 1997 cited in Radic-Sestic *et al*, 2012).

Campigotto *et al* (2012) conducted an action research study over five months which collected data within two SEN classrooms catering for 25 learners aged 12-21 years in Canada. They explored the impact of iPod Touch and iPhones and the MyVoice app on attention and motivation and factors that contribute to effective technology integration within a standard curriculum. Although self-confidence and perceptions of success were positive, some challenges included the practicality of the approach, teacher comfort and the limitations of the device. Difficulties encountered included the requirement for website set up for MyVoice, speech being too rapid and not used to potential and teacher resistance.

A US exploratory study studied the use of a wireless controller called TabAccess™, an alternative interface for children with difficulty in using touch screen interaction, by nine children aged eight to 14 with a variety of conditions including cerebral palsy, spina bifida, spinal muscular atrophy, traumatic brain injury and autism (Howard & Park, 2014). In a series of sessions the AT was used in combination with switch access robot interaction apps to interact with Lego Mindstorms, the Scribbler robot, and the Romibo robots. The impact of the accessible interface on attitudes to technology was positive and the dissemination of the approach and of accessible robotic kits for children with disabilities was planned as a result.

## 4.4.2 AT's impact from a disability perspective

### Section Summary

In the previous section the studies tended to focus on AT's impact from the perspective of educational outcomes. The personal characteristics of study participants were diverse in terms of impairment, age and gender or involved specific or mild learning disabilities. This section reports on literature reviews and intervention studies best viewed from a disability perspective. The types of disabilities addressed included ASD, visual and hearing impairments, physical impairments and intellectual impairments.

The main findings included:

#### **Learners with ASD:**

- Need for initial and continuing teacher education in the domain of ASD;
- Technology-assisted interventions were associated with positive outcomes in terms of social, communication, behavioural, cognitive, motor and adaptive skills;
- Evidence to support the use of virtual reality environments was equivocal apart from the impact on vocabulary learning. The extent of transfer to natural settings was unclear;
- iPads used with social stories impacted on behaviours but represented a challenge for learners with ASD with coordination difficulties;
- Computer-aided instruction had some positive effects on receptive vocabulary, facial recognition of emotions, social and communicative learning.

#### **Learners with visual impairments**

- Low vision aids reduced the need to prepare materials and increased independent learning;
- LVAs increased speed of reading and comprehension;
- Social factors and attitudes affected usage;
- Learners with visual impairments preferred CCTV to standard optical devices;
- Braille could represent a barrier to participation in exams.

## Section Summary

### Learners with hearing impairments

- Sound field amplification significantly improved the achievement scores in mainstream classrooms.

### Learners with physical impairments

- Regardless of the type of ICT device, learners benefited in curriculum access and enhanced educational participation;
- AT use was associated with feelings of enhanced participation, increased independence and improved learning experiences;
- Word processing and prediction software affected legibility, spelling and longer sentences;
- Speech recognition software had a positive impact on fluency and length but not on accuracy and was more appropriate for learners with very low typing speeds.

### Learners with intellectual impairments

- Benefits of low and high tech devices in inclusive education were evident;
- No specific devices emerged as being more effective than others;
- Effective AT use required collaboration and support from educators, administrators and families.

In one US study, data on AT usage and services received was gathered from 682 students with disabilities aged three to 21 years who were registered as disabled (Quinn *et al*, 2009). A survey was completed by school staff indicating the type of AT being used, location of use, related services being accessed and the type of disability. The category most frequently associated with AT use was multiple disabilities. Other categories with frequent usage were ASD, intellectual disabilities, orthopaedic impairment and learning disabilities. Only 30 per cent of students were also receiving AT-related services.

The Autism Treatment Survey was carried out in the US with a representative sample of 185 teachers working with 226 children from pre-school to Grade 12. Findings indicated that AT was one of the top five educational strategies used in classrooms (Hess *et al*, 2007). It was the most frequently used intervention, with 22 per cent of teachers reporting using AT strategies in special mainstream elementary classrooms. A need for pre-service and continuing teacher education in use of AT for learners with ASD was identified. The authors rated AT as a practice that showed promise.

Parsons & Cobb (2011) reviewed research carried out in 2001-11 and explored the evidence to support the effectiveness of virtual reality (VR) applications for learners with ASD. The AS Interactive project implemented in the UK over three years in the early 2000s showed that virtual environments were easy to use and their relationship to reality was understood. Progress

in VR before 2000 was about demonstrating acceptability and feasibility of the technology, the period 2001-07 reflected optimism about its potential, while post 2008 it involved continued optimism with an overall consensus that VR could make an important contribution even in the absence of strong research evidence. The main conclusions were that computer-animated heads facilitated vocabulary learning and transferred to real world. There was no evidence that VR facial emotional signifiers improved recognition, evidence for the effectiveness of collaborative virtual environments was lacking and evidence for generalisability of learning was inconsistent.

Case studies of four US males with ASD aged nine to 11 years explored the processes involved in assisting learners with ASD to use iPads and to apply that competence to learn phonics (Fan, 2012). The design was described as teacher action research. Conclusions were that the visual channel can be the strongest modality for many learners with ASD but iPad use can represent a challenge for users with fine or gross motor coordination difficulties.

A review of literature published in 1992-2012 on the impact of computer-assisted technologies (CAT) on the social, communicative, and language development of children with ASD concluded that although studies lacked rigour, many suggested promise (Ploog *et al*, 2013). The review's scope included language, emotion recognition, theory of mind (being able to infer what another person is feeling or thinking) and social skills. Early studies indicated that CAT was motivational but were unclear about their instructional impact. Many studies focused on linguistic development such as reduced echolalia and increased functional communications. Positive results included increases in receptive vocabulary size for some (young children with ASD), an impact on facial recognition of emotions, transfer of learning was unclear and an impact on sustained social and communicative learning was seen. The evidence impact of virtual reality was promising. Evidence for CAT effects on theory of mind was equivocal.

Flores *et al* (2014) studied use of the Apple iPad2 to deliver literacy-based behavioural interventions and Social Stories™ to seven participants with ASD (aged three to 11) enrolled in an extended school year programme in the US. A single subject design was used which compared performance pre and post baseline. It was concluded that the interventions changed behaviours positively, teachers found the method easy to use, the iPad provided portability of the stories throughout the classroom and student interactions in the activities provided teachers with opportunities in a more natural and interactive way.

Whalen *et al* (2010) investigated the impact of TeachTown Basics, a computer-assisted instructional intervention, on the language, cognitive, auditory processing and social skills of 22 pre-school and kindergarten children with ASD in the US. The design involved a comparison group of 25 controls who participated in the established curriculum. The conditions were randomised by classroom. Over three months the experimental group was exposed to the intervention for 40 minutes per day, 20 minutes of which involved computer activity. Most participants in the intervention group (15 out of 22 participants) mastered on average five to six lessons. The language skills and cognitive processing within the intervention group were enhanced overall. However, only the Peabody Picture Vocabulary Test showed a significant effect and only then for pre-schoolers. The authors cited previous evidence that CAI can be more motivating than traditional instruction, can assist pupils to learn more quickly and that language skills can transfer to natural contexts and social behaviours and communication can be enhanced.

A more recent review of the evidence for positive learning outcomes of focused interventions for learners with ASD, from early childhood to young adulthood, made no specific reference to AT (Wong *et al*, 2014). Rather the authors referred to technology-aided instruction and intervention (TAll) which included speech-generating devices, smartphones, tablets, computer-assisted instructional programmes, and virtual networks. Nine group and 11 single case studies that supported TAll were identified in 1990-2011 covering a range of outcomes including social, communication, behaviour, joint attention, cognitive, school-readiness, academic, motor, adaptive, and vocational skills (Wong *et al*, 2014; p96). The National Autism Center's National Standards Project Phase 2 report referred to technology-based interventions rather than TAll (National Autism Center, 2015). These were listed as emerging interventions on the basis that seven articles evaluating technology-based Interventions met the criteria for inclusion in the study. Wong *et al* (2014) also reported on other potentially relevant studies such as visual supports which were supported by evidence from 16 single case studies and visual modelling which was supported by evidence from one group and 31 single case studies.

Jutai *et al* (2009) reviewed research studies (1980 to 2007) on AT's effectiveness for persons with visual impairment or low vision. These included randomised and non-randomised study designs, systematic reviews and meta-analyses (108 studies in all – 24 RCTs and 84 non-randomised designs). Four RCTs and six non-randomised studies used outcome measures that included subjective perceptions and objective measures of performance. The study also reviewed preference, ease of use or satisfaction and performance. The main conclusions were that CCTV devices were preferred over standard optical devices mainly for reasons of portability and cost. Proper lighting was essential and account needed to be taken of colour vision or contrast.

Douglas *et al* (2011) reviewed literature on approaches to facilitating print access for learners with visual impairments identified in specialist journals and through database searches on behalf of the NCSE. They summarised the findings on good practice in educating blind and visually impaired students (Douglas *et al*, 2009). Little comparative research on benefits of access through large print in contrast to alternative formats was identified. The review covered low vision aids (LVAs) CCTV and electronic magnification (mainly computer-based magnification software). Their conclusions included that LVAs had the advantage that the learner had independent access to standard print and did not have to depend on others to prepare materials. In addition, increased silent reading speeds and comprehension rates were evident and reading standard print with optical devices was as effective as reading large print. Magnification technologies were generally more effective than hardcopy enlarged print. Even though college students emphasised computer, assistive technology and keyboarding skills as important in education, electronic formats were rarely preferred, according to service providers. Children cited peer pressure and that it made them feel different as reasons for not using LVAs.

Despite the importance of Braille translation software for learners with severe visual impairment, its limitations in participating in exams was highlighted. This contention was supported by a study into the compatibility of state examinations for Braille users carried out in the US (Kamei-Hannan, 2008).

The Mainstream Amplification Resource Room Study (MARRS, 2003) documented a statistically significant improvement in the achievement scores of learners with hearing impairment in mainstream classrooms with sound field amplification compared to controls in unamplified classrooms in the US (Marttila, 2004).

Murchland & Parkyn (2010) explored the perceptions and experiences of five computer-based AT users with muscular dystrophy (one female and four males aged ten to 14) in mainstream school in Australia through in-depth interviews. A thematic analysis revealed that learners acknowledged that AT enhanced participation, that it reduced barriers to independence and assisted in better learning experiences and results. However, issues remained about ease of access, social concerns and technology systems. AT was considered to save time, reduce writing load, and allowed them to keep up with the class. It was felt to be more useful for people with high literacy demands. Other benefits included the elimination of the requirement for physical manipulation of tools and materials, the independent completion of work (without assistance) and the production of work of higher quality.

In Canada, Mirenda *et al* (2006) explored the perceptions of 24 experienced Co:Writer users with physical disabilities (eight females and 16 males) and their adult supporters on its impact on the quality of writing samples. Research materials were posted to potential participants who returned a student survey, a supporter survey and three writing samples within two weeks. Participants were asked to carry out a writing task under three conditions: using Co:Writer, using word processing software and using handwriting. Over half of learners and supporters believed word prediction and word processing were helpful. In comparison to handwriting, word processing and/or Co:Writer were associated with a greater proportion of legible words, correctly spelled words and correct word sequences; and in longer mean lengths of consecutive correct word sequences.

A US study, investigated the relative impacts of speech recognition and word processing on writing first drafts with five participants with motor control disabilities (aged 15-18) (Tumlin Garrett *et al*, 2011). Participants had two years of computer and word processing experience, were capable of direct interaction but had no experience of speech recognition. An alternating treatments design was used to explore fluency, accuracy, type of word errors, recall of intended meaning and length. Conditions were counterbalanced and presented in a random order. Results showed fluency and length were greater with speech recognition, accuracy was lower and memory of intended meaning was less. The authors cited a previous study that indicated that although more experienced users fared better and speed of text production compared to writing was higher, correcting errors was inefficient (three seconds using a keyboard compared to 25 seconds using speech recognition (Karat *et al*, 2000 cited in Tumlin Garrett *et al*, 2011). Accuracy rates ranged from 62 per cent to 84 per cent and users with physical disabilities made twice as many utterances as the text should require. Another study concluded that speech recognition is most appropriate if typing speed is below 15 words per minute and should be used only for first draft production (Honeycutt, 2003 cited in Tumlin Garrett *et al*, 2011).

Lidström & Hemmingsson (2012) reviewed the benefits of the types of ICT devices used by learners with physical impairments in school activities in 32 articles, 16 of which were intervention studies. More than 50 per cent of users in the studies had motor impairments. It was concluded that learners benefited from ICT use regardless of the type of device. AT helped access to the class curriculum and enhanced participation in educational activities.

Alquraini & Gut (2012) conducted a review of 72 studies of inclusion in general education for pupils with severe intellectual disabilities. These studies addressed both low and high tech devices including AAC devices, switches, touch screens and alternative keyboards. While no conclusions were reached on the effectiveness of specific devices, it was accepted that AT could play a significant role in inclusive settings, particularly in the context of collaborative team approaches, combining effective typical instructional strategies and special education strategies and constructive support from students, teachers, administrators and families.

### 4.4.3 Assessment of need and matching the person and AT

#### Section Summary

This section reviews articles that addressed AT needs assessment and matching. Given the sociotechnical perspective adopted in this study, it is important to summarise these, as they shed light on the social elements of the process of AT identification, matching and implementation.

A number of commentators proposed approaches to assessment processes, the most appropriate AT solution and verification that a good match has been achieved. There was a strong consensus on the need for a proper functional needs profile for the individual, having access to expert knowledge of the specifications of the technology, the importance of adequate funding, using an iterative and supportive matching process and providing training and support to all stakeholders concerned.

The key principles emerging from the review included:

- User-centred approach that acknowledges the person characteristics, AT predisposition and preferences of the AT user;
- Multi-faceted, biopsychosocial and collaborative approach and consensus-based decision making;
- Centrality of the fit between the user and the AT;
- Importance of family in the process;
- Availability of technical support and training;
- Impact of the psycho-social environment and subjective wellbeing;
- Focus on mainstream settings;
- Need for planned trials;
- Effective data collection and analysis.

The Irish Matching Person and Technology tool (IMPT) was considered to incorporate these key principles.

Johnston & Evans (2005) conducted a review of articles to identify supporting evidence for matching theory. They considered the contributions of response efficiency (the rate of reinforcement, quality of reinforcement, response effort and immediacy of reinforcement) on reducing abandonment and increasing contextual fit (characterised as the congruence between an intervention, the person and the physical and social environment). The authors concluded that the application of matching theory may influence an AT user's choice and behaviour and consequently improve the impact of AT interventions. However, they identified a need for empirical studies to validate its potential.

Lenker & Paquet (2004) proposed a user-centred model for predicting AT usage. The model characterised AT usage not as a one-time, all or nothing decision but as a process that recurs over time. An important factor in determining use was considered to be the influence of interventions operating at the same time in parallel or instead of AT. A reciprocal relationship between quality of usage, AT impact and the extent of future use was proposed.

The ATOMS (Assistive Technology Outcomes Measurement) database lists 15 models and assessment instruments within the educational sphere<sup>36</sup>. There is an acknowledgement that multiple dimensions need to be considered in assessing AT suitability and measuring outcomes. These include the way in which the AT affects performance or functioning and participation, the extent to which it is used to effect, user satisfaction, AT's contribution to achieving goals and enhancing quality of life and the costs (Edyburn, 2003).

Selecting an AT device is not only about the most appropriate piece of technology but may also entail the complete reconstruction of a person's life and relationships with personal assistants, friends and family. It is critical for professionals to work in genuine partnership with end-users. This approach leads not only to greater control on the part of the end-user but also better clinical outcomes and more cost effective results (Andrich & Besio, 2002). An ineffective assessment of needs and an inconsistent matching process can substantially reduce the impact of an AT application or result in abandonment. The most frequent reason cited for not using AT devices was a poor fit between user, technology and environment (Scherer, 2005). Abandonment can result when the process fails to take account of individual and family needs, where there is little participation of the user in the choice, if there is insufficient funding to acquire the correct technology, the AT is not reliable, technical support is not available or if the user is concerned about the negative attention or stigma that could arise from its use (Alper & Raharinirina, 2006). For example, peer pressure and feeling different were reasons for not using LVAs frequently given to young learners with visual impairments (Douglas *et al*, 2011). The availability of technical support, teacher knowledge and experience in using AT and logistical issues were other reasons specified for ineffective use (O'Malley *et al*, 2013). This finding supports the view that effective AT usage depends not only on the fit between the device and learner's needs but also on the psychosocial environment and the sociotechnical system.

A successful assessment and match needs to include an individual plan that is relevant to family goals, AT that is linked to the user's goals, a collaborative approach between the person and the professionals, effective communication, ongoing support and timely problem resolution (Alper & Raharinirina, 2006). An effective assessment must take account of user needs and expectations,

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<sup>36</sup> ATOMS Assistive Technology Outcomes Measurement System <http://www.r2d2.uwm.edu/atoms/>

appropriate AT, training and support in learning how to use the application and a proper assessment of the impact on learning (Specht *et al*, 2007). It should be sensitive to the stage of development of the user and the requirements of the processes for which AT is being acquired (Peterson-Karlan *et al*, 2008).

Assessment of skill and AT should include cognitive learning abilities, physical abilities needed to use the AT, history of technology use, device characteristics, user's awareness and motivation, expectations, environmental supports, distractors in the context and on the device and the need for repetitions to ensure learning (Radic-Sestic *et al*, 2012).

In the US, the SETT (student, environment, tasks and tools) collaborative approach was illustrated using the case of a Grade 7 boy with SLD (Zabala, 2005; Gillette, 2006). The assessment team included a SEN teacher, a speech-language pathologist, a general education teacher, a classroom assistant, his mother and an AT specialist. During the assessment process a range of software and hardware including optical character recognition (OCR), text to speech, writing and planning, voice recognition, editing, publishing and headphones was explored. The assessment progressed from 1:1 sessions with the AT specialist to a small team meeting and finally a full team meeting followed by a one-month trial. An alternating conditions design (ABAB) was used to assess the AT's appropriateness and effectiveness. This involved measuring a baseline, assessing the effects of AT use, reviewing performance when the AT was removed and then reintroducing it and measuring the change (Gillette, 2006).

Gillette (2006) described the principles of collaborative team assessment. These included:

- Shared responsibility;
- Access to the general curriculum;
- Data collection and documentation;
- Understanding the student and the environment;
- Adequate funding;
- Equal participation of the family, student and educational professionals;
- Initial data-gathering in a small team;
- An AT specialist with expertise in the process(es) for which the AT is intended;
- Decisions on student needs, abilities and preferences assessed in a typical setting over time;
- Consensus decision making through shared individual perspectives;
- Decisions informed by current research and practice evidence;
- Planning addresses the integration of AT into the curriculum;
- Plans included training and support options for team to implement the AT in context with the student;
- Collaborative problem solving during implementation to overcome challenges.

The Wisconsin Assistive Technology Initiative (WATI, 2009) proposes a sequential approach to the process:

1. Information gathering;
2. An initial team meeting;
3. Team decision making using a problem solving approach;
4. Implement the assessment plan;
5. Implement planned trials;
6. Follow-up and data collection;
7. A plan for permanent use.

Matching Person & Technology (MPT) is a tool that supports a set of assessments which evaluates a person's technology predisposition and the impact of technology use in a wide range of settings including work and education. The MPT approach evolved over two decades and has been evaluated in a number of studies. It is based on a biopsychosocial approach to assessment and has been benchmarked against the ICF (WHO, 2001). A feature of the MPT methodology is the way in which it empowers the user through active participation in the assessment and selection processes (Scherer, 2005, 2008).

An Irish version of the MPT (Irish Matching Person & Technology tool – IMPT) was validated in a longitudinal study that tracked 45 students with a range of disabilities in their transition from second level education to further and higher education (Craddock, 2006). An assistive technology device predisposition assessment (ATD – PA) and the subjective wellbeing scale (SWB) are core components of both the IMPT and MPT. These scales assess personal factors essential in understanding an individual's predisposition to use an AT application and the AT's quality of match to the individual. In a set of data analyses generated through many studies the scales significantly predicted the quality of the AT-user match during follow-up. This was viewed as providing strong evidence that the two scales can help in achieving better outcomes for AT services (Scherer *et al*, 2011).

The logic underpinning the IMPT is that each child has a predisposition that can influence AT use which depends on their personality characteristics, perception of subjective wellbeing, views about their capabilities, experiences and future expectations, level of social acceptability, financial resources available and environmental supports for technology use. The importance of getting the right match between the child's characteristics and the AT application is critical to successful and sustained AT use (Scherer & Craddock, 2002; Zapf & Craddock, 2012).

#### 4.4.4 AT training and support

##### Section Summary

The importance of training and support for AT use in education is a common theme in the literature not only around its successful use but also in terms of the identification of learners that might benefit from AT in the first place. Some common themes included:

- Need for AT to be addressed in initial and continuing professional development of educators, administrators and assessment professionals;
- Requirement for teachers, educational support workers, families and AT users for training and support with specific AT applications;
- Impact of familiarity of supporters with the AT involved;
- Training and support can be crucial at times of transition even for experienced users;
- Effective AT use was associated with formal and informal supports from individual teachers and a positive school environment;
- Attitudes of those involved in providing support could influence AT use;
- Lack of family support was associated with abandonment.

A recent review of research related to technology use to support inclusive education for vulnerable school age learners, and in particular students with disabilities, has been undertaken by the European Agency for Development in Special Needs Education (EADSNE, 2013), highlighting the importance of training and support.

Teachers and administrators need to be educated to systematically screen for learners who could benefit from AT (Edyburn, 2000, cited in Forgrave, 2002). The need for pre-service and continuing teacher education in AT has been emphasised (Hess *et al*, 2007). A lack of skilled professionals to make AT recommendations inhibits effective use (Zhang-Farrelly, 2011). Training in AT use contributes to its successful use (Zapf & Craddock, 2012). McKnight and Davies (2013) pointed to the need for more consistent AT provision across levels of education, the importance of AT support for informal and self-directed independent learning and the need to deploy existing technologies more widely and find more affordable technologies.

Effective AT education and training for AT users was explored by the EUSTAT project which involved six organisations from five EU member-states working together over a period of two years (Andrich & Besio, 2002). Inter alia, the study generated a set of principles to inform the development and implementation of AT education and self-education materials for end-users and field tested these in a user organisation. At the core of EUSTAT was the contention that it is empowerment rather than just the transmission of information and knowledge that should form the basis for AT education. AT end users should be able to use their knowledge to improve the quality of their lives.

EUSTAT identified six issues to be kept in mind when designing AT education:

1. Importance of addressing the AT user as consumer rather than a patient;
2. AT user's autonomy in planning his or her own life;
3. Role of the environment in the disablement process and the role of AT as an environmental facilitator;
4. Viewing knowledge transfer about AT to the end-user as a mechanism for enhancing quality of life;
5. Importance of managing relationships with formal and informal personal assistants and AT to achieve a balance of support;
6. Using experienced AT users as peer mentors about the challenges and impact.

Craddock (2006), using the IMPT assessment tool, identified three categories of AT users based on the type of technology they used, how they used it, and how satisfied and comfortable they were with it – novice, transition and power users. The power users were using high-end technology, such as voice recognition, screen readers and other voice output systems. They were more likely to have been using technology for a longer duration, to be surrounded by formal and informal supports and a more supportive school environment. Individual teacher support emerged as a critical factor in successful AT use.

Abandonment of AT was linked to a lack of family support by Maor *et al* (2011). Support from parents, carers, teachers and other professionals were noted as factors influencing AT use and quality of access to AT (Seale, 2014). Important support characteristics included the availability of 1:1 support, level of the supporters' familiarity with the AT and attitudes and perceptions of supporters.

The importance of support in the transition from primary to secondary school was highlighted by Specht *et al* (2007). The challenges of transition include transferring AT from a context where it was effective to a new context, heightened awareness of self in a more competitive and socially sensitive environment, class and school size, multiple teachers and demanding academic requirements. It would be unwise to assume that what worked in primary school will work in secondary school. The probability of drop out from secondary education is twice as high for learners with special educational needs as a result of school failure, deteriorating teacher relationships and falling behind with school work (Specht *et al*, 2007). Authors recommend interventions in key areas:

- Ensure there is no incompatibility between methods of assessment and the AT;
- Ensure leadership in smoothing the transition for teachers, parents and AT users through a continuum of support;
- Carry out a person, AT, environment fit analysis in the new context;
- Train in the use of AT especially for teachers but also for users in the new context;
- Advocacy to ensure that the voices of the key actors are heard by those who can influence the environment.

#### 4.4.5 AT Identification and acquisition process

##### Section Summary

AT identification and acquisition processes emerged as potential environmental barriers or facilitators to successful uptake depending on how they were designed and operated. Good quality identification and acquisition processes were considered essential to timely and effective AT use. Adequate funding was also important. AT uptake could be influenced by the degree of involvement of parents, school ethos and perceptions of the learning potential of the AT user. The level of awareness of AT's potential to impact positively and the knowledge of assessment professionals were important factors. Outreach to potential AT users needed to be included in the system of provision. The efficiency of delivery mechanisms, including funding authorisation, was key to effective use.

Sixty per cent of potential beneficiaries with visual impairments in an Illinois survey had no access to AT (Kappermann, 2002, cited in Kelly, 2011). A secondary analysis of the US National Longitudinal Transition Study-2 (NLTS2) data at three time periods from 2000 to 2005 explored AT use by high school students. It found significant predictors of AT use included a parent being involved, the school which the learner attended and the expectation that the learner would get paid employment.

The expense of purchasing, maintaining and updating AT can also be a barrier (Hong, 2012). Other factors affecting uptake included infrastructure (systems, compatibility), funding, curriculum planning and the knowledge, skills and attitudes of support persons (Seymour, 2005). Barriers to effective use included AT availability, high costs and lack of funding; lack of awareness of AT's potential in services, limited AT knowledge of professionals, a lack of ongoing support and eligibility issues (Alper & Raharinirina, 2006).

The design and implementation of an effective set of processes to ensure timely and effective access to AT for learners who require it is essential to the sociotechnical system. A set of quality indicators for AT services (QIAT Consortium, 2009) has been proposed. These cover:

- Assessing AT & documenting AT needs in IEPs;
- Implementing services;
- Evaluating effectiveness;
- Planning for transition;
- Offering professional development and training;
- Garnering administrative support.

Craddock (2002) discussed nine stages in the service delivery process that need to operate effectively to deliver timely and effective AT to end users:

- Outreach;
- Initiative;
- Assessment;
- Typology of the solution;
- Selection;
- Authorisation for financing;
- Delivery;
- Training;
- Management and follow-up.

This could provide a useful framework for a set of processes and procedures that proactively seeks learners that might benefit from AT and provide a continuum of support in the acquisition process and in its sustainable use.

#### 4.4.6 Educators' perceptions of AT

##### Section Summary

Two surveys investigated the perceptions of educators and academics on AT. Themes that emerged included the need for enhanced expertise on the part of academic staff involved in teacher education, better targeting of AT in teacher education curricula, the need to engage with AT providers in teacher education, restricted access to continuing professional development in the domain of AT, the need for enhanced understanding and expertise on the part of teachers and the importance of involving parents and learners in decision making.

Michaels & McDermott (2003) surveyed the perceptions of coordinators or directors of 143 special education graduate programmes in the US. Key questions related to the extent to which special education teacher preparation addressed AT knowledge skills and disposition in comparison to an ideal scenario and in particular the extent to which an understanding of AT, using AT and making AT decisions were covered by their programmes. They found significant discrepancies between respondent perceptions of current practices with what was considered to be required in all areas surveyed. In addition, the research identified potential facilitators for more effective practice including increased faculty expertise, more consistent integration of AT in the curricula, providing specific AT courses, procuring AT equipment and collaborating with AT providers. Barriers to improvement were lack of funding, lack of expertise, limited perceptions of AT relevance and absence of an AT development strategy.

More recently, Okolo & Diedrich (2014) undertook a survey of 1,143 Michigan educators in an online survey. Educator perceptions of AT were generally positive, but while they viewed their knowledge of technology in general as adequate, they were less positive about specific AT use and functions. Ratings of technology support received were mixed and were moderate for special educators and low for general educators. Most expressed a desire for further professional development. Lack of such training, restricted access to technology and insufficient funding were identified as major barriers to AT use. Other concerns raised included insufficient understanding of how students used their AT and little participation in AT decisions by class teachers, parents and learners. Respondents also specified barriers to use such as staff knowledge, access to adequate technology, funding and implementation issues. AT's positive impacts included improved access to the curriculum and improved academic performance. Others were improved instructional and functional outcomes.

#### 4.4.7 Universal Design for Learning (UDL) and AT

##### Section Summary

Various articles addressed the importance of viewing AT use within a Universal Design for Learning (UDL) framework. Within this framework, AT use was considered to be one of a number of strategies to ensure that learners could participate effectively in educational settings and access curricula and learning resources. Using universal design for AT devices themselves needed to be addressed particularly for learners with more complex needs. The presence of such features in AT devices was associated with more successful use.

UDL's conceptual and theoretical basis has been widely discussed in the literature (e.g. Rose *et al*, 2005; Meyer *et al* 2013; Rose, 2015). Starting from the premise that all students learn differently, UDL provides a basis for engaging all learners using multiple formats and channels (Rose, 2015). Disability is viewed as arising from inflexible educational environments rather than the characteristics of a particular learner. The focus is on the curriculum rather than learner capacity, but it is also a requirement of a UDL approach that learners must be able to use whatever tools they require in order to participate. This is particularly important for those who have to use AT.

Studies addressed the theme of UDL and AT (Kamei-Hannan, 2008; Wehmeyer *et al*, 2008; Marino *et al*, 2011; Courtad & Bouck, 2013). Kamei-Hannan (2008) evaluated the accessibility of computerised adapted tests for users of visual aids and Braille applications and devices. Barriers for Braille users included scroll bars, underlining, formatting, graphical information, pictures, translation errors, decontextualised Braille symbols and line limitations. Users of magnifiers such as Zoom Text took substantially longer than controls – 2 hours 45 minutes compared to 40 minutes. The author proposed the need for UDL to be applied to computer-based examinations and tests.

A meta-analysis of 81 studies of learners with intellectual impairment had a specific focus on UD features (Wehmeyer *et al*, 2008). Most technologies reviewed were intended to assist in modulating behaviour. The study identified a lack of UD features and customisation to individual

needs. A comparison of devices with at least one UD feature (183) and those with none (272) revealed a significant effect for UD features. People with more severe disabilities had less positive results. Another study noted accessibility issues in using the iPad with persons with fine or gross motor coordination challenges (Fan, 2012).

A practical guide based on UDL principles for science teachers seeking to procure instructional software for students with learning disabilities advised there were six types of issues to be addressed when choosing software – the interface, accessibility, content, instruction, critical thinking and assessment (Marino *et al*, 2011). The application of UDL to use of mobile electronic devices in a classroom was investigated by McMahon and Walker (2014). They described how built in features and third party apps could provide support for perception, language, maths and symbols, comprehension, physical action, expression and communication and executive functions, recruiting interest, sustaining effort and persistence and self-regulation. Edwards *et al* (2010) proposed a set of UDL criteria for software design.

## 4.5 Synthesis and Conclusions

The European Agency for Development in Special Needs Education (2013) identified a number of challenges across Europe, similar to those that emerged from this review. Based on a systematic search of online resources and almost 100 abstracts from across Europe, themes were identified and the report noted in particular:

- Lack of training available to address the knowledge and attitudes of educators;
- Challenge of keeping pace with the rapid evolution of AT;
- Relative advantages of mobile, tablet and emerging technologies compared to dedicated devices;
- Matching appropriate use of technology with learner needs;
- Gaining access to up-to-date evidence on the range of products available.

There was a general acceptance in the literature review for this study that AT in all its forms has a positive impact on the learning and educational engagement of pupils with disabilities and special education needs. This positive conclusion was reflected in the majority of review articles and intervention studies even in the absence of strong evidence from well-designed control group and correlational studies. It was not possible to draw conclusions based on strong evidence in relation to the effectiveness of particular types of technologies in comparison to others.

Commentators drew attention to various challenges to generating robust evidence. The field lacked a single widely accepted specification of what constituted acceptable evidence and was particularly challenged by the wide diversity and complexity of individual needs and personal characteristics, AT types and functionality and learning contexts which precluded the application of randomised design, use of appropriately matched control groups and large scale longitudinal designs.

Most intervention studies used single subject alternating designs or case studies over relatively short periods of time. A consistent definition of effectiveness was lacking across studies and ranged from precise measurements to user reports about perceived impact. It was difficult to identify sufficient studies in the same domain which focused on similar technologies to draw strong conclusions. The rapid development of technologies and particularly apps means that by the time a peer reviewed study is published, it is likely that the technology of interest has already been superseded.

A proposal worthy of consideration is to view research along a continuum which in the early stages is about exploratory studies, observations and descriptions which lead to classroom demonstrations. These can lead to more rigorous testing of hypotheses through formal research designs and in particular to small scale studies in which participants act as their own controls such as multiple baselines, alternating treatments, multiple probes and concurrent time series probe designs (Peterson-Karlan & Parette 2007, 2011).

The distinction between technology for learning and technology for access was not applied consistently across studies or even within the same studies. The approach adopted was to include technology for learning studies that addressed the needs of learners with disabilities.

In spite of the heterogeneity of articles broad conclusions can be drawn from this review. Many are similar to those generated by the European Agency for Development in Special Needs Education (EADSNE, 2013) which included involving learners in AT choice, a more multi-stakeholder approach, access to AT assessment services; enhancing the competence of assessment professionals in identifying and matching needs with solutions, increased educator initial and continuing AT training, allowing sufficient time for AT assessments and generating reliable data on the level of need for AT to monitor the impact and effectiveness of policies and processes.

### **1. AT has the potential to impact positively on educational participation**

The overall impression obtained from this review was that AT was beneficial for learners with special educational needs in capacity building and learning and access to learning resources.

### **2. An effective AT assessment process is the foundation of successful use**

The most frequent reason cited for not using AT devices was poor fit between user, technology and environment. The general consensus was that an effective AT assessment and matching process was essential and that this was not a one-off assessment but an iterative process that occurs over time, involves taking into account complex factors and includes systematic follow-up to evaluate AT's impact. The process of matching user to appropriate device is collaborative in which the user must play an active role. It is essential to adopt a biopsychosocial approach and to ensure that the overall sociotechnical system is addressed. It must be acknowledged that the experience of usage has a direct effect on AT impact which in turn influences the extent of future use in a reciprocal relationship.

Among the factors that need to be addressed are:

- Device reliability;
- The purpose for which technology is to be used;
- Availability of technical support;
- User satisfaction;
- Quality of life impact;
- Personal characteristics;
- Cognitive and physical abilities;
- Users expectations, attitudes and sensitivity to stigma;
- User's stage of development;
- Assistive technology device predisposition;
- Supportive relationships, friends and families, teachers;
- Costs;
- Impact on learning;
- Subjective wellbeing;
- History of device use.

Most of these factors are addressed by the Matching Person to Technology process, whose particular strength is the user's active participation in the assessment and selection processes. It can significantly predict the quality of the AT-user match and has a cultural fit with the Irish context.

Important factors in AT assessment include having an assessment team member who knows about AT and current research and practice evidence, measuring baseline performance, assessing AT use, reviewing performance in the absence of AT a second time and then reintroducing it and measuring the change.

### **3. AT training and support are essential to effective AT deployment**

The availability of training and support is a major factor in successful AT usage. This needs to take place at various levels and stages within the system including pre-service and continuing teacher education in AT, CPD for other professionals involved in AT assessment and use, providing access to information resources about AT, preparing individual teachers to support successful use of specific AT configurations. In addition, supportive parents, carers, teachers and professionals were noted as factors influencing AT use. Changing attitudes and raising awareness among supporters are also important as is the need to focus on support during transition from primary to secondary education.

#### **4. Educators acknowledge they need enhanced access to AT training and support**

Teacher cooperation was an important intervening factor in effective AT use. Areas for improvement identified in surveys of educators included enhanced awareness of AT potential, increased knowledge and access to support, a better understanding how students use the technology, more awareness of implementation challenges, greater familiarity with the identification, acquisition and support infrastructure (systems, compatibility), funding and curriculum planning procedures.

#### **5. The fit of AT with a UDL environment needs to be considered**

AT has an important role to play in a UDL approach. First, in the absence of an effective UDL-based curriculum, AT can serve to ensure access to learning and educational engagement. Second, in design of UDL curricula, it is essential to ensure that those who require AT can use whatever tools they require in order to participate. Thirdly, well-designed curricular materials must interface seamlessly with common AT devices and technologies. Fourthly, AT provision must be supported by interventions to ensure the learner can use the AT to navigate through the physical context and the curriculum itself.

## 5. AT User Survey Interviews: AT Impact

This strand was by far the largest part of the study's empirical work. It consisted of undertaking interviews with a sample of 96 pupils who used AT and their parents in relation to a range of issues concerning the process of acquiring and using AT and the impacts it had on a number of indicators educational performance.

The data collected from the pupils and their parents were quantitative and qualitative – a story-based approach followed by structured prompts was used to conduct the interviews with pupils (on their own, with their parents or by proxy where appropriate). Quantitative data were generated from the pupil's interviews, where they produced ratings of the acquisition process and the impacts of AT on various educational dimensions. In addition, elements of the qualitative data were coded so that quantitative analysis could be performed. Interviews about the process were carried out with parents exclusively and produced qualitative data.

This chapter reports on the analyses of this study according to the following structure:

- Impacts of using AT – this section outlines results obtained from the interview data on the impacts of using AT;
- Process of acquiring and using AT – this section presents findings from interviews on the perceptions of the process of acquiring and implementing AT;
- Exploratory analysis of factors associated with the impacts of using AT – this section presents results from exploratory quantitative analysis of the interview data;
- Multivariate analysis of factors associated with the impacts of using AT – this section presents findings from multivariate analysis of the data in which the main factors associated with AT's impact are simultaneously analysed;
- Summary of findings – this section presents a summary of all findings from the survey of AT users.

### Note on numbers:

A sample of 96 pupils was drawn up to take part in the study. All these pupils and their parents provided at least some data for the various parts of the interview. However, data were not available for analysis from all 96 respondents on all variables. In part, this was due to some aspect of the interview not applying to their situation, for example not all pupils faced educational challenges in all of the areas investigated, or for some areas of the implementation process where respondents had no comments to make. In addition, a few parents were not available to complete Part 2 of the interview which is concerned with their perceptions of AT implementation.

This meant that for some analyses it was not feasible to analyse records from all 96 respondents due to missing data on some variables. The numbers responding to the various parts of the interview, the reasons for these numbers and the numbers available for specific analyses are provided in each of sections below.

## 5.1 Experience of Using AT: Educational Participation

### Section Summary

Experience of using AT was examined in terms of the kinds of educational challenges that pupils remembered they had before they obtained their AT, and the numbers of these challenges that were met by the AT they subsequently received through the DES scheme. Overall, about 70 per cent of the challenges pupils said they had faced were affected by the AT they had received. However this varied across the different aspects of educational participation. The type of educational challenges most frequently reported by respondents related to curriculum access, attainment (in academic and non-academic e.g. independence areas) and educational engagement. Specifically:

- Curriculum access: 84 students reported challenges of which 81 per cent were met;
- Educational engagement: 62 students reported challenges of which 78 per cent were met;
- School involvement: 27 students reported challenges of which 52 per cent were met;
- Attainment: 77 students reported challenges of which 70 per cent were met;
- Subjective wellbeing: 44 students reported challenges of which 81 per cent were met.

This section reports the data on the experience of using AT. It uses data from Part 1 of the interview, which is reported on below in terms of the challenges faced in taking part in education, and more generally in life activities relevant to education, and the extent to which the AT received had addressed these challenges (see section 2.3.3 for details). Respondents were not probed about areas in which they experienced no challenges. A description of the method by which the data were categorised into different types of impact is followed by a report on how respondents perceived these impacts.

These data go to the heart of the research question: what works? As will be seen below, the level of impact reported by respondents was generally very positive – on average about 70 per cent of the challenges they faced were mitigated by the AT they had received. However, interpreting this data should recognise that it refers only to those who had received AT and only to the AT they had received under the DES scheme. Nevertheless, it is clear that the findings show substantial positive effects for most AT users.

Section 1 of the interview addressed two main issues using a story-based approach followed by prompts:

- What were the educational experiences of the respondent prior to having received AT?
- What were the impacts of AT on these challenges?

Initially, respondents were asked about their education experience in an open-ended manner. These stories were analysed to identify any challenges referred to during this process. These were coded as 'spontaneous'. In addition, respondents were prompted, using the five categories of educational participation and their sub-elements (see Tables 5.1 to 5.5) to say if any other challenges were experienced. This distinction is useful because it relates to what the respondents perceive as the most important challenges and benefits. Then they were asked whether the AT they received under the DES had impacted positively on the spontaneous and prompted challenges they had reported.

Interviewers categorised the types of challenges students described into five domains: curriculum access, educational engagement, school involvement, attainment in academic and life skills and subjective wellbeing. Each domain included sub-elements, 23 in all. Nine of these were not raised by respondents spontaneously and some were raised very infrequently. The most common issues raised spontaneously were classroom participation (n=38), assessment (n=10), access to learning resources (n=24), cognitive engagement (n=8), behavioural engagement (n=18) and literacy and numeracy (n=23).

It should be noted that the spontaneous responses of younger respondents and those with communication or cognitive difficulties were quite restricted in content and the story-based approach was more useful in orienting them to the interview purpose than in generating narratives. As a result these are less frequently represented in the responses presented as illustrations below.

Tables 5.1 to 5.5 present the number of respondents who reported spontaneously challenges in relation to each element of educational participation; the total number of respondents with challenges under each element; and the numbers and percentages of respondents who reported that AT had a positive impact on each element and dimension of educational participation.

In terms of challenges, they thus identify the most important challenges (in terms of numbers of spontaneous reports), the overall prevalence of challenges (in terms of overall numbers of challenges) and the extent to which these challenges were met by AT. This last indicator refers only to the total number of challenges reported.

As an introduction to the results, it should be noted that all respondents reported educational participation challenges of some kind and that the nature and severity of their disability, their age and their communication skills influenced the types of challenges reported. The percentages of respondents reporting that a challenge was met in the tables below are calculated with reference to the numbers of respondents reporting a challenge, rather than the overall sample of 96 respondents – this provides a more meaningful indicator of effectiveness.

Few respondents reported challenges in all areas of educational participation – this was mainly because, for the most part, the nature of disabilities meant that specific areas of educational participation did not cause problems. Finally, it should be noted that in relation to some challenges, AT had limited impact. This was often because the AT the respondent had might not be expected to address all challenges that the individual faced. These themes are picked up throughout the next section of the report as they occur.

## 5.2 Curriculum Access

Curriculum access was identified as a challenge if a respondent implied or expressed a barrier to accessing such features of the curriculum as materials, equipment or resources. The vast majority of respondents reported challenges in accessing the curriculum (n=84/96) and 81 per cent of these indicated the AT provided through the DES scheme had adequately addressed these challenges.

Three indicators of curriculum access were identified: classroom participation, participation in assessment and access to learning materials and resources. The frequency with which challenges and positive impacts were identified in the indicators is presented in Table 5.1.

Curriculum access challenges<sup>37</sup> were most frequently mentioned in the descriptions of educational participation before acquiring the AT. Under this heading classroom participation and access to learning materials or resources were most common. Classroom participation was spontaneously mentioned by more than half of respondents, while participation in assessment may be seen as a less important challenge, as less than a quarter of respondents with this challenge mentioned it spontaneously.

**Table 5.1: Challenges in curriculum access and percentage of positive AT impacts**

	Number of Respondents Reporting Challenges		Respondents Reporting Positive Impact of AT	
	Spontaneous	Total	Number	Percentage
Classroom participation	38	71	61	86%
Access learning materials/ resources	24	60	47	78%
Participation in assessment	10	47	33	70%
<b>Overall curriculum access impact</b>		<b>84</b>	<b>68</b>	<b>81%</b>
<b>No challenges</b>		<b>12</b>		

Classroom participation refers to taking part in all classroom activities including listening, asking questions, carrying out tasks, sustaining attention, acting appropriately, not interrupting, responding appropriately to correction and learning from instruction. In the case of 71 respondents challenges in classroom participation were reported spontaneously during the story-based inquiry or were confirmed in response to structured prompts and 86 per cent of these were considered to have been resolved by DES-funded AT. Typical responses included:

*Couldn't see board it was brutal ... life is better ... with AT better ... can zoom in, even for sums (ID: 0189 Male, nine years, multiple disabilities, visual aid user, primary school)*

<sup>37</sup> These related to the qualification criteria for accessing AT under the DES scheme.

*I tended to be a lot slower than the rest of the class. Like, writing wise I couldn't keep up. It wasn't readable and I would constantly make spelling mistakes. So like even if the word was readable it wouldn't make sense. I've been able to keep up with the class more. I've found it easier to take down notes and to keep up with learning in general (ID: 2169 Male, 14 years, ASD, e-learning software, post-primary school)*

*...had difficulties reading, following stories in class ... reading is easier because ... you just highlight the text and it reads it for you (ID: 0504 Male, 12 years, SLD, laptop, Read & Write Gold and Dragon Naturally Speaking, primary school)*

*Couldn't see the board, read books with small writing in it ... It's like there's a secret button on the thing and you press the screen and it will come up all blank and you put it under and you can see the page (ID 1285 Male, 11 years, visual impairment, magnifier and tripod, primary school)*

*I had to sit really close to the board ... [now] If I want to see ... on the board I put on the camera and zoom in (ID 1286 Female, 12 years, visual impairment, liberty scholar CCTV system, primary school)*

*Can hear the teacher better ... too loud sometimes (ID 1788 Female, nine years, speech and language disorder, FM system, primary school)*

Access to learning materials and resources was a challenge for 60 respondents, 78 per cent of whom reported that AT positively impacted on them. This was characterised as references to reading written texts, copying from the blackboard, white board or work sheets, using learning materials, equipment and technologies or obtaining the materials required for learning in the classroom and at home. For example:

*Now I was able to actually look at something and study it. And it was a lot less hassle to try and find out the information. Like before I'd have to borrow a copy off someone I knew because they had the notes, they were in the same class. But now it's easy. Yeah, I think [my] marks improved (ID: 2292 female, 17 years, physical disability, laptop user, post-primary school)*

*(Before magnifier)... used large print books, you could have five books for one book, so your bags is heavy and stuff. OK for primary school but wouldn't work for secondary school (too many books) (ID: 2210 Male, 16 years, visual impairment, zoometext and printer, post primary school)*

Participation in assessment emerged as a challenge for 47 respondents and 70 per cent of these said the challenges were being addressed by the AT provided under the scheme. Reference to participation in assessment referred to being able to successfully demonstrate acquired learning in a formal written or oral examination, to read and understand questions, to complete answers within the required time or to produce understandable responses. For example:

*Tests grand now since the laptop ... Used to get pain in the hand from writing, now typing in school (ID: 7008 Male, 14 years, ASD, e-learning software, post primary school)*

*Writing essay type answers was difficult before laptop (ID: 2704 Male, 16 years, multiple disabilities, laptop user, post- primary school)*

*I used to be allowed extra time cos I just couldn't write long essays as fast and then if I did try to write fast it would be just a scribble, my handwriting would deteriorate... time runs out [in exams]. I wasn't like so rushed, for example like in English essay, I'd typed it and I knew there would be no problem with handwriting, I was able to like slow down and think about what I was writing, I didn't have to worry about time (ID: 2209 Male, 16 years, emotional/ behavioural, Read & Write Gold, post primary school)*

*... if it [test] was like really long ... I thought it could be better... writing sloppy ... so much faster (at writing with laptop), so would have time for different questions (ID 2018 Female, 17 years, physical disability, laptop and headphone, post primary school)*

### 5.3 Educational Engagement

References to challenges with educational engagement were reported by 62 respondents and 78 per cent of these reported that AT had had a positive impact on these challenges. This domain included references to difficulties or a lack of interest in becoming involved in essential educational and learning activities that occur inside and outside the classroom or at home or motivation towards learning and education.

There were four indicators of educational engagement: school process engagement, cognitive engagement, behavioural engagement and affective (emotional) engagement. The frequency of challenges and positive impacts is presented in Table 5.2.

Overall, only behavioural engagement was spontaneously cited as a challenge by a sizeable numbers of respondents. In most cases for the other three indicators, these were cited as challenges only following prompting by the interviewer.

**Table 5.2: Challenges in educational engagement and percentage of positive AT impacts**

	Number of Respondents Reporting Challenges		Respondents Reporting Positive Impact of AT	
	Spontaneous	Number	Number	Percentage
Behavioural engagement	18	43	34	79%
Cognitive engagement	8	42	33	79%
School process engagement	2	23	14	61%
Affective engagement	1	20	18	90%
<b>Overall educational engagement impact</b>		<b>62</b>	<b>49</b>	<b>78%</b>
<b>No challenges</b>		<b>34</b>		

The most common challenges were mainly in the areas of behavioural and cognitive engagement. Behavioural engagement such as being able to sit down to work on assignments, being organised, managing time or sustaining effort arose as a challenge in 43 interviews and 79 per cent of AT positive impacts were reported. For example:

*I got into trouble ...before [the AT] (ID 4769 Male, 13 year, physical disabilities, laptop user, post-primary school)*

Challenges in cognitive engagement with learning included reference to remembering, thinking, problem solving or concentrating. This emerged as challenge in interviews with 42 respondents and 79 per cent of these reported this had been addressed by the AT. For example:

*Spelling wise I couldn't remember most things. And it's great since I got the laptop. I've been making mistakes and I've seen the corrections and it's helped me to remember that bit more (ID: 2169 Male, 14 years, ASD, e-Learning Software, post primary school)*

Challenges in school process engagement related to such areas as being involved in all aspects of school life both within and outside the classroom, taking an interest in school life and activities or being aware of what was going on in school and keeping up-to-date. This was specified by 23 respondents, 61 per cent of whom indicated that they had been successfully addressed by AT. For example:

*If I was doing any homework or anything it would take me a very long time (ID: 2292 Female, 17 years, physical disability, laptop user, post-primary school)*

*it was kinda hard as I have a weakness in my hands ...if it was like essay I would get really tired (ID 2018 Female, 17 years, physical disability, laptop and headphone, post primary school)*

Reference to being motivated and happy to get involved in learning activities in school and at home, wanting to do homework, making an effort to do well in learning activities, being curious and being interested in gaining new knowledge were considered to relate to this area.

Affective/emotional engagement challenges related to interest, motivation, liking learning, tolerating frustration or wanting to do better. This was identified as a challenge in the case of 20 respondents, though only one reported this spontaneously, and 90 per cent of these were considered to have been successfully addressed by the AT. For example:

*I think, the frustration is the biggest thing with [pupil] before she got the iPad, because of the non-verbal, she just couldn't communicate [Interview By Proxy, Quote From Class Teacher] (ID 0385 Female, nine years, ASD, user of laptop communication device, primary school)*

## 5.4 School Experience

School experience refers to challenges in becoming involved in aspects of school or learning and the broader educational experience not directly related to the curriculum. Relatively few challenges were reported in this domain with 27 respondents indicating a challenge and just over half of these specifying a positive AT impact (52 per cent). All instances of school experience challenges came from probing subsequent to the story-based inquiry.

Three indicators of school experience were addressed: participation in school-related activities, participation in extra-curricular activities and relationships with peers or teachers. The frequency with which challenges and positive impacts were identified in the indicators is presented in Table 5.3.

**Table 5.3: Challenges in school experience and percentage of positive AT impacts**

	Number of Respondents Reporting Challenges		Respondents Reporting Positive Impact of AT	
	Spontaneous	Number	Number	Percentage
Participation school-related activities	0	22	12	55%
Extra-curricular school activities	0	11	5	45%
Relationships with peers and teachers	0	11	8	73%
<b>School involvement impact</b>		<b>27</b>	<b>14</b>	<b>52%</b>
<b>No challenges</b>		<b>69</b>		

Participation in school-related activities challenges related to participating in formal aspects of school activities such as breaks, library time, recreation or assemblies and use of and access to school facilities. These were indicated by 22 respondents, all as a result of probes. Over half of these respondents indicated these challenges had been addressed by AT acquisition.

Participation in extra-curricular activities related to activities offered to pupils outside school hours such as sports, school trips, debating societies, science clubs or drama. This arose as a challenge in interviews with 11 respondents mainly in response to probing, 45 per cent of whom reported that these had been addressed by the AT.

Challenges in relationships with peers or teachers were identified by 11 respondents and 73 per cent of these were considered to have been addressed by the AT they were using. These related to both informal aspects such as play, socialising, meeting up or communicating with fellow pupils or communication and relationships with teachers; support from teachers, trust in teachers, positive regard or respect from teachers.

## 5.5 Attainment

Attainment relates to the successful acquisition of both academic knowledge and skills and improved learning in competences related to life. It included reference to challenges in achieving or doing better in school, getting good grades, learning things, accomplishing or gaining an ability or competence relevant to living. These types of challenges could be identified in the interviews of 77 respondents and a positive impact for AT was reported in 70 per cent of cases. However, with the exception of literacy and numeracy challenges, the others were not reported spontaneously with high frequency.

Eight indicators of attainment were explored. Three categories of academic achievement were included to gain a full insight into academic attainment. This approach was adopted to distinguish pupils experiencing challenges in overall academic performance from those performing adequately academically but who were experiencing specific challenges in literacy or numeracy or who faced challenges only in specific subjects e.g. languages. Five categories of non-academic achievement were included: learning skills for life, learning to be more mobile, enhance daily living skills, learning to be more independent and learning to socialise. The frequency with which challenges and positive impacts were identified in the indicators is presented in Table 5.4.

Literacy and numeracy were the areas of attainment in which challenges were most frequently referred to spontaneously by respondents.

Challenges in achieving in overall terms without reference to a particular academic subject or skill were classified as academic attainment. These were indicated by 35 respondents with a positive impact for AT specified by 80 per cent. For example:

*Sometimes a teacher might comment, they don't know how messy my writing is, and say I need to write neater or something. And, yeah, I found that really annoying. [Having got laptop] teachers can look at it [work] and give me my actual grade (ID: 2292 Female, 17 years, physical disability, laptop user, post-primary school)*

**Table 5.4: Challenges in attainment and percentage of positive AT impacts**

	Number of Respondents Reporting Challenges		Respondents Reporting Positive Impact of AT	
	Spontaneous	Number	Number	Percentage
Literacy and numeracy	23	67	55	82%
Independence	3	28	14	50%
Academic achievement	2	35	28	80%
Subject specific	2	26	18	69%
Skills for life	0	19	13	68%
Mobility	0	17	3	18%
Daily living skills	0	18	4	22%
Socialisation	0	12	4	33%
<b>Attainment impact</b>		<b>77</b>	<b>54</b>	<b>70%</b>
<b>No challenges</b>		<b>19</b>		

Literacy or numeracy challenges were indicated by 67 respondents and in 82 per cent of cases the AT was deemed to address these challenges. References to learning to read, write or calculate; reading, writing or calculating at age level and struggling to decode print or produce written content were included. For example:

*Within nine months of the laptop and the recommendations being put in place, he came up six years in his maths, and five years in his reading, and there are reports to prove that [Pupil was accompanied by parent, quote from parent] (ID: 7002 Male, 12 years, multiple disabilities, Word processing user, primary school)*

*My writing wasn't the greatest... my hands get sore, that's when the writing gets sloppy ... slow at reading ... learning is easier [with the laptop] ... easier to keep up, with the typing ... you can see what you're taking down clearer on the computer, than on a copy (ID: 2288 Male, 18 years, assessed syndrome, laptop and accessories, laminator, digital camera and photocopier, post primary school)*

*My handwriting isn't very good ... my hands would get like tired towards the end of the day and it was just much easier once I was able to use a computer and programmes like that ... It helps you widen your vocabulary [Thesaurus] ... typing, and then highlight it reads it back ... can then [I] hear errors (ID: 2209 Male, 16 years, emotional/behavioural, Read & Write Gold, post primary school)*

Challenges in achieving in specific subjects such as history, geography, art, woodwork, physical education were raised by 26 respondents, 69 per cent of whom indicated the AT they had been granted had impacted positively. For example:

*Most notes for subjects like geography and science and that tend to be long so since I've had this [laptop], since they are readable, it's easier for me to read and easier to understand*  
(ID: 2169 Male, 14 years, ASD, e-learning software, post primary school)

All instances of challenges in life domains were as a result of probing subsequent to the story-based inquiry rather than being mentioned spontaneously.

Skills for life were characterised as including achievements in team work, cooperating, being assertive, persisting with tasks, learning by correction, coping with stress, dealing with problems, handling disagreements, managing money, developing hobbies or following rules. Challenges in learning in these areas were indicated by 19 respondents and 68 per cent of these reported positive AT impacts.

Mobility referred to achievement in getting around the school, commuting to and from school or accessing all areas of the school. These were identified in 17 interviews and in 18 per cent of cases the AT was considered to have a positive impact.

Daily living skills related to achievements in grooming and hygiene, self-care, toileting, doing chores, tidying the classroom work space, taking care of books and copies or eating or drinking. These types of challenges were specified by 18 respondents and 22 per cent of these indicated the AT had made a positive difference.

Independence covered achievements in doing things or carrying out tasks without needing to be reminded or having the support of another person. Challenges such as these arose in 28 interviews and positive AT impacts were indicated by 50 per cent of these respondents. For example:

*I didn't have to sit with him while he was doing homework. It gave him more independence*  
(ID: 1423 Male, 13 years, multiple disabilities, laptop user, special school – proxy)

Socialising covered achievements in making friends, handling interpersonal relationships, being part of a group or being involved in informal play or activities. This was indicated as a challenge by 12 respondents and 33 per cent of these specified that their challenges in this area had been addressed by DES-funded technology.

## 5.6 Subjective Wellbeing

Subjective wellbeing included positive feelings or emotional reactions, a sense of satisfaction, fulfilment of desires or affirmative perceptions of self. Challenges to subjective wellbeing were identified in 55 interviews, 81 per cent of which were successfully addressed by the AT according to the respondents. Five indicators of subjective wellbeing were explored: academic orientation, enjoyment, self-esteem, confidence and optimism. The frequency with which challenges and positive impacts were identified in the indicators is presented in Table 5.5.

Respondents infrequently referred spontaneously to challenges in the area of subjective wellbeing.

Academic orientation related to a desire, motivation or interest in learning, education or doing well in school. In ten cases this was identified as a challenge and 70 per cent were considered to have been successfully addressed by AT. For example:

*Before getting the AT ... I kind of lost interest in school, well like in the homework really*  
(ID: 2290 Male, 18 years, SLD, text to speech software user, post-primary school)

**Table 5.5: Challenges in wellbeing and percentage of positive AT impacts**

	Number of Respondents Reporting Challenges		Respondents Reporting Positive Impact of AT	
	Spontaneous	Number	Number	Percentage
Academic orientation	1	10	7	70%
Enjoyment	3	33	26	79%
Self-esteem	1	17	14	82%
Confidence	2	35	31	89%
Optimism	0	13	11	85%
<b>Subjective wellbeing impact</b>		<b>55</b>	<b>44</b>	<b>81%</b>
<b>No challenges</b>		<b>41</b>		

Enjoyment referred to feelings of pleasure or happiness, having a good time, getting the best out of life in school or feeling entertained. Enjoyment challenges were indicated by 33 respondents, 79 per cent of whom reported positive AT impacts. For example:

*Before I got it [laptop], no, I hated school* (ID: 2292 Female, 17 years, physical disability, laptop user, post-primary school)

Self-esteem included a positive sense of self, pride, and self-worth, self-respect as a person and as a learner. This arose as a challenge in 17 interviews and 83 per cent of these respondents indicated that the AT had positive impacts.

Confidence was characterised as belief in oneself, trust in one's own abilities, feelings of being good enough, belief that one can achieve, not being afraid to try or being able to speak out. This was reported as a challenge by 35 respondents and 88.57 per cent indicated that the AT had made a positive impact. For example:

*I wasn't really that confident in learning to be quite honest about it [before AT] (ID: 2170 Male, 15 years, physical disability, laptop and e-books, post-primary school)*

*To be able to come in and turn on the computer, get into what game he wanted to get into or what subject he wanted to do, I suppose he was happier, when he showed me what he could do on the computer he was very happy with it. General learning, and being able to show me what games he could do [Interview By Proxy, Quote From Parent] (ID: 0455 Male, 11 years, moderate GLD, laptop and boardmaker user, primary school)*

Optimism related to a positive view of the world, hope, belief that things would get better, a sense that challenges could be overcome, looking forward to a brighter future or belief in the good intentions of others. This arose as an issue in 13 interviews and 84 per cent of respondents considered that the AT had a positive impact. For example:

*It was like I was carrying around this big huge sack of just rocks on my back and then they're suddenly taken off. It was so much stress taken off me. I was constantly worried. I was just afraid I was just going to end up nowhere in life because I didn't get any good grades or anything because nobody could read my writing and I didn't even know what I was saying (ID: 2170 Male, 15 years, physical disability, laptop and e-books, post-primary school)*

Some respondents who reported no challenges to subjective wellbeing referred to the affective impact of the AT in describing the implications of acquiring it. These related to feelings about being perceived as an AT user.

*Didn't like being called Laptop Kid, also [it was] difficult to carry laptop around and keep safe (ID: 2701 Male, 16 years, SLD, voice recognition user, post-primary)*

*[Friends] slag me for using the laptop ... slag them back, it doesn't bother [me] (ID 4769 Male, 13 year, physical disabilities, laptop user, post-primary)*

*He felt important carrying the laptop. And he had to mind it, it gave him responsibility. [Pupil Was Accompanied By Class Teacher, Quote From Class Teacher] (ID 7003 Male, 11 years, ASD, laptop user, special school)*

## 5.7 Summary of Challenges and Positive Impacts

The number of respondents reporting challenges (spontaneous plus prompted) was used to rank the domains and indicators in terms of positive impact of the AT received under the DES scheme on those challenges. This provided a relative indication of where the AT had made a difference and the number of respondents who had experienced challenges. These are summarised in Tables 5.6 and 5.7.

It should be noted that all pupils interviewed faced challenges of some sort, but the most common were in the areas of curriculum access and attainment. Relatively few pupils faced challenges in school involvement or educational engagement.

The percentage of reported positive impacts in the domains of curriculum access, subjective wellbeing and educational engagement are about 80 per cent indicating that about 20 per cent of challenges in these domains were not being met by the AT according to the respondents.

Attainment and school involvement challenges were met less frequently. School Involvement challenges were indicated by the lowest number of respondent (n=27). These rankings of the effectiveness of AT in meeting challenges are consistent with the reasons why AT was awarded in the first place to students. These awards are made for reasons of supporting the individual in engaging in educational tasks. In this context, it is hardly surprising that the impact on school involvement (the domain least directly involved with education) was lowest. On the other hand, the high percentages of challenges met in relation to the other four domains of educational participation would suggest that at least some parts of the AT process are working well.

**Table 5.6: Rankings of the five domains of educational participation**

	No Challenges	Respondents with Challenges	Respondents Reporting Positive Impact of AT	
	Number	Number	Number	Percentage
Curriculum access impact	12	84	68	81%
Subjective wellbeing impact	41	55	44	81%
Educational engagement impact	34	62	49	78%
Attainment impact	19	77	54	70%
School involvement impact	69	27	14	52%

Table 5.7 ranks all indicators that make up the domains of educational participation and expands on these results. The most common areas of challenge related to classroom participation, literacy and numeracy, Access to Learning materials and resources and participation in assessment – for each of these more than half of the pupils faced challenges.

Eleven indicators were rated over 78 per cent in terms of positive AT impact. The majority of subjective wellbeing indicators (78-88 per cent) were rated positively in terms of AT impact. Affective, cognitive and behavioural engagement challenges were reported as being successfully addressed by a high percentage of respondents (78-90 per cent). The positive impact of AT on classroom participation and access to learning was rated very positively (86 per cent and 78 per cent respectively). Challenges in academic achievement and literacy and numeracy were also high (80 per cent and 82 per cent respectively).

**Table 5.7: Rankings of the 23 indicators of educational participation**

	No Challenges	Respondents with Challenges	Respondents Reporting Positive Impact of AT	
		Number	Number	Percentage
Classroom participation	25	71	61	86%
Literacy and numeracy	29	67	55	82%
Access learning materials/ resources	36	60	47	78%
Participation in assessment	49	47	33	70%
Behavioural engagement	53	43	34	79%
Cognitive engagement	54	42	33	79%
Confidence	61	35	31	89%
Academic achievement	61	35	28	80%
Enjoyment	63	33	26	79%
Independence	68	28	14	50%
Subject specific	70	26	18	69%
School process engagement	73	23	14	61%
Participation school-related activities	74	22	12	55%
Affective engagement	76	20	18	90%
Skills for life	77	19	13	68%
Daily living skills	78	18	4	22%
Self-esteem	79	17	14	82%
Mobility	79	17	3	18%
Optimism	83	13	11	85%
Socialisation	84	12	4	33%
Relationships with peers and teachers	85	11	8	73%
Extra-curricular school activities	85	11	5	46%
Academic orientation	86	10	7	70%

Attainment challenges in non-academic areas relevant to educational participation were rated relatively low in terms of positive AT impacts (between 18 per cent for mobility challenges and 68 per cent for skills for life). Challenges to participation in school-related and extracurricular activities were also less frequently rated as being successfully addressed by AT (55 per cent and 44 per cent respectively).

## 6. AT User Survey Interviews: Process of Acquiring and Using AT

### Section Summary

Respondents, who in this part of the study were all parents, were asked for their opinions and experiences of the process of acquiring AT, at eight stages of the process beginning with the identification of AT needs and carrying through to the post installation phase of using it.

Overall ratings of the process were generally positive (these were ratings of each stage made by interviewers on the basis of parents' comments). Between 47.8 per cent and 82.8 per cent of parents rated the eight stages positively.

However, they were also asked to comment on each stage process in terms of how they could be improved. Here the comments related to aspects of the process they rated negatively.

A major finding from this part of the survey was that many parents (in some cases a majority) had no comments to make on specific stages. This was for two reasons – either they did not wish to make a comment or in many cases they were not aware of the details of what activities took place at a given stage. Application and allocation processes seemed particularly opaque to parents. This finding points to communication difficulties within the process.

Another major finding was that most comments made related to areas for improvement and challenges to be addressed (by a ratio of about 3.5:1). Parents were particularly concerned about the processes relating to the matching of needs to technology, AT procurement, training of stakeholders and support available post installation of AT. On the other hand, there was a balance of opinion expressed on the AT identification stage of the process.

Parents were asked to report on their experience of the process of AT implementation and to suggest how it might be improved. From the previous chapter, the AT provided under the DES scheme was seen to be rated as meeting a substantial number of the educational challenges users faced. However, parents' ratings of the processes whereby their children sought, received and used AT were somewhat more nuanced. These processes were the subject of the second part of the user interviews. The questions here were designed to be answered by either the pupil and/or by the parent. In all cases the questions were asked of the parent, since by their nature, only the parent was likely to have the information to enable an answer to be given.

Interviews with parents took place either via a face-to-face or telephone interview. In most cases, a telephone interview was used as either the parent was not present at the interview or time constraints prevented a face-to-face interview. Face-to-face interviews were recorded, but telephone interviews were not – in these cases extensive contemporaneous notes were taken by the interviewers.

These procedures mean it is not possible to give direct quotes from parents here. The examples of issues raised below are taken from interviewers' notes and should not be taken as verbatim quotes from parents.

Parents were asked open-ended questions about eight distinct elements of the entire process:

- Identification of potential AT needs – refers to how it was decided the individual would or might benefit from AT;
- Assessment of needs – refers to the needs assessment process;
- Matching of needs to technology – refers to how the needs of the individual were matched to appropriate technologies;
- The application process – refers to the administrative process of applying for AT;
- The allocation process – refers to how decisions were made on the award of AT;
- The procurement of the AT – refers to how the AT was bought and delivered;
- Training for stakeholders – refers to how training was organised (if any) for the main stakeholders in the AT;
- Support following installation of the AT – refers to the types of help people received to get the best out of the AT.

The AT procurement process is common to all school types with one exception – ETB schools procure AT for pupils at the level of the ETB district, rather than the school as is the case for the other school types. An analysis of differences between ETB and the other school types was carried out to see if this influenced the parents' perception of the process. In general, no differences were seen between ETB schools and the other school types, with one exception. This difference is referred to in section 7.4 below.

Parents of 93 pupils took part in this part of the interview, giving a response rate of 96.8 per cent. These parents provided an almost complete data set on the process of implementing AT (one parent provided only partial data for this section).

Two kinds of data were generated from the interview. The first involved the interviewers rating the parents' overall responses to each stage of the implementation process as being either predominantly positive or negative. The response rate therefore to all of these questions was considered to be 96.8 per cent. The second type of data came from detailed notes of the responses to the questions by parents. However, not all parents chose to answer all questions about each stage – in some cases they did not have the information that would enable them to answer, while in others they had no comments to make.

## 6.1 Overall Perceptions of the Process

Table 6.1 presents percentage of positive ratings made and the number of respondents contributing in terms of the DES-funded AT being used by the pupils. This result shows that ratings for most stages of the process were high – more than half of respondents rated each stage of the implementation process positively with the exception of the procurement process.

However, also clear from the overall ratings was a reduction in positive ratings of the stages as the project progressed – the earliest stage was rated positively by more than 80 per cent of parents (Identification of AT needs), while the latter three were rated positively by only about half of parents.

Table 6.1 illustrates the overall pattern within the ratings respondents of the process, with cells where the percentage of positive ratings exceeded 75 per cent are highlighted in green and those where the percentage of positive responses was less than 50 per cent are highlighted in yellow. This clearly shows the fall-off in positive ratings as the stages of the process progress.

**Table 6.1: Positive ratings of stages of AT process by AT type**

		Type of AT						
		Total	Visual Aids	Audio Systems	Communication Devices	Software	Control Devices and Accessories	Laptops and Computers
Identification of AT needs	n	93	12	19	6	15	16	25
	% Positive	82.8	100.0	89.5	100.0	73.3	87.5	68.0
Assessment of needs	n	93	12	19	6	15	16	25
	% Positive	67.7	83.3	57.9	83.3	80.0	75.0	52.0
Person technology match	n	93	12	19	6	15	16	25
	% Positive	66.7	66.7	78.9	50.0	53.3	75.0	64.0
Application procedure	n	93	12	19	6	15	16	25
	% Positive	66.7	91.7	89.5	83.3	66.7	50.0	44.0
Allocation process	n	93	12	18	6	15	16	25
	% Positive	50.0	58.3	61.1	50.0	53.3	43.8	40.0
Procurement process	n	92	12	18	6	15	16	25
	% Positive	47.8	66.7	66.7	33.3	46.7	31.3	40.0
Training in AT use	n	92	12	18	6	15	16	25
	% Positive	51.1	83.3	38.9	50.0	26.7	68.8	48.0
AT follow-up and support	n	92	12	19	6	14	16	25
	% Positive	51.1	66.7	36.8	50.0	35.7	62.5	56.0

Ratings of stages varied somewhat according to the type of AT children received. At no stage did respondents using software, laptops and computers assign positive ratings above 70 per cent. Furthermore, only for users of visual aids did the percentage of positive responses exceed 75 per cent in the later stages of the AT process and specifically for AT training. In part this may be due to the visiting teacher service, but the reasons behind these ratings are discussed in more detail below.

Table 6.2 below gives the breakdown of the numbers of parents who provided comments on the 8 stages of the implementation process. It also summarises the number of comments (positive and challenges to be addressed) made by parents in relation to each of the 8 stages. It should be noted that parents could make more than one comment about each stage – hence the numbers of comments is higher than the number of parents who responded to these questions.

**Table 6.2: Numbers of respondents and comments for implementation process**

Stage of the Process	Number of Respondents	Number of Comments	
		Challenges	Positive
Identification of potential AT needs	35	27	28
Assessment of needs	38	51	20
Matching of needs to technology	51	61	7
Application process	26	25	11
Allocation process	23	25	3
Procurement of AT	26	34	4
Training for stakeholders	57	59	12
Support post-installation of AT	54	54	8
<b>Total</b>	<b>23-57</b>	<b>336</b>	<b>93</b>

In all, 427 distinct comments were made by parents. These were made by 23 to 57 interviewees and on average less than half of parents commented on the eight stages of the implementation process. The reasons for this apparently low level of comment were mainly concerned with two issues – either they were not aware of the details of some elements of the process, or they had not experienced any problems with them.

Parents were least aware of the details of the earlier stages of the process and of the processes associated with the application and allocation stages of the process. In part this was because these are among the more technical or administrative elements and it might be expected that parents would have relatively little knowledge of them, as they were 'expert' led.

Most comments were made about the matching of technology to needs process and the latter stages of implementation. Again, this might be expected since these are the most visible stages and the ones which involve parents most.

Parent comments were classified into positive comments and those relating to challenges needing to be addressed. This was done via key word analysis by the researchers.

The balance of the comments between positive and challenges varied considerably across the stages of the process. Overall, the challenges comments outweighed positive ones by more than 3:1. However, the earlier stages and the more technical/administrative stages were more likely to attract positive comments, while in the later stages, challenges comments outweighed positive ones by as much as 7:1 or 8:1. This would support a theory that the stages they knew most about were the least satisfactory.

The tables below detail the nature of the comments made about each stage of the process. They also describe the data from fixed response questions which asked about:

- People involved in the process;
- In what areas could the process be improved?
- Perceptions of the process – were they mainly positive or mainly negative?

## 6.2 Identification Process

### Who was involved in the identification process?

Table 6.3 details parent's perceptions of the people who were involved in the process of identifying an AT need in their children. This is broken down by the type of AT the child received. This Table shows that most commonly involved actors were parents. These were closely followed by Class Teachers, Visiting Teachers and Occupational Therapists. Resource teachers, AT resource teachers, Speech and Language Therapists were mentioned less often.

**Table 6.3: Parent reports of stakeholder involvement in needs identification process by AT type**

	Visual Aids	Audio Systems	Communication Devices	Software	Control Devices	Laptop and Computer	Total
Parent		4	2	5	3	14	28
Class teacher	3	4	2	3	4	8	24
Resource teacher	1		2	1	4	2	10
Learning support teacher		1		1		1	3
Special needs assistant			1				1
AT resource teacher	2		2	3	1	3	11
Principals	2	3		1	1	1	8
Psychologist				7	3	7	17
Physiotherapist						1	1
Occupational therapist			1	5	6	10	22
Special educational needs officer	1	2			1	1	5
Speech and language therapist			4		3	2	9
Visiting teacher	9	12				2	23
<b>Total</b>	<b>18</b>	<b>26</b>	<b>14</b>	<b>26</b>	<b>26</b>	<b>52</b>	<b>162</b>

However, these actors were not involved in the same way for each type of technology. Visiting teachers, for example, were involved almost exclusively with visual aids and audio systems, while psychologists were not involved with these types of AT, but were mostly involved in software, control devices and with unspecified AT. Occupational therapists were also mostly involved with these types of AT.

### Comments on identification process

In all 55 keywords were identified from the responses of the 34 respondents who provided qualitative data on this issue (see Table 6.4). These were almost equally split between positive comments and challenges. The most common positive comments related to the role of external services. The role of teachers also attracted some positive comments.

Where potential needs were identified early, this was due to external services (mostly for people with hearing or visual impairments) in half of the references. For example, one parent was noted to make the point that *'a clinic, a young person's unit was involved. They were very good and worked hard with their son'*.

Other positive elements here were the roles of teacher and visiting teachers.

**Table 6.4: Perspectives on identification process**

Challenges		Positive Keywords	
Late identification	12	External service role	13
Parent initiation	7	Teacher role	4
Trouble at school	4	Good assessment	3
Needs early assessment	2	Resource teacher role	3
Unhelpful principal	1	VT role	3
Assessment not helpful	1	Timely approval	2
<b>Total</b>	<b>27</b>	<b>Total</b>	<b>28</b>

On the challenges side almost half the comments related to the potential late identification of needs. These often referred to difficulties of diagnosis. In many cases, it was only through the persistence of parents that problems were ultimately identified. One parent was noted to say that *it was very evident when [the] son started school that he had difficulties and it should have been picked up then. [It was not picked up until pupil was in 3rd or 4th class]*.

### 6.3 Assessment Process

In all, 67 keywords were identified in the assessment process from the 37 respondents to this question (see Table 6.5). Forty-nine of these related to challenges, while 18 were positive. Commonly, the process was viewed as taking a long time and being late, i.e. it should have taken place earlier. Parents reported not being listened to in relation to their child's needs. They also pointed to inefficiencies in the handover process, mainly between first and second level schools, where it appears new assessments were needed in many cases despite the child's needs not having changed. For example, one parent reported sending in all their son's assessment reports to the secondary school before he started (reports from the educational psychologist on his dyslexia and dyspraxia) and a clinica (on his autism) to see if they could facilitate his needs before he went there. But the school was unable to do this.

**Table 6.5: Perspectives on assessment process**

Challenges		Positive Keywords	
Late assessment	7	External agents	7
Transfer	7	Happy with process	4
Parent not listened to	7	Transfer	3
Slow process	6	Educational psychologist	2
Assessment not accepted	4	SENO	1
Teacher	4	Speech and language therapist	1
No assessment	4		
Parents not informed	3		
Private payment	2		
Too much assessment	1		
Doctor not recognising condition	1		
No monitoring	1		
No SNA involvement	1		
External agents	1		
<b>Total</b>	<b>49</b>	<b>Total</b>	<b>18</b>

Other issues with the assessment process concerned its results not being accepted by the school, i.e. principals or specific teachers not acting on assessment results.

On the other hand, about 30 per cent of the keywords relating to the assessment process related to positive experiences. The largest categories of comments here concerned the role of external agents in the process, especially for assessments undertaken by organisations supporting visually and hearing impaired people. For example, one parent was noted to report about their son that *'an OT<sup>38</sup> did a number of assessments with him over a couple of months – assessing mobility and his writing. She recommended the laptop. OT phoned the SENO and the parent phoned the SENO as well'*.

Other parents were happy with the assessment process – they felt it identified their child's needs and had taken place in a timely fashion. Interestingly, some parents thought the transfer process between schools had worked well, thereby showing that this issue could be managed effectively, at least in some cases.

<sup>38</sup> Occupational therapist.

## 6.4 Matching Process

The matching of AT products and needs is key in promoting efficient and effective AT usage, potentially leading to positive educational outcomes. The 69 keywords relating to it came from 50 respondents and these were mostly concerned with challenges (61 related to challenges faced) and support the conclusion that this part of the overall process was primarily technologically or expert driven (see Table 6.6). Most keywords related to no choice of AT being presented to pupils or parents or to no trial period with the new technology built into the process. This often led to problems in usage and it was only with difficulty that effective usage was eventually (sometimes) achieved. For example, one parent reported *'the "bare bones of a laptop was given" – it was too slow, and the parent had to upgrade the memory and buy MS Office for it (and also pay for it). No choice was given'*.

**Table 6.6: Perspectives on matching process**

Challenges		Positive Keywords	
No choice of AT	24	Good match	4
No trial of AT	14	School knows best	1
Inadequate for needs	6	Choice available	1
Laptop too heavy	2	Trial available	1
Laptop too slow	2		
Additional AT needed	2		
Not informed	2		
Not involved	2		
Different AT given	2		
Not used	1		
Needs monitoring	1		
Technical problems	1		
No SNA involvement	1		
Insurance	1		
<b>Total</b>	<b>61</b>	<b>Total</b>	<b>7</b>

Another pointed to the lack of trial period for the AT – *'We had no choice. More tests should be done to see if the system works for the pupil. We were landed with it and had to like it or lump it, more or less'*.

Other keywords occurred less often, but sometimes related to key issues. For example, it was pointed out that the nature of some conditions varies over time, but that this does not seem to be taken into account in the assessment process. One parent said *'it would be better if the suitability of AT is monitored over time, the match was good then, not now. Technology has moved on, e.g. new software, Smartphone, apps etc needs also change over time'*.

Other potentially important issues concerned the adequacy of the AT given – there were a number of complaints about laptops being too heavy or too slow and in some cases different AT was awarded to that decided earlier in the process.

However, the strongest conclusion to be drawn from this question was that parents felt there was no AT choice given and that no trial period was allowed for – in many people’s perspective, this process was perceived as being a *fait accompli*.

Few positive comments were made about the matching process, although four referred to a positive outcome.

## 6.5 Application Process

The AT application process attracted relatively few comments from parents<sup>39</sup>. In all, 26 responded to this question and 36 keywords were identified from the responses, 25 of which concerned challenges and 11 of which were positive (see Table 6.7).

**Table 6.7: Perspectives on application process**

Challenges		Positive Keywords	
Slow process	9	Positive school	7
School inefficiency	4	Professional involvement	4
Transfer process	3		
No transparency	3		
Non acceptance of needs	2		
Not meeting needs	1		
No knowledge of entitlements	1		
Very difficult	1		
Lack of SNA involvement	1		
<b>Total</b>	<b>25</b>	<b>Total</b>	<b>11</b>

The most common element concerns the perceived slowness of the process – nine such keywords were identified. Four keywords concerned what might be termed school inefficiencies, i.e. where delays occurred due to administrative problems, while three keywords each referred to a lack of transparency in the process and difficulties in the transfer of information between primary and secondary schools.

<sup>39</sup> It should be noted that parents do not make the application to the NCSE.

A typical scenario was that the parents had to ask the school to apply for the AT. In one case the school got the funding but bought cheap laptops and no Read & Write Gold. The parent then had to apply through the school to get the programme herself, which took a lot of time.

Another type of comment pointed to the effects of waiting – *‘The process was long, prolonged, dragged out anxiety ridden. It was very stressful, not transparent, and involved a lot of waiting’*.

However, there were some positive comments about the roles of the school and external professionals. A typical comment here was *‘the head of the resource department and the principal were both involved in the application process. The SENO was also involved. The school was very familiar with the application process and this was beneficial’*.

Overall, where parents provided additional commentary on elements of the process, they were either not generally aware of the details of the administrative process (the low level comments on this element of the process would support this interpretation), not involved in making an application for AT or had a perception that the process was slow.

## 6.6 Allocation Process

Respondents made few comments on the allocation process, i.e. to how decisions were made in awarding AT. Generally, they were aware of the inputs to that process and of its outputs, but did not know of the mechanisms whereby the decisions themselves were made. Only 23 respondents commented on this process and these yielded 28 keywords for analysis (see Table 6.8).

**Table 6.8: Perspectives on allocation process**

Challenges		Positive Keywords	
Poor communications	8	Rapid process	2
Slow process	6	No problems	1
Transfer process	4		
Did not meet needs	3		
Inefficient process	2		
No choice	1		
Stress	1		
<b>Total</b>	<b>25</b>	<b>Total</b>	<b>3</b>

The main concerns here related to poor communications about the process. For example, one parent said they got no information from the school and had to ring constantly and make a nuisance of themselves to find out when it would be sanctioned.

Another parent referred to the length of time the process took when saying: *'I feel I should have been informed about whatever the issue was with not getting the iPad back in 1st year. He didn't have any choice in the laptop that he was given and he didn't get it until almost one year after starting school – he should have got it earlier.'*

A further issue concerned the transfer process – respondents wanted to know why information on the allocation process did not automatically transfer within the allocation process when the pupil moved between schools.

## 6.7 Procurement Process

Twenty-five respondents made comments on the AT procurement process from which 38 keywords were identified (see Table 6.9). As with the other elements of the process, the majority of these concerned challenges to be addressed (34 keywords). The biggest issues in procurement concerned the lack of a trial period with the AT. Pupils and parents felt the AT often just appeared and no support was provided to any of the main stakeholders during the procurement process. This can lead to less than optimal AT being acquired. For example, one parent noted that *'no mention was made of any trials being possible before buying the iFlex camera. Trials should have been made available'*.

**Table 6.9: Perspectives on procurement process**

Challenges		Positive Keywords	
No trial	9	Not aware of details	3
Slow process	8	Not too long	1
Separate awards of H/S ware	4		
School inefficiency	2		
Transfer process	2		
Parents bought it	2		
Slow payment to school	1		
Low quality laptop	1		
HSE/School relationship	1		
Poor communications	1		
No choice	1		
No one to set it up	1		
Insurance	1		
<b>Total</b>	<b>34</b>	<b>Total</b>	<b>4</b>

Another prominent issue concerned the length of time it took for the process to be completed. Most comments just stated that procurement took a long time but one pointed to school holidays, which are apparently counted as part of the three-month window available between AT being awarded and its purchase. If the award is made late in the school year, it can mean that buying the AT in autumn may not be allowed.

A further issue concerned the situation when both a laptop and software are being acquired. In some circumstances at least, the acquisition process can be separate, leading to significant delays on one or the other AT arriving. One parent noted that *'the laptop and software came separately. The software came first and the teacher had to put it on our home computer. Had trained his voice on this when the laptop came. When the software was then put on the laptop he had to train his voice again to use it'*.

Few comments made about the procurement process were neutral or positive.

## 6.8 Training Process

A total of 57 respondents commented on training, referring to 71 keywords in all. Fifty-nine of these related to challenges, while 12 were either positive or neutral (see Table 6.10).

**Table 6.10: Perspectives on training process**

Challenges		Positive Keywords	
No training for parents	17	Good initial training	4
No training for pupils	14	Training by VT	4
No training for teachers	12	Training from CRC	1
No training	3	Resource teacher training	1
Speech input training	3	SNA training	1
Handover to teachers	2	Training from EI	1
No training for resource teachers	2		
Low IT skills by teachers	2		
Quality of training	1		
Guidelines needed	1		
Trained at wrong time	1		
No typing training	1		
<b>Total</b>	<b>59</b>	<b>Total</b>	<b>12</b>

The vast majority of these comments related to the complete absence of training – 50 of the 57 challenges referred to the experience of there being no training for parents, pupils, teachers or anyone at all. A further three comments related to the absence of specific types of training while the remainder related to other issues. A typical statement regarding training was that *'it would have been good if the pupil had been given training on it by himself (one-to-one) as during class the teacher hasn't much time as they have a classroom of kids to deal with. So it was trial an error and the pupil learned as he went along, mostly at home'*.

Handing over was also raised, this time in relation to the primary to second level transition, but also with the handover between teachers at second level (all would need some form of training).

There were also a few positive comments about training. Here good initial training was referred to, often provided by the visiting teacher. These positive comments usually came from parents of children with sensory deficits, especially those with hearing difficulties. An example was *'the visiting teacher came into the classroom to brief the class teacher on how to use it. They also briefed the pupils and the mother. They explained how it worked to the pupil'*.

Overall, it is clear that training levels provided to stakeholders are inadequate for their purposes. Parents are often left to fend for themselves with the technologies, and so it would appear, are pupils and teachers.

## 6.9 Support Process

The final part of the AT acquisition process concerned the level of support given following AT implementation. Of particular interest here is the level of monitoring, maintenance and other supports that may be available. A total of 60 issues were mentioned by 50 respondents on this part of the process, 52 of which were challenges and eight of which were neutral or positive (see Table 6.11).

**Table 6.11: Perspectives on support process**

Challenges		Positive Keywords	
Insufficient support	12	SNA support	3
No follow up	10	Class teacher support	2
No maintenance	6	RT support	2
No monitoring by teacher	6	Good school support	1
No VT support	4		
Usage failure (pupil)	3		
Usage failure (teacher)	3		
No support for teachers	3		
No manufacturer support	2		
Continuity of support (VT)	1		
Lack of school knowledge	1		
No eBooks	1		
<b>Total</b>	<b>52</b>	<b>Total</b>	<b>8</b>

The most common issue to arise concerned the lack of follow-up once AT was installed, a lack of post-installation support and a lack of monitoring of the effectiveness and functioning of the AT<sup>40</sup>. The support referred to here may include support for pupils, teachers and parents. A typical comment on these issues included the view that the Visiting Teacher for the Blind service should be reinstated to provide support for pupils using assistive technology for visual impairment. Another parent noted that they had no memory of their child ever saying he got help from any of the teachers in secondary school – *'he had an SNA up to Junior Cert and she was good and could help him'*. Another noted that there should be follow-up support to see the child was getting full use of the AT.

Other relatively common comments concerned lack of maintenance of equipment and the difficulties of having repairs done when needed. These difficulties can sometimes lead to usage of the systems stopping, either by the pupil or the teacher.

On the other hand, some positive comments related mainly to the supportive roles played by SNAs, class teachers and RTs. Visiting teachers were, perhaps surprisingly, absent from this list, as they are highly regarded for their role in other parts of the process. This is probably due to cutbacks in the visiting teacher service in some cases. It may be that the reduction is concentrated on the post-installation phase.

<sup>40</sup> Also relevant here is the monitoring of AT functioning in relation to what may be a dynamic disability.

There was some difference between school types regarding perceptions of the support process – such perceptions were significantly more positive in community and comprehensive schools than in ETB or secondary schools.

## 6.10 Discussion of Parental Perceptions of the Implementation Process

The professionals involved most frequently in the process within the school included classroom and resource teachers, AT resource teachers and principals. External professionals included visiting teachers (for visual and auditory AT) and allied health professionals including occupational and speech and language therapists and psychologists. Less frequently respondents referred to SENO involvement in the process.

The type of AT used by respondents was significantly associated with how positively they commented on the AT identification and acquisition overall and at all stages of the process. For example users of visual and auditory AT were very positive about the identification, assessment of needs and matching and application procedures. A high proportion of visual AT users also commented positively on the training they received.

In contrast, positive ratings by users of software, laptops or computers rarely exceeded 60 per cent and for the later stages of the process i.e. allocation, procurement, training and follow-up ranged from a low of 26.7 per cent (software users' perceptions of the training they received) to a high of 48 per cent (perceptions of users of laptops or computers of training). Other AT categories associated with positive comments of less than 50 per cent included users of communication devices (procurement) and of control devices (allocation and procurement).

Overall, most ratings of the stages of the process were positive. However, for parents who provided spontaneous comments, most pointed to areas for improvement at various stages. Moreover, many parents who made positive ratings still experienced problems with specific aspects of the process. For example, it was a common experience for parents to be relatively happy with the outcome of the process of acquiring AT (as is evidenced by the ratings), yet they could still point to challenges with various aspects of the process such as delays in acquiring the AT, the lack of training and support available and difficulties in getting their child's need recognised.

Another common feature of the results was the number of parents who felt unable to comment on various aspects of the acquisition process. It was clear that for many, some, if not all parts of the process were opaque to them. During interviews, many parents professed they were not aware of some elements of AT acquisition and so felt unable to comment on them. This finding strongly points to the need for raising awareness among parents of how the process works.

There were generally no differences between the school types on perceptions of the AT implementation process. This indicates that the entire process seems to be common across all schools and that it generates similar problems and successes for parents of children in these schools.

## 6.11 Results from Irish Matching Person and Technology Tool (IMPT)

### Section Summary

The IMPT provides measures of key variables for students in the study – these include their educational goals, their level of capability, their quality of life, their motivation towards using AT, their technology preferences and their AT usage.

Generally, respondents scored quite highly on these indicators, with all scores on the positive side. Quality of life was rated the highest, while educational motivation was the lowest.

The IMPT was included in the study for various reasons, mainly to contribute to the assessment of AT impact, but also to help describe the general life and school experience of pupils. This section reports on the findings for IMPT as a whole, while the next section deals with the IMPT regarding development of impact indices for the study. The IMPT was completed by each AT user or his or her proxy. Two versions were used depending on the age and level of understanding of the respondent. The questionnaire is divided into six sections.

#### 1. Determining educational goals:

- This section assists the respondent to explore educational goals and the extent to which they aspire to, and believe he or she can, achieve these goals;
- Their own and other's educational goals are rated in terms of the extent to which the respondent agrees with the goals and whether he or she can achieve it using a five-point scale ranging from totally disagree to completely agree;
- Extent that he or she wishes to achieve the goals is rated on a five-point scale ranging from not at all to completely.

#### 2. Current capabilities:

- This section allows the respondent to assess their abilities and the extent to which they will improve, disimprove or remain the same;
- Capabilities are rated on a five-point scale ranging from no capability to excellent;
- Extent to which the capability will change in the future is rated on a three-point scale (improve; remain the same; disimprove).

### 3. Student's subjective quality of life:

- This section allows the respondent to indicate how satisfied he or she is with what he or she has achieved in ten areas of life;
- The respondent rates each area on a five-point scale ranging from no satisfaction to excellent.

### 4. Technology utilisation worksheet:

- This section explores with the respondent his or her use of the variety of AT that he or she is using in terms of duration and intensity of use; satisfaction with each type of AT; its perceived usefulness; the support available; and technologies needed or wanted which the respondent does not have and those needed but he or she does not want;
- The majority of this section records the comments of the respondent;
- Satisfaction is rated on a five-point scale ranging from very dissatisfied to very satisfied.

### 5. AT device predisposition:

- This section assists the respondent to assess the extent to which the technologies 'fit' with their needs and lifestyle. It also gathers information about reasons why technologies are no longer being used;
- The respondent rated the extent to which a device meets their needs and characteristics on a five-point scale ranging from *all the time* (100 per cent of the time) to not all (0 per cent of the time). A 'not applicable' response category is also provided.

### 6. Student self-evaluation:

- This section allows the respondent to select from a list of 40 personal characteristics the ones they think most closely reflect him or her as a person;
- Rating scale used is binary (yes/no).

Table 6.12 outlines the descriptive findings in relation to the IMPT variables. These are shown in terms of means on a five-point scale, where 5 = excellent and 1 = none for the first five of the variables, while the remaining two are described in terms of percentages.

**Table 6.12: Scores on the Irish Matching Person to Technology Instrument**

Component	Variables	Means/ Percentages
<b>Educational goals</b>	Motivation (1=not at all; 5= completely)	3.1
	Self-esteem (1=totally disagree; 5=completely agree)	3.5
<b>Current capabilities:</b>	Self-assessed capabilities (1=no capability; 5=excellent capability)	3.7
<b>Subjective quality of life</b>	Quality of life (1=no satisfaction; 5=excellent satisfaction)	4.1
<b>AT device predisposition</b>	Device impact (1=not at all; 5=all the time)	3.3
<b>Technology utilisation</b>	Use/abandonment (percentage of respondents who abandoned a device)	85%/15%
<b>Student self-evaluation</b>	Self-concept (technology preference) (The percentage of respondents who rated their preference for technology solutions as being low, moderate or high). This scale was derived from the overall scale.	Low – 12.5% Moderate – 63.5% High – 24.0%

These findings show pupils tended to rate themselves relatively positively in terms of these indicators. In particular, quality of life was rated most highly, but the remaining four were also rated positively.

In relation to orientation towards technology, it was notable that only 15 per cent of students had abandoned their technology, which is low in relation to other studies (Scherer, 2000; Prior, 2011 cited in Ravneberg, 2012; Foley & Ferri, 2012). In addition, students tended to have relatively high levels of preference for or predisposition towards technology – about five out of six were moderately or highly predisposed to technology in the sample.

## 7. AT Impact and Acquisition Process: A Statistical Analysis

### Section Summary

This section presents the results of a set of multivariate and univariate analyses. Multivariate analyses are useful because they combine a number of variables into a single analysis in order to control for interactions between them and to minimise the possibility that a significant result is due to random effects. Univariate analyses in which one variable is analysed are important because they can provide insight into which variables are contributing to a significant effect at multivariate level.

The statistical analyses addressed the study's main question – what works? This was explored through three subsidiary questions.

1. Was there an association between the type of AT provided under the DES scheme and the impact of that AT on user's experiences of educational participation?
2. Was there an association between the type of AT being used and perceptions of the process of acquiring AT?
3. Was there an association between the type of AT being used and user's perceived quality of life?

It is important to keep in mind when considering these questions that an association or correlation is not an indication of a causal influence.

Before answering these questions, analyses were carried out to explore the associations between AT type and other factors such as how the interview was undertaken, the age, gender and type of school the student attended, where the student lived and the student's general orientation towards AT on respondents' perceptions. In addition, abandonment was investigated.

Findings indicated that:

- The level of a student's disability was associated with the impact of AT on his/her educational participation – those for whom a proxy was interviewed tended to have lowered levels of educational participation on the IMPT capabilities scale. This was probably due to these students having greater levels of need;
- Where pupils lived was associated with AT's impact on their educational participation – students in Dublin tended to report higher levels of positive AT impact and had higher scores;
- A complex set of findings was seen in relation to student age – however no clear pattern emerged to suggest a relationship between age and the various outcome variables;

## Section Summary

- Gender was a factor regarding AT impact on educational participation, with girls reporting a lower impact on one of the outcome domains – school Involvement. This is likely due to girls reporting a low number of challenges in this area however;
- AT abandonment rates were low – only 15 per cent of students did not use their AT. The findings also showed that those who abandoned AT tended to report its lowest impacts;
- Pupil's rating of predisposition to using AT was not associated with any of the outcome variables. However, their familiarity or experience with AT was – students who had been using their AT for longer tended to rate the process of introducing AT higher.

Results from the main analysis indicated that

- Positive ratings of AT impact on educational participation were not significantly related to type of AT used;
- AT type was associated with perceptions of the process by which it was acquired and introduced. Perceptions of the process were better for users of visual aids and audio systems and for users of communication devices and control devices than for those using software and computers;
- The earlier stages of the process were rated most highly, but this differed according to AT type that users had. More users of software, control devices and laptops rated the later stages of the process less well than users of other AT types;
- Users with higher levels of capability were more likely to rate the impact of AT highly in terms of educational participation, the implementation process and AT's impact on wellbeing.

## 7.1 Introduction

The main statistical analysis was structured to address the question of 'what works' in terms of AT type used by exploring the relationships between the type of AT students were using (independent variable) and various student outcomes identified in this study (dependent variables). 'What works' in terms of AT type was explored in terms of three specific dependent variables in this study:

- An AT educational participation index derived from participants' spontaneous and prompted responses about the challenges they had experienced and positive AT impact;
- Perception of the process of acquiring AT derived from parent reports of the AT users;

- Perceived device impact of the AT was based on responses to the subjective quality of life scale of the IMPT which allowed respondents to rate their satisfaction with achievement in a number of life areas.

Other variables that could be associated with respondent views on AT's impact on educational participation were also included in the main test of 'what works' as covariates<sup>41</sup>. Specifically, it was hypothesised that the way people felt about themselves and their motivation to do well in education could be associated with their perceptions of AT's impact. Equally, respondent capabilities could be linked to how they perceived AT's impact. The IMPT provided three useful indicators of these variables:

- Self-esteem in terms of the extent to which respondents rated their potential to achieve their educational goals during the IMPT interview.
- Extent to which respondents expressed motivation to succeed in education during the IMPT interview.
- Respondents' ratings of their capabilities. This IMPT scale was a good indication of the overall capacity of each respondent in the absence of objective measures of the complexity and severity of impairment.

A further set of variables (counterbalanced variables<sup>42</sup>) were not included in the analysis for statistical reasons. These related to variables included as considerations in drawing up the sample, but which could not be included in the integrated analysis because of the relatively small size of the sample. These variables (rural/urban location, age level, gender, county and type of school) could potentially be associated with AT impact and so their relationships were examined in a separate set of analyses.

The following sections present a description of how the dependent variables and covariates were generated and the relationships between these variables, and the extent to which proxy interviewers might have influenced responses. They also describe the relationships between the counterbalanced variables on perceptions of AT and the acquisition process, and the association between technology preference and abandonment. Finally the test of the main hypothesis – what works – is presented.

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<sup>41</sup> Covariates are secondary variables that can affect the relationship between dependent and independent variables.

<sup>42</sup> Counterbalancing means the sample has been drawn to ensure sufficient numbers of pupils are in the sample to allow for an analysis of these potentially important variables, but that they have not been sampled in a randomised manner.

## 7.2 Variables Included in the Analysis

Three sets of variables<sup>43</sup> were used in the statistical analysis of the user survey data:

- Dependent variables
- Covariates
- Independent variable.

Dependent variables in the analysis were:

- AT educational participation index: The score on this variable ranged from '1' representing the perception that the AT provided had met all challenges to '0' representing the view that it had met none of the challenges faced in participating in education.
- Perception of the process: This was generated by summing parent responses to the eight separate stages of the AT acquirement process. The maximum score was 16. Higher scores meant the ratings of the process were more positive.
- IMPT device impact: This variable was generated by summing over the 12 items of the assistive technology device predisposition scale. Higher scores indicated a greater fit between the AT device and their life and temperament and a more positive contribution to attaining life goals.

Covariates in the analysis were:

- IMPT motivation: The extent to which respondents aspired to meet educational goals. Higher scores indicate higher motivation.
- IMPT self-esteem: The expectation that educational goals were attainable. Higher scores indicate higher self-esteem.
- IMPT capabilities. Respondents rated their perceptions of their strengths and needs on a five-point scale ranging from 'excellent' to 'none'.

The independent variable was type of AT:

- Visual aids and devices
- Audio systems
- Communication devices
- Software with and without computer
- Input, output and control devices, accessories and sundry equipment
- Laptops and computers.

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<sup>43</sup> Details on how these were calculated can be found in Appendix 5.

### 7.3 Relationship Between Proxy Interview and Impact of AT

Respondents and their parents or guardians had the option of being accompanied at the interview or, if it was felt to be more appropriate, to opt for the interview to be carried out by proxy. Many of those for whom a proxy interview was selected were not present at the interview. The relationship between the interview procedures and the dependent variables and covariates was tested using MANOVA<sup>44</sup> (Tables 7.1 and 7.2). IMPT Quality of Life (QOL) was included in the analysis. In the following tables, the multivariate significance is presented in the right-hand column and the univariate significance levels for the two interview procedure variables are specified in the column next to the means of each variable.<sup>45</sup> Significant differences between means were identified using the Bonferroni Multiple Comparisons Test<sup>46</sup>. These are indicated using the superscripts (+) or (++) to indicate a significantly higher mean and (-) or (-) to indicate significantly lower means.

No multivariate main effect on the dependent variables was identified for either being accompanied or being interviewed by proxy, although a significant univariate effect for the educational participation impact of AT was present for both of these. Here, accompanied respondents reported the highest levels of AT impact on educational participation, while the impact of AT for children whose interviews were given by a proxy was lower on this variable.

Significant multivariate effects for both being accompanied and for having a proxy interview were identified in relation to the covariates (the IMPT variables self-esteem, motivation, capabilities and quality of life). These were associated with significant univariate effects in the case of being accompanied at the interview in relation to each of the covariates and for the proxy condition for capabilities and quality of life.

Overall the ratings of educational participation impact, self-esteem, motivation, capabilities and quality of life for respondents not present at the interview were lower than those respondents who were, whether accompanied or unaccompanied. Specifically:

- Children who were accompanied rated the educational participation impact of their AT and their quality of life significantly higher than AT users not present.
- Self-esteem and quality of life ratings of AT users who were unaccompanied were significantly higher than those who were not present and their motivation ratings were significantly higher than all other respondents.
- Ratings on behalf of those for whom a proxy interview was undertaken were significantly lower in relation to capabilities and quality of life.

<sup>44</sup> A MANOVA (multiple analyses of variance) is a statistical technique for simultaneously comparing the means of a number of groups on a number of dependent variables. In this case, for example, the relationship between whether the interview was carried out with a proxy, and whether the respondent was accompanied, was analysed in relation to the impact on educational participation, perceptions of the AT process and IMPT device impact.

<sup>45</sup> A univariate analysis of variance tests the effect of a single independent variable on a dependent variable.

<sup>46</sup> This test enables multiple comparisons between pairs of means to be carried out simultaneously.

These findings would suggest that children capable of undertaking an interview alone had a higher level of functioning than those who were accompanied and those who required a proxy.

**Table 7.1: Relationship between interview procedures and dependent variables**

Interview Procedures			Dependent Variables							
			N	Educational Participation Impact	Uni-variate Sig.	Perception of Process	Uni-variate Sig.	IMPT Dev1 Impact	Uni-variate Sig.	Multi-variate Sig
Accompanied	Unaccompanied	Mean	9	0.63	p<0.01	11.11	NS	3.13	NS	NS
	Accompanied	Mean	57	0.81(+)		11.21		3.44		
	Not present	Mean	24	0.63 (-)		11.58		3.20		
Proxy	No	Mean	58	0.78	p<0.01	11.45		3.45		NS
	Yes	Mean	31	0.63		11.26		3.13		

(+) Indicates a significantly higher mean and (-) lower mean identified using Bonferroni Multiple Comparisons

**Table 7.2: Relationship between interview procedures and the covariates**

Interview Procedures			Covariates								
		n	IMPT Self-Esteem	Uni-variate Sig.	IMPT Motivation	Uni-variate Sig.	IMPT Capabilities	Uni-variate Sig.	IMPT QOL	Uni-variate Sig.	Multi-variate Sig
Accompanied	Unaccompanied	11	4.09(+)	p<0.05	4.55(+)	p<0.01	3.93(+)	p<0.001	4.23	p<0.01	p<0.05
	Accompanied	57	3.52		3.06(-)		3.92(+)		4.18(+)		
	Not present	27	3.19(-)		2.70(-)		3.05(-)		3.84(-)		
Proxy	No	59	3.58	NS	3.31	NS	3.97	p<0.001	4.17	p<0.05	p<0.001
	Yes	35	3.30		2.81		3.17		3.94		

(+) Indicates a significantly higher mean and (-) lower mean identified using Bonferroni Multiple Comparisons

## 7.4 Urban/Rural, County, School Type, Age Level and Gender

The restriction on sample size meant a number of variables which might interact with perspectives on AT effectiveness or the type AT being used, could not be included in a fully factorial design, i.e. in that each variable is crossed with all other variables which would allow an analysis of the interaction between variables. For example, in the case of the urban/rural variable it was not possible to test for an interaction between it and school type. As a result it was not possible to test main effects or interaction terms for these variables in the test of the main hypothesis.

Nevertheless, it was essential that the possible influence of these variables be controlled for in the design. This was done by using them as stratification variables in generating the random sample of schools which ensured they were counterbalanced across the design. The procedures for sample selection are described in the Chapter 2 and sample structure in terms of independent and counterbalanced variables is presented in Tables 2.1 and 2.2.

The relationship between these variables and the dependent variables and covariates are presented in Tables 7.3 and 7.4. The IMPT quality of life variable was also included. Similarly to analyses of interview procedures, the multivariate significance is presented in the right-hand column and the univariate significance levels are specified in the column next to the means for each variable. As before, the Bonferroni Multiple Comparisons Test was used to identify significant differences between means.

### Urban/rural

No significant effects were found on either dependent variables or covariates indicating that perceptions of AT users in urban schools were similar to those in rural schools.

### County

A significant main effect at the multivariate level for county was identified for the dependent variables ( $p < 0.05$ ). This was associated with a univariate effect for IMPT Device 1 Impact. This was due to respondents from Dublin city ratings being somewhat higher, though this was not significant based on multiple comparisons (Table 7.3).

A significant multivariate main effect for county was identified for the covariates as well ( $p < 0.001$ ) (Table 7.4). This was associated with univariate effects for all covariates and in many cases significant differences were identified through multiple comparisons. Specifically:

- Self-esteem ratings for Dublin city respondents were significantly higher than all other counties except Galway;
- Motivation rating for Dublin city respondents were significantly higher than Cork respondents;
- There was a univariate effect for capability ratings but this could not be attributed to specific differences between the means of the groups;

- Dublin city respondents' ratings of quality of life on the IMPT were significantly higher than respondents from Kildare.

### **Type of school**

There was no significant multivariate main effect for type of school in the analysis of the dependent variables, although there was a univariate effect for perception of the process. Here the perceptions of pupils from post-primary schools were less positive than the other groups (Table 7.3).

A significant main effect for type of school and the covariates was identified at the multivariate level ( $p < 0.001$ ). This was associated with significant univariate effects for three of the covariates (Table 7.4). Specifically:

- Self-esteem ratings of primary school respondents were significantly lower than respondents for other school types ( $p < 0.001$ ).
- Motivation ratings differed significantly for each school type with post-primary respondents having a higher rating than both primary and special school respondents, while special school respondents had higher motivation ratings than respondents from primary school.
- Capabilities ratings for respondents from special schools were significantly lower than either primary or post-primary respondents.

### **Age level**

A significant multivariate main effect for age on the dependent variables was identified ( $p < 0.05$ ). This was associated with significant age effects for the perception of the process and IMPT Device1 Impact (Table 7.3).

With regard to the covariates, there was also a significant multivariate effect ( $p < 0.001$ ). This was associated with a univariate effect for self-esteem and motivation (Table 7.4).

Multiple comparisons revealed a complex relationship between age level and these variables. Specifically:

- Perception ratings of AT users in the older primary school age range were significantly more positive than those in the younger secondary age range;
- Older secondary AT users rated the impact of AT devices significantly more positively than those in the older primary age range;
- Self-esteem and motivation ratings of older secondary AT users were significantly more positive than AT users in both primary school age groups;
- Motivation ratings of AT users in the younger secondary age group were significantly higher than older primary AT users.

**Table 7.3: Relationship between counterbalanced and dependent variables**

Counterbalanced Variables			Dependent Variables							
			N	Educational Participation Impact	Uni-variate Sig.	Perception of Process	Uni-variate Sig.	IMPT Dev1 Impact	Uni-variate Sig.	Multi-variate Sig.
Urban/rural	Urban	Mean	69	0.70	NS	11.61	NS	3.32	NS	NS
	Rural	Mean	21	0.83		10.29		3.41		
County	Dublin County	Mean	26	0.64	NS	11.81	NS	3.13	p<0.05	p<0.05
	Dublin City	Mean	23	0.76		11.26		3.84		
	Cork	Mean	20	0.85		12.20		3.34		
	Galway	Mean	14	0.75		10.43		3.12		
	Kildare	Mean	7	0.57		8.71		2.93		
School code	Primary	Mean	44	0.72	NS	12.11(+)	p<0.05	3.24	NS	NS
	Post-primary	Mean	26	0.72		9.81(-)		3.45		
	Special	Mean	20	0.77		11.45(+)		3.41		
Age	6-9 years	Mean	16	0.73	NS	10.81	p<0.01	3.67	p<0.01	p<0.05
	10-13 years	Mean	34	0.71		12.97(+)		3.06(-)		
	14-16 years	Mean	18	0.68		9.22(-)		3.04		
	17-19 years	Mean	22	0.80		10.77		3.79(+)		
Gender	Female	Mean	23	0.60	p<0.05	10.87	NS	3.23	NS	p<0.05
	Male	Mean	67	0.78		11.45		3.38		

(+) Indicates a significantly higher mean and (-) lower mean identified using Bonferroni Multiple Comparisons Test

**Table 7.4: Relationship between stratification variables and covariates**

Counterbalanced Variables		Covariates									
		N	IMPT Self-Esteem	Uni-variate Sig.	IMPT Motivation	Uni-variate Sig.	IMPT Capabilities	Uni-variate Sig.	IMPT QOL	Uni-variate Sig.	Multi-variate Sig.
Urban/rural	Urban	73	3.51	NS	3.20	NS	3.63	NS	4.09	NS	NS
	Rural	22	3.43		2.91		3.82		4.07		
County	Dublin County	30	3.32 <sup>(-)</sup>	p<0.01	3.12	p<0.001	3.46	p<0.05	4.05	p<0.05	p<0.001
	Dublin City	23	4.13 <sup>(+)</sup>		4.09 <sup>(+)</sup>		3.76		4.28 <sup>(+)</sup>		
	Cork	21	3.21 <sup>(-)</sup>		2.24		3.97		4.09		
	Galway	14	3.54		2.79 <sup>(-)</sup>		3.68		4.08		
	Kildare	7	2.86 <sup>(-)</sup>		3.43		3.37		3.56 <sup>(-)</sup>		
School code	Primary	46	3.05 <sup>(-)</sup>	p<0.001	2.40 <sup>(-)</sup>	p<0.001	3.82 <sup>(+)</sup>	p<0.001	4.12	NS	p<0.001
	Post-primary	27	3.96 <sup>(+)</sup>		4.26 <sup>(+)</sup>		3.89 <sup>(+)</sup>		4.16		
	Special	22	3.82 <sup>(+)</sup>		3.27 <sup>(-)(+)</sup>		3.10 <sup>(-)</sup>		3.92		
Age	6-9 years	17	3.00	p<0.001	2.56 <sup>(--)</sup>	p<0.001	3.49	NS	4.08	NS	p<0.001
	10-13 years	37	3.14 <sup>(-)</sup>		2.42 <sup>(-)(-)</sup>		3.72		4.08		
	14-16 years	18	3.72		3.64 <sup>(+)</sup>		3.52		3.99		
	17-19 years	23	4.24 <sup>(+)</sup>		4.30 <sup>(++)</sup>		3.84		4.18		
Gender	Female	24	3.44	NS	3.04	NS	3.73	NS	4.12	NS	NS
	Male	71	3.51		3.16		3.65		4.07		

(+) Indicates a significantly higher mean and (-) lower mean identified using Bonferroni Multiple Comparisons Test

## Gender

A significant multivariate effect was identified for gender and the dependent variables ( $p<0.05$ ). This was associated with a univariate effect on educational participation ( $p<0.05$ ). The ratings of girls on educational participation impact were lower than those of boys (Table 7.3). This effect was explored further through two ANOVAs, in one of which gender was crossed with age and in the other with AT type. Significant main effects for gender were identified by both analyses but no significant interactions emerged.

To identify the source of the gender effect, a series of ANOVAs crossing AT type and gender were carried out on the five educational indicators that contributed to the participation index. No significant gender effects were identified for curriculum access, attainment or subjective wellbeing impact ratings. In the analysis of educational engagement ratings, a significant effect for AT type but not gender was identified. Significant gender differences were identified only for school involvement. However, it is important to note that only six girls indicated challenges in this area and only one of these specified a positive AT impact. On this basis, it is likely that the gender effect on ratings of AT impact on school involvement is due to the small numbers of girls reporting challenges in this area of participation and the lack of impact that the AT they received had on these challenges. This is consistent with the relative under-representation of girls in the overall sample and should be borne in mind when interpreting the study's overall results.

No significant multivariate or univariate effects were identified for gender (Table 7.4) on the covariates.

## 7.5 Familiarity, Technology Preference and Abandonment

Of interest were issues concerning the potential influence of the technological orientation of pupils and whether they had abandoned their technology. Do pupils at ease with technology report a higher impact of their AT? By contrast, do pupils who do not use their AT report a lower impact? These issues are explored further below.

### Technology preference and familiarity

An issue of interest was the extent to which respondents' preference to use technology influenced their ratings of AT educational participation impact. To test this, a variable was generated from section 6 of the IMPT student self-evaluation scale using three items:

- I like using a computer;
- I prefer getting feedback from a computer than from my teacher;
- I sometimes feel intimidated by technology.

Respondents were assigned to three groups – low, moderate and high predisposition – based on their combined scores on these items. A oneway ANOVA was carried out with technology preference as the independent variable and the AT educational participation index as the dependent variable. No significant effects were identified for technology preference.

Also of interest was whether pupils more familiar with the AT were rating its impact higher. The length of time that respondents had been using the technology before the interview was used as a measure of familiarity. This variable was correlated with the AT educational participation index, the perception of the process variable and IMPT device impact to identify potential relationships. These revealed that the length of time respondents had been using their AT applications was significantly correlated only to the perception of the process ( $r=0.22$   $p<0.05$ ), meaning that children with higher levels of familiarity rated the process somewhat higher, but they did not rate its impact on educational participation or the device impact more highly.

## Abandonment

Abandonment of AT, i.e. where children stop using their AT, is a consistent theme in the literature. Fourteen respondents indicated they had stopped using their AT, representing an abandonment rate of 15 per cent. This is substantially lower than such rates documented in the literature which is generally accepted to be around 30 per cent (Scherer, 2000; Prior, 2011 cited in Ravneberg, 2012; Foley & Ferri, 2012).

No common single reason for abandoning AT emerged in this study, but the reasons given for it included lack of help in using it (N=2), lack of training (N=1), a lack of fit (N=3), not effective or necessary (N=2), a preferences for a home computer (N=1) and anxiety (N=1). Two respondents had replaced the AT with another device. Whether these were replaced under the DES scheme was not specified. One respondent had no need for it in a transition year programme. Two respondents gave no reason.

It was also of interest to examine whether pupils who had abandoned their AT differed from those who had not. To test this, respondents were assigned to two categories reflecting use and non-use. This was included as the independent variable in a one-way ANOVA with the AT educational participation index as the dependent variable. The impact ratings were significantly different. The mean participation index for those who had abandoned their AT was 0.40 compared to an index of 0.83 for those who were still using their AT ( $p < 0.0001$ ). This is a very large difference and indicates that pupils who had abandoned reported significantly lower participation.

The literature would indicate that reasons for abandonment range from lack of access to, and information about, devices, change in user needs, poor performance of the device, lack of consideration of the user's opinion during device selection, lack of information about repair and maintenance, changes in functional abilities or activities of the user, inflexibility or ineffective device performance, lack of support, lack of motivation, minimal or no need for the device, or negative family attitudes (Phillips & Zhao, 1993; Brown-Triolo, 2002; Martin *et al* 2011; Ravneberg, 2012). Only one of these predictors relates directly to the technology; the others are related to the user.

Craddock (2006) found that unsuccessful student AT users reported many reasons for non-use, including a desire to 'fit-in' that might be threatened by AT use, for example being less inclined to use communication devices even though they can improve communication due to the perceived stigma. Another reason related to lack of teacher education in AT use, especially special education teachers working with students with disabilities. Informal supports were also crucial and these mainly referred to family and friends. In particular the mother played a crucial role in obtaining the AT devices and also supporting its use in the home. Craddock identified critical human factors, such as having classroom assistants working closely with the students and the teacher. In many instances, it was the support given by individual teachers that materialised as a critical factor in successful AT use.

To get a clearer profile of respondents who had abandoned their AT, a set of cross tabulations were carried out for the abandonment variable against the main independent and dependent variables. Significant and almost significant Chi squares are reported below. These are presented for information purposes only and need to be interpreted with care.

Abandonment was not significantly related to school or disability type or gender, but:

- Most who abandoned their AT were in post primary school ( $p < .10$ );
- Respondents who reported a positive impact of AT on classroom participation were less likely to have stopped using AT ( $p < .10$ );
- No respondents who reported that AT had positively impacted on participation in assessments abandoned their AT ( $p < .01$ );
- Very few respondents who reported a positive AT impact on access to learning materials and resources abandoned their AT ( $p < .05$ );
- Respondents who reported behavioural engagement challenges had a very low abandonment rate ( $p < .05$ );
- No respondents who reported that AT had impacted positively on behavioural engagement abandoned their AT ( $p < .10$ );
- Respondents who reported positive AT impact on literacy and numeracy did not abandon ( $p < .10$ );
- Respondents who reported challenges in daily living skills were more likely to abandon ( $p < .10$ );
- No respondents reporting positive AT impact on independence abandoned their AT ( $p < .10$ );
- Respondents reporting challenges with confidence and those reporting positive AT impact on confidence were less likely to have abandoned ( $p < .05$ ).

It was not possible to include abandonment in the multivariate analysis as an independent variable as it would have reduced the power of the analysis below acceptable levels. Nevertheless, the impact of abandonment was randomly distributed throughout the design and respondent ratings were reflected in all dependent variables and covariates in the analysis.

## 7.6 AT Type and Perceptions of AT Impact and Process

A multivariate analysis of covariance (MANCOVA) was considered the most appropriate to test for the effects of the type of AT being used. Specifically, it simultaneously examined the three key questions relating to 'what works best'. These were the relationship between the type of AT being used and perceptions of (1) the impact of AT on educational participation, (2) the AT identification and acquisition process and (3) the impact of AT on their lives.

To control for other variables that could affect the ratings of respondents, three covariates derived from the IMPT were included in the analysis i.e. personal factors (self-esteem and motivation) and the severity and complexity of impairments (capabilities).

A MANCOVA tests all the variables included in a single test of significance thus controlling for Type 1 error, i.e. the possibility of finding a significant effect when there is none. With regard to Type 2 error i.e. not finding a significant effect when one exists, often referred to as the power of the analysis, a widely available app (G\*Power)<sup>47</sup> was used to calculate this statistic. The power of the statistical analysis carried out to test the 'what works best' hypothesis was calculated to be 0.82. The convention is to accept a power of greater than .80 in studies such as this (Cohen, 1988). In addition, SPSS provided an estimate of the power and these were within accepted parameters (educational participation: 0.82, perception of the process: 0.97 and device impact: 0.95).

Only when a significant effect is identified at the multivariate level (i.e. including all the variables in the analysis) is it legitimate to interpret univariate tests of significance. In addition, when there is both a significant multivariate and univariate effect, it is allowable to examine differences between groups using multiple comparisons that control for Type 1 error. In this case, significant differences between means were identified, similar to earlier analyses reported above, the Bonferroni Multiple Comparisons Test was used.

The structure of the analysis:

- The independent variable was the type of DES-funded AT used by respondents (Type of AT) which had six levels – visual aids, audio systems, communication devices, software, control devices/accessories and laptops and computers<sup>48</sup>.
- Type and location of school, age, gender and type of disability were counterbalanced within the design.
- The three dependent variables<sup>49</sup> were:
  - Ratings of the extent to which the AT positively impacted on educational participation (AT educational participation index);
  - Perceptions of the process through which AT is allocated (perception of process);
  - Overall ratings of the impact of the AT as represented by the Device Impact Scale of the Irish Matching Person to Technology questionnaire (IMPT Device 1 Impact).
- Covariates were:
  - Self-esteem as indicated by the educational goals scale of the IMPT (IMPT Self-Esteem);
  - Motivation to succeed in education as indicated by the educational goals scale of the IMPT (IMPT Motivation);
  - Self-assessed capabilities represented by the capabilities scale of the IMPT (IMPT Capabilities).

<sup>47</sup> <http://www.gpower.hhu.de/en.html>

<sup>48</sup> AT devices and application included in each category of this variable are listed in Table 2.4 Technologies included in the type of technology variable.

<sup>49</sup> The way in which these variables were generated is described in Appendix 5.

To control for missing data a listwise deletion procedure was applied which resulted in 89 cases in the analysis.

**Table 7.5: Type of AT, educational and life impact of AT and allocation process**

				Dependent Variables		
				Educational Participation Impact	Perception of Process	IMPT Device 1 Impact
Independent variable	Type of AT		N	Mean	Mean	Mean
				Visual aids	12	0.57
		Audio systems	18	0.84	11.33	3.36
		Communication devices	5	0.64	13.40	3.39
		Software	14	0.68	9.93	2.87
		Control devices/accessories	16	0.75	12.50	3.71
		Laptops and computers	24	0.75	9.92 <sup>(-)</sup>	3.42
		Total	89	0.73	11.35	3.33
	Type of AT	Univariate sig		NS	$p < .001$	NS
		Multivariate sig		$p < .01$		
Covariates	IMPT self-esteem	Univariate sig		NS	NS	NS
		Multivariate sig		NS		
	IMPT motivation	Univariate sig		NS	NS	NS
		Multivariate sig		NS		
	IMPT capabilities	Univariate sig		$p < .01$	$p < .01$	$p < .01$
		Multivariate sig		$p < .001$		

<sup>(+)</sup> Indicates a significantly higher mean identified using Bonferroni Multiple Comparisons Test

<sup>(-)</sup> Indicates a significantly lower mean identified using Bonferroni Multiple Comparisons Test

The results are presented in Table 7.5. In summary:

- There was a significant multivariate main effect for AT type being used at the multivariate level (Wilks' Lambda 0.649;  $F: 2.435, p < 0.01$ , Partial Eta Squared: .134);
- The multivariate effect could be attributed at the univariate level to the perception of the AT identification and acquisition process ( $F: 4.426, p < 0.001$ , Partial Eta Squared: .217), but not to the other two dependent variables;

- Overall, the ratings of the AT process by software, laptop and computer users were lower than the ratings of other AT users;
- Multiple comparisons (Bonferroni) revealed that ratings of the AT identification and allocation process by users of laptops and computers (9.92) were significantly lower than the rating of users of visual aids (13.5) ( $p < 0.01$ );
- Capability ratings of respondents were significantly related to their ratings of all three of the dependent variables – educational participation impact of AT, perception of the process and the impact of the device (Wilks' Lambda 0.268;  $F: 6.969$ ;  $p < .001$ , Partial Eta Squared: .211);
- No main effects were identified on the impact of AT type on educational participation nor was device impact identified at univariate level. Respondents' ratings of self-esteem and motivation were not significantly related to the other variables.

## 7.7 Summary of Findings

Before presenting a summary of the AT user interview findings, it is important to highlight features of the data that influence the interpretation of the data analyses:

- The study does not address the question of what works on the basis of objectively measured evidence but rather on the perceptions of AT users, their parents and other professionals acting as proxies;
- The extent to which the sample selected represented the actual population of AT users is difficult to estimate fully for a variety of reasons, but it was broadly representative of the AT users within the overall NCSE database;
- 67 seven schools were selected in the initial sample, of which 49 consented to participate – a 73 per cent response rate. A further 20 additional schools were sampled based on school consents to achieve the final sample of 96 AT users;
- Some AT users in each school were using DES-funded AT whose records were not included in the original sample and others whose records were in the dataset who were not available either because consent was not forthcoming or because they were unable to take part for other reasons;
- The sample was relatively small in relation to the complexity of the questions addressed and could not be used to address any interactions that might occur between AT use, age, disability, type of school, gender and location.

Finally, interpretation of statistical analyses requires that two types of error need to be addressed. The first of these is finding a significant effect when there is none (Type 1 error). The second is missing an effect that is actually there (Type 2 error). In the main analysis Type 1 was controlled by minimising the number of analyses carried out and by selecting appropriate probability levels. However, this was not controlled for in the analyses of the interview procedures or counterbalanced variables.

Type 2 error requires ensuring that the ratio of variables and factor categories to the number of participants or data points is sufficient. The main hypothesis, 'what works', was tested using a single analysis with three indicators of what works and six levels of AT. In addition, three other variables that might account for variation in the three indicators were also included. The power of this analysis was within accepted parameters (0.82) which means that the chance of missing a significant effect for AT when there actually was one was 0.18.

### **Perceptions of AT impact on educational participation**

The overall AT educational participation index provided an indication of the proportion of challenges specified that were positively addressed by the AT from the perspective of the respondents. Thus, the overall index of 0.74 reflected the view of respondents that over 70 per cent of challenges they faced in participating in education were positively addressed by the AT they received. Similarly, the indicator for curriculum access was indicative of an 80 per cent positive impact. The proportion of respondents reporting positive AT impact on subjective wellbeing was 0.81. Only the school involvement indicator (0.52) was suggestive of a less than 70 per cent positive impact on identified challenges.

The numbers of respondents at the level of items was such that it would be unwise to read too much into the proportions and particularly so for each of the AT types. Nevertheless, the proportion of positive responses at item level indicates the areas where AT was having its widest impact in terms of the number of respondents specifying challenges and reporting positive impacts. In particular, 71 respondents specified classroom participation as a challenge and almost 86 per cent of these reported that DES AT had positively affected these. Other areas in which positive responses were over 80 per cent included academic achievement and literacy and numeracy. It is also interesting to note that only 20 respondents reported challenges in emotional (affective) learning engagement, 90 per cent of these reported that the AT they were given addressed these challenges.

The challenges spontaneously referred to by respondents, which can be considered an indication of their salience for participants, clustered around a small number of categories all of which were rated as being positively affected by the AT provided under the DES scheme:

- Classroom participation (86 per cent) in terms of being able to take part in all classroom activities including listening, asking questions, carrying out tasks, sustaining attention, acting appropriately, not interrupting, responding appropriately to correction, learning from instruction;
- Participation in assessment (70 per cent) such as being able to successfully demonstrate acquired learning or knowledge in a formal written or oral examination, to read and understand questions, to complete answers within the required time, to produce understandable responses;
- Access to learning materials and resources (78 per cent) in terms of being able to read written texts, to copy from the blackboard, white board or work sheets, to use learning materials, equipment and technologies, to obtain the materials required for learning in the classroom and at home;

- Cognitive engagement (78 per cent) such as remembering, thinking, problem solving or concentrating;
- Behavioural engagement (79 per cent) such as sitting down to work, being organised, managing time or sustaining effort;
- Literacy or numeracy (82 per cent) in terms of learning to read, write and calculate at the appropriate age level, struggling with decoding print and producing written content.

The challenges for which a greater proportion of respondents reported positive impacts were areas which the DES scheme specifically aims to address. The areas in which fewer positive AT impacts were reported were perceived as challenges by fewer respondents and were less central to educational participation. These included areas of non-academic attainment such as mobility, daily living skills, independence and socialisation and involvement in broader school activities such extra-curricular activities and relationships.

The type of AT respondents were using had no significant effect on the AT impact ratings given.

Variables with a significant relationship to educational participation ratings were:

- Interview procedures: Interviewees whether accompanied or unaccompanied rated the impact of their AT on educational participation more highly;
- Age-level: The relationship between age and perception of the AT process was significant;
- Gender: The educational participation ratings of AT's impact on girls were significantly lower than boys and may have been associated with the domain of school involvement. The few girls reporting these challenges make this difficult to interpret;
- Abandonment: Abandonment rates of respondents who had ceased using the AT obtained through the DES scheme were lower than those reported in the literature. They also rated AT's impact on their educational participation significantly lower than other respondents;
- Capability: Respondents who rated their capabilities lower were likely to rate the impact of their AT less positively.

### **Perceptions of the AT identification and acquisition process**

Variables associated with ratings of the AT identification and acquisition process were:

- Age level: Respondents in upper primary commented on the AT process more positively than those in lower post-primary;
- Capability: Respondents who rated their capabilities lower were likely to comment less positively on the AT process.

### **IMPT variables and AT impact**

In addition to IMPT's contribution to the multivariate analysis, other insights emerged from analysis of questionnaire responses:

- Interview procedures:
  - Ratings of self-esteem, motivation, capabilities and quality of life of respondents not present at interview were lower than those who attended;
  - Ratings on behalf of those for whom a proxy interview was selected were significantly lower for capabilities and quality of life;
- County: Respondents from Dublin City rated their self- esteem, motivation and quality of life more highly than respondents from other parts of the country;
- Type of school:
  - Self-esteem and motivation ratings of primary school respondents were lower than respondents from other schools;
  - Post-primary respondents and particular older AT users rated their motivation more highly than respondents from other schools;
- Age level: Older post-primary school respondents rated the overall device impact more highly than those in upper primary;
  - Capability: Respondents who rated their capabilities lower were likely to rate the life impact of their AT less positively.

## 8. Teacher Survey

### Section Summary

The survey of teachers aimed to explore their experiences of being involved with the acquisition and use of AT for pupils with special educational needs. Though a convenience sample was used, the teachers were evenly split between the primary and secondary sectors. They had a range of experience of being involved with AT and were therefore in a position of some authority to comment on the AT implementation process.

Teachers ratings of the different stages of the AT acquisition process revealed that they felt improvements could be made to many of the stages. They were happiest with the identification of AT needs, but they felt that more training could be provided to both pupils and staff in the usage of AT and that more supports could be provided post-implementation.

Despite these difficulties, teachers were generally positive in their perceptions of AT's impact on aspects of educational participation. They were especially positive about its impact on academic progress, curriculum access and educational engagement, but less so in relation to school involvement.

Teachers were also asked about their main sources of information on AT. It was striking that there were multiple sources, but few were used by large numbers of teachers. Obtaining reliable and up-to-date information was a problem for them, and they would value more support in this regard.

A large part of the teacher survey was concerned with obtaining qualitative information and much useful information was gathered. When asked to give advice and suggestions for colleagues, they referred to the positive role played by visiting teachers and SENOs as well as the assessment professionals. Similarly, they made suggestions for changes in NCSE and DES procedures.

The third main strand to the research was a survey of teachers involved in or knowledgeable of the AT implementation process. The results below are presented in terms of the profile of the schools from which the teachers were drawn, the profile of the teachers themselves and their experiences of being involved in the AT process.

A total of 46 teachers responded to the survey and were drawn from the schools participating in the survey and from other sources. It was a sample of convenience rather than a representative one, but it should be noted that all had experience of the AT process and therefore had some experience in the issues involved.

## 8.1 School Profile

The profiles of the schools in which the respondents worked are presented in Table 8.1. A similar number were working in primary and secondary schools – 17 and 18 respectively. Eight respondents came from the community/comprehensive sector and three respondents were from special schools. Four DEIS schools were represented and eight respondents worked in schools that had special classes. These results showed that variety of school types was sufficient to be illustrative of the experience of AT across the major school types. It should be noted that no teacher came from an ETB school, and that this limits the generalisability of the findings. However, despite this there is some difference between ETB schools and the others (they acquire AT at ETB rather than school level), their overall experience of AT use in the classroom could be assumed to be similar to teachers from other school types.

The questions on school approach to AT provide an insight into how they deal with the challenge of providing appropriate AT to their pupils. It should be noted that the schools relied almost exclusively on the DES scheme to acquire AT for their pupils – very few had additional AT to offer their pupils (five schools):

- About a third of schools had a formal school policy on AT (15 schools) and about 40 per cent had assigned responsibility for AT to a specific staff member, though it should be noted that there is no obligation on schools to have either a policy or a post of responsibility related to AT. A wide range of staff roles were designated as being responsible for AT. Most frequently the principal, learning support or resource teachers assumed this role.
- The majority of schools monitored AT use (32 schools). This mainly involved class teachers, learning support and resource teachers.
- Approximately half of the schools provided training (21) and support (27) to pupils who used AT. These were mainly provided by class teachers, learning support and resource teachers.
- A third of schools had organised training for their staff, which was most frequently organised by the principal, the AT supplier or an external expert.

The schools catered for over 480 pupils with disabilities distributed across all the categories of disability under which AT is granted by the DES.

**Table 8.1: Profile of schools in the staff survey**

		Number	%
<b>School type</b>	Primary	17	37
	Secondary	18	39
	Community/comprehensive	8	17
	Special	3	7
<b>School characteristics</b>	DEIS status	4	9
	Special class	8	17
<b>School approach to AT</b>	Additional AT devices available (not through DES scheme)	5	11
	School policy on AT	15	33
	Staff member with formal responsibility for AT	20	43
	AT use monitored	32	70
	Pupil at training provided	21	46
	Pupil support provided	27	59
	AT training for staff organised	15	33
	<b>Number of students with disabilities served by schools</b>		
Hearing	36		
Visual	30		
Physical	90		
Severe/prof GLD	8		
Mod GLD	46		
ASD	80		
Emotional/behavioural disorder	41		
Specific learning disabilities	114		
Speech and language	16		
Multiple disabilities	25		
Other	2		
<b>Total</b>		<b>488</b>	

**Table 8.1: Profile of schools in the staff survey (continued)**

Responsibilities	AT in School	Monitoring AT Use	Pupil Training Organiser	Pupil Support Provider	Staff Training Organiser
Assistant/deputy principal	2				
Class teacher	2	8	7	11	
IT committee	1				
IT co-ordinator/manager	2	1	2		2
IT teacher	1		2	2	
Learning support teacher	7	5	3	5	
Principal	5				5
Resource teacher	7	8	6	13	1
SEN coordinator	1				
Visiting teacher		1	4	2	3
AT supplier			2	1	6
External expert			4		4
SNA			2	6	
Family/parent			1	1	1

## 8.2 Respondent Profiles

Respondents were asked to rate their familiarity with AT on a scale of 1 to 5 in which 1 = very unfamiliar and 5 = very familiar. For the analysis the respondents were split into two groups based on their self-assessed AT familiarity. This was done to explore the possibility that teachers with different levels of familiarity might have differing perceptions of the various stages of the process. For example, it may be the case that less familiarity is associated with more problems with process, a finding that would have implications for training and support.

Table 8.2 presents the profile of the two groups. Some respondents specified more than one role that they fulfilled in school and so a percentage is a better representation of how roles were distributed between the low/moderate AT familiarity group and the group with greater familiarity.

There was very little difference in the types of roles fulfilled by respondents in each group. The presence of a special class in a school was not related to greater familiarity with AT. The respondents in the group with greater familiarity rated their knowledge of AT significantly higher than the low/moderate group. Nevertheless, the level of knowledge of the more familiar group was only slightly higher than a moderate level of knowledge. Only two of the respondents rated their knowledge as extensive.

**Table 8.2: Profile of respondents<sup>50</sup>**

		Familiarity with AT		
		Low/mod	High	Total
Role in education	Class teacher	22%	30%	26%
	Learning support teacher	22%	15%	19%
	Resource teacher	33%	39%	36%
	Principal/ass principal	8%	9%	9%
	Other <sup>50</sup>	14%	6%	10%
Special class in school		6	2	8
Level of AT knowledge		2.65	3.50	3.01*

\* Respondents were asked to rate their knowledge of AT using a five-point scale ranging from very little knowledge to extensive

Respondents with moderate to low familiarity described working in class with pupils who used AT or pupils with special educational needs. Some had attended formal courses at which AT in education was addressed including a post graduate diploma in SEN, special needs training, IT courses and in-service, in-school or SESS training. The range of AT that they were familiar with included laptops, text to speech or spelling (text prediction) software, e-books and Soundfield systems. The AT roles fulfilled by these respondents included responsibility for the AT application process, communicating children's needs to other staff, setting up AT devices and software and supporting other staff with the use of iPads, tablets and apps. These respondents identified useful sources of information as the visiting teacher or other staff who happened to be knowledgeable in AT.

Respondents with good to high familiarity with AT described being involved with pupils with a range of disabilities who used AT over an extended period of time. They were involved in setting up AT software and hardware or providing devices to pupils for many years. The types of AT specified included laptops and iPads, software, MS Word tools, internet tools and personalised laptop settings. These respondents identified useful information sources as the visiting teacher, assessment professionals, formal qualifications in IT and having researched the appropriate AT for a pupil.

### 8.3 Sources of AT Knowledge

Respondents were asked to indicate where they had acquired their AT knowledge, to rate the quality of information acquired and explain reasons for their ratings. These responses are summarised in Table 8.3 for each of the groups. A wide range of sources of knowledge were cited, but it was notable that no single source predominated and that generally very low percentages of teachers used any single source – no source was used by more than 20 per cent of teachers.

<sup>50</sup> Year head, SEN coordinator, deputy principal, resource/special educational needs coordinator.

Both groups reported using knowledge resources to the same extent, apart from SENO advice which was used significantly more frequently by the group with greater AT familiarity. The groups also differed significantly in their ratings of the quality of information gained with those with more familiarity rating the information they acquired significantly more positively.

**Table 8.3: Ratings of AT knowledge resources utilised**

		Familiarity with AT		
		Low/mod	High	Total
<b>Sources of AT knowledge</b>	Academic courses	11%	14%	12%
	Continuing professional development	13%	6%	10%
	SENO advice	4%	11%	7%*
	Assessment professional	13%	14%	13%
	Other expert	18%	15%	16%
	Other teachers	18%	15%	16%
	Parents	13%	13%	13%
	AT suppliers	9%	11%	10%
	Personal research online	2%	1%	2%
	Information quality rating	2.91	3.95	3.38*

\* Respondents were asked to rate their knowledge of AT using a five-point scale ranging from very little knowledge to extensive

Positive comments included references to the excellence of course instructors and to the usefulness of information provided by visiting teachers, parents, professionals, AT suppliers and other teachers. The importance of learning from 'hands on' experience of using AT, contact with experienced people, e.g. an IT teacher or SEN coordinator, and feedback from people who use AT, was emphasised.

It is noteworthy that there were few references to teacher education and training as a source of information. This reflects some findings in the literature (e.g. Bausch & Hasselbring, 2004) which point to a lack of training and trained AT personnel in the US, at least.

Respondents highlighted a number of areas for improvement including:

- Information from many sources was either too general, limited or brief;
- Lack of easy access for teachers to training opportunities and clinical or expert advice;
- NCSE SENOs being more involved in processing and approving applications;

- Assessment professionals not always being well briefed in the latest AT;
- Rapidly changing AT creating a need for regularly updating knowledge, but at the same time, teachers having little time to access the information required.

Suggestions for improvement involved:

- Access to a large base of users' reviews would be useful;
- Centralised guidelines on specific AT applications suitable for different pupils with special educational needs;
- Better and more specific training e.g. in the use of iPads;
- More formal and extensive support from external agencies.

## 8.4 Use and Quality of Online Resources

Respondents also indicated the websites they had used and rated the quality of the information obtained from them. These responses are summarised in Table 8.4. Usage patterns for both groups were similar as were their quality ratings apart from the NCSE website which was used more often by the group with greater AT familiarity and the quality ratings of the websites of voluntary organisations which were rated more positively by respondents with greater AT familiarity. The SESS site was the most frequently used site overall. In general, ratings fell within the moderate to good quality range.

There were a number of references to the high quality, clarity and up-to-date information available through websites. They were considered positive resources offering good support, with a wide range of helpful and accessible information and particularly useful in generating applications for AT. Websites singled out for positive mention included Assist Ireland (good advice), SESS (helpful and user friendly), CRC (helpful and responsive to emails), voluntary organisations (specific and practical information).

Areas for improvement included the lack of specificity, relevance and currency of the information available, lack of access to theory-based knowledge and the fact that the information was mainly about what to buy and not about how it should be used or how to troubleshoot challenges. Having to access multiple sites and lack awareness of the best sites to get the information required, in the context of restricted internet access and/or bandwidth at school, and time pressures on teachers were raised as challenges. Specific sites referred to included NCSE (lacking currency) and DES (hard to navigate). Some respondents expressed a preference for getting information from professionals, peers or 'hands on' training.

**Table 8.4: Ratings of AT online resources utilised**

		Familiarity with AT		
		Low/mod	High	Total
Online resources use and quality	NCSE	14%	21%	17%
	Information quality rating	3.22	3.69	3.5*
	DES	14%	17%	15%
	Information quality rating	3.20	3.50	3.36
	SESS	26%	17%	21%
	Information quality rating	3.28	3.75	3.47
	NDA	2%	5%	3%
	Information quality rating	3.00	3.75	3.50%
	Assist Ireland	3%	3%	3%
	Information quality rating	2.33	4.50	3.20
	CRC	2%	5%	3%
	Information quality rating	2.50	3.33	3.00
	Voluntary organisations	8%	8%	8%
	Information quality rating	2.60	4.60	3.60*
	Other sites: DAI, clinical websites, Google search	33%	27%	30%
	Information quality rating	4.00	3.67	3.83

\* Respondents were asked to rate their knowledge of AT using a five-point scale ranging from very little knowledge to extensive

Some respondents emphasised that getting information was only a part of the process, after that there were a variety of 'hoops to jump through'. The necessity for a full clinical report to access AT and the difficulty in accessing a professional recommendation as a result of limited time available from NEPs were mentioned as major challenges.

## 8.5 AT Identification and Acquisition Process

Respondents were requested to describe the procedures through which AT needs were identified, the people involved in the AT identification and acquisition process and to rate the effectiveness with which each stage was being implemented.

Procedures respondents described for identification of AT needs could be categorised into three approaches. In the first, there were pupils who arrived in schools with a pre-diagnosed condition such as hearing or visual impairment for which recognised AT solutions were available. The second

included schools where staff took a proactive approach to identifying pupils who could benefit from AT and attempted to acquire it on their behalf. The third category consisted of schools that reacted to external factors and particularly to professional reports:

- **Pre-diagnosed hearing or visual impairment:** Where the pupil had a pre-diagnosed visual or hearing impairment, the diagnosing professional normally consulted the visiting teacher or the school staff in making an application to the NCSE;
- **Proactive school-based approach:** The class teacher was most often the person who first identified the potential requirement for AT. The procedure followed differed depending on school type and policy. In one school the issue was raised with the relevant allied health or medical professional at an individual planning meeting with a multidisciplinary team or through the principal. The clinician wrote an application to the NCSE and where possible the pupil was provided with a trial of the device or software. In another school, the class teacher discussed the potential for AT with the learning support teacher and then, where appropriate, referred to the deputy principal who organised a psychological assessment. In various schools, the teacher consulted the resource teacher, SENCo or SNA and usually also consulted parents. Following this, the teacher attempted to obtain a report from an acknowledged professional and/or an appropriate allied health designation e.g. occupational or speech and language therapist, physiotherapist or psychologist. This usually involved the principal or a staff member, if the principal had delegated this role. In many cases this stage was viewed as being a challenge and particularly so if there were no resources to commission a private assessment;
- **Reactive school-based approach:** On receipt of a professional report the principal considered whether or not to apply for AT and usually consulted the teachers involved with the pupil and parents before applying.

At the AT identification and acquisition stage, (Table 8.5) a wide range of people were identified as being involved, including school staff (principal, class teacher, learning support and resource teachers and SNA), the family of the pupil, visiting teacher, SENO or external professionals.

In the AT selection stage, the people most frequently identified in the decision were school staff, in particular the learning support and resource teachers and external professionals. At the submission, procurement and maintenance stage, respondents identified the principal, assistant or deputy principal and resource teacher as the most frequently involved.

**Table 8.5: People involved in the AT identification and acquisition process**

	AT Identification Process	Selecting AT	Submitting Application	NCSE Liaison	AT Procurement	AT Maintenance
Principal	13	7	18	19	16	11
Assistant/deputy principal	4		2	2	2	1
Class teacher	27	11	4	1	4	9
Learning support teacher	20	16	6	7	4	4
Resource teachers	18	23	12	12	11	12
Special needs assistant	15	4			0	1
Visiting teacher	13	4	1	1	1	1
Family	15					1
Pupil	1					
SENO	15					
Resource/SEN coordinator	1	3	2	2	2	1
ICT Teacher/coordinator					2	3
Guidance counsellor		1				
Secretary					1	
External professional	5	14				
External agency		2				1
AT supplier						1

Respondents rated each stage of the AT identification and acquisition process on a scale of 1 to 5 in which 1= substantial improvement required and 5 = no change required. Table 8.6 present the average ratings of respondents broken down by level of familiarity with AT.

Teachers rated AT training for pupils as needing substantial improvement. The identification of AT needs stage was rated as requiring moderate changes. All other stages of the process were rated as requiring some improvement. Both groups assigned similar ratings to most of these stages although respondents who indicated a higher familiarity were more positive about AT training and support for pupils and training for staff. Nevertheless, all ratings, apart from the rating of the high familiarity group of the AT needs identification stage, indicated a need for improvement.

Some teachers reported positive experiences with the process. It was referred to as a straightforward experience managed well by the SENO and school principal. The positive contribution of visiting teacher services was specifically mentioned. The in-school procedures also received positive mention from some teachers. The role of parents in terms of knowledge about information technology and their ability to pay was also highlighted as an important factor in gaining access to AT.

**Table 8.6: Staff ratings of AT identification and acquisition process**

	AT Process Stage	Familiarity with AT		
		Low/mod	High	Total
Ratings of AT process	Identification of AT needs	2.86	3.50	3.17
	Assessment of AT needs	2.76	2.95	2.85
	AT application	2.91	2.65	2.79
	AT selection decision	2.91	2.76	2.84
	AT procurement	2.46	2.95	2.68
	AT training pupils	1.55	2.42	1.95*
	AT training staff	1.67	2.77	2.16*
	AT supports	1.67	2.50	2.03*

\* Statistical significance <0.05

Respondents made a variety of comments and suggestions for improving the AT process:

- References were made to the ad hoc approach or lack of training, support and follow-up for pupils, parents and teachers, e.g. the need for training for pupils with laptops or computers in keyboard skills. The lack of financial and other support for troubleshooting, repairing or maintaining AT was also raised. The challenge for staff responsible for AT providing training and support for AT devices was also identified;
- Respondents suggested that AT should be more readily available and noted that many pupils who would benefit from AT had no access to it. In some cases teachers said pupils who applied had not been approved, or in other cases that pupils who would benefit were having difficulty gaining an appropriate diagnosis. There was a view that the new application procedures and how SENOs interpret the wording of reports in terms of AT allocation were very restrictive (e.g. the absence of the word 'essential' could result in an application being denied). The need for such a complex application process was questioned;
- Access to appropriate expertise was raised as a concern in terms of a need for a specific staff member with AT knowledge and responsibility, more direct input from the visiting teacher, easier access to AT expertise and support for equipment maintenance;

- Significant concerns were also raised about the amount of administration required and the number of steps in the allocation process. Respondents highlighted the amount of paperwork involved, onerous procedures, financial and administrative demands on the school, need for three quotations even for standard equipment and the system's lack of flexibility. There was a suggestion that the procurement process could be carried out by a central purchasing mechanism or an external agency;
- A further issue raised was the length of the process from receipt of a report indicating AT need and the pupil actually acquiring it. Delays were ascribed particularly to the purchasing/procurement phase. Delays were also mentioned in relation to device repairs;
- A few teachers referred to a lack of a coherent approach either in their schools or externally, particularly relating to matching a pupil's needs to appropriate AT solutions. The fragmentation between the assessment and the granting systems was mentioned;
- Difficulties in finding assessment professionals with the requisite knowledge and expertise in AT and NCSE eligibility requirements including HSE clinicians were raised.

Respondents were further asked to describe the main challenges they experienced in ensuring that AT was used effectively to support the education and learning of pupils with special educational needs, based on their own observations. The main challenges specified were:

- Lack of appropriate training to prepare teachers to support students using AT and support for them to keep their skills up to date;
- Finding the right equipment and getting the right training, making sure that the AT matched user's needs; a lack of knowledgeable and competent staff to train and support pupils in the appropriate use of AT, ensure its correct installation and monitor its use;
- It was reported that using AT effectively in mainstream classrooms requires changing the attitudes of classroom teachers who sometimes view AT as a 'crutch', that teachers sometimes lack commitment to AT and view it as a SEN issue and in some cases refuse to accept homework in alternative formats;
- Meeting the criteria for AT eligibility was viewed as restrictive and the evidence required considered to be onerous to obtain;
- Ensuring that the AT was up-to-date, meeting the needs of the user, troubleshooting difficulties or finding alternatives if the AT did not work out;
- The time it took to acquire AT on behalf of a pupil;
- The complex, cumbersome and bureaucratic process involved in procuring AT;
- The inconsistencies in the system. For example the DES funds iPads as AT but the examinations section has not sanctioned their use in State exams;
- Pupils concerned about being different and standing out and the stigma attached to using AT;

- The lack of resources for and the availability of ancillary equipment such as computers on which to run assistive software and printers for students to print home and school work;
- Equipment challenges such as the short shelf life of laptops, the lack of portability of some equipment from one classroom to another, ensuring that pupils can manage the equipment (making sure that it is charged) or locating pupils near to a power source;
- The effort required by the school to access the knowledge of specific AT required to ensure that teachers and pupils do not become frustrated with malfunctions. The effort also required to act as an intermediary between the SENO and the assessment professional.

## 8.6 Impact of AT on Educational Participation

Respondents were asked to describe what they perceived to be the impact of AT on educational participation under four headings; curriculum access, education engagement, school involvement and academic progress<sup>51</sup>.

The proportion of positive comments for each of the domains of educational participation is presented in Table 8.7 for each group (low/moderate and high familiarity).

**Table 8.7: Teacher ratings of AT's positive impact on educational participation**

		Familiarity with AT		
		Low/mod	High	Total
Proportion of positive AT ratings	Curriculum access	54.2	85.0	68.3
	Educational engagement	54.2	80.0	65.9
	School involvement	12.5	35.0	22.7
	Academic progress	70.8	80.0	75.0

In general, respondents with high AT familiarity provided more positive comments about its impact in all categories. The domain least frequently commented on was school involvement. This was also the domain in which AT users reported the fewest challenges and the lowest positive impact. The other three domains were commented on positively with similar frequencies.

Respondents were also asked to identify the benefits of AT for pupils in relation to each of these four dimensions. Their responses were broken down into specific benefits and negative impacts. Often, teachers mentioned more than one issue and as a result the following tables refer to the number of 'citations' of an issue rather than to the number of teachers citing a specific issue.

<sup>51</sup> Some respondents made similar comments under more than one heading.

**Table 8.8: Issues relating to curriculum access**

	Totals		Totals
Improved participation/interaction	16	Better assessment	5
Better preparation/access to materials	15	Better attention	5
Improved reading and written work/ numeracy	10	Less stress/more confidence	4
Better outcomes	10	Improved oral work	3
Better learning materials	8	Improved interest/motivation	2
Better homework	8	35-minute classes	2
Easier communications	7	Problems printing	1
Better note keeping	7	Not taking responsibility	1
<b>Total citations – 104 (34 respondents)</b>			

The most common issues in relation to curriculum access related to improved participation and interaction with curriculum activities and to being able to prepare better for class, often due to having access to learning materials that they would not have otherwise been able to access. Other common themes were positive impacts on reading literacy and numeracy and obtaining better educational outcomes. A typical response in this area is:

*AT has increased access to the curriculum: Using text-to-speech software allows for our students to read their textbooks and comprehend more content as without AT, the student's comprehension is broken down with trying to decode each unfamiliar word.*

It should be noted that the curriculum access benefits were most often cited by respondents – 104 issues were cited by the sample (see Table 8.8). Comments on engagement with learning and education were also relatively common – 66 such citations were made (see Table 8.9).

The most common issues here were benefits in terms of improved interest in learning and classwork and improved interaction and participation with classwork and classmates. It was also mentioned that AT allowed for better preparation and access to materials as well as reducing pupil stress levels, thereby allowing for better engagement with the learning process. A typical comment in this area is:

*Most students come to school to learn and be with their peers. Students with SEN have further needs that can hinder this experience. The use of AT means a student can engage with their peers and their teachers. This encourages intrinsic motivation and a desire for the student to do well and further succeed.*

**Table 8.9: Issues relating to engaging with learning and education**

	Totals		Totals
Improved interest	15	Better outcomes	2
Improved participation/interaction	9	More fun	2
Better preparation/access to materials	7	Better attention	1
Less stress/more confidence	6	More efficient learning	1
Better learning materials	5	Wandering attention	1
Easier communications	4	Less getting in trouble	1
Improved written work	3	iPads are not reasonable accommodations	1
Better educational experience	3	Refuse to use it	1
Depends on AT type	2	Suits child's needs	1
<b>Total citations – 65 (31 respondents)</b>			

The teachers had fewest comments to make about the overall educational experience (school involvement) – only 22 citations were made (see Table 8.10). The most common of these related to being able to partake in recreational opportunities in school. However, some respondents said the AT had no effects on this issue, pointing out it had no effect on break time activities, for example. Typical comments here included:

*The technology is only available in the classroom. However, since the child got hearing aids just prior to the assistive technology, her participation in recreational activities has also improved.*

*Not good for use @ break/recreation time, but great for library time.*

**Table 8.10: Issues relating to educational experience (school involvement)**

	Totals		Totals
Improved recreation	4	Improved participation/interaction	2
No benefit/break time	4	Easier communications	1
Better educational experience	3	Less stress/more confidence	1
Refuse to use it	3	Better preparation/access to materials	1
Better outcomes	3		
<b>Total citations – 22 (17 respondents)</b>			

Many benefits of AT were cited for academic progress (see Table 8.11). In all, 66 such citations were made, with the commonest relating to improved literacy and numeracy and better educational outcomes. Other common benefits related to improvements in homework and, to a lesser extent, improved motivation. Typical comments in this area included:

*AT benefits SEN students as they can submit work using AT, they can enhance their work which makes them feel proud and further motivated as they get feedback from their peers and teachers. AT technology makes it easier for them to read through large amounts of text and assists them when analysing information.*

*... without these supports our students would struggle to achieve the levels of success they currently enjoy at both Junior and Senior Cycle. However specific subjects and indeed specific teachers are more suited than others to the use of AT.*

**Table 8.11: Issues relating to academic progress**

	Totals		Totals
Improved reading, written work/ numeracy	25	Improved participation/ interaction	1
Better outcomes	16	Improved oral work	1
Better homework	6	Better assessment	1
Improved interest/motivation	3	Better attention	1
Better preparation/access to materials	3	More fun	1
Better learning materials	2	Depends on AT type	1
Depends on subjects and teachers	2	Suits child's needs	1
Less stress/more confidence	2		
<b>Total citations – 66 (33 respondents)</b>			

Respondents also mentioned improvements due to AT in other areas (Table 8.12). However, there were relatively few such citations – 24 in all and there were few new issues mentioned. Many of them related to improved life skills and impacts on wellbeing – the most common were related to improved life skills, having more confidence and being better able to take responsibility and to having less stress and more self-confidence. Some typical comments included:

*It adds to their daily confidence and self-esteem to be included in daily activities of their mainstream class.*

*Excellent for life skills using technology. Gaining independence, communication with others, blogging.*

**Table 8.12: Issues relating to other areas of school life**

	Totals		Totals
Life skills	3	Improved participation/ interaction	2
More independence/responsibility	3	Easier communications	2
Less stress/more confidence	3	Better attention	1
Improved recreation	3	Better outcomes	1
Improved accessibility	2	Better educational experience	1
Improved interest/motivation	2	Better posture	1
<b>Total citations – 24 (14 respondents)</b>			

## 8.7 Suggestions for Colleagues

Respondents were asked what advice they might give to colleagues who were to become involved in the AT implementation process. This question attempts to identify key features and problems in AT implementation. Table 8.13 below summarises the findings for this question.

**Table 8.13: Advice and suggestions to colleagues**

	Total		Total
Contact SENO	6	Child needs basic skills	1
Contact visiting teacher	6	Allow for variable process	1
Refer to guidelines	6	Get practical experiences	1
Collaborate with assessment professionals	6	Collaboration with all	1
Contact other teachers	6	Get samples of work	1
Contact educational psychology services	5	Psychological assessment report may be inaccurate	1
Look at needs as well as AT	5	Be aware of transitions	1
Attend training courses	3	Resource/LS teachers	1
Collaborate parents	3	Communicate procedures	1
Aware of time involved	3	Get parents to get laptop	1
Collaborate with principals	3	Needs identified by groups of people	1
Contact outside agencies	3	Keep it simple and cheap	1
Contact OTs	2	Copy from previous applications	1
Contact Department	2	Be aware of usage delays	1
<b>Total citations – 73 (31 respondents)</b>			

In all, 73 distinct comments were made by 31 respondents. These covered a wide range of issues suggesting there are many problems with the system that might be addressed. However, there was a common theme running through many of these suggestions – this relates to the need for improved communications between the various stakeholders involved in the process of acquiring and implementing AT. Examples of these issues included advice to contact the SENO, collaborate with assessment professionals, contact other teachers and contact educational psychology services among others. Some typical comments included:

*Collaboration is key, conversations need to take place in a formal setting where other key personal and experts can give advice and direction.*

*Communicate with the SENO through the whole process, tell them what your intentions are and why and ask them what they need in the form of a professional recommendation for the child so that the professional report contains exactly what the SENO requires in order to meet the needs of the child.*

Respondents were also asked to suggest improvements to the NCSE and DES (see Table 8.14). In all, 50 suggestions were made. However, there was little common ground among respondents in the suggestions they made. This would imply many issues need to be addressed with the implementation process. More common suggestions related to improving training for staff, for parents and for pupils. Others referred to what was perceived to be a system that is too bureaucratic. Some typical quotes from teachers' issues included:

*Make more school-based training available to staff and parents.*

*We need the professional help of outside agencies.*

**Table 8.14: Suggestions for NCSE and DES**

	Total		Total
More training staff	4	Less attention for private assessments	1
Reduce time lags in process	3	Improve cash flow for schools	1
More discretionary funding for schools	3	Central AT bank of equipment	1
Appoint AT expert in/for schools	3	Trial period	1
Ensure objectivity of criteria	2	Streamline procedure for low cost AT	1
Let SEN decide/advise	2	Improve communications between stakeholders	1
More coherent centralised approach	2	General AT bank for special schools	1
Pay more attention to professional recommendations	2	Special schools to trial AT	1
More training parents	2	Bigger role for teachers	1
Provide training for all	2	Typing training each week	1
Remove 3 quotes requirement	2	VT service for pupils with AT	1
More teacher involvement in process	2	Assessment professionals and SENOs liaison	1
Reduce rigidity of current guidelines	1	Give reasons for not getting AT	1
Provide pro-forma contracts	1	Provide appropriate IT infrastructure for all	1
VTs to update teachers	1	Use e-mail for applications process	1
Match AT to SEN categories	1	Focus group for stakeholders	1
Support transitions	1	Guidelines on purchasing	1
Provide Psychological report template	1	Use outside agencies more	1
<b>Total citations – 53 (22 respondents)</b>			

## 8.8 Summary

The findings from this strand of the study need to be interpreted with caution, as the sample of 46 teachers was unrepresentative of all teachers. In addition, this is an opinion survey where all findings are from self-report measures – it was not part of the study brief to seek objective measures. Nevertheless, the sample of teachers included in the survey had experiences of the processes involved in the acquisition of AT and of its impacts, and may be regarded as having some expertise.

The main findings from the teachers' survey strand of the study were:

- The level of familiarity with AT differed. This was no more than moderate overall, and teachers who rated themselves with lower levels of familiarity tended to say they had experienced more problems with the acquisition and operation of AT;
- Multiple sources of information were used by teachers to obtain information on AT, but there was little commonality about the sources they used;
- According to the teachers, school principals were consistently involved in the AT acquisition process. External professionals were most often involved early in the process, but resource teachers and learning support teachers from within the school were most involved throughout the stages of the process;
- The level of training and support for teachers was identified as a problem for teachers, especially for those with lower levels of familiarity with AT;
- Teachers identified significant problems with issues such as the length of the process, the difficulties of qualifying for AT and the support for the equipment post-installation. All aspects of the process caused problems for at least some teachers;
- Despite these problems, teachers generally rated the impacts of the AT positively for three indicators of education. However, one other (school involvement) was impacted only in a limited way;
- Many suggestions were made about advice to colleagues, to the NCSE and DES. There was little agreement between them, however, suggesting the problems they perceive with the process are widespread rather than focused on a few issues.

## 9. Focus Group Results

### Section Summary

The focus group participants discussed issues concerning referral pathways, information sources, the role of assessment professionals and support needs in relation to keeping up to date with developments in the AT field.

Referral pathways to assessment professionals were reported to have varied considerably and included parents, health professionals, teachers, VTs, OTs, ophthalmologists, and audiologists. Pre-school assessment was felt to be a smoother process by focus group participants and different professionals were involved in assessing school-age children.

Strategies to keep up-to-date with developments in AT involved the internet, AT suppliers, peer networks, YouTube and continuing professional development. Participants also pointed to difficulties in keeping up with developments in relation to apps.

Training in how to carry out assessments was reported as not being widely available.

Generally, focus group participants reported that assessment professionals provided no ongoing support to pupils or schools. Exceptions to this included the CRC, DeafHear and Enable Ireland.

The most important problems reported were difficulties with AT transfer between first and second level schools, having to demonstrate eligibility, problems associated with late onset diagnosis of certain conditions, accessing appropriate expertise, how to integrate AT that is acquired by parents into the system and a perceived lack of finances for AT.

### 9.1 Introduction

This chapter reports on the findings from two focus groups held with a range of professionals involved in different ways in the AT acquisition and implementation process. In all, 15 participants took part covering a range of professional groups, including occupational therapy, speech and language therapy, and educational psychology. They also came from representative organisations for groups with visual and hearing difficulties and represented such groups as parents, SENOs and educators. However, participants being drawn in such a purposive way places limitations on interpretation of the findings.

## 9.2 Findings

### 9.2.1 Coming into contact with professionals

Participants stated that referral to assessment professionals came from a range of sources and were to some degree dependent on the nature of the disability of the pupil and also on their age. Referrals were noted to have emanated from either non-health or health professionals. Many referrals to assessment professionals began with the child's parents or their teachers. Visiting teachers were seen as a special case in this regard – they provided a well-functioning referral service for sensory impaired pupils. The health professionals who may have referred pupils included ophthalmologists, audiologists, occupational therapists, educational psychologists and the HSE school age team. It was noted that some of these referrals might have come from privately hired professionals. Other school-based professionals may also have referred according to participants – teachers and SNAs were also potential referral sources. Bodies such as the National Parents Council might also have played a role, especially in providing advice to parents on the referral and assessment process.

In the case of children with hearing difficulties, recent advances in assessment meant assessments often took place within the first 12 months of life – the children arrived at school with a clear assessment of needs and referral was not needed in these cases.

Overall, it was clear from discussions that the pathways whereby children with visual or hearing disabilities came into contact with assessment services were more defined than was the case for children with other learning-related disabilities.

### 9.2.2 Role of assessment professionals

Discussions revealed that the role of assessment professionals varied considerably, depending on the type of organisation they worked for and the type of impairment in which they specialised. Where organisations provided services across the lifecycle (e.g. DeafHear, NCBI), assessment tended to take place at pre-school age thereby leading to a relatively smooth transition to school and the acquisition of appropriate AT, according to participants. Visiting teachers played an important role here.

However, it was noted that where learning difficulties only became apparent at school, the role of the professional changed somewhat. A wider range of assessment professionals might become involved – these included OTs, educational psychologists, speech and language therapists and others. Assessment might be arranged privately or through the public system despite its long waiting times.

Both Enable Ireland and the CRC provided an assessment service and contracted services to the HSE, according to participants.

### 9.2.3 Information resources and keeping up to date

The focus group participants reported that assessment professionals from different backgrounds tended to use similar strategies, if different information sources, in keeping up to date with developments in their field. These information sources included:

- Internet is a source of information for all – more important sites include:
  - Special Education Support Service (SESS) – used by many types of professionals. Both the SESS and National Council for Technology in Education resource were cited as important sources of information on software;
  - NCSE website;
  - Chronicle for Higher Education (technology blog);
  - Blogs by leaders in the field;
- Suppliers of AT – provide systematic, if somewhat coloured information, on their own products. Often, they are invited to make presentations to assessment professionals;
- Peer networks and fellow professionals – may be made up of national or international colleagues. Some are online;
- YouTube is sometimes used as a means of checking functionalities of technologies;
- Continuous professional development – conferences are seen as a useful way of achieving this. Important events include the annual Educational Technology Conference;
- Information resources in the UK e.g. the Ewing Resource Unit.

These information resources underline the fast-changing nature of AT and the difficulties professionals have in keeping up with developments. This is particularly so for new apps for tablets and other platforms. Even though information sources are available for apps, there is a profusion of developments in this field and it appears that traditional information sources cannot keep pace with them. According to focus group participants, a feature of this problem was that scientific sources did not keep up with developments and so blogs by trusted sources became more important. In some cases, parents might buy apps that were inappropriate for their children, which might cause problems for their educational and other attainments.

### 9.2.4 Assessment professionals and ongoing support

Discussions revealed that generally, assessment professionals, per se, were not involved in providing ongoing supports for children with AT unless further assessment was required. Once AT was installed, it was left to the actors at school level to provide children with supports.

There were exceptions to this – organisations such as DeafHear provided a monitoring service and track AT functioning and the service to their clients over time. In addition, organisations such as NCBI provided further support on request, while the CRC could to some extent monitor the progress of their clients using their 'review' system. However, these ongoing services were not necessarily provided by assessment professionals.

It was noted that training was not generally provided to actors within the school by either assessment professionals or by organisations involved in providing services to specific groups.

### 9.2.5 Training in making AT assessments

According to respondents, training available to assessment professionals for AT was limited. The only accredited training course in Ireland is a foundation course in DIT. However, the CRC (for OTs) and Enable Ireland provided some training for assessment professionals and in some cases also offered telephone-based advice to assessment professionals. It was noted that in the past some training was available through the Department of Education for teachers, but the funding for this had been discontinued.

### 9.2.6 Problems and potential solutions

Specific problems were noted in the overall assessment and delivery process. In some cases potential solutions to these were suggested, including:

**Transfer of equipment between schools:** While the NCSE indicated the transfer of AT from school to school was permitted when pupils made a transition (e.g. from primary to secondary, or from secondary to tertiary), the focus group participants seemed unaware of this. Their view was that AT users were not entitled to take their AT with them as it belonged to the school of origin. This leads to a need for re-assessment, when some form of transfer system or AT depreciation system would allow for AT to be attached to the pupil rather than the school. Better long-term planning is needed to anticipate and support transitions between different levels of schools. It was noted that the handover was not just about the technology, but also concerned the expertise of teachers between schools, between suppliers and schools and so on.

**AT is less than optimal:** There were problems with the initial usage period of AT where pupils might find the AT assigned to them was not optimal. Some kind of trial period would help overcome this problem. This could be facilitated by a 'clearing house' which keeps track of equipment that is not in use and would make equipment available for trial. This happens on an informal basis at the moment but a clearing house would go some way towards resolving this problem.

**Eligibility:** Some conditions affecting learning are not recognised or recognised only with difficulty as being eligible for AT – these include dyslexia and sensory processing disorder.

**Late onset diagnosis:** Where a disability is recognised relatively late in the pupil's school career, it may be difficult for the problem to be recognised and for AT to be awarded. For example, one participant reported it had been estimated that only about 40 per cent of children with hearing difficulties obtained AT due to late onset of problems. Often, difficulties did not become apparent until the pupil was placed under higher demands, such as when they moved from primary to secondary education.

**Financial issues:** A range of issues was discussed here including late payments (which can have a disproportionate effect on smaller schools) and the financial limits placed on specific pieces of AT.

**Access to expertise:** Given the area's dynamic nature, there is a constant need to be able to access expertise, especially from within the schools. However, recent cuts in funding have tended to reduce that access and this leads to inefficiencies in the system.

**Parent-acquired AT:** Some parents acquired equipment for their children which can lead to a problem if it was not accepted as a 'reasonable accommodation' for State exams at a later stage.

**Knowledge of the system:** An uneven level of knowledge within the system about the system itself was noted. Those involved in detecting a need for and applying for AT would benefit from better information and training. An appeals process would help to overcome errors and rigidities within the system. For example, the requirement that AT must be for '*regular use and used throughout the school day*' needs to be reviewed. It does not allow the gradual introduction of AT for those with progressive conditions and introducing AT before it is required so learners can develop competence before the AT becomes essential.

**Communications within the system:** Communications between key actors and organisations were seen to be problematic. Improvements are needed in communications, for example, between the HSE and the Department of Education and Skills.

**Training:** There was an expressed need for continuing training and updating of knowledge for all of parties concerned in the AT procurement process given the dynamic nature of the field. Teachers, pupils and assessment professionals need such training. The education centres may be useful with this. Web-based training should also be considered.

**Procurement policies:** Problems can occur with procurement, e.g. where laptops are bought in bulk. In some cases they do not meet the specific requirements of individuals who may need different specifications. It was also noted that the tender requirements for the supply of equipment effectively meant the use of local suppliers was eliminated.

**Delays in the system:** The time lag between identification and delivery of AT needs to be shortened. The four- to six-week turn around by NCSE is considered acceptable but delays often occur at other stages of the process such as procurement.

## 10. Summary of Findings

This study of the effectiveness of AT in supporting children with special educational needs took a multi-dimensional approach to its investigations. Five main lines were used:

- Analysis of the policy context;
- Review of the international literature;
- Study of pupils using at in schools;
- Survey of teachers with experience of AT;
- Study of the opinions of assessment and other professionals involved in the AT process.

Underlying the five elements of the study is a socio-technical model of how AT is introduced. This model acknowledges the importance of three main dimensions to the success or otherwise of implementing AT – the technology itself, the social environment and the individual. Each dimension can play a defining role in the process and the conclusions made reflect the importance of each element.

The summary of findings from the study are organised in relation to each of the lines of investigation. There is a considerable level of synergy in the findings which provides a sound basis for drawing conclusions from the study.

### 10.1 Policy Context

The main findings that can be drawn from this element of the work are:

**Legislation adequacy:** In the absence of the full implementation of the EPSEN and Disability Acts, the Education Act and Equality Acts provide a strong basis for the deployment of AT as a means of promoting full participation in education for learners with special educational needs and/or disabilities.

**International AT policy context:** The main international policy of relevance is the UN Convention on the Rights of Persons with Disabilities (UNCPRD), which the Irish Government is committed to ratifying and which specifies access to AT for an affordable cost as being a right and an important component in inclusive education. The effective deployment of AT in education is also supported by a range of international organisations.

An overview of delivery systems for AT in education in various other jurisdictions highlighted the essential role of expert advice and support services: Other common themes included viewing AT from an inclusive education and universal design perspective, the usefulness of a code of practice/guidelines for deployment of AT, the importance of collaboration of health and education services in AT assessment, the need for the active involvement of the learner, AT as a core component of individual educational planning and the need to monitor impact.

**National AT policy context:** Issues have been raised about the operation of the DES AT scheme in terms of fairness, adequacy, use of diagnosis as a criterion for eligibility and lack of transparency in the appeals procedure. The NCSE has raised concerns about current procedures for allocating AT including delays in the system, lack of continuity during transition, level of teachers' AT knowledge, need for AT supports, up-to-date information about AT and standards for AT assessment.

The NCSE has recommended that a working group be established to develop a national AT policy that specifies its purpose in education; the standards for professionals involved in making recommendations; the type of AT that should be made available; the basis for grant aid to schools; the roles and responsibilities of those involved in the identification and allocation process; and training requirements.

Irish AT policy should be viewed within the broader field of ICT in education. Concerns have been raised about the deployment of clear policy commitments in this area including the need to enhance teachers' expertise, increased investment in infrastructure and equipment, greater support for schools and insufficient resources.

AT policy needs to take account of the recommendations in the broader domain of SEN resources and particularly the adoption of a biopsychosocial approach to assessment, the involvement of parents and student and moving away from diagnosis as a grounds for the allocation of resources.

**Finances for AT:** Current spending on AT is about €1.26m per annum. This is less than one tenth of 1 per cent of the financial resources assigned to SEN personnel supports (€1.3bn). No evidence-based benchmark for national educational spending on AT was found, but the relatively small proportion of SEN funding allocated to AT calls into question the financial and logistical rationale for splitting the operation of the scheme between the NCSE and other sections in the DES.

**Administration of the system:** Eligibility for the scheme requires evidence of a diagnosed disability and that the AT is essential to education. Currently, both of these are evaluated on the basis of a report from a clinical assessment. There are a number of concerns with this procedure. Firstly, there is a risk that the absence of the word 'essential' in an expert report is sufficient to exclude a student from the scheme – such decisions should not be based on the syntax or lexical content of a report. Secondly, both eligibility and appropriate technology are assessed at the same time. Thirdly, the system does not allow for a trial period in using the AT. Fourthly, the NCSE has recommended that the basis for allocating SEN personnel resources should move away from individual diagnosis to a school profiling system. This calls into question the rationale for retaining disability as an entry criterion for the AT scheme.

Furthermore, assessment is most often a once-off procedure that takes place outside the school context in which the AT is intended to be used. Assessment professionals are infrequently involved in implementation, except in the case of students with sensory impairments. Teachers and parents are generally not actively involved in assessment of AT needs. There are no guidelines for assessment methods or tools most useful in identifying users' needs and matching these to the most appropriate technology.

Fundamentally, the DES scheme adopts a reactive approach to providing AT, i.e. it waits until applications are received rather than having a proactive screening process. It is also truncated in that it does not initiate until an application is received and terminates after an AT application has been approved or rejected apart from administrative or appeal processes.

Good quality information on AT is difficult to find – none of the AT information resources recommended by the DES in its circular on the AT grant scheme offers up-to-date evidence-supported information on AT practices.

Transferring AT between schools is problematic. The NCSE has noted that the DES needed to clarify for schools that essential AT could be transferred with a pupil particularly in the transition from primary to post-primary education.

Other areas for improvement indicated by the NCSE included the requirements for:

- Measures to be put in place to support the timely and consistent access to AT for students who require it;
- Professionals involved in assessment of AT to be up to date in their knowledge about the functionality and potential educational impact of AT;
- Teachers to be supported to gain familiarity with the AT;
- Standards to be developed to guide the assessment and recommendation of AT.

**National and international guidelines:** The policy review also addressed the issue of best practice guidelines. Many of these were identified in Ireland and internationally. The main messages that come from these guidelines centre on common themes such as the need to involve parents and pupils; the need to provide access to relevant information; the need for training and support for all stakeholders; the need for an effective phased matching processes; and the need to integrate AT into a universally designed, inclusive education process.

## 10.2 Literature Review

The literature review revealed that many commentators viewed much of the research in the field as of low scientific quality. Chief among the reasons for this is that AT is evolving and diverging more rapidly than can be captured through one-off studies, no matter how well they are designed. This is especially true in the case of apps. In addition, there are definitional issues in relation to AT. One consequence of this is that it is often difficult to distinguish between assistive (access) and instructional technology. Both are relevant to supporting effective education for learners with special educational needs. Similarly, standards based on previous evidence will often be out of date before they are published. A more dynamic approach to evidence is required.

Other issues identified were methodological issues in terms of research design, small sample sizes and the multiplicity of outcome measurement strategies. Many of these arise from the heterogeneity of populations in terms of needs and abilities, the low prevalence of many

conditions, the diversity of devices and contexts for AT use and difficulties in establishing high levels of experimental control. Single subject designs in which participants acted as their own controls and longitudinal studies were recommended.

Notwithstanding these difficulties there was still a relatively high level of agreement in the literature on many issues. Despite the low number of well-designed studies, it was generally accepted that AT had a positive impact on education. Key findings include:

- AT positive impacts are not explicable in terms of type of application or brand;
- It is unwise to assume that AT applications will be accessible to an individual user.

There was common agreement that collaborative assessment based on a biopsychosocial model is essential to ensuring the best fit between the individual's needs, the AT and the environment in which education takes place. An AT expert is an important member of the assessment team. AT experts are not always clinical experts.

Agreement was also widespread that assessment must include a trial period in which performance with and without AT is measured systematically in alternating conditions. This reflected findings from the empirical part of the study where parents and teachers commented negatively on the lack of a trial period for AT within the Irish system.

The literature pointed to teacher cooperation as an important intervening factor and that teachers needed access to expert advice and to training and support. This was also a finding within the empirical part of this study. Continuing professional development and initial teacher education are essential to create the conditions for the effective use of AT in education but training and support specific to an AT device may well be required at individual level.

The literature pointed to parents being a significant factor in determining whether a potential AT user gets the technology they need. Within the Irish system it is clear that although parents are heavily involved in this process they have no formal role.

The literature pointed to the need for AT training for new users to be empowering and participative. It is not sufficient merely to provide the specific skills needed to operate a given piece of AT. Personal factors, familiarity with AT and formal and informal supports are significantly related to empowered AT use in the transition to post-secondary education.

### **10.3 AT User Survey**

The survey was carried out with 96 students and reflects only the views of respondents granted AT under the DES scheme. The views of students deemed ineligible or potential users who had not been identified as needing AT were not gathered.

### 10.3.1 Educational participation

In general, respondents viewed the AT they received in a positive light. The AT granted under the DES scheme was valued by the majority of those interviewed. It helped pupils meet the educational challenges they faced – though there were no benchmarks available for this question, satisfaction with the AT received was considerable:

- The AT was considered to meet about 80 per cent of curriculum access, subjective wellbeing, academic attainment and educational engagement challenges. The majority of respondents faced challenges in these areas;
- Challenges in attaining life skills relevant to education and to school involvement were met less frequently. These challenges were specified by a lower number of respondents;
- Level of positive impact reported did not differ in terms of the type of AT used;
- Level of positive impact reported was significantly related to personal factors such as self-assessed capabilities and quality of life;
- Respondents with lower self-assessed capabilities rated the educational participation impact of AT as meeting fewer of their challenges;
- Respondents who had abandoned the AT reported significantly fewer positive impacts than those who continued to use their AT. However, the abandonment rate was lower than international estimates;
- Self-esteem and educational motivation differed according to age but not in terms of educational participation;
- Length of time respondents had been using their AT was significantly related to perceptions of the process but not to ratings of the positive impact of AT.

### 10.3.2 Perception of process

Considerable amounts of qualitative data were gathered in this part of the study on perceptions of students and their parents of the process of acquiring and implementing AT. The summary of results presented below is organised by the various stages of this process. It should be noted that although a majority of respondents were positive, the comments for the most part pointed to areas for improvement – respondents did not generally feel moved to make positive comments. Also, it should be noted that many parents felt unable to comment on various stages of the process – in many cases this was because they were unaware these stages existed, reflecting a quite low level of involvement with, and awareness of, the process as a whole.

#### People involved in the process and type of AT

The number and types of people reported by parents to have been involved in the identification of AT needs varied considerably with the type of AT the person received – parents and class teachers were most often involved for all types AT. However, visiting teachers were almost exclusively involved with visual aids and audio systems, while OTs were not involved at all

with these systems. Psychologists were not involved either, but were exclusively involved with software and computer systems and with control devices.

### **Identification of potential AT needs**

Most respondents rated this part of the process positively (82 per cent did so) although the comments made pointed to problematic issues. The most common of these was that schools could be slow to pick up or acknowledge that a child might have a special educational need. Most often, external services identified potential needs earlier than schools (often at the pre-school stage). It was also reported that needs were often not identified in a timely manner and that relying on parents alone for identifying potential needs was problematic.

### **Assessment of needs**

Respondents were less positive about the needs assessment process (65 per cent were positive) and most of the comments related to areas for improvement. The main problems here were that assessment was perceived to have taken place too late, the views of parents were not always taken into account and the transfer of AT between schools (primary to secondary) was very difficult. However, respondents did point to the positive role played by external services.

### **Matching of needs to technology**

Sixty-seven per cent of respondents were positive about the process of matching needs to technology. However, most comments pointed to issues with this process, the most common of which was that no choice of AT was offered and there was no trial period for trying out the AT. Some respondents also said the AT they did receive was inadequate for their needs. However, a small number said there was a good match between their needs and the AT's functionality.

### **Application process**

Most respondents had had positive experience of the application process (66.7 per cent). Positive comments, which were fewer, related to good approaches by the school and by assessment professionals (especially visiting teachers). Areas for improvement related to inefficiencies in the school, delays in the process and the transfer of AT between first and second level schools.

### **Allocation process**

The process of allocating AT was viewed less favourably by respondents – only 50 per cent held positive views on this element of the process. There were relatively few comments here and these were almost all relating to areas for improvement. Poor communications and delays in the process were the most common comments made.

### **AT procurement**

The majority of respondents held negative views of the procurement process – only 48 per cent viewed it positively. Most comments related to areas for improvement and included the lack of a trial period with the AT, delays in the process and the practice of having separate awards for hardware and software.

### **Training for stakeholders**

A small majority of respondents (51 per cent) had positive views of the training process. Positive comments were relatively few but related to well-received initial training. Lack of training for parents or teachers or pupils was the most common area for improvement raised.

### **Support following installation of the AT**

A small majority of respondents (51 per cent) had positive views of the process of providing support following installation of the AT. Very few positive comments were made on this part of the process. Areas for improvement included the lack of follow-up of the pupils who received AT, maintenance programmes for much of the AT and the monitoring of progress of the individual who was using the AT.

## **10.4 Teacher Survey**

The teacher survey had 46 respondents (not a representative survey), most of whom were from schools in which the AT user sample had been drawn. They came from a wide range of school types at first and second level. Respondents felt the policy and practice of how AT was introduced and managed left something to be desired. Policy and practice concerning AT was seen to be disorganised – two-thirds of schools had no AT policy, while 60 per cent had no designated teacher responsible for AT. Many did not monitor usage and only half provided training to pupils, while two-thirds provided no training to staff.

### **Knowledge sources**

A wide range of information sources was used, though no single source predominated, and there was relatively little satisfaction with these. To improve this situation, it was suggested that there should be some type of central knowledge resource, that there should be guidelines on the AT applications process and that there should be more training and support for teachers involved in the process.

The most commonly used information resources were the SESS, NCSE, and DES websites. However, the quality ratings for these websites were moderate. There was no single source of information which could be used, nor was there one used by the majority of teachers. Furthermore, there was no guidance provided on the best or most appropriate sources of information. In this context, it is no surprise that many respondents preferred face-to-face advice.

### **AT acquisition process**

Teachers were asked to comment on the entire acquisition process based on their experience. From these comments three predominant approaches to the process could be identified. The first involved situations where pupils had already been diagnosed with an impairment before coming to school; the second involved schools being proactive in trying to identify pupils with special educational needs who could benefit from AT; while the third and most common was a reactive approach where schools waited to be approached by others about potential AT needs of pupils.

Teachers rated the earliest stages of the acquisition process most highly. They rated the latter stages of the process, i.e. providing training for staff and pupils and parents as well as ongoing support, as areas for improvement.

System strengths included the role of visiting teachers, the positive attitudes of school principals and the actions of SENOs. However, improvements were also suggested. These related to providing more and better training for all, providing more AT, having access to appropriate expertise when needed, reducing the administrative load of applying for AT, reducing delays in the process, having a more coherent approach to the awarding of AT and the difficulties of finding appropriate assessment professionals.

Barriers to AT implementation in schools were also identified. These included lack of training for all; negative attitudes towards AT by some teachers; trying to find the appropriate or the right equipment; the criteria used for awarding AT; inconsistencies in the system; keeping up to date on AT; and a general lack of resources within the system.

### **AT impact on educational participation**

Respondents were also asked to rate the impact of AT on the educational participation of their pupils. In general, ratings were very positive with the exception of overall school involvement. In relation to curriculum access, teachers pointed to improved participation and interaction by pupils, better preparation of materials, improved reading and writing and better educational outcomes for their pupils. Teachers also noted improvements in the educational engagement of their pupils. Specifically, they cited improved interest in educational issues, improved participation and interaction in class, better preparation of materials, and lower levels of stress and higher levels of confidence among their pupils. Academic progress was also influenced by AT in terms of improved literacy and numeracy, better overall educational outcomes and an improvement in homework quality.

Finally, teachers were asked to suggest advice to colleagues. By far the most common suggestions related to the need for better communications particularly with the professionals involved in acquisition (visiting teachers, occupational therapists, SENOs, psychologists and others). They also identified a need to look at the pupils' needs as well as the type of AT that might be awarded.

## **10.5 Expert Focus Groups**

The final element of the study involved two focus groups with selected AT experts. The first question of interest concerned referral pathways for pupils who might benefit from AT. Multiple referral sources were apparent, including parents, health professionals, teachers, visiting teachers, OTs, ophthalmologists and audiologists. It was notable that these professionals came from the public and private sectors. It was also noted that early life stage and later life stage referrals differed considerably. The role of assessment professionals varied with the type of organisation they worked for and with their specialty.

Pre-school assessment tends to be a smoother process and different assessment professionals are involved in the assessment of school-age children. It was noted that the role of the Central Remedial Clinic (CRC) had diminished in recent times – it had less involvement in direct assessment and was more active in terms of supporting assessment by other professionals.

Participants were asked about the types of information sources used to keep up-to-date with developments in AT. Similar sources were used by different professionals and these included the internet, AT suppliers, peer networks, YouTube and continuing professional development. However, they also pointed to the difficulties of keeping up with developments in apps. Often, the sources of information for apps were not reliable and the general pace of development caused problems. It was also noted that training in how to carry out assessments was not widely available. The CRC and Dublin Institute of Technology (DIT) provided some training and support in this area.

Generally, assessment professionals do not provide ongoing support to pupils or schools. Exceptions to this include the CRC, DeafHear and Enable Ireland.

Finally, participants were asked to identify the most important problems and solutions they might have for the entire process of awarding AT. They pointed to issues such as transfer of AT between first and second level schools; having to demonstrate eligibility; problems associated with late onset diagnosis of certain conditions; getting access to expertise that is needed; how to integrate AT that is acquired by parents into the system; and lack of finance for AT. They also pointed to problems about the AT being less than optimal; a lack of knowledge of how the system works among many stakeholders; less than optimal communications between stakeholders in the system; too little training available; and delays in the system.

## 10.6 Assessment of Findings for Research Questions

The study addressed six research questions which were:

- What does research evidence tell us about what is the most effective AT/equipment to support children with special educational needs to access the curriculum, engage in learning and enhance their educational experience?
- What does research evidence tell us about the training and support needs of users and practitioners in this regard?
- What evidence is available from best practice guidelines documents in Ireland and internationally?
- What are the views of users, practitioners responsible for supporting users in the classroom and the assessment professionals recommending the technology about what AT is most effective and requirements in relation to assessment, training and support?
- What lessons can be identified from this evidence?
- What are the implications arising from this review for the provision of assistive technology/equipment for children with special educational needs in Ireland including issues relating to maintenance and repair?

The international research evidence is not conclusive about 'what works'. In part this is due to the technology's nature, which is rapidly changing and proliferating (especially in the case of apps) and the difficulties of setting up robust experimental designs in the area. As a result, the research evidence is relatively weak on the specifics of the efficacy of given technologies. Nevertheless, consensus is quite widespread that AT is beneficial in the educational process, even if this statement is made about relatively small-scale studies of specific AT types in relation to specific impairments.

The literature is far more conclusive on training needs – there is a strong conclusion that training is essential, that it should be part of training for assessment professionals and teachers, that it should be updated regularly as technology changes and that it should reach down to school level, where it should be available to class teachers and others, as well as to the users and their parents.

Evidence from best practice guidelines supports the need for training and information to be made widely available. It also points to the need for inclusive AT acquisition procedures, i.e. involving parents and users, and the need for effective inclusion into the educational curriculum. In essence, they point to the need for a structured, inclusive and well-informed process of AT acquisition and implementation.

The user survey did not find evidence that any single type of technology was necessarily better than another. Instead of pointing to the need for specific technologies to be adopted, it generally pointed to process issues, i.e. to the need to improve the entire process of obtaining and using AT.

The general lessons to be drawn from the evidence collected point to the need to adopt a sociotechnical approach to the AT acquisition process, whereby social and technical issues should be simultaneously addressed and information, training and support activities should be improved.

What are the implications of these findings in relation to the AT acquisition system in Ireland?  
This is a substantive issue and is addressed in detail in Chapter 11.

## 11. Implications for Policy and Practice

The implications for policy and practice described in this chapter are based on the major findings from the study's five strands. They are based on a sociotechnical perspective on AT in education in which the AT itself and the system for delivery are included. Overall AT was considered an effective SEN intervention in the literature and by each of the study's three groups of respondents. This finding must be placed in the context of the views of the parents of AT users, teachers and professionals participating in the study that the way in which AT is provided within the Irish educational system is in need of substantial improvement.

The study findings reflect four broad themes which inform the eight major implications for policy and practice aimed at improving the AT system of provision.

The first of these relates to the importance of viewing AT from a Universal Design for Learning (UDL) perspective. This was supported by the review of policy and good practice guidelines and the literature and reflected in the responses of the parents of AT users, teachers and professionals.

The second theme emerged primarily from the policy and literature review and was evident in the views of the parents of AT users and professionals. It is essential that the AT provision system (policy and practice) is continually updated and reoriented to take account of current developments in the fields of disability, AT and good practice. The pace of change, especially in AT technology, is rapid, and an effective AT system should be responsive to these changes.

A third major theme reflected in the views of all three groups of respondents is that, to a greater or lesser extent, more effective procedures are required at all stages of the implementation process. Parents, teachers and professionals all had difficulties with this and there was a clear implication that changes were desirable if the efficiency and effectiveness of the process is to be improved.

The fourth major theme concerned the need for access to information, training and ongoing support for AT use. This emerged in the good practice and literature reviews and was evident in the responses of each participant group. This carries implications for policy and practice at all levels of the system. At policy level there is a need to acknowledge that the awareness raising, training and support activities need to be considered integral components of the AT funding and delivery system. At the level of practice, easy access to up-to-date information and training about AT and its benefits is required by professionals, teachers, parents and pupils. In addition, AT use needs to be supported and monitored on an ongoing basis.

In specifying the implications, areas for improvement at policy, system level and school levels were considered.

## 11.1 Universal Design for Learning (UDL)

Universal Design for Learning has been identified as an evolving and accepted method to create inclusive learning environments. Technology can be a means for creating a collaborative learning environment for all within a UDL classroom and AT is an important element of this. A UDL approach requires that access to tools and AT be optimised and that simply providing AT to a learner, as is currently the approach in the DES scheme, is not sufficient and should be augmented by support to use the tool effectively to navigate through the environment in terms of both the physical context and the curriculum itself.

In this regard, the analysis of the AT user interviews identified areas for improvement from a UDL perspective particularly in application, procurement, training and support. These perceptions were shared by the teachers and professionals who participated in the study.

A UDL approach is appropriate in responding to the increasing overlap between mainstream ICT, ICT for learning and AT identified in the good practice and literature review and by the professionals in the focus groups. From a UDL perspective, issues that could be considered are:

- Developing the AT provision system in the broader context of ICT for education: Any redesign of the AT identification and acquisition system should acknowledge the views of all stakeholders that the current pace of deployment of ICT for education needs significant improvement and that this can affect level of need for AT;
- Reviewing the current system of AT provision from a UDL perspective: It could be useful to audit the current eight stages of the AT identification and acquisition process using a UDL framework with a view to developing a more user-friendly, proactive transparent and administratively efficient approach to AT provision. In schools, a UDL checklist might be useful to review practices and approaches to AT provision.

## 11.2 Implementation and Funding of the Current System

While no evidenced-based international benchmark was identified for the appropriate proportion of a SEN budget to be allocated to AT, its funding emerged as a significant issue in the professional focus groups and the teacher survey. The concern took various forms, including funding levels available, difficulties in accessing funding, types of AT eligible for funding and the inadequacy of funding for ancillary services such as assessment of AT needs, training and support.

There was a view that the use of appropriate assessment instruments and trained personnel could greatly reduce the cost associated with the acquisition of less than appropriate AT and inefficient use of suitable AT. Appropriate equipment, training and a good local support network were identified as key to successful use of AT technology in the good practice and literature reviews. At present, funding is confined to the costs of acquiring the AT. The findings highlight the desirability for funding to also cover the cost of assessment of AT needs, training and ongoing support.

It was also difficult to determine the rationale underpinning the current system from an administrative perspective. Specifically, the reasoning behind the substantial engagement of the NCSE and the DES and the steps involved in administering what is proportionately a very small budget in comparison to the overall SEN budget was unclear. There is little doubt that a more efficient approach could be designed.

These findings and observations carry implications for the system at the level of policy and practice. Issues worth exploring are:

- **Determining a systematic benchmark for AT spending levels:** Appropriate proportional allocation of SEN resources to AT in education is not easy to establish, taking into account definitions of AT, eligibility criteria and the state of development of ICT for education within the mainstream education system. A possible approach to this could be developing relationships with jurisdictions of a similar size and level of development to explore appropriate metrics;
- **Enhancing schools' ease of access to funding:** Aspects of this issue include streamlining procedures for schools to access AT funding, making it easier to determine eligibility, structuring funding streams into a number of allocations so that funding for a proper assessment of need can be carried out for all students including those who cannot afford to pay and more efficient procurement procedures for technology and training and support;
- **Assessing the appropriateness of funding for all stages of the AT acquisition process:** In addition to funding for AT devices and equipment, resources for the training of learners and teachers, support and follow-up could be considered. This could involve a complementary budget for training and support for AT users.

### 11.3 Common and Standardised Approach to AT Acquisition

The policy review identified a recommendation that an AT working group on national standards for assessment professionals, educational supports and use of resources be established. If implemented, this could contribute to any system redesign process that may take place.

An important finding of the literature review was that the field of AT was evolving so rapidly that traditional approaches to generating and evaluating evidence were insufficient and often out of date by the time they were published. The recommendation of a number of expert commentators was that information generated in classroom contexts could be pooled to provide a basis for evidence supported decision-making. This requires that teachers and professionals implement systematic methods to evaluate the impact of AT and that this information is gathered in a properly curated information source for parents, teachers and professionals. The Able Data resource is an example of a useful approach but would need to be linked to evidence generated through research and practice. The SOLAS project was an example of how this could be structured within an Irish context.

If developing national standards in the area is to be addressed, the following might be considered as part of this process:

- **Broadening the terms of reference of the proposed AT working group:** The scope of the working group remit could include a review of the AT identification and acquisition process, procedures to support evidence-informed practice and information resources. This could result in a more robust and standardised approach to the whole process;
- **Extending the system for AT identification and acquisition:** Consideration could be given to including a follow-up stage in which AT outcomes and impacts can be measured. Systematic monitoring and data gathering procedures on the educational participation outcomes for students granted AT could generate an evidence base for decision making informing future decisions.

## 11.4 Proactive System to Identify AT's Potential Benefits

Areas for improvement at many stages of the AT implementation process were identified by study respondents and are dealt with throughout the remainder of this chapter. However, there were also implications from the results about how dynamic the process was.

Among participating parents, teachers and professionals the consensus was strong that the current system for assessing needs and awarding AT was slow and reactive. Currently, the onus is on the student, his or her family and the school to prove the learner is eligible and that AT is required. Delays can critically affect assimilation of AT into the student's education particularly in the absence of a visiting teacher service.

In parallel, the teacher survey revealed that in many (but not all) schools a reactive approach to AT was adopted which was activated only when parents raised the issue. Both AT user interviews and teacher survey identified that pupils with pre-existing special educational needs or disabilities were more likely to be dealt with proactively than learners whose need for AT emerged after starting school.

Among the implications of these findings is that the AT implementation system needs to be more dynamic and proactive in nature. If such a reorientation was to happen, some issues to be considered are:

- **Designing a proactive approach to identifying pupils who could benefit from AT:** System design should be based on a commitment to a more proactive approach to identifying pupils with needs that could be addressed by AT. Sufficient resources need to be allocated to an active screening and assessment process that support the timely provision of AT.
- **Enhancing communications between systems:** Efficiency and effectiveness of communications between actors within the education and health systems need to be improved so pupils identified with a need for AT in one system are brought to the attention of actors in the other system. This could be enhanced by adopting a common framework and terminology for describing needs and strengths such as that provided

by the International Classification of Functioning, Health and Disability (ICF). Ongoing communication between teams (HSE multidisciplinary teams) working with statements of needs and educational teams could avoid costly duplication and ensure the access needs of each student are fully met.

- **Raising awareness of AT's potential benefits:** Awareness levels of AT's potential to benefit learners needs to be high among parents, principals, teachers and professionals and its availability. This could be supported by requiring a commitment to the proactive identification of students with a potential to benefit from AT in the school plan. This type of activity could be provided by the proposed ISS.

## 11.5 Assessment of Needs and Matching the Person and Technology

Analysis of the AT user interviews revealed that while AT assigned under the DES scheme was perceived to be meeting about 80 per cent of educational challenges identified in curriculum access, educational engagement, academic attainment and subjective wellbeing, it was viewed as being less effective in overcoming challenges in school involvement and non-academic attainment. These findings were supported by the respondents to the teacher survey.

AT users who rated their capabilities as more severe and complex reported less positive impacts and those who abandoned their technology were particularly negative about its impact on educational participation.

Currently determining eligibility, assessing need and awarding AT are part of a single process. A strong case could be made for these processes to be separated so that pupil eligibility for AT is established before the assessment and matching process. The literature review, the review of good practice guidelines and the review of AT assessment systems available internationally all supported the view that an iterative approach was required for assessing AT needs and matching these to technology. It should take place within the context in which the user will apply the AT and involve the active participation of the user and his or her parents.

These findings point to the importance of ensuring a robust, reliable and effective process for identifying needs and matching technology to needs in an optimal way. Issues to consider in developing such an effective system relate to organisation of the process and the tools that may be used to support what is often a challenging and imprecise process. In improving the current process, some issues for consideration are:

- **Reviewing the current system for AT assessment and matching:** Review of AT assessment systems could be carried out as a basis for producing an AT assessment and matching process policy. This could be included in the terms of reference of the proposed AT working group;

- **Changing the focus in the assessment process towards the learner's abilities:** The key question in assessment should be what technology can enable the student to fully participate in education rather than what the child cannot do. The assessment should also draw out the child's view and include his or her aspirations and needs. It should also include a greater role for parents;
- **Facilitating schools to provide a trial period and choice of AT:** Schools need to be equipped to facilitate provision of choice and a trial period for AT as part of the acquisition process. A biopsychosocial assessment tool to support the process could be introduced. These features would benefit not only the child, but also the teachers and parents, who would have the opportunity to become familiar with the AT in a less pressurised way;
- **Adopting a standard approach to AT assessment and matching:** The IMPT tool was used in the current study to assess the matching of technology to a pupil's needs. The literature on the IMPT documented the benefits of its person-centred, biopsychosocial characteristics. Even though adjustments to this tool were needed, the IMPT provided important insights into AT users and their needs. IMPT's potential to form the basis for a standard approach to AT assessment and matching should be reviewed;
- **Enhancing AT options for learners with complex needs:** AT assessment and matching process should be developed on the basis of principles of universal design with a particular emphasis on pupils with severe and more complex needs.

## 11.6 Application, Allocation and Procurement

The current system for determining AT eligibility is based on a medical model of disability which relies on formal diagnosis and a professional recommendation that the AT is essential to education. This is counter to the best practice identified in the international literature in which there was a consensus that a biopsychosocial approach to the assessment and matching of the person to AT was essential and that this needed to take place in context and involve a systematic evaluation of the performance of each user's educational performance with and without the AT.

The determination of appropriate technology is based on a report from professionals who, apart from the visiting teacher service, assess the pupil outside the context in which the AT is to be used. In some cases, according to the professionals participating in the focus groups, a decision not to recommend AT can be based on the syntax or phrasing of a report rather than its substantive content. The allocation, procurement, training and follow-up processes for AT were perceived positively by 50 per cent or less of respondents to the user interview and were identified as areas for improvement by both teachers who responded to the teacher survey and professionals who participated in focus groups.

These issues imply policy and practice implications should a reorientation of the system be considered:

- **Reviewing criteria for AT eligibility:** Revision of the criteria for eligibility specified in the current Circular Letter 0010/2013 should be considered so that they focus more clearly on the functional requirements of learners and the person – activity – environment interaction;
- **Adopting a staged approach to assessment of AT eligibility and needs:** Graduated approach to judging eligibility, selecting the most appropriate AT solutions and providing training and support should be considered. Procedures should be based on a biopsychosocial approach to assessment and eligibility assessment;
- **Enhancing the efficiency of the AT application process:** In practical terms, this refers to more efficient procedures and the removal of unnecessary delays within the system. Particular attention could be paid to improving the quality of support available to principals and to teachers responsible for AT. The visiting teachers service is an example of how this could be achieved. More generally, improving the effectiveness of communications between schools and external actors, especially assessment professionals and SENOs would be important;
- **Streamlining the application process:** Could be achieved by providing schools with a more direct application procedure with fewer steps and providing professionals with a template for making applications. This should require a description of the biopsychosocial strengths and needs of the learner and the educational activities which are affected; environmental barriers to be addressed; interventions and supports implemented to resolve the participation challenges and outcomes of these interventions.

## 11.7 Support and Follow-Up

There was a common perception that the current system does not allow for the systematic provision of post-implementation support for either pupils or teachers involved with AT and levels of support available to users, parents and teachers after its acquisition were in need of improvement. Training for these groups in how to use the AT was often lacking and support for its ongoing usage was also rare (with the exception of AT to support users with sensory disabilities). Systematic monitoring of AT usage was not standard practice.

Views of support differed along a number of dimensions. The views of users of sound systems and visual aids were more positive than users of other types of AT which could indicate that in-school support provision by the visiting teacher service is appreciated. Further, AT users in upper primary schools were more positive than those in lower post-primary schools suggesting the transition to post-primary school can result in fewer effective system responses. This conclusion was supported by the views of the parents of AT users, teachers and professionals participating in the focus groups.

The NCSE working group report (2013) recommended the establishment of a NCSE Inclusion Support Service (ISS) to bring together the diverse support services currently available to build the capacity of schools and support them in responding to exceptional circumstances. The

perceptions of parents, school staff and professionals participating in this study all support the view that, where support is available in the school, the AT identification and acquisition operates more effectively as in the case of the visiting teacher service.

It is clearly desirable to have an ongoing support and monitoring service if AT usage is to be optimised. This could not only improve usage and reduce abandonment rates, but also provide evaluation data that could be used to improve the earlier stages of the implementation process.

Strategies to enhance support to all actors should take the following considerations into account:

- **Supporting schools and parents in the AT implementation process:** Type of support provided by the visiting teacher services could be considered for all types of AT provision as a means of preventing AT abandonment and of improving the efficiency with which it is used. This could be achieved by incorporating an AT advice and support service into the proposed ISS or alternatively to expand the visiting teacher services to cover all pupils with disabilities;
- **Raising awareness that AT can be transferred with the user from school to school:** Awareness needs to be raised among all actors in the system that AT can transfer with the user when this is required. Transfer of AT between primary and post-primary needs to be accompanied by the transfer of know-how to the multiple teachers involved in education at secondary level;
- **Supporting users of AT at times of transition:** Co-ordination at transition periods is vital at all levels of the system including from pre-school to primary education, between schools and in particular between primary and secondary. System guidelines should address how AT use is managed during these phases;
- **Including AT needs and use in an individual educational planning process:** Inclusion of AT provision in individual educational plans should be considered when this component of the EPSEN Act is commenced as a means of increasing a successful transition and ensure the appropriate technology is in situ.

## 11.8 Training and Information

The connected issues of knowledge and training recurred throughout the study's various investigations. The need for access to information, training and support in AT use emerged from the parents of AT users, the school survey and the professional focus groups in all aspects of the AT implementation process, including its identification, assessment and use.

The teacher survey and the focus groups each identified the lack of up-to-date and robust evidence about the effectiveness of AT as a major challenge in identifying, commissioning and deploying appropriate AT. There was a general consensus among parents, school staff and professionals that lack of access to information was a limiting factor in deciding on the most appropriate AT. This finding was supported by educator surveys reviewed as part of the literature review.

The need for technical training in the field of AT for teachers and support personnel emerged as a strong theme in the teacher survey and focus groups. Respondents indicated they currently received no training in AT application nor had they adequate resources to effectively assess, implement, and follow-up on its use in the classroom.

In addition, a need was expressed for a centre for access to information and knowledge to be created whereby actors could obtain advice on AT.

Considerations for policy and practice relevant to training and support were identified:

- **Reviewing current training from the perspective of both ICT for education and AT:** Teaching Council is engaging in a consultation process on professional learning and could include professional development in ICT and AT within its remit. The proposed AT working group could also address this issue;
- **Establishing a central AT information resource for evidence supported practice:** A properly curated central information resource to ensure access to up-to-date information on evidence supported AT practices for parents, teachers, assessment professionals and potential users would add significant value to the system;
- **Facilitating access to national and international AT expertise:** A properly supported online information resource acting as a portal to useful national and international websites should be part of the information resource. Its functionality should support networking between professionals, AT experts, experienced and novice teachers and the collection of evidence of effectiveness from users and teachers. Access to one-to-one advice and guidance from people with experience and expertise in the field of AT should be available online;
- **Enhancing AT coverage in initial and continuing professional development:** Resources need to be invested in professional development to maximise the opportunities that AT can provide for all concerned. Extensive teacher training in ICT in education would provide a good baseline for AT use in the classroom. Such training could include an understanding of disability and diversity and the application of ICT and AT within a universally designed learning environment;
- **Making training in the use of specific AT available at school level:** Training in relation to the use of specific AT is essential for school level actors involved in the AT implementation process. It should not be confined to teachers but should also include parents and pupils and be provided on a routine basis. It should also recognise that there is an ongoing need for this training to update skills and knowledge of developments within AT.

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# Appendices

## Appendix 1: Stakeholders and Experts Consulted in the Study

### Dr Marion Palmer, DIADT

### Advisory Group

Gerald Craddock, NDA National Disability Authority

Tom Daly, Special Education Support Service

Janet Fitzpatrick, visiting teacher, Department of Education and Science

Vourneen Gavin Barry, Desmond College, Co. Limerick

Mary Grogan, senior SENO, National Council for Special Education

Caitríona Hanevy, Department of Education and Science

Ann Jackson, Central Remedial Clinic School, Dublin 3

Rory Mc Gann, Mary Immaculate College, Limerick

Joan McNamara, visiting teacher, Department of Education and Science

Fidelma Morris, St Laserian's Special School, Carlow

Terry Reynolds, special education, Department of Education and Science

Clare Farrell, National Council for Special Education (Chair)

### International Panel

Desleigh De Jong, Australia

Gert Jan Gelderblom, The Netherlands

Marcia Scherer, North America

Renzo Andrich, Italy

Magnus Magnusson, Sweden

Rory O'Sullivan, Ireland

## Appendix 2: Approach to the Literature Review

### Search strategy

**Table A2.1: Search terms used and databases and other sources searched**

Search terms	Proquest databank	Additional Journals	Open Sources	Relevant Organisations
<ul style="list-style-type: none"> <li>• Assistive technology</li> <li>• Assistive technology &amp; education</li> <li>• Education (primary &amp; secondary)</li> <li>• Software solutions in education</li> <li>• Assistive technology devices</li> <li>• AT assessment</li> <li>• AT teacher education</li> <li>• Educational technology</li> <li>• Emerging technology</li> <li>• AT &amp; teaching</li> <li>• AT elementary education</li> <li>• AT curriculum development</li> <li>• Computer technology</li> <li>• Special schools</li> <li>• Rehabilitation</li> <li>• IEPs</li> <li>• Hearing impairment(s)</li> <li>• Teaching methods</li> <li>• AT teacher attitudes</li> <li>• Physical impairment(s)</li> <li>• Intellectual impairment(s)</li> <li>• Accessible instructional materials</li> <li>• Physical disability(ies)</li> <li>• Learning disability(ies)</li> <li>• Special needs student</li> <li>• Autism</li> <li>• Visual impairment(s)</li> <li>• Developmental disability(ies)</li> <li>• Teacher attitudes</li> <li>• Technology applications</li> </ul>	<ul style="list-style-type: none"> <li>• ABI/INFORM® Professional Advanced</li> <li>• Australian Education Index</li> <li>• British Education Index</li> <li>• Embase®</li> <li>• Embase® Alert</li> <li>• Gale Group Computer Database™</li> <li>• Inspec®</li> <li>• MEDLINE®</li> <li>• PASCAL</li> <li>• PsycINFO</li> <li>• Social SciSearch®</li> <li>• Wilson’s Education</li> <li>• Dissertations Abstracts</li> <li>• ERIC</li> </ul>	<ul style="list-style-type: none"> <li>• Assistive Technology (RESNA)</li> <li>• Journal of Assistive Technology</li> <li>• Journal of Technology in Special Education</li> <li>• Disability &amp; Rehabilitation</li> <li>• Disability &amp; Rehabilitation: Assistive technology</li> <li>• Disability and Technology (AAATE)</li> </ul>	<ul style="list-style-type: none"> <li>• Abledata</li> <li>• ATOMS</li> <li>• EASTIN</li> <li>• AssistIreland for devices</li> <li>• ATis4all</li> <li>• Campbell Library</li> <li>• Cochrane Library</li> <li>• Google scholar</li> <li>• Inclusive Education UNESCO</li> <li>• Taylor &amp; Francis Science &amp; Humanities</li> <li>• Informa Healthcare (IRL)</li> <li>• Wiley Online Library</li> <li>• Science Direct</li> <li>• EBSCO</li> <li>• Sage Publications</li> <li>• SpringerLink</li> </ul>	<ul style="list-style-type: none"> <li>• Department of Education</li> <li>• Special Education Support Service</li> <li>• National Disability Authority database resources</li> <li>• National Council Special Education resources</li> <li>• AHEAD</li> <li>• PDST Technology in Education</li> <li>• DeafHear</li> <li>• National Council for the Blind in Ireland</li> <li>• Dyslexia Association Of Ireland</li> <li>• INTO Resources</li> </ul>

The search terms in column 1 were combined by means of three Boolean logic operators 'And, Or, Not' to reduce the number of non-relevant results. Appropriate protocols were also employed, depending on the databases listed in column 2, e.g. Dialog Classic protocols (Proquest). Wildcard truncation was used to expand searches and alternative spellings and abbreviations were applied to the 110 journals identified in the search. The specialist journals specified in column 3 were individually electronically scanned. The open source resources listed in column 4 were also explored.

In addition, some relevant Irish journals, e.g. Reach, that do not appear in electronic databases were hand searched; publications from Government Departments, non-governmental and educational organisations sourced using Google search protocols and expert recommendations; further searches were carried out on websites, of suppliers and manufacturers and a range of additional sources of relevance including the Assistive Technology Industry Association (ATIA), British Educational Training and Technology (BETT), Council for Exception Children (CEC); California State University, Northridge (CSUN); Closing the Gap (CTG) and International Society for Technology in Education (ISTE).

Inclusion criteria applied to the selection process are presented below. Initially the search focused on meta-analyses, reviews, intervention studies and surveys, both quantitative and qualitative. During the abstract review, however, various relevant commentaries based on previous research or by acknowledged experts in the field were identified that did not meet the initial inclusion criteria in terms of type of study.

- Initial typology of studies:
  - Meta-analysis
  - Systematic review
  - Literature review
  - Comparison group non randomised
  - Longitudinal
  - Single subject designs
  - Non-experimental case studies
  - Qualitative and observation studies
  - Surveys.
- Additional articles included:
  - Commentary
  - Descriptive.

- Types of participants:
  - Age – children in primary or second-level education
  - Functional needs:
    - special educational needs
    - disability
    - intellectual impairment
    - physical impairment
    - visual impairment
    - hearing impairment
    - specific learning disability
    - autism spectrum disorder
    - speech and language
    - cognitive impairment
    - emotional behavioural problems
    - multiple disability.
- Types of interventions:
  - Type of AT:
    - assistive technology
    - visual aids
    - auditory aids
    - augmentative and assistive communications
    - software
    - devices, switches, alternative input devices
    - laptops and computers
    - ebooks
    - virtual reality
    - computer assisted instruction
    - Universal Design for Learning
  - Training/support interventions.

- Types of outcomes – studies had to include data or content on outcomes with centrality to education:
  - Curriculum access
  - Learning engagement
  - Educational experiences
  - Academic achievement and subjective wellbeing.
- Time period – published 2000-13.
- English language.

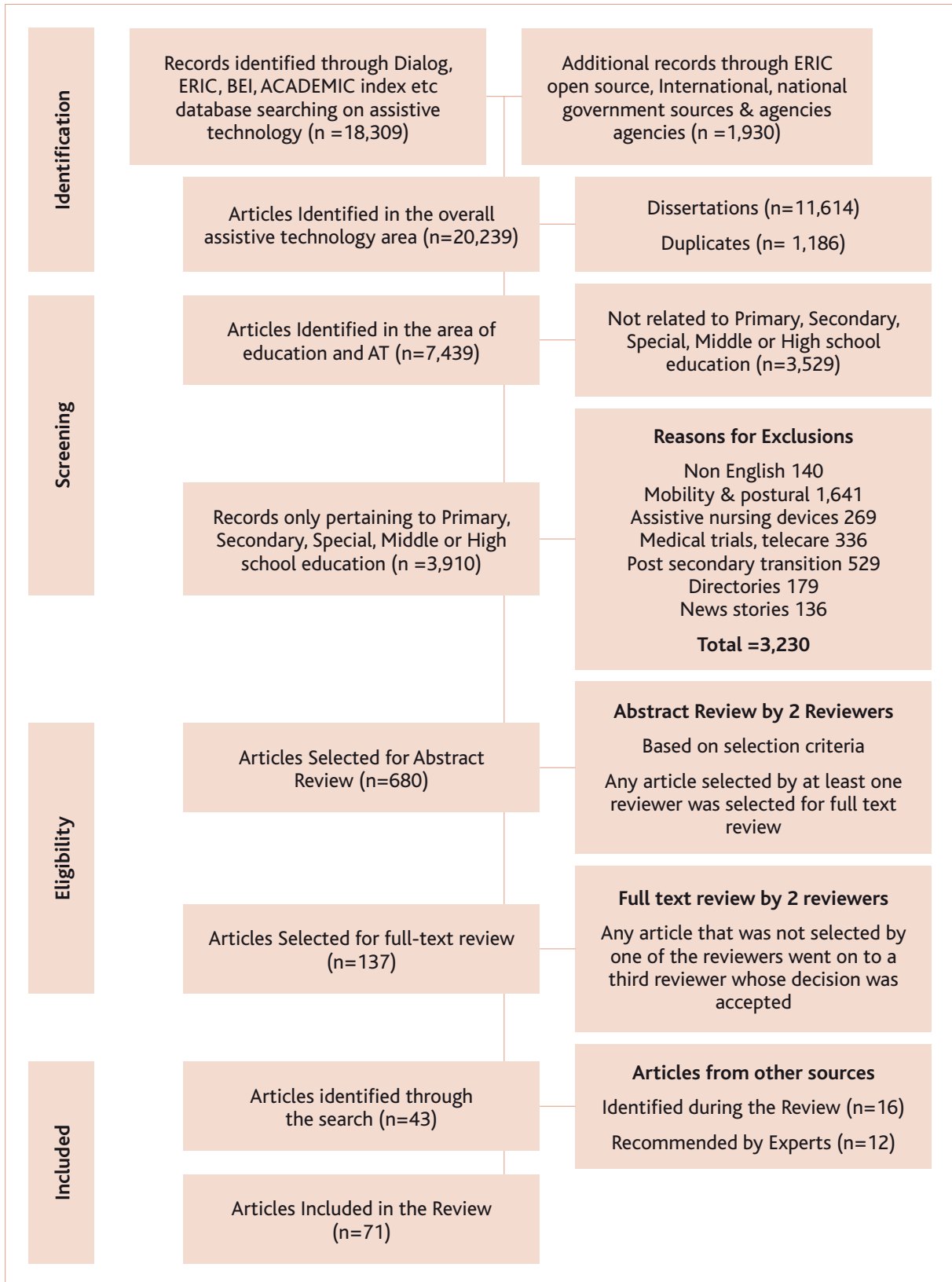
Figure 1.1 outlines the search process and the stages involved. In addition, it outlines the articles identified, reasons for exclusion and number of articles selected at each stage of the search. Of the 20,239 records identified through the initial database and broader searches, 11,514 were dissertations and 1,186 were duplicates. In all, 7,439 unique records relating to AT in education were identified. When records that did not relate to primary, secondary, special, middle or high school education were excluded, 3,910 records remained. These were screened for relevance in terms of interventions, participants and outcomes. This screening further reduced the number of articles for abstract review to 610.

Each of the 680 abstracts was reviewed by two reviewers on the basis of relevance and quality in terms of:

- Relevance of the characteristics of study participants;
- Relevance to an educational or learning context;
- Relevance of the type of AT evaluated;
- Relevance of the outcome measures used;
- Relevance of the conclusions or recommendations.

The abstract reviewers were provided with a set of evaluation criteria and a response template that allowed them to feed back the reasons for their decision to include or exclude an abstract.

**Figure 1.1: Overview of the literature search and selection process**



The reviewers rated each abstract in terms of whether it should be definitely included, potentially included or definitely excluded. Only articles rejected by both reviewers were excluded and any abstract recommended for inclusion by at least one reviewer was brought forward for a full text review.

On this basis, the full texts of 137 articles were selected to be read by two reviewers. Where the reviewers differed in their choices for inclusion, a third reviewer was available to make a final decision. In practice the two reviewers were able to reach consensus on the final selection without referring to a third reviewer.

The number of articles selected for inclusion in the review was 43. In addition, a further 16 articles were identified during the review of the 43 articles. Finally, the literature review was distributed to a number of external readers for comments and these recommended the inclusion of a further 12 articles. As a result 71 articles were read, summarised and included in the final literature review.

The review revealed a distinct lack of quantitative evidence and effectiveness studies, focusing on successful use of AT in education at primary and secondary level. There was a good deal of qualitative evidence (mostly from small scale studies) and this seemed to characterise publications in the AT field. A clear example of this was the small number of systematic reviews in this area, only one was identified in the Cochrane library. Although 95 were identified in the ProQuest search, 93 were unpublished dissertations.

NCSE AT summary of articles reviewed	
Disabilities Addressed	Number of Articles
Special educational needs	6
Disability	3
Intellectual impairment	5
Physical	12
Visual	8
Hearing	3
Specific learning disability	16
Autism spectrum disorder	10
Speech and language	2
Cognitive	2
Emotional behavioural	1
Multiple disability	3
Types of Methodologies	Number of Articles
Meta-analysis	1
Systematic review	5
Literature review	11
Alternating conditions	6
Multiple baseline	1

NCSE AT summary of articles reviewed	
Comparison group	1
Longitudinal	1
Single case studies	5
Case studies	4
At device/programme review	4
Qualitative and observation studies	3
Commentary	4
Descriptive	8
Teacher survey	2
Type of Assistive Technology	Number of Articles
Assistive technology	6
Visual aids	5
Auditory aids	2
Augmentative and assistive communications	8
Software	12
Devices, switches, alternative input devices	7
Laptops and computers	11
Ebooks	2
Virtual reality	3
Computer-assisted instruction	8
Universal Design for Learning	1
Focus of Assistive Technology	Number of Articles
Reading	7
Spelling	13
Writing	13
Maths	4
Social skills	1
Behaviour	1
Mobility	2
Speech	5
Organisation	3
Voice rec	5
Music	1

## Summary of Articles Reviewed

Tables A2.2 and A2.3 summarise article types reviewed on type of disability covered and types of AT that were the subject of the articles. Table A2.4 summarises the main points and findings from each of the reviewed articles.

**Table A2.2: NCSE AT summary of the articles reviewed – disability and type of article**

Authors	Assistive Technology	Disability													Reviews										Interventions									
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey							
Wehmeyer <i>et al</i> (2008)	UD & AT for modulating behaviour																																	
Radic-Sestic <i>et al</i> (2012)	AAC, mobility, computer adaptations																																	
Jutai <i>et al</i> (2009)	Visual aids																																	
Maor <i>et al</i> (2011)	AT reading, spelling and speech																																	
Alper & Raharirina (2006)	AT																																	
Lidström & Hemmingsson (2012)	AT text; speech; access or instruction																																	
Seale (2014)	AT																																	
Courtad & Bouck (2013)	AT literacy and maths																																	
Marttila (2004)	Soundfield Systems																																	
Parsons & Cobb (2011)	Virtual reality (VR)																																	
Bouck & Flanagan (2009)	AT maths																																	

Authors	Assistive Technology	Disability													Interventions													
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey	
Ploog <i>et al</i> (2013)	VR, CAI																											
Alquraini & Gut, D. (2012)	AAC, switches, touch screens, alt keyboards																											
Douglas <i>et al</i> (2011)	Visual aids																											
Peterson-Karlan (2011)	AT writing																											
Campbell <i>et al</i> (2006)	Switches, computers, mobility, AAC																											
Forgrave (2002)	Speech synth. organisational, voice recognition																											
Scherer (2005)	AT Assessment																											
Abbot <i>et al</i> (2014)	AT																											
Johnston, & Evans (2005)	AT																											
McKnight & Davies (2013)	AT																											
Lenker <i>et al</i> (2005)	AT																											
Smith & Kelly (2014)	AT																											
Schmitt <i>et al</i> (2011)	Listening While Reading																											

Authors	Assistive Technology	Disability												Reviews			Interventions												
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey		
Miranda <i>et al</i> (2006)	Word prediction and processor																												
Drager & Light (2010)	AAC																												
Whalen <i>et al</i> (2010)	CAI																												
Liu <i>et al</i> (2006)	Tablets, wireless network																												
Tumlin Garrett <i>et al</i> (2011)	Word recognition, Word processor																												
Floyd & Judge (2012)	Portable text reader																												
Higgins & Raskind (2004)	Speech recog. PPT, recorded Speech																												
Noble (2014)	Mathematics eText																												
Kelly (2011)	Visual aids																												
Craddock (2006)	AT, characteristics of AT Users, AT use																												
Gillette (2006)	Headphones, Talking Word Proc. OCR scan																												
Mezei & Wolff Heller (2009)	Word prediction and processing																												

Authors	Assistive Technology	Disability												Reviews			Interventions											
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey	
O'Malley <i>et al</i> (2013)	Tablets																											
Eymenova <i>et al</i> (2010)	Word prediction																											
Flores <i>et al</i> (2014)	iPad																											
Specht <i>et al</i> (2007)	AT																											
Zapf & Craddock (2012)	AT, AT in education																											
Fan (2012)	iPad																											
Ford & Rabe (2011)	iPod Touch																											
Campigotto <i>et al</i> (2012)	iPhone and iPod Touch																											
Howard & Park (2014)	Tablets and robotics																											
Peterson-Karlan <i>et al</i> (2008)	Word processor, spell checkers, word prediction, speech recognition, text to speech																											
Hong (2012)	Braille Notetaker, Smartphone refreshable Braille																											

Authors	Assistive Technology	Disability												Reviews			Interventions												
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey		
Marino <i>et al</i> (2011)	Software																												
Edwards Santoro & Bishop (2010)	Instructional AT for reading																												
Murchland & Parkyn (2010)	Access and Instructional AT																												
Seymour (2005)	AT																												
Kamei-Hannan (2008)	Accessibility of computerized adapted tests																												
Shamir & Margalit (2011)	Digital books and VR																												
Peterson-Karlan & Parette (2007)	AT																												
Reichle (2011)	AAC																												
Edyburn (2006)	Instructional AT																												
Craddock & Scherer (2002)	AT Assessment																												
Scherer <i>et al</i> (2011)	AT, AT Assessment																												
Craddock <i>et al</i> (2005)	AT, AT in education																												

Authors	Assistive Technology	Disability												Reviews			Interventions											
		SEN	Disability	ID	Physical	Visual	Hearing	SLD	ASD	Speech and lang.	Cognitive	Emotional	Multiple	Meta-analysis	Systematic Rev	Literature rev	Alternate cond	Multi Bbseline	Comparison g.	Longitudinal	Single cases	Case study	AT review	Qualitative	Commentary	Descriptive	Educator survey	
Borg, Larsson, & Östergren (2011)	AT																											
Lenker & Paquet (2004)	AT																											
Barbetta & Spears-Bunton (2007)	Instructional AT for writing																											
McMahon & Walker (2014)	Mobile Devices																											
Skouge, Rao, Boisvert (2007)	Audio and video 'books'																											
Andrich & Bestio(2002)	Criteria for Selecting AT																											
Watson & Johnston (2007)	AT writing and reading																											
Barone & Wright (2008)	AT reading and spelling																											
Horn & Kang, (2012)	Switches, listening devices, AAC, mobility																											
VanWeelden (2011)	AT and music																											
Hess et al (2007)	AT																											



**Table A2.3: NCSE AT summary of the articles reviewed – type and focus of assistive technology**

Authors	Types of Assistive Technology											Focus of Technology											
	AT	Visual	Auditory	AAC	Software	Devices	Laptops/computers	eBooks	Virtual reality	CAI	UDL	Reading	Spelling	Writing	Maths	Social skills	Behaviour	Mobility	Speech	Organisation	Voice rec	Music	
Abbott <i>et al</i> (2014)																							
Alper & Raharirina (2006)																							
Alquraini & Gut, D. (2012)																							
Andrich & Besio(2002)																							
Barbetta & Spears-Bunton (2007)																							
Barone & Wright (2008)																							
Borg <i>et al</i> (2011)																							
Bouck & Flanagan (2009)																							
Campbell <i>et al</i> (2006)																							
Campigotto <i>et al</i> (2012)																							
Courtad & Bouck (2013)																							
Craddock & Scherer (2002)																							
Craddock (2006)																							
Douglas <i>et al</i> (2011)																							



Focus of Technology	Music																				
	Voice rec																				
	Organisation																				
	Speech																				
	Mobility																				
	Behaviour																				
	Social skills																				
	Maths																				
	Writing																				
	Spelling																				
	Reading																				
	Types of Assistive Technology	UDL																			
CAI																					
Virtual reality																					
eBooks																					
Laptops/computers																					
Devices																					
Software																					
AAC																					
Auditory																					
Visual																					
AT																					
Authors		Johnston, & Evans (2005)	Jutai <i>et al</i> (2009)	Kamei-Hannan (2008)	Kelly (2011)	Lenker & Paquet (2004)	Lenker <i>et al</i> (2005)	Lidström & Hemmingsson (2012)	Liu <i>et al</i> (2006)	Maor <i>et al</i> (2011)	Marino <i>et al</i> (2011)	Marttila (2004)	McKnight & Davies (2013)	McMahon & Walker (2014)	Mezei & Wolff Heller (2009)	Michaels & McDermott (2003)					



Authors	Types of Assistive Technology											Focus of Technology											
	AT	Visual	Auditory	AAC	Software	Devices	Laptops/computers	eBooks	Virtual reality	CAI	UDL	Reading	Spelling	Writing	Maths	Social skills	Behaviour	Mobility	Speech	Organisation	Voice rec	Music	
Schmitt <i>et al</i> (2011)																							
Seale (2014)																							
Seymour (2005)																							
Shamir & Margalit (2011)																							
Skouge <i>et al</i> (2007)																							
Smith & Kelly (2014)																							
Specht <i>et al</i> (2007)																							
Tumlin Garrett <i>et al</i> (2011)																							
VanWeelden (2011)																							
Watson & Johnston (2007)																							
Wehmeyer <i>et al</i> (2008)																							
Whalen <i>et al</i> (2010)																							
Zapf & Craddock (2012)																							
	<b>21</b>	<b>6</b>	<b>2</b>	<b>10</b>	<b>14</b>	<b>9</b>	<b>13</b>	<b>2</b>	<b>4</b>	<b>8</b>	<b>2</b>	<b>11</b>	<b>15</b>	<b>16</b>	<b>9</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>8</b>	<b>5</b>	<b>7</b>	<b>2</b>	

**Table A 1: NCSE AT summary of the articles reviewed – methodology and findings**

Authors	Methodology	Findings
<p>Abbott, Brown, Evett, &amp; Standen (2014)</p>	<p><b>LITERATURE REVIEW</b></p> <p>A descriptive analysis of much of the extant literature in Europe 2007-11 with reference to North American and Asian research where it supported or differed from European findings under three headings.</p> <ul style="list-style-type: none"> <li>• Technology to train or practise including gaming, internet-based tools, computer assisted instruction, touch interfaces, person digital assistants,</li> <li>• Technology to assist learning including voice output communication aids, assistive and augmentative communication devices tablets, speech recognition, graphic symbol sets, Braille, screen readers, animation, mobile devices, games, robotics, video internet communication and,</li> <li>• Technology to enable learning including virtual environments, sound to image technologies, multimedia applications, alternative input devices and interfaces, interactive whiteboard, All types of functional limitations were included.</li> </ul>	<ul style="list-style-type: none"> <li>• The authors conclude there is a scarcity of longitudinal studies of AT and identified various trends including:</li> <li>• The increasing availability and lower cost,</li> <li>• The rapid evolution and improved reliability of technologies,</li> <li>• The emerging emphasis on user involvement and inclusive or User-centred design,</li> <li>• Increasing interaction and collaboration between people with disabilities and developers,</li> <li>• The growing use of mobile mainstream devices,</li> <li>• The visibility of AT use in mainstream settings,</li> <li>• The focus on alternative interface technologies.</li> </ul>
<p>Alper &amp; Raharimirina (2006)</p>	<p><b>SYSTEMATIC REVIEW</b></p> <p>A systematic Review 60 Studies carried out 1988-2003; Ages ranged between five and 21; disabilities include: learning disability and Intellectual Impairment – 59, autism and physical – 9, visual impairment – infrequent</p>	<ul style="list-style-type: none"> <li>• Abandonment arises from the individual and family needs, lack of participation of the user in the choice, complex design, insufficient funding, unreliable technology, lack of technical support, negative attention and stigma.</li> <li>• Success factors include an education programme linked to family goals, AT linked to user's goals, collaborative approach, ongoing communication, ongoing maintenance and updating, timely problem resolution</li> </ul>
<p>Alquraini &amp; Gut, D. (2012)</p>	<p><b>LITERATURE REVIEW</b></p> <p>Review of 72 studies of inclusion in general education for pupils with severe intellectual disabilities between 2000 and 2010. AT was included in the review</p>	<ul style="list-style-type: none"> <li>• Although AT can play a significant role in assisting students with severe disabilities, to be successful in inclusive settings it requires collaboration between classroom and SEN teachers,</li> <li>• No conclusions relating to effectiveness of specific AT devices were reached.</li> </ul>

Authors	Methodology	Findings
<p>Andrich &amp; Besio (2002)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of the findings and deliverables of a two-year EU study (EUSTAT) study, implemented by a partnership involving three research centres and three disability representative organisations, that used the results of a literature review and a survey of over 83 educational activities aimed at people with disabilities to produce, deliver and validate materials for independent learning and a user manual to enhance the competence of AT users to better match their needs to appropriate AT solutions. The materials are available in six European languages.</p>	<ul style="list-style-type: none"> <li>• The importance of addressing the AT user as consumer rather than patient,</li> <li>• Contributing to the AT user's autonomy in planning his or her own life,</li> <li>• Understanding the role of the environments in the disablement process and equally AT as an environmental facilitator,</li> <li>• Viewing knowledge transfer about AT to the end-user as a mechanism for enhancing QOL,</li> <li>• Acknowledging the importance of managing relationships with formal and informal personal assistants and AT to achieve a balance of support,</li> <li>• Using experienced AT users as peer mentors about the challenges and impact,</li> <li>• These issues were synthesised with good practice in learning and education to develop a range of AT education options ranging from 1:1 counselling, through training and education to awareness raising and information</li> </ul>
<p>Barbetta &amp; Spears-Bunton (2007)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of seven technologies to assist in learning to write for students with disabilities and other academically weak pupils. The technologies reviewed were: digitised text, text to speech, word prediction, organisational applications, speech recognition, electronic reference tools and alternative writing devices such as adapted keyboards.</p>	<ul style="list-style-type: none"> <li>• English and SEN educators should collaborate to develop effective instructional methods to assist students with disabilities to develop writing skills and AT can be helpful in this regard.</li> </ul>
<p>Barone &amp; Wright (2008)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of how a Grade 4 teacher applied digital and media technologies in the classroom to support literacy development and specifically laptops, writing software and apps to enable pupils to engage in early literacy activities.</p>	<ul style="list-style-type: none"> <li>• New literacy technology in the general classroom can improve performance even on traditional paper and pencil language achievement tests.</li> </ul>

Authors	Methodology	Findings
<p>Borg, Larsson, &amp; Östergren (2011)</p>	<p><b>COMMENTARY</b></p> <p>A content analysis of the UN Convention on the Rights of Persons with Disabilities (CRPD). The conceptual and content fit between the general principles and specific articles of the CRPD and the domain of AT were explored including the meaning of disability, assistive technology and accessibility. Five dimensions were examined in 25 articles: assistive technology term, action, target group, area of life and actor.</p>	<ul style="list-style-type: none"> <li>The analysis revealed that explicit actions relating to AT were not very 'far reaching'; no single article addresses the full AT process from design and production, availability, affordability, information, training and use; assessment and Follow up were not addressed. The main action focus identified was on availability and use rather than general provision. The rights explicitly linked to AT were freedom of expression and access to information; education; and participation in political and public life.</li> <li>The conclusion reached was that a non-discriminatory approach to interpreting the CRPD was most appropriate and supported the entitlement of people with disabilities to demand available and affordable AT in order to ensure full participation and equal rights and freedoms.</li> </ul>
<p>Bouck &amp; Flanagan (2009)</p>	<p><b>LITERATURE REVIEW</b></p> <p>A review of studies into three approaches to teaching mathematics involving technology: anchored instruction, computer-assisted instruction (CAI) and calculators; 17 articles from 1996-2007 were reviewed</p>	<ul style="list-style-type: none"> <li>Anchored instruction improved problem solving but computation reduced,</li> <li>CAI improved maths facts, basic skills and problem solving,</li> <li>Calculators as an assessment accommodation – mixed results.</li> </ul>
<p>Campbell <i>et al</i> (2006)</p>	<p><b>LITERATURE REVIEW</b></p> <p>A review of 104 articles published in 1980-2004 which addressed AT for young children including reported practices in teaching, switch use, use of computers, mobility and alternative communication. AT was considered to have two components: the devices and the services to identify appropriate AT and train users and families to use them (p3). Designs included 1 RCT and 77 group, single-subject and case study on AT practices and 27 empirical studies. Most studies reported positive learning of device use. Only ten articles in 1990-2004 in comparison to an increase of teacher reports.</p>	<ul style="list-style-type: none"> <li>Switch interface device use – relatively strong evidence that children as young as 18 months can learn to use switches,</li> <li>Computer-use evidence inconclusive as a result of poor design and a small number of studies,</li> <li>Power mobility only a few studies but participants did acquire the competence to use powered mobility devices,</li> <li>Augmentative and alternative communication devices training in the device generalised to peer-to-peer communication.</li> </ul>

Authors	Methodology	Findings
<p>Campigotto, McEwen &amp; Demmans Epp (2012)</p>	<p><b>INTERVENTION STUDY</b>                      Action research study was carried out over five months with data collection within two SEN classrooms Grades 7 and 12 involving 25 learners aged 12-21 using mobile devices to modulate attention and motivation and explore factors that contribute to effective technology integration within standard curricula.</p>	<ul style="list-style-type: none"> <li>• Flexibility of mobile devices was evident.</li> <li>• Self-confidence and perceptions of success.</li> <li>• Challenges included:                             <ul style="list-style-type: none"> <li>• issues of practicality</li> <li>• teacher comfort with, and resistance to, technology</li> <li>• the limitations of the device and difficulty in integrating app into curriculum</li> </ul> </li> <li>• MyVoice restrictions (requirement for website set up) location mode, speech too rapid and not used to potential</li> </ul>
<p>Courtad &amp; Bouck (2013)</p>	<p><b>LITERATURE REVIEW</b>                      Review of selected experimental studies, reviews and meta-analyses focusing on people with specific learning disabilities</p>	<ul style="list-style-type: none"> <li>• Importance of UDL – a concept that focuses on multiple means of presentation, multiple means of engagement, and multiple means of expression,</li> <li>• An environmental and larger contextual solution rather than an individual solution.</li> </ul>
<p>Craddock (2006)</p>	<p><b>COMMENTARY</b>                      This study investigated quantitatively and qualitatively the impact of assistive technology on quality of life, self-esteem and satisfaction of use among students with disabilities. A mixed methods approach was used to gather data from 45 students with disabilities in their final year of second level education.</p>	<ul style="list-style-type: none"> <li>• Clear groupings emerged signifying key characteristics which defined novice to power users of AT in education. The study validated the Irish Matching Person with Technology (IMPT),</li> <li>• The impact of the students' experiences and skills developed at second-level education had a major impact on their participation, use of technology, and general satisfaction at post second-level education,</li> <li>• Key outcomes were:                             <ul style="list-style-type: none"> <li>• validation of IMPT</li> <li>• impact of when AT was provided</li> <li>• impact on type of AT used</li> <li>• psychosocial/personal factors critical on use or non-use of AT</li> <li>• impact on the type of school attended</li> <li>• strategies/supports used to access the curriculum</li> </ul> </li> </ul>

Authors	Methodology	Findings
<p>Douglas <i>et al</i> (2011)</p>	<p><b>LITERATURE REVIEW</b> Literature review of studies addressing the facilitation of print access for learners with visual impairments</p>	<ul style="list-style-type: none"> <li>• Distinction between 'educational technology' and 'access technology' (often called 'enabling' or 'assistive' technology),</li> <li>• Little comparative research on one approach vs another,</li> <li>• Low vision aids (LVAs) meant users could have independent access to standard print without having to rely on other people to prepare material for them,</li> <li>• LVAs increased silent reading speeds and comprehension rates,</li> <li>• Reading standard print with optical devices was as effective a literacy medium as large print,</li> <li>• Magnifying technology is generally more effective than hardcopy enlarged print for accessing print,</li> <li>• Peer pressure from other pupils was a major reason cited by children with visual impairment for not using an LVA. LVAs made them feel 'different',</li> <li>• College students emphasised computer, assistive technology and keyboarding skills as important.</li> </ul>
<p>Drager &amp; Light (2010)</p>	<p><b>INTERVENTION STUDY</b> Twenty five-year-olds were presented with 30 items of vocabulary. They were asked to find them using iconic encoding. Four sessions were implemented for training followed by ten using iconic prediction and ten without.</p>	<ul style="list-style-type: none"> <li>• The iconic prediction group did not perform significantly better but some generalisation to other items was evident.</li> <li>• A previous study identified difficulties in learning how to use AAC (Light <i>et al</i>, 2004).</li> </ul>
<p>Edwards Santoro &amp; Bishop (2010)</p>	<p><b>INTERVENTION STUDY</b> Evaluation of 39 programmes (21 in detail) intended to assist in early reading development by an instructional technology and a special education expert. A scale reflecting four dimensions was used: interface design, instructional design, phonological awareness and alphabetic understanding.</p>	<ul style="list-style-type: none"> <li>• The quality of instructional software for beginning reading instruction requires a substantial amount of further investigation,</li> <li>• Many programmes did not meet research-based criteria for interface, instructional design and beginning reading content required for at-risk learners,</li> <li>• Performance was not related to price,</li> <li>• Only one addressed phonological awareness and alphabetic understanding.</li> </ul>

Authors	Methodology	Findings
Edyburn (2006)	<p><b>COMMENTARY</b></p> <p>Explanation of Time Series Current Differential (TSCD) designs to collect evidence using an example of a classroom-based research project using web resources to assist students with disabilities to learn about current affairs.</p>	<ul style="list-style-type: none"> <li>• Time Series Current Differential (TSCD) model described by Smith (2000) is useful in demonstrating effects,</li> <li>• Performance outcome data to be measured with and without technology over time.</li> </ul>
Evmenova <i>et al</i> (2010)	<p><b>INTERVENTION STUDY</b></p> <p>An alternating conditions design was used to evaluate the impact of three-word prediction programmes on students' journal writing as compared to word processing. The project was implemented in a technology summer camp with six subjects, all male from Grades 6-9.</p>	<ul style="list-style-type: none"> <li>• Regardless of programme type word prediction increased the proportion of words spelled correctly for all the participants,</li> <li>• Other less conclusive results included: increases in total number of words and composition rate (which was still slower than handwriting).</li> </ul>
Fan (2012)	<p><b>INTERVENTION STUDY</b></p> <p>Teacher action research was used to explore four case studies in using iPads with pupils with ASD, males aged nine to 11 years Grades 4-5</p>	<ul style="list-style-type: none"> <li>• All participants began learning more independently after the iPad was introduced,</li> <li>• Their performance in communicating and in recognition and identification of letters became apparent,</li> <li>• There were iPad access issues for people with fine or gross motor coordination challenges</li> </ul>
Flores <i>et al</i> (2014)	<p><b>INTERVENTION STUDY</b></p> <p>A single subject design (AB) was used to explore use of the iPad2 as an assistive technology device to deliver literacy-based behavioural interventions and social stories to seven students ages three to 11 with ASD enrolled in an extended school year programme across four classrooms. Social stories presented cues and appropriate responses in specific situations from the perspective of the person with ASD to assist in handling anxiety, aggression or obsession and to prepare new routines, skills or behaviours.</p>	<ul style="list-style-type: none"> <li>• iPad2 capitalised on visual strengths to foster communication and independence and to teach social skills,</li> <li>• Desirable changes were observed student behaviour in all classrooms,</li> <li>• Teachers were motivated to apply technology supported interventions in their classrooms for pupils with disabilities.</li> </ul>

Authors	Methodology	Findings
<p>Floyd &amp; Judge (2012)</p>	<p><b>INTERVENTION STUDY</b>                      A multiple baseline design across participants was used to examine the effects of Classmate Reader (a portable ebook text-to-speech reader) on reading comprehension of six students with specific learning disabilities in a SEN programme, aged 19 to 22, of 15 standard reading passages (400 words).</p>	<ul style="list-style-type: none"> <li>• All participants performed better; there was moderate impact for four readers,</li> <li>• Mixed benefits for: size and portability; time required to read; proofing, seeing and hearing.</li> </ul>
<p>Ford &amp; Rabe (2011)</p>	<p><b>INTERVENTION STUDY</b>                      A parent and teacher collaborated in using an iPod Touch to support a male aged 20 with an intellectual disability to self-regulate and time manage, to keep in touch socially and make decisions.</p>	<ul style="list-style-type: none"> <li>• AT proved effective in routine situations,</li> <li>• Issues with the volume level of the communication device,</li> <li>• When things changed, it was difficult to revise the reminders,</li> <li>• A substantial effort was required to update and ensure accurate schedules and alarms and to maintain back-ups.</li> </ul>
<p>Forgrave (2002)</p>	<p><b>LITERATURE REVIEW</b>                      Review of selected experimental studies and meta-analyses in three technology applications for literacy education: speech synthesis (text to speech), organisational software and voice recognition.</p>	<ul style="list-style-type: none"> <li>• Expert support must be available,</li> <li>• Careful planning was required,</li> <li>• Use and exposure to AT did not in itself improve literacy but must be part of an overall IEP,</li> <li>• Speech synthesis allowed readers to correct mistakes thereby reducing frustration and supporting better comprehension,</li> <li>• Speech synthesis could also improve decoding and word recognition skills,</li> <li>• Concept mapping significantly improved quality of writing, summarising text information, assessment scores in academic subjects,</li> <li>• Voice recognition was faster than handwriting in writing essays,</li> </ul>

Authors	Methodology	Findings
<p>Gillette (2006)</p>	<p><b>INTERVENTION STUDY</b></p> <p>A single case study (ABAB) illustrating a collaborative approach to effective assessment for AT for literacy development. A Grade 7 male with SLD and limited keyboard skills was the participant. A multidisciplinary team used SETT (student; environment; tasks and tools) to profile the learner. A one-month trial was implemented.</p>	<ul style="list-style-type: none"> <li>• Length of composition increased by 50 per cent,</li> <li>• Time per paragraph reduced by 50 per cent,</li> <li>• Spelling errors reduced by 66 per cent,</li> <li>• More pages were read,</li> <li>• Word recognition and comprehension scores improved from 65 per cent to 85 per cent,</li> <li>• Assignments were easier to grade.</li> </ul>
<p>Hess <i>et al</i> (2007)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A web-based survey of representative sample of 185 teachers reporting on 226 children with ASD from pre-school to G12 in Georgia, US (the Autism Treatment Survey) to identify educational strategies used.</p>	<ul style="list-style-type: none"> <li>• AT was rated as 'promising practice' for ASD (Simpson <i>et al</i>, 2005),</li> <li>• 22.12 per cent of teachers reported use assistive technology strategies, in both special mainstream elementary classrooms,</li> <li>• Identified need for pre-service and continuing teacher education.</li> </ul>
<p>Higgins &amp; Raskind (2004)</p>	<p><b>INTERVENTION STUDY</b></p> <p>Study to assess the effectiveness of a speech-recognition SR and a computer- and text-based automaticity programme. Twenty-eight participants aged eight to 18 over 17 weeks with a comparison group of 16. Nine classes were involved: three at elementary, three at middle and three at secondary. One class at each level was selected as the contrast at the mid-point in terms reading and spelling attainment.</p>	<ul style="list-style-type: none"> <li>• Improvements in word recognition and reading comprehensions for experimental group but not spelling,</li> <li>• Other effects included process and reading efficiency,</li> <li>• Speech recognition can be effective but is not suitable for all learners,</li> <li>• It is also difficult to use in a classroom setting,</li> <li>• Significant training to proficiency is required.</li> </ul>
<p>Hong (2012)</p>	<p><b>INTERVENTION STUDY</b></p> <p>Comparison of functionality, portability and cost of Braille Note-takers and a combination of iPhone, speech to text apps and refreshable Braille display.</p>	<ul style="list-style-type: none"> <li>• Both Braille note takers and Smartphone can deal with email, webpages, schedules and calendars, produce documents, carry out mathematical calculations and be used for foreign language learning,</li> <li>• But the dedicated Braille device cost \$5000-6000 and cannot process PDF, Flash Player etc,</li> <li>• Need to memorise chord commands (device specific).</li> </ul>

Authors	Methodology	Findings
Horn & Kang (2012)	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of current knowledge and issues to be resolved in three areas of recommended practice to address the medical, physical, educational and socio-emotional interaction needs of young children with multiple disabilities including collaborative practice, meaningful and individual curriculum and AT as an instructional strategy.</p>	<ul style="list-style-type: none"> <li>• A collaborative approach between professionals and families,</li> <li>• AT, which includes a device and instruction on use, can enhance engagement with the environment and the achievement of developmental milestones,</li> <li>• A device in the absence of training and support is insufficient,</li> <li>• Independent use should be the aspiration.</li> </ul>
Howard & Park (2014)	<p><b>INTERVENTION STUDY</b></p> <p>Nine children aged eight to 14, with a variety of conditions including CP, spina bifida, spinal muscular atrophy, TBI, and autism participated in a series of sessions using a wireless controller called TabAccess™, an alternative interface for children who have difficulty with touch screen interaction, in combination with switch access robot interaction apps to interact with Lego Mindstorms, the Scribbler robot, and the Romibo robots. The impact on attitudes to working with computers and robotics as adults was assessed.</p>	<ul style="list-style-type: none"> <li>• The impact of the accessible interface on attitudes was positive and the dissemination of the approach and of accessible robotic kits for children with disabilities was in process.</li> </ul>
Johnston & Evans (2005)	<p><b>LITERATURE REVIEW</b></p> <p>A review of articles to extract evidence supporting the view that matching theory based on the concept of response efficiency (operationalised as rate of reinforcement, quality of reinforcement, response effort and immediacy of reinforcement) can be applied to reduce abandonment and increase contextual fit i.e. congruence between an intervention, the person and the physical and social environment.</p>	<ul style="list-style-type: none"> <li>• The authors presented an illustration of the application of matching theory and proposed that empirical studies were required to assess its relevance to AT assessment and use.</li> </ul>

Authors	Methodology	Findings
<p>Jutai, Graham Strong &amp; Russell-Minda (2009)</p>	<p><b>SYSTEMATIC REVIEW</b> Data from 108 studies on visualAT were reviewed (24 RCTs &amp; 84 non-random). The article discussed four randomised controlled trials and six non-randomised studies.</p>	<ul style="list-style-type: none"> <li>• Often, success with an assistive device is determined by how well the device performs and how satisfied the user is with it (Jutai, Fuhrer, Scherer, &amp; De-Ruyter 2005),</li> <li>• CCTV was preferred over standard optical devices but these devices were preferred for portability and cost,</li> <li>• Proper lighting was also required,</li> <li>• Account should be taken of colour vision or contrast sensitivity.</li> </ul>
<p>Kamei-Hannan (2008)</p>	<p><b>INTERVENTION STUDY</b> A qualitative study carried out in Arizona School for the Deaf and Blind in 2005-06 in relation to the Measure of Academic Progress (MAP). It explored the barriers for students using AT and Braille N=49 ages seven to 21 using magnification, Zoom Text V7.0 7 and No magnification. The DV were Magnification Level and Time on Test</p>	<ul style="list-style-type: none"> <li>• Controls and low magnification took substantially less time 40 minutes compared to 2 hours 45 minutes for Refreshable Braille n=29 80-cell PowerBraille 80 and 32-cell Braille-Note Jaws 5.1 braille translation,</li> <li>• Barriers included scroll bars, underlining, formatting, graphical information, pictures, translation errors, decontextualised Braille symbols, line limitations.</li> </ul>
<p>Kelly (2011)</p>	<p><b>INTERVENTION STUDY</b> Secondary analysis was carried out on the of National Longitudinal Transition Study-2 (NLTS2) data. Three time periods in 2000-05 were analysed for high school students using visual aids.</p>	<ul style="list-style-type: none"> <li>• Significant predictors of AT use included:                             <ul style="list-style-type: none"> <li>• a parent being involved</li> <li>• the school which the learner attended</li> <li>• the expectation that the learner would get paid employment</li> </ul> </li> </ul>

Authors	Methodology	Findings
Lenker & Paquet (2004)	<p><b>COMMENTARY</b></p> <p>A user-centred model for predicting AT usage in terms of perceptions of relative advantages of AT was proposed.</p>	<ul style="list-style-type: none"> <li>The model characterises AT usage not as a one-time, all or nothing decision but as a process that recurs over time. An important factor in determining use is the influence of interventions operating at the same time in parallel or instead of AT. The quality of usage has a direct effect on AT impact which in turn influences the extent of future use in a reciprocal relationship.</li> </ul>
Lenker, Scherer, Fuhrer, Jutai & DeRuyter (2005)	<p><b>LITERATURE REVIEW</b></p> <p>A review of 82 intervention studies carried out in 1980-2001 which evaluated the adequacy of the outcome evidence reported.</p>	<ul style="list-style-type: none"> <li>It was concluded that researching AT outcomes needed to overcome various challenges including diversity of AT devices, user characteristics and environments. Major barriers identified included diversity in age, disability and AT, lack of distinctive sub-groups, study specific measures of user perceptions, and insufficient information about reliability and validity and requirements for staff learning. Recommendations were made to improve reporting assistive technology research.</li> </ul>
Lidström & Hemmingsson (2012)	<p><b>SYSTEMATIC REVIEW</b></p> <p>A systematic review of 32 articles (16 intervention studies) participants in more than 50 per cent of the studies had motor impairments. Quantitative design (n = 26) (two with cohort designs); Single-subject design (n = 4); Before-after design (n = 10); Case-study design (descriptive) (n = 5); Cross-sectional design (n=6) and Qualitative design (n=5).</p>	<ul style="list-style-type: none"> <li>Learners benefited from ICT use irrespective of the type of device,</li> <li>AT for writing, spelling, and communication emerged as particularly effective.</li> </ul>
Liu <i>et al</i> (2006)	<p><b>INTERVENTION STUDY</b></p> <p>Eight videotaped sessions using an alternating conditions design to compare interactions between a teacher and seven hard-of-hearing junior high school pupils, the cognitive load and progress in a mathematics classroom during a geometry and polynomials lesson using non WiTech maths instruction and a WiTech classroom configuration using a wireless network, tablets and a shared whiteboard. An error analysis was carried out on 112 worksheets.</p>	<ul style="list-style-type: none"> <li>Scaffolding tools on tablets reduced error rates,</li> <li>WiTech reduced distraction behaviour,</li> <li>Learners valued the WiTech environment.</li> </ul>

Authors	Methodology	Findings
<p>Maor, Currie &amp; Drewry (2011)</p>	<p><b>SYSTEMATIC REVIEW</b> A systematic review of research in 2004-09 into the impact of AT to support literacy. Fifteen studies involved learners with special educational needs between kindergarten and Grade 12 and focused on skill or academic improvement.</p>	<ul style="list-style-type: none"> <li>• General agreement on AT's potential to impact on the educational performance of learners with special educational needs in a range of areas.</li> <li>• What was lacking is empirical research involving control groups, adequate sample sizes and repeated measures pre-post studies.</li> <li>• The majority of studies were equivocal.</li> <li>• It was difficult to identify specific devices that were effective because of, small samples, lack of controls,</li> <li>• Nevertheless, most studies documented positive effects for the AT involved,</li> <li>• No evidence of sustainability,</li> <li>• Additional features to enhance impact include clear readability, speech feedback and multi-functionality.</li> </ul>
<p>Marino, Tsurusaki &amp; Basham (2011)</p>	<p><b>INTERVENTION STUDY</b> Analysis of the features and functions of software packages to support learning in the sciences such as simulation and gaming software for pupils with specific learning disabilities. Six categories of questions designed to assist in selecting useful software are elaborated: 1. interface design, 2. accessibility, 3. content, 4. instruction, 5. critical thinking and 6. assessment</p>	<ul style="list-style-type: none"> <li>• Combining well-designed software and Universal Design for Learning principles can support access to the curriculum and the learning of pupils with specific learning disabilities (Bull and Bell 2008),</li> <li>• A practical guide based on the principle of UDL is presented for science teachers seeking to procure instructional for students with specific learning disabilities.</li> </ul>
<p>Marttila (2004)</p>	<p><b>LITERATURE REVIEW</b> Review of Mainstream Amplification Resource Room Study (MARRS, 2003)</p>	<ul style="list-style-type: none"> <li>• In mainstream classrooms with sound field amplification, learners' achievement scores improved to a statistically significant greater extent than controls in unamplified classrooms. Availability of a professional audiologist is essential.</li> </ul>

Authors	Methodology	Findings
<p>McKnight &amp; Davies (2013)</p>	<p><b>LITERATURE REVIEW</b></p> <p>This review's main goal was to raise awareness of development in AT technologies for people with little experience of AT. This technology was characterised as enabling technologies that allow some form of learning not previously possible (Abbott, 2007). Three domains of classification structured the review: user needs, abilities and goals; the capability of the technology; and the context of use with specific reference to learners with ASD, dyslexia/dyscalculia, ADHD, visual/hearing/mobility impairments and dyspraxia. The main types of technologies reviewed included voice recognition, mobile devices, tangible technology, tabletop and surface technology, symbol-based interaction, virtual reality and augmented reality and robotics.</p>	<ul style="list-style-type: none"> <li>• Research on assistive learning technologies is prevalent but lacks consistency across disciplines and domains,</li> <li>• Longitudinal studies are required that address the context for use, and AT impact on overall education and wellbeing across the lifespan,</li> <li>• Independence, anxiety and self-confidence need to be considered by researchers in addition to accessibility and learning,</li> <li>• Effective solutions require taking into account of learner needs and abilities, the functionality of the technology and the context for use,</li> <li>• More consistent provision across levels of education,</li> <li>• AT support for informal and self-directed independent learning,</li> <li>• Need to deploy existing technologies more widely and find more affordable technologies.</li> </ul>
<p>McMahon &amp; Walker (2014)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>Application of the Universal Design for Learning principles to the use of mobile electronic devices in a classroom; options were illustrated using an example of a girl with specific learning disabilities.</p>	<ul style="list-style-type: none"> <li>• Accessibility to instructional activities and technology can support UDL in the classroom,</li> <li>• Built in iOS and third party apps can offer a range of options including support for perception, language, maths and symbols, comprehension, physical action, expression and communication, executive functions, recruiting interest, sustaining effort and persistence and self-regulation,</li> </ul>
<p>Mezei &amp; Wolff Heller (2009)</p>	<p><b>INTERVENTION STUDY</b></p> <p>An alternating treatment design (ABBABAAB- BAABABBA) was implemented to explore the impact of word prediction software. Four writers with physical disabilities (aged 12-18) participated. The dependent variables were (a) reading comprehension, (b) spelling, (c) word identification, (d) word processing skills and (e) student's typing rate (WCPM).</p>	<ul style="list-style-type: none"> <li>• The study found no gains in speed,</li> <li>• Spelling and keyboard errors were reduced.</li> </ul>

Authors	Methodology	Findings
<p>Michaels &amp; McDermott (2003)</p>	<p><b>EDUCATOR SURVEY</b></p> <p>The perceptions of coordinators or directors of 143 (40 per cent response rate) special education graduate programmes in the US were surveyed about the extent to which current practices in special education teacher preparation addressed AT knowledge skills and disposition in comparison to the ideal. A semi-structured questionnaire using open ended and Likert scale items explored how understanding of AT, using AT and making AT decisions were covered.</p>	<ul style="list-style-type: none"> <li>• There were significant discrepancies between respondent perceptions of current practices with what was considered to be required in all areas surveyed,</li> <li>• Qualitative analysis revealed a number of potential facilitators for more effective practice including increased faculty expertise, more consistent integration of AT in the curricula, providing specific AT courses, procuring AT equipment and collaborating with AT providers,</li> <li>• Barriers to improvement identified related to funding, lack of expertise, limited perceptions of the relevance of AT and the absence of a development strategy for AT.</li> </ul>
<p>Mirenda, Turolido &amp; McAvoy (2006)</p>	<p><b>INTERVENTION STUDY</b></p> <p>The study explored the impact on the quality of writing samples of three conditions: 1. word prediction, 2. word processing and 3. handwriting of 24 experienced word prediction users (16 males and eight females) with physical disabilities and the perceptions of users and their adult supporters. Research materials were posted out to potential participants who returned a student survey, a supporter survey and three writing samples within two weeks.</p>	<ul style="list-style-type: none"> <li>• Over half of learners and supporters believed that the work prediction and word processing condition were helpful,</li> <li>• In comparison to the handwriting condition, the word processing and/or word prediction conditions were associated with a greater proportion of legible words, correctly spelled words, and correct word sequences; and in longer mean lengths of consecutive correct word sequences.</li> </ul>
<p>Murchland &amp; Parkyn (2010)</p>	<p><b>INTERVENTION STUDY</b></p> <p>A thematic analysis of in-depth interviews with five computer-based AT users aged ten to 14 with physical disabilities (muscular dystrophy) attending mainstream school and a significant adult) one females and four males.</p>	<ul style="list-style-type: none"> <li>• Perceptions of respondents included that AT:             <ul style="list-style-type: none"> <li>• saved time</li> <li>• reduced writing load</li> <li>• allowed a learner to keep up with the class</li> <li>• was more useful for subjects with high literacy demands,</li> <li>• eliminated the requirement for physical manipulation of tools and materials</li> <li>• facilitated independent completion of work (without an assistant)</li> <li>• produced higher quality of work</li> </ul> </li> </ul>

Authors	Methodology	Findings
<p>Noble (2014)</p>	<p><b>INTERVENTION STUDY</b></p> <p>Two classroom-based studies compared the maths performance of middle school pupils with learning disabilities using an etext application that could translate mathematical notation to speech (using MathMI) with control classrooms using standard read-aloud accommodations.</p>	<ul style="list-style-type: none"> <li>• The LD students in the intervention classroom consistently outperformed controls in the short term and over the year and outpaced the Grade 7 average in terms of progress,</li> <li>• Practical implementation barriers included difficulties with equipment and wireless access,</li> <li>• Dissemination challenges relate to the availability of expertise for schools, the availability of compatible maths text books and upskilling teacher to produce eText themselves.</li> </ul>
<p>O'Malley, Lewis &amp; Donehower (2013)</p>	<p><b>INTERVENTION STUDY</b></p> <p>An ABAB design was used to explore the effectiveness of iPads to increase independence in completing tasks and maths skills for seven learners with ASD, two females and five males aged ten to 13. The alternating conditions were traditional instruction vs iPad instruction for four to five sessions over four weeks.</p>	<p>The experimental condition (iPads):</p> <ul style="list-style-type: none"> <li>• Required less teacher support,</li> <li>• Was more flexible,</li> <li>• Reduced class non-compliance,</li> <li>• Was rated highly by teachers,</li> <li>• Promoted progress towards enhanced learning skills,</li> <li>• Mixed results for maths skills and non-compliant behaviour,</li> <li>• Moderate effect for independent completion,</li> </ul> <p>Challenges identified included:</p> <ul style="list-style-type: none"> <li>• Availability of technology support,</li> <li>• Dependence on teacher knowledge and experience,</li> <li>• Students regarded technology as an entertainment device</li> <li>• Logistical issues.</li> </ul>

Authors	Methodology	Findings
<p>Okolo &amp; Diedrich (2014)</p>	<p><b>EDUCATOR SURVEY</b></p> <p>An online survey of 1,143 Michigan educators consisting of 58 questions administered in 2011 exploring the level of knowledge of AT, the frequency with which AT was used, how AT decisions were made and who was involved, the perceived educational impact of AT, the barriers to greater availability and strategies that could increase the utilisation of AT in education.</p>	<ul style="list-style-type: none"> <li>• Educators' perceptions of AT were positive,</li> <li>• While they viewed their knowledge of technology in general as adequate, they were less positive about specific AT use and functions,</li> <li>• Ratings of technology support received were moderate for special educators and low for general educators,</li> <li>• The majority of respondents expressed a desire for further professional development and attributed this and insufficient funding as major barriers to AT use,</li> <li>• Respondents reported insufficient understanding of the ways in which students used their AT,</li> <li>• Participation in AT decisions by class teachers, parents and learners was considered rare,</li> <li>• The main barriers to use raised were:             <ul style="list-style-type: none"> <li>• staff knowledge</li> <li>• access to adequate technology</li> <li>• availability of funding</li> <li>• Implementation issues</li> </ul> </li> <li>• The main impacts were considered to be:             <ul style="list-style-type: none"> <li>• improved access to the curriculum</li> <li>• Improved academic achievements</li> </ul> </li> <li>• Outcomes reported included:             <ul style="list-style-type: none"> <li>• better instruction</li> <li>• enhanced functional outcomes</li> </ul> </li> </ul>

Authors	Methodology	Findings
Parsons & Cobb (2011)	<p><b>LITERATURE REVIEW</b></p> <p>Review of research in 2001-11 research into virtual reality and ASD.</p>	<ul style="list-style-type: none"> <li>• Children with ASD understand VR and like to use it but no clear evidence of generalisability,</li> <li>• Inconsistent evidence of generalisation,</li> <li>• May work better for procedural learning.</li> </ul>
Peterson-Karlan & Parette (2007)	<p><b>COMMENTARY</b></p> <p>Review of the implications of the policy requiring evidence-based practice on AT research practice. A range of alternatives to RCT designs were explored and useful web resources on technology and research-based practice are described.</p>	<ul style="list-style-type: none"> <li>• No single definitive specification of what constitutes acceptable evidence,</li> <li>• AT research is inherently complex (randomisation and stratification almost impossible); variability of participants (type and severity); educational contexts low prevalence,</li> <li>• Continuum of research approaches is required:             <ul style="list-style-type: none"> <li>• preliminary ideas</li> <li>• hypotheses</li> <li>• observations or descriptions</li> <li>• classroom based demonstrations</li> <li>• single-cases and small groups</li> <li>• time series (pre-post)</li> <li>• matched pairs</li> <li>• random assignment</li> </ul> </li> </ul>
Peterson-Karlan (2011)	<p><b>LITERATURE REVIEW</b></p> <p>A descriptive review of 25 years research (85 studies) into technology support for writing (four process areas: 1. planning, 2. transcription, 3. editing, and 4. revising) for pupils with learning and academic disabilities in 1994-2010. Experimental studies (N= 18); Quasi-experimental (N=12); Single subject (N=13); Case studies (N=17).</p>	<ul style="list-style-type: none"> <li>• Research has not kept pace with the proliferation of ICT-based writing support tools over the last decade,</li> <li>• Apart from transcription there were insufficient well-designed studies to come to conclusions about the effectiveness of AT on the writing process.</li> </ul>

Authors	Methodology	Findings
<p>Peterson-Karlan, Hourcade &amp; Parette (2008)</p>	<p><b>INTERVENTION STUDY</b> Review of devices to assist in writing including word processors, spell checkers, word prediction, speech recognition, text to speech and screen readers. The review was structured in terms of writing processes: language development, planning and organisation, text generation, text transcription, drafting, editing and revising.</p>	<ul style="list-style-type: none"> <li>• Word prediction – scan-and-select requirement may actually decrease text transcription speed,</li> <li>• Need to match AT to developmental requirements of writing</li> </ul>
<p>Ploog <i>et al</i> (2013)</p>	<p><b>LITERATURE REVIEW</b> Review of literature 1992-2012 on the impact of computer-assisted technology (CAT) in the areas of language, emotional recognition, theory of mind, and social skills for pupils with ASD.</p>	<ul style="list-style-type: none"> <li>• Reduced echolalia and increased functional communications:</li> <li>• Facial recognition of emotions.</li> <li>• Mind reading – effective but transfer unclear.</li> <li>• Theory of mind: false belief – mixed result.</li> <li>• Social skills video modelling – sustained social and communicative learning.</li> <li>• VR – promising.</li> <li>• Topobo (construction tool) more social play compared to Lego.</li> </ul>
<p>Quinn, Behrmann <i>et al</i> (2009)</p>	<p><b>EDUCATOR SURVEY</b> Data on the AT usage and services received was gathered on 682 students with disabilities aged three to 21 who were registered as being disabled. A survey was completed by school staff indicating AT type being used, location of use, related services being accessed and the type of disability.</p>	<ul style="list-style-type: none"> <li>• Category most frequently associated with AT use was multiple disabilities. Other categories with frequent usage were ASD, intellectual disabilities, orthopaedic impairment and learning disabilities.</li> <li>• Only 30 per cent of students were also receiving AT-related services.</li> </ul>
<p>Radic-Sestic <i>et al</i> (2012)</p>	<p><b>SYSTEMATIC REVIEW</b> Review of the literature relating to people with cognitive disabilities and an illustrative case study for a 17-year-old with short-term memory problems.</p>	<ul style="list-style-type: none"> <li>• AT can decrease stress between carers and people with disabilities,</li> <li>• It can enhance autonomy and self-confidence of the person,</li> <li>• It has the potential to reduce the costs of providing care,</li> <li>• For people with cognitive disabilities such as short-term memory AT can assist in modulating behaviour through the use of alarms, instruction and reminder,</li> <li>• It can restructure the demands of tasks to reduce the complexity and improve independent performance.</li> </ul>

Authors	Methodology	Findings
Reichle (2011)	<p><b>COMMENTARY</b></p> <p>Commentary on four studies and a systematic review exploring AT use with children with severe developmental disabilities including camera-based micro switch technology with three young children with profound multiple disabilities; the impact of speech programmable on challenging behaviour; the iPod as a mechanism for entertainment videos; computer-based sight reading programme for pupils with ASD and a systematic review of communications technology.</p>	<ul style="list-style-type: none"> <li>• Within-subject alternating-treatment designs replicated across participants is the most appropriate design,</li> <li>• Need to consider procedural fidelity. AT fidelity is highly dependent on the competence and confidence of the staff,</li> <li>• Collateral effects of AT in terms of communication, speech production and non-targeted behaviours,</li> <li>• Competing schedules of reinforcement – selective behaviours,</li> <li>• Treatment intensity vs content,</li> </ul>
Scherer (2005)	<p><b>LITERATURE REVIEW</b></p> <p>Using prior research and a literature review identified the critical needs for an assessment process that would serve to identify key elements known to influence the successful use of assistive technology and other supports by persons with cognitive disabilities.</p>	<ul style="list-style-type: none"> <li>• A quantifiable relationship exists between the MPT ATD PA's measure of personal factors and the Social Wellbeing scale such that it is possible to characterise an individual's predisposition to use a particular ATD,</li> <li>• Results also show the scales are predictive of the quality of the ATD and user match at follow-up,</li> <li>• Rehabilitation practitioners who use the ATD PA may achieve enhanced assistive technology service delivery outcomes by using this evidence-based measure,</li> </ul>
Schmitt <i>et al</i> (2011)	<p><b>INTERVENTION STUDY</b></p> <p>An intervention study involving 25 remedial readers aged 11-15 who were performing two grade levels below their expected level. Participants included six Grade 6 students, ten Grade 7 students, and nine Grade 8 students enrolled in a general education and remedial reading. The study was designed so that each student engaged in only one condition (either listening while reading LWR or silent reading SR) per day across two consecutive days. The condition order was counterbalanced across participants.</p>	<ul style="list-style-type: none"> <li>• Even without prior training the LWR accommodation was more effective in terms of factual and inferential comprehension than SR.</li> </ul>

Authors	Methodology	Findings
Seale (2014)	<p><b>LITERATURE REVIEW</b></p> <p>Review of selected experimental studies and meta-analyses in three areas of literacy education for people with specific learning disabilities.</p>	<ul style="list-style-type: none"> <li>• Key areas for consideration in effective use:                             <ul style="list-style-type: none"> <li>• 1:1 support critical</li> <li>• level of supporters' familiarity with tech</li> <li>• attitudes and perceptions of supporters</li> <li>• degree of control provided to users</li> <li>• interventions diverting participants from meaningful interactions</li> <li>• shared decision making</li> <li>• positive risk management strategies</li> <li>• skilled professionals to make good AT recommendations (Zhang-Fairrelly, 2011).</li> </ul> </li> </ul>
Seymour (2005)	<p><b>INTERVENTION STUDY</b></p> <p>A qualitative study with seven individuals with disabilities in South Australia, (three of whom were children) to explore the factors that shaped decisions to adopt or abandon technology from the perspectives of self-identity of the user and how the broad global dimensions of politics and economics impact on technology use.</p>	<ul style="list-style-type: none"> <li>• Influences on decisions to adopt or abandon:                             <ul style="list-style-type: none"> <li>• computer use is socially valued</li> <li>• improves self-concept</li> <li>• supports more independent action</li> </ul> </li> <li>• Biggest risks were:                             <ul style="list-style-type: none"> <li>• the cost of maintaining the relevance and currency of the AT through upgrades without which the AT could be disabling</li> <li>• unrealistic expectations leading to disappointment</li> </ul> </li> </ul>
Shamir & Margalit (2011)	<p><b>COMMENTARY</b></p> <p>A summary of six studies exploring multimedia technologies and computerised learning environments including a review of technologies for reading, spelling and speech; the role of digital picture books, for three- to seven-year-olds; the impact of e-books on vocabulary; and the potential of virtual reality for pupils with physical or intellectual disabilities or ASD.</p>	<ul style="list-style-type: none"> <li>• Technology can be an effective mediating tool during learning,</li> <li>• The key question, however, that is not so easily answered is which technologies for which educational needs,</li> <li>• By facilitating access to information and knowledge through multiple modes of communication it has the potential to particularly benefit learners with cognitive disabilities.</li> </ul>

Authors	Methodology	Findings
<p>Skouge, Rao, Boisvert (2007)</p>	<p><b>DESCRIPTIVE ARTICLE</b> A description and review of technology and media supports including ebooks and mainstream video and audio recordings and free apps that promote shared reading experience between children and adult with an emphasis on children with disabilities including children with hearing or visual impairments and physical or cognitive impairments.</p>	<ul style="list-style-type: none"> <li>• Properly applied technology can assist in creating accessible conditions for literacy development thorough shared stories,</li> <li>• To capitalise on the opportunities offered, teachers require to update their competences and collaborate with young people,</li> <li>• Investment in current technologies and multimedia that are in general use by many younger people are also required.</li> </ul>
<p>Smith &amp; Kelly (2014)</p>	<p><b>LITERATURE REVIEW</b> A review of 397 articles published in 1965-2013 that addressed AT for students with visual impairments in an educational setting.</p>	<ul style="list-style-type: none"> <li>• The number of articles published each year has been increasing. However, only 98 articles over the period were considered to be categorised as research studies and only four studies met rigorous standards for experimental design. Twenty-four articles were classified as qualitative including case studies and 24 studies used correlational quasi-experimental design. Five of these were single subject designs.</li> </ul>
<p>Specht, Howell &amp; Young (2007)</p>	<p><b>INTERVENTION STUDY</b> Four case studies were carried out through an initial and follow up interview with AT users (one female and three males, two in Grade 9 with a range of special educational needs including limited vision and mobility, expressive language difficulties, handwriting, reading and spelling) in transition from primary to secondary education and their parents and teachers in Ontario.</p>	<ul style="list-style-type: none"> <li>• Four key area for intervention were identified:             <ul style="list-style-type: none"> <li>• assessment – ensuring there is no incompatibility between methods of assessment and the AT</li> <li>• environment – the need to ensure leadership in smoothing the transition for teachers, parents and AT users through a continuum of support, and carrying out a person, AT, environment fit analysis in the new context</li> <li>• training – training in the use of AT especially for teachers but also for the user within the new context</li> <li>• advocacy – ensuring that someone is designated to ensure that the voices of the key actors are heard by those who can influence the environment</li> </ul> </li> </ul>

Authors	Methodology	Findings
<p>Tumlin Garrett <i>et al</i> (2011)</p>	<p><b>INTERVENTION STUDY</b></p> <p>An alternating conditions design was used to explore the impact of voice activated word processing with five participants with problems in fine or gross motor control. Participants had two years' computer and word processing experience and were capable of direct select interaction with the computer but had no experience of speech recognition.</p>	<ul style="list-style-type: none"> <li>• Participants used twice as many utterances as the text should require,</li> <li>• Speech recognition may be most appropriate if typing speed is below 15 WPM,</li> <li>• SR should only be used for first draft production (Honeycutt, 2003).</li> </ul>
<p>VanWeelden (2011)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of how both low and high tech AT can enhance the participation of pupils with disabilities in the music classroom. Solutions described include low tech AT such as wheelchair lapboards, Velcro to attach instruments or mallets to student's hands, or using doorstop wedges as jumbo guitar picks and high tech AT such as text to speech software, voice activated word processing, magnified electronic documents and song lyrics.</p>	<ul style="list-style-type: none"> <li>• AT can increase the accessibility of music learning for pupils with special needs in second level music classrooms,</li> <li>• Many supports can also be used in the assessment of progress,</li> <li>• AT specific to an individual learner and utilising a particular learning channel can assist teachers to meet the needs of all learners.</li> </ul>
<p>Watson &amp; Johnston (2007)</p>	<p><b>DESCRIPTIVE ARTICLE</b></p> <p>A description of the application of a variety of low, light and high technology AT in science classroom using Lahm and Morrisette's (1994) seven areas where AT can help students including flow charts, concept maps and graphic tools to support organisation; mind mapping and digital recorder for note taking; word processors, text to speech and symbol boards for writing; personal digital assistants and pen input devices for productivity, talking dictionaries and resources for referencing; visual cues as cognitive assistance; and captioning software, magnifiers, speech to text and Braille label makers to modify learning materials.</p>	<ul style="list-style-type: none"> <li>• It is essential that teachers of science know how AT can enhance the learning of pupils with special educational needs,</li> <li>• Many devices are low tech and low cost and are easily integrated into teaching approaches,</li> <li>• Finding the finance for high technology solutions can be a challenge but can be sourced through the education budget, insurers or voluntary organisations.</li> </ul>

Authors	Methodology	Findings
Wehmeyer <i>et al</i> (2008)	<p><b>META-ANALYSIS</b></p> <p>Meta-analysis of single case studies of AT applications with learners with intellectual impairments with a particular focus on universal design features. Most technologies were about modulating behaviour. The analysis used Percentage of Non-Overlapping Data (PND) and Percentage of Zero Data (PZD)</p> <p>411 articles were identified: 275 involved data collection and analysis; 81 single subject designs with 281 participants with 455 implementations; 169 males &amp; 106 females (gender was missing for 6 cases missing), 9 categories of technology were addressed; Ages ranged from 2-68 and IQ ranged from 15-75</p>	<ul style="list-style-type: none"> <li>• Devices with at least one UD feature (183) were compared to those with none (272),</li> <li>• A significant effect was identified for UD features,</li> <li>• People with more severe disabilities had less positive results</li> </ul>
Whalen <i>et al</i> (2010)	<p><b>INTERVENTION STUDY</b></p> <p>Twenty-two pre-school and Kindergarten children with ASD participated in a computer-assisted instructional intervention (TeachTown: Basics) over three months for 40 minutes per day (20 minutes' computer activity). Twenty-five controls participated in normal education. Participants were randomised by classroom. Study focus was improvement in language, cognitive, auditory processing and social skills.</p>	<ul style="list-style-type: none"> <li>• The experimental group demonstrated enhanced language and cognitive processing enhanced overall,</li> <li>• Fifteen of 22 pupils in the intervention group mastered on average five to six lessons,</li> <li>• Only the Peabody Picture Vocabulary Test showed a significant effect and only for pre-schoolers.</li> </ul>
Zapf & Craddock (2012)	<p><b>INTERVENTION STUDY</b></p> <p>A qualitative account of the importance of the special teacher/educator in the process of integrating assistive technology for students with disabilities into the educational system. The special teacher/educator is a crucial team member, providing knowledge of the students' educational capabilities and their daily interaction in the use of assistive technology. Findings are based on two studies conducted in Ireland</p>	<p>Lack of training is a major factor in the successful use of AT,</p> <p>The importance for statement of need or the individual educational plan,</p> <p>The importance of adequate resources to effectively assess, implement and follow-up on the use of assistive technology in the classroom,</p> <p>The study outlines the importance of training in use of assistive technology.</p>

## Appendix 3: Description of Disability Categories from DES Circular

SP ED 08/02 (NCSE, 2014a, pp58-60)

High Incidence Disabilities	
<b>Borderline mild general learning disability</b>	A psychologist has assessed such pupils as having a borderline mild general learning disability. The pupil's full scale IQ will have been assessed in the range 70 to 79.
<b>Mild general learning disability</b>	A psychologist has assessed such pupils as having a mild general learning disability. The pupil's full scale IQ will have been assessed in the range 50 to 69
<b>Specific learning disability</b>	Such children have been assessed by a psychologist as:  Of average intelligence or higher;  Having a degree of learning disability specific to basic skills in reading, writing or mathematics which places them at or below the second percentile on suitable, standardised, norm-referenced tests.
Low Incidence Disabilities	
<b>Autism/autistic spectrum disorder (ASD)</b>	A psychiatrist or psychologist will have assessed and classified such pupils as having autism or autistic spectrum disorder according to DSM-IV or ICD-10 criteria.  Note: In 2013, the DES also informed the NCSE that a diagnosis using DSM-V would meet the criteria for resource allocation.
<b>Emotional disturbance and/or behaviour problems</b>	A psychiatrist or psychologist is treating such pupils for such conditions as neurosis, childhood psychosis, hyperactivity, attention deficit disorder, attention deficit hyperactivity disorder and conduct disorders that significantly impair their socialisation and/or learning in school.
<b>Hearing impairment</b>	Such pupils have a hearing disability so serious it impairs significantly their capacity to hear and understand human speech, thus preventing them from participating fully in classroom interaction and from benefiting adequately from school instruction. Most have been prescribed hearing aids and avail of visiting teacher services.
<b>Severe and profound general learning disability</b>	A psychologist has assessed such pupils as having a severe or profound general learning disability. The pupil's full scale IQ will have been assessed as being below 35. In addition, such pupils may have physical disabilities.
<b>Severe emotional disturbance and/or behaviour problems</b>	The criteria for severe EBD are that the pupil is in the care of a psychiatrist or clinical psychologist for a severe clinical disorder. A very small number of pupils would be expected to fall within this category.
<b>Moderate general learning disability</b>	A psychologist has assessed such pupils as having a moderate general learning disability. The pupil's full scale IQ will have been assessed in the range 35 to 49.
<b>Multiple disabilities</b>	Pupils assessed with multiple disabilities meet the criteria for two or more of the low incidence disabilities described above.
<b>Pupils with special educational needs arising from an assessed syndrome</b>	Such pupils with an assessed syndrome, e.g. Down syndrome, William's syndrome and Tourette's syndrome in addition to any of the other low incidence disabilities.

Low Incidence Disabilities	
<b>Physical disability</b>	<p>Such pupils have permanent or protracted disabilities arising from such conditions as congenital deformities, spina bifida, dyspraxia, muscular dystrophy, cerebral palsy, brittle bones or severe accidental injury. Because of the impairment of their physical function, they require special additional intervention and support if they are to have available to them a level and quality of education appropriate to their needs and abilities.</p> <p>Many require the use of a wheelchair, mobility or seating aid, or other technological support.</p> <p>They may suffer from a lack of muscular control and coordination and may have difficulties in communication, particularly in oral articulation, e.g. severe dyspraxia</p>
<b>Specific speech and language disorder</b>	<p>Such pupils should meet each of the following criteria:</p> <ul style="list-style-type: none"> <li>• In the case of specific speech and language disorder it is a pupil's non-verbal or performance ability that must be within the average range or above, that is, non-verbal or performance IQ of 90 or above.</li> <li>• The pupil must also have been assessed by a speech and language therapist and found to be at two or more standard deviations (SD) below the mean, or at a generally equivalent level (– 2 SD or below, or below a standard score of 70) in one or more of the main areas of speech and language development.</li> <li>• Two assessments, a psychological assessment and a speech and language assessment are necessary in this case.</li> </ul>
<b>Visual impairment</b>	<p>Such pupils have a visual disability which is so serious as to impair significantly their capacity to see, thus interfering with their capacity to perceive visually presented materials, such as pictures, diagrams and the written word. Some will have been diagnosed as suffering from such conditions as congenital blindness, cataracts, albinism and retinitis pigmentosa. Most require the use of low-vision aids and are availing of the Visiting Teacher Service.</p>

## Appendix 4: Interview Procedures for AT User Survey

### Introduction

The views of both AT users and their parents or guardians are essential to the NCSE AT study. In effect where the AT user and parent are interviewed together the information gathered through the interview must reflect both perspectives on the AT.

If the AT user is not accompanied by a parent or guardian, the interview should generally be held in the company of a third adult party such as a teacher or SNA. In such as case, the interviewer should contact the parents/guardians by phone and gather their views using the telephone questionnaire.

If the AT user is not in a position to respond on his or her own behalf or an interpreter is required, the proxy version of the interview should be used. It would be usual to invite the AT user's parent or guardian to nominate or act as proxy.

The primary focus of the interview is the pupil, as an AT user, and all questions should be addressed directly to him or her initially. However, it is essential that the views of the accompanying parent or guardian are also reflected in the responses.

Depending on the age and developmental level of the AT users, the parent/guardian may play a more supportive and predominant role in the interview. At all ages, parents or guardians are likely to be able to provide important information about the identification, assessment and procurement process through which the AT was obtained and the training and support provided.

### General Procedures

- When making arrangement with the school for a location for the interview, it is essential to make sure that there is a table in the room.
- The interview should sit beside the AT user and spread the forms out so that they are in full view.
- The interview should be carried out as a collaborative exercise and where an AT user does not understand something, time should be given to clarify any issues.
- Ensure that the respondents are comfortable.
- Establish a rapport with the respondents by thanking them for meeting with you and asking some informal questions.
- Explain the purpose of the interview and how you intend to proceed.
- Get permission to record the interview and explain that you will be taking notes during the interview.

- Confirm that the AT User understands what is expected of them by reviewing the Information for AT Users using Document (G) NCSE AT Respondent Oral Information Sheet (pages 7-8 in this manual).
- Request that the AT User confirms assent by signing a form or confirming orally on tape – Document (H) NCSE AT Assent Form (page 9 in this manual).
- The language in the interview and questionnaire is not standard so it is acceptable to re-word and re-formulate directions and questions to ensure that the respondents understand the meaning. It is important that the prompts are expressed in age-appropriate language for younger respondents.

## Duration of the Interview

The interview should not last more than 60 minutes. It is important there is sufficient time to administer the Irish Matching the Person to Technology Assessment Tool. This can take up to 40 minutes. In order to ensure that the duration of the interview does not exceed one hour, discontinue the narrative component after 20 minutes. If additional information is required arrange to carry out a telephone interview on the remaining aspects at a later date.

The best approach is to ensure that Questions 1 and 2 are completed and to leave Question 3 for the telephone interview.

## Type of Interview Procedures

There are a number of versions of the interview and the language of the interview should be adapted accordingly.

### Interview types

- a. Joint interviews with AT users and Parent or Guardian,
- b. Individual face to face interviews with AT users (with or without a 3rd party) and telephone interviews with parents,
- c. Directions for the administration of the interview in a proxy version if it is considered that interpretation or other support is required.

## Debriefing the respondent

At the completion of the interview the respondent should be debriefed using Document (K) NCSE AT Debrief Sheet (pages 23-24 in this document).

## Interview Protocol

### Confirm the identity and personal details of the AT user

Before the interview complete as much of **FORM 1 NCSE AT Details of the Student** as you can. At the start of the interview confirm the information and complete the form.

FORM 1 NCSE AT Details of the Student				
Date of Interview		Date of Birth		Code
NCSE AT Sequence Number		Roll Number		
Name of school		Location	Urban	
Type of school	Primary		Rural	
	Post Primary	County		
	Special	Type of disability		
Gender	Male			
	Female			
Current Class				
Age Cohort	Younger Primary			
	Older Primary			
	Younger Secondary			
	Senior Secondary			
Exact product names of the AT recommended by NCSE and funded by the Department of Education and Skills				
If the respondent is accompanied, please note her or his name and relationship to the respondent				
If the interview is being carried out with a proxy or interpreter, describe who is acting as interpreter or proxy and the relationship to the AT user				
Give a brief description of the context within which the interview was carried out (location and passive surveillance arrangements)				
Please provide below any other details that may be relevant to the interpretation of the information provided by the respondent(s)				

## **Confirm that the AT User understands what is expected of them**

### **(Document (G) NCSE AT Respondent – Oral Information Sheet)**

I understand from your school that you are using equipment or software to help you in school and with your learning.

I would like to talk to you about the way in which this is helping you to get on better in school.

I work for a research company called the Work Research Centre and we have been asked by the National Council for Special Education (the NCSE) to find out what kinds of equipment or software works best for learners.

To help you decide if you would like to be interviewed, this document gives you information about what is involved.

You can discuss this with your parents or a teacher if you need help to decide.

### **What we want to know**

We would like to hear about your experiences before you got the equipment or software, what it is like now you have it and what help you have been given to get the best out of it.

### **Do you have to take part?**

You do not have to take part. If you decide not to this will make no difference to the help you are receiving at school.

If you decide to take part, you should sign the Assent Form that I will give you once you are happy that you understand what the interview is about.

At any time during the interview you can decide that you do not want to continue and you will not have to say why.

### **What will happen at the interview?**

The interview will last about one hour.

You will be able to take breaks any time you wish.

I will ask you about:

- What it was like at school before you got the equipment or software,
- The difference that the AT has made to you in school and with homework,

- The help you got to learn how to use the equipment properly,
- Other equipment or software that you think would be useful at school,
- How you feel about using the equipment.

I ask you the questions first and then others can add anything else they want to say. I will talk to your parents later on the telephone if I need additional information or if we run out of time.

### **What are the benefits and risks of taking part?**

We hope that the research will help the National Council for Special Education to know the kinds of equipment or software that work best for people like you.

We hope that we will learn about the difference that giving pupils the equipment they need to take part in school makes and what help should be given to them.

We would like to find out how best to make sure that those who need it, get the equipment or software they need when they need it.

We believe that there are no risks to you if you decide to do the interview.

### **How will what you say be used and who will know about it?**

Your interview will be audio taped and used to complete the forms for the research. Everything from the interview will be locked away and kept safe.

The answers that you give to our questions will be confidential and anonymous except where someone might be at risk. This means that we will not show or report your answers to anyone outside of the WRC and that we will not store or report on information that allows anyone to identify you in any of the reports that we have to write.

The information you give us will be analysed along with information from other people we interview to help us to learn important lessons.

Eventually, when we are allowed and it is no longer of any use, we will destroy all the information collected.

We will publish two reports for the NCSE – a 'long' one containing all the details, and a shorter one that will be easier to read and explaining what we have found out.

### What if there is a problem?

If you have any concerns about this research, you should talk to your parents or someone in your school.

Are you happy to do the interview? If so I would like you to complete the Assent Form.

### Confirm Assent

Introduce **Document (H) NCSE AT Assent Form**, read it with the respondent, ask him or her to check each item and sign and date it.

## NCSE AT Research Study

### Assent Form

**Title of Project:** Assistive technology/equipment in supporting the education of children with special educational needs – What works best?

### Principal Researcher

Dr. Richard Wynne, Director, Work Research Centre, 3 Sundrive Rd, Kimmage, Dublin 12

Email: [r.wynne@wrc-research.ie](mailto:r.wynne@wrc-research.ie)

Phone: 01 4927042

Please tick the box to indicate your consent	Yes
<ul style="list-style-type: none"> <li>I understand the purpose of the interview and have had the opportunity to ask questions.</li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>I am happy that the interview will be recorded on tape.</li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>I know that I do not have to answer questions if I don't want to, that I can stop the interview at any time and that this will not make a difference to the support and help I get at school.</li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>I understand that information about me, my parents or my school and what I say will be kept safe and will not appear in any report.</li> </ul>	<input type="checkbox"/>

I understand that if I have any questions concerning this research, I can talk to my parents and teachers or I can phone Richard Wynne at WRC or email him

Name of pupil:	
Signature of pupil:	
Date:	

## Story Based Enquiry

### Introduction

What I would like you do is to tell me the story about you and the AT you got to help you with learning, your education and the life of the school. You should tell your story in your own words and then your mother/father can add anything else that might be useful or important. I may/will phone your mother/father later to get his/her opinions.

I am interested in things like:

- The way you got the AT;
- The types of AT that you use;
- The things that are easy for you to do using the AT;
- The type of training you got in how to use the AT;
- The kinds of support you have in getting the most out of your AT;
- The differences that the AT makes in taking part in the life of the school;
- Other types of technology that you find useful;
- Whether there are other assistive devices that you think would benefit you in your education and in taking part in school life.

### Question 1 – Pre-AT Experiences

We can get started by you telling me about what it was like before you got the AT and what happened then.

### Materials

- **FORM 2 NCSE AT Challenges and Positive Impact Comment Sheet**
  - **FORM 3 NCSE AT Challenges Record Form**
1. While the AT user (and where appropriate his or her parent or guardian) is telling his or her story about educational and school experiences before educational AT was allocated, note in the left hand column of **FORM 2 Challenges and Positive Impact Comment Sheet** the issues spontaneously mentioned in the narrative using the letter 'S' to indicate a spontaneous reference.

In **FORM 3 NCSE AT Challenges Record Form** note the items spontaneously mentioned by the AT user in the right hand column by inserting the letter 'S'.

The definitions and examples of each of the elements in **FORM 3 NCSE AT Challenges Record Form** are presented in **Annex 1** to this manual.

If the parent or guardian is present:

- a. Redirect questions of clarification to the accompanying parent or guardian,
  - b. When the AT user has finished telling his or her story, invite the parent or guardian to add any additional recollections.
2. When the respondent has finished recounting their experiences, use the prompt list in **FORM 3 NCSE AT Challenges Record Form** to check whether any of the areas of focus for the study, not mentioned spontaneously, were considered to be challenges. Additional challenges specified should be recorded by inserting the letter 'P' in the left hand column of the form.
- a. Use the general prompt, presented in bold type in the prompt list initially. If the person responds that there were no challenges, you do not progress to the specific prompts.
  - b. If a person indicates that there were challenges use the specific prompts to clarify. Specific prompts can be used directly to clear up any outstanding issues.

**After the interview, record the challenges specified in FORM 7 NCSE AT Challenges and Positive Impact Analysis Sheet**

FORM 3 NCSE AT Challenges Record Form-and Prompts (Question 1)	
<b>Date of Interview</b>	
<b>NCSE AT Sequence Number</b>	<b>School Roll Number</b>
Curriculum Access	Were you able to take part in the classroom, exams and use all the books and materials you needed to learn?
• Classroom participation	Were things working out OK in class at that time?
• Participation in assessment	Were you able to do tests and exams?
• Access to learning materials and resources	Were you able to use books and worksheets provided in the classroom?
<b>Educational engagement</b>	Were you able to get involved in all school activities, to learn and remember the things you needed and did you find it easy and enjoyable to learn?
• School process	Were you able to be involved in all school activities?
• Learning engagement	Did you find it easy to get involved in learning
• Cognitive	Did you find it easy to remembers things and solve problems?
• Behavioural	Did you find it easy to finish your exercises and homework?
• Affective	Were you happy being involved in learning?
<b>Enhanced school involvement</b>	Were you able to take part in school activities outside the classroom such as break time, games and school tours and did you get on OK with the teachers and other pupils?

<b>FORM 3 NCSE AT Challenges Record Form-and Prompts (Question 1)</b>	
<ul style="list-style-type: none"> <li>• Participation in school-related activities</li> </ul>	Could you get involved in school activities outside the classroom, for example at break time or games?
<ul style="list-style-type: none"> <li>• Extra-curricular school activities</li> </ul>	Were you able to take part in other school activities such as school tours or take part in school shows?
<ul style="list-style-type: none"> <li>• Relationships with peers and teachers</li> </ul>	Did you get on OK with the teachers and the other pupils?
<b>Attainment</b>	Were you happy with your marks in reading, writing and other subjects such as geography and were you able to cope with life in school including getting around and taking care of yourself?
<ul style="list-style-type: none"> <li>• Academic achievement</li> </ul>	Were you happy with the marks you were getting for your school work?
<ul style="list-style-type: none"> <li>• Literacy and numeracy</li> </ul>	Were able to read the books and worksheets and write your answers?
<ul style="list-style-type: none"> <li>• Subject specific</li> </ul>	Were you doing OK in subjects other than reading and writing such as history or geography?
<ul style="list-style-type: none"> <li>• Skills for life</li> </ul>	Were you able to cope with life as a pupil?
<ul style="list-style-type: none"> <li>• Mobility</li> </ul>	Were you able to get around the school without a problem
<ul style="list-style-type: none"> <li>• Daily living skills</li> </ul>	Were you able to take care of yourself alright?
<ul style="list-style-type: none"> <li>• Independence</li> </ul>	Were you able to do the things you wanted without someone's help?
<ul style="list-style-type: none"> <li>• Socialisation</li> </ul>	Did you find it easy to make friends?
<b>Subjective wellbeing</b>	Were you enjoying learning, feeling good about yourself, confident and were you positive about the future?
<ul style="list-style-type: none"> <li>• Academic orientation</li> </ul>	Were you interested in doing well as a learner and succeeding in school?
<ul style="list-style-type: none"> <li>• Enjoyment</li> </ul>	Did you enjoy learning and being in school?
<ul style="list-style-type: none"> <li>• Self-esteem</li> </ul>	Did you feel good about yourself as a learner?
<ul style="list-style-type: none"> <li>• Confidence</li> </ul>	Were you confident that you could cope with learning and school?
<ul style="list-style-type: none"> <li>• Optimism</li> </ul>	Did you feel positive about the future?

## Question 2 – Positive Impact of the AT

Moving on to the present, I would like to ask some questions about how useful you find the AT. I am interested in particular in the differences that it has had on your school work, not in other areas of your life. For example, you tell about the way it helps you to cope with your school work, your level of interest school and learning, your experience of education, doing test and exams, getting on with your teachers and other pupils. It would be great if you could describe the best things about having the AT and any problems you are having.

### Materials

- **FORM 2 NCSE AT Challenges and Positive Impact Comment Sheet**
- **FORM 4 NCSE AT Positive Impact Record Form**

1. While the AT user is telling his or her story about educational and school experiences after educational AT was allocated, note in the right hand column of **FORM 2 NCSE AT Challenges and Positive Impact Comment Sheet** whether the AT user felt that it helped to resolved any challenges. Pay particular attention to the issues raised in the past narrative. Use the letter 'S' to denote items mentioned spontaneously during the narrative.

In **FORM 4 NCSE AT Positive Impact Record Form** note the items spontaneously mentioned by the AT User in the right hand column by inserting the letter 'S'.

If the parent or guardian is present:

- a. Redirect questions of clarification to the accompanying parent or guardian,
  - b. When the AT user has finished telling his or her story, invite the parent or guardian to add any additional recollections.
2. When the narrative is finished, check any challenges that were raised in Question 1 not mentioned spontaneously by using the positive impact prompts in FORM 4 NCSE AT Positive Impact Record Form. Only address the challenges that were specified previously. Record these using the letter 'P' in the right hand column. Note the nature and degree of the impact of the impact in the right hand column of **FORM 2 NCSE AT Challenges and Positive Impact Comment Sheet**.

**After the interview, record the challenges specified in FORM 7 NCSE AT Challenges and Positive Impact Analysis Sheet**

FORM 4 NCSE AT Positive Impact Record Form (Question 2)		
NCSE AT Sequence Number	School Roll Number	Date of Interview
<b>Curriculum Access</b>		
<ul style="list-style-type: none"> <li>Classroom participation</li> </ul>	You said you had issues taking part in class, did the AT sort these out?	
<ul style="list-style-type: none"> <li>Participation in assessment</li> </ul>	You mentioned that tests and exams were an issue, did the AT help with this?	
<ul style="list-style-type: none"> <li>Access to learning materials and resources</li> </ul>	Did the AT make a difference in the problems you had using books and learning materials in the classroom?	
<b>Educational Engagement</b>		
<ul style="list-style-type: none"> <li>School process</li> </ul>	Did the AT make a difference in getting involved in school activities?	
<ul style="list-style-type: none"> <li>Learning engagement</li> </ul>	How has the AT changed the way you get involved in learning this?	
<ul style="list-style-type: none"> <li>Cognitive</li> </ul>	Did the AT help with your difficulties in learning and solving problems?	
<ul style="list-style-type: none"> <li>Behavioural</li> </ul>	You had issues finishing school and homework, has the AT made this easier?	
<ul style="list-style-type: none"> <li>Affective</li> </ul>	You said you were not happy with learning, how is this now you have AT?	
<b>Enhanced School involvement</b>		
<ul style="list-style-type: none"> <li>Participation in school-related activities</li> </ul>	Getting involved in school activities outside the classroom was another challenge you described, has this improved as a result of having AT?	
<ul style="list-style-type: none"> <li>Extra-curricular school activities</li> </ul>	You mentioned that taking part in other school activities such as school tours was not easy, has the AT made any difference to this?	
<ul style="list-style-type: none"> <li>Relationships with peers and teachers</li> </ul>	You described having issues getting on with teachers or other pupils, does the AT make this any easier?	
<b>Attainment</b>		
<ul style="list-style-type: none"> <li>Academic achievement</li> </ul>	You weren't happy with your marks before you got the AT, is this better now?	
<ul style="list-style-type: none"> <li>Literacy and numeracy</li> </ul>	Has the AT helped with your reading and writing	
<ul style="list-style-type: none"> <li>Subject specific</li> </ul>	You had difficulties in doing well in some subjects, did the AT help with this?	
<ul style="list-style-type: none"> <li>Skills for life</li> </ul>	You found it difficult coping with life as a pupil, has the AT helped with this?	
<ul style="list-style-type: none"> <li>Mobility</li> </ul>	Getting around the school was not easy for you, does the AT make this easier?	
<ul style="list-style-type: none"> <li>Daily living skills</li> </ul>	You mentioned problems taking care of yourself, has the AT made this better?	

FORM 4 NCSE AT Positive Impact Record Form (Question 2)	
• Independence	Has the AT helped you to learn how to do things better without help?
• Socialisation	You mentioned have issues with making friends, has the AT helped you to learn how to do this more easily?
<b>Subjective Wellbeing</b>	
• Academic orientation	You said you weren't really interested in doing well in school, has the AT changed this in any way?
• Enjoyment	You said that you did not really enjoy learning or school, has the AT made any difference in this?
• Self-esteem	You said you did not feel good about yourself as a learner, has the AT changed this?
• Confidence	You mentioned that you lacked confidence in yourself in school, has the AT made you more confident?
• Optimism	You weren't very positive about the future, has the AT changed this?

### Question 3 – The Identification, Procurement, Training and Support Process

That was excellent. Now I would like you to talk about how you came to get the AT you were given to help you with learning and school. For example, tell me about who suggested that you could get AT and how it was decided what was the right AT for you. You could also describe the kinds of training or help you got in how to use the technology.

#### Materials

- **FORM 5 NCSE AT Perceptions of the Assessment, Allocation, Training & Support Record Form**
  1. There are a number of questions included here – it is not a single question.
  2. The interviewer should introduce each one in sequence and make sure to ask specifically about each of the issues using the general prompt initially and introducing specific prompts where required.
  3. It is likely that the parent or guardian will be more aware of the processes involved in obtaining educational AT, nevertheless, address the questions to the AT user initially.
  4. Where it is relevant, redirect questions of clarification to the accompanying parent or guardian.
  5. When the AT user has finished telling his or her story about each item, invite the parent or guardian to add any additional views about positive impact.

6. Record whether the story told is mainly positive or mainly negative for each of the areas of focus.
7. Provide a brief description of the content of the narrative in the comment sheet.

**After the interview record the perceptions in FORM 8 NCSE AT Perceptions of the Assessment, Allocation, Training & Support Analysis Form**

FORM 5 NCSE AT Perceptions of the Assessment, Allocation and Support Process Record Form (Question 3)		
NCSE AT Sequence Number	School Roll Number	Date of Interview
<b>Relationship of informant to the AT Users</b>		
<b>1. Identification of the potential for AT</b>		
<b>How was it decided that you could benefit from AT and if this could have been done better?</b>		
For example who first suggested that AT could be useful for you in education and anyone else who was involved in the decision to apply for the AT?		
<b>2. Assessment of AT Needs</b>		
<b>Tell me about any assessments that were done to decide on your needs before you got your AT and whether these could be improved?</b>		
For example, what kind of assessment was it, who carried it out and what was the result?		
<b>3. Person-Technology Matching process</b>		
<b>How was the AT that you got matched to your needs?</b>		
For example, were you given a choice in the type of AT you wanted and were able to try it out.		
<b>4. Application process</b>		
<b>Tell me how your application for AT was made and if it could have been done differently?</b>		
For example who was involved in this and should anyone else have been involved?		
<b>5. Allocation Process</b>		
<b>Describe how it was decided that you should get the AT and whether there is a better way for this to happen</b>		
For example, do you know how the decision was made and who was involved in the decision and were you informed about how the decision to give you AT would be made?		
<b>6. Procurement Process</b>		
<b>Tell me about how the AT was bought and delivered and whether you would change the way this was done</b>		
For example, who was involved in buying the AT and did you get a chance to try it out first?		

**FORM 5 NCSE AT Perceptions of the Assessment, Allocation and Support Process Record Form  
(Question 3)**
**7. Training Process**

**Tell me about the training you, and other people such as your teacher or parents/guardian, got to make sure that you could use the AT well**

For example, were you trained in how to use the AT when you first got it, were your teachers or parents trained. Would you suggest any changes to the way training is provided?

**8. Support Process**

**Tell me about the types of help you get to make sure that you get the most out of your AT.**

For example, who do you go to if there is a problem with your AT, who makes sure that things are going OK with your AT and provides you with support for using AT, e.g. a teacher, a parent/guardian, someone else?

## Irish Matching the Person to Technology

### Introduction

The IMPT for children is based on the Matching Assistive Technology & Child (MATCH) instrument, The MATCH assessment instruments were derived from the Matching Person and Technology assessment instruments through a collaborative effort of parents and professionals working with Dr Marcia Sherer at the Institute of Matching Person with Technology. The instrument was subsequently developed through the Phd work of Dr Ger Craddock and the Inclusive Learning through Technology Project undertaken in two special and two mainstream schools in Ireland. The instrument consists of a progression of questions and subsets designed to find the most appropriate match of child and technology. It has been designed to help the provider and the user to work together to ensure the most appropriate technology for the user. Research has shown that traditional standardised testing is not appropriate for assessing many students with disabilities, particularly regarding their match with technologies, as so many individualised influences and factors come into play.

The IMPT instrument is applied to a specific individual (*idiographic measures*) rather than comparing that person to group norms (*normative measures*). The IMPT has three crucial areas of focus that represent the primary components found to most influence successful use of assistive technologies. They are characteristics of (1) the child who will be the user of the technology, (2) the technology itself, and (3) the milieu or environment(s) in which the user will interact with the technology.

Characteristics within these three primary components of the model – the child, the technology, and the milieu or environments of use – can each contribute either a positive or a negative influence on technology use. If there are too many negative influences, the chance of the technology being successfully used is greatly reduced. In fact, the technology itself can appear perfect for a given need, but without the appropriate person/social characteristics or the necessary environmental support, that perfect technology may go unused, or it may be used inappropriately and cause frustration and expense for all those involved.

It should be kept in mind that characteristics of the model's components may vary slightly with given situations. For example, when trying a particular strengthening system in a centred-based program, the importance of family support may be minimal; whereas for a communication system, such family support may be paramount. But even though certain characteristics vary, the basic three components remain the same in all situations.

To ensure people are empowered through the process, assessment requires sensitivity in how questions are asked. All questions should be asked in the context of engaging with the person and building rapport. Successful interviewing includes asking questions in a conversational manner, rather than reading questions from a list or form.

Each set of questions is quick, easy and self-explanatory and no specific scoring system need be used for most practical applications. It is believed that careful completion of each subset of questions item and observation of the balance of positive to negative responses will often give the provider sufficient insight to determine the quality of the match of a person and a technology.

1. The questionnaire is a collaborative process and is part of an oral interview. The interviewer may find it necessary to modify the actual wording on the user form in order to obtain the most helpful responses from the user, for it is the *meaning* of the items and not the specific wording that is important. In fact, the actual wording on the master forms may be changed to specify particular technologies, conditions, etc. Be aware that parent's or guardian's views may or may not parallel those of the child.
2. The Interviewer should complete the appropriate forms with the user and identify any factors that may have hindered the user's acceptance or use of the technology. Questions requiring information that you do not currently have should be left blank with a notation to obtain that information later.
3. The questionnaire is divided into the following subsets
  - **Determining Educational Goals.**
  - The **Current Capabilities subset** is to obtain a child's users' limitations, goals and interventions as well as strengths which can be built upon in planning interventions.
  - **The Student's Subjective Quality of Life.**
  - **Technology Utilisation Worksheet** for the Irish Matching Person & Technology (IMPT) Model.
  - The **AT device predisposition** to review technologies the child is currently using, has used in the past, and needs.
  - **The student self-evaluation.**

## Strategies for Optimising Use of the IMPT Process and Measures

To optimise use of the IMPT process and forms, it is important for the professional to:

1. Become familiar with the format of the forms (eg, scaling, information being asked). Incomplete forms, as well as ones completed incorrectly, yield poor results.
2. Working and discussing with the consumer when completing the appropriate form, focusing on current feelings and attitudes. [Do remember that the consumer form may serve as a guide for an oral interview, if that seems more appropriate for the situation.] You may find it necessary to modify the actual wording on the consumer form in order to obtain the most helpful responses, for it is the meaning of the items and not the specific wording that is important. In fact, the actual wording on the master forms may be changed to specify particular technologies, situations, etc.
3. Encourage consumers to answer honestly and to provide a response to each item, since non-responses affect the reliability of the scoring and results.
4. Discuss with the consumer those factors that may indicate problems with his or her acceptance or appropriate use of the technology. Work with the consumer to identify specific intervention strategies and devise an action plan to address the problems and to describe proposed interventions.

## Materials

There are two versions of the IMPT, one for older AT users (FORM 6a) and one for younger AT users (FORM 6b). The decision as to which version should be used is based in the age of the respondent and his or her capacity to understand abstract concepts. As rule FORM 6a is most appropriate for pupils in secondary school and FORM 6b for pupils in primary schools. In special schools the interviewer should decide

- **FORM 6a Irish Matching Person & Technology IMPT Older AT Users**
- **FORM 6b Irish Matching Person & Technology IMPT Younger AT User**

## Directions for Administration

- The IMPT process is user driven and person centred. To gain the most benefit from the questions, the procedures listed below should be followed:
  - As indicated earlier, it is important to create a collaborative environment, so the interviewer should sit beside the AT user with the questionnaire open so that both can proceed to work together filling out the questions, while engaging in conversation about the student's experience of the AT, the environment etc.
  - To ensure the AT user feels empowered through the process requires sensitivity in how questions are asked. All questions should be asked in the context of engaging with the user and building rapport. Successful interviewing includes asking questions in a conversational manner, rather than reading questions from a list or form.

- It is highly likely that the AT user will provide information relevant to the IMPT while they are telling their stories in the earlier part of the interview. Rather than asking the same questions again, the interviewer should note these items in the IMPT form at the time they are raised. This will shorten the interview and avoid repetition.
- Interviewers should become familiar with the format of the forms (eg, scaling, information being asked). This avoids incomplete forms, as well as ones completed incorrectly which will yield poor results.
- The student should understand that the IMPT is not a test, that there is no right or wrong answer and that it is a collaboration. It should involve the AT user and the parent/guardian as active participants in the process. The assessment is done 'with' not 'to' a person. Information is obtained, exchanged and jointly considered in a culture of collaborative problem solving and partnership.
- The interviewer should work, and discuss, with the AT user when completing the age appropriate form, focusing on current feelings and attitudes.
- The key to successful administration is to remember that the IMPT form is a guide for an oral interview in the current study.
- The interviewer may find it necessary to modify the actual wording on the form in order to obtain the most helpful responses, for it is the meaning of the items and not the specific wording that is important. In fact, the actual wording on the master forms may be changed to specify particular technologies, situations, etc.
- The interviewer should discuss with the AT user those factors that may indicate problems with his or her acceptance or appropriate use of the technology. Work with him/her to identify specific intervention strategies and encourage him or her suggest things to address problems and record the proposed interventions.
- Encourage AT users to answer honestly and to provide a response to each item, since non-responses affect the reliability of the scoring and results.
- The interviewer should explain that he/she will ask the questions and will discuss their meaning with the student, allowing the student to ask any questions.
- The interviewer should also inform the AT user that, at any time during the interview, if he or she would like to stop, or take a break that there is no problem.
- The AT user should be reminded that they can refuse to answer any question at any time or stop the interview if they wish.
- Before commencing the administration of the IMPT, the interviewer should ensure that the student understands what they will have to do and that they are happy to continue with the questionnaire.

### **Debrief the informant**

Once the interview is complete, thank the respondent for their contribution and introduce **Document (K) NCSE AT Debrief Sheet**. Make sure that the informant has no additional questions and direct him or her to the names and addresses of the support organisations that are attached to the debrief sheet.

### **Debrief Sheet**

#### **Assistive Technology/Equipment In Supporting The Education Of Children With Special Educational Needs – What Works Best?**

**Thank you very much for taking part in this research study.**

We are gathering the views and opinions of assistive technology users like you about how effective it is in supporting participation in school and in education and being engaged in learning. Your interview is important to the research because it will help to create the evidence that is needed to inform the way in which the National Council for Special Education does things and how it supports professionals and students. Your interview will also help the NCSE to contribute to future policy development in relation to how AT is provided to pupils with special educational needs.

If, as a result of the interview, you feel you would like to talk to someone about any concerns you may have, you can contact the appropriate organisation in the attached list for information and support.

If you would like to know more about the study or you wish to have your personal information removed from the study, please contact Dr. Richard Wynne, Director, Work Research Centre, 3 Sundrive Rd, Kimmage, Dublin 12 Email: [r.wynne@wrc-research.ie](mailto:r.wynne@wrc-research.ie) Phone: 01 4927042

So thanks again for your contribution and let me reassure you that your personal information and everything you said is confidential and anonymous, and when we publish it will not be in any way identifiable as yours.

Dr. Richard Wynne, Director, Work Research Centre

Email: [r.wynne@wrc-research.ie](mailto:r.wynne@wrc-research.ie)

Phone: 01 4927042

## Appendix 5: Generating the Variables for Analysis

### Dependent Variables

Three sources of information were used to generate the dependent variables for the study. These came from section 1 of the interview (challenges and impacts of AT), section 2 of the interview (respondent's perceptions of the process) and the IMPT Device Impact Scale. The relationship of the dependent variables to the source data is illustrated in Figure A5.1.

**AT Educational Participation Index:** The score on this variable ranged from 1 representing the perception that the AT provided has met all challenges to 0 representing the view that it has met none of the challenges faced in participating in education.

**Perception of the Process:** This variable consisted of eight items. For each stage in the process each respondent's views were coded as 0 if the comment was primarily negative, 1 if it was neutral and 2 if it was mainly positive. The final variable was generated by summing respondent views across the eight phases of the AT identification and acquisition process. The maximum score was 16.

**IMPT Device Impact:** The variable was generated by summing over the 12 items of the AT Device Predisposition Scale. Respondent views on the extent to which each AT device fitted with their life and temperament and contributed to attaining life goals was measured on a five point scale (0 = not applicable; 1 = not at all (0 per cent of the time); 2 = sometimes (around 25 per cent of the time); 3 = half of the time, neutral (about 50 per cent of the time); 4 = often (around 75 per cent of the time); 5 = all the time (100 per cent of the time)).

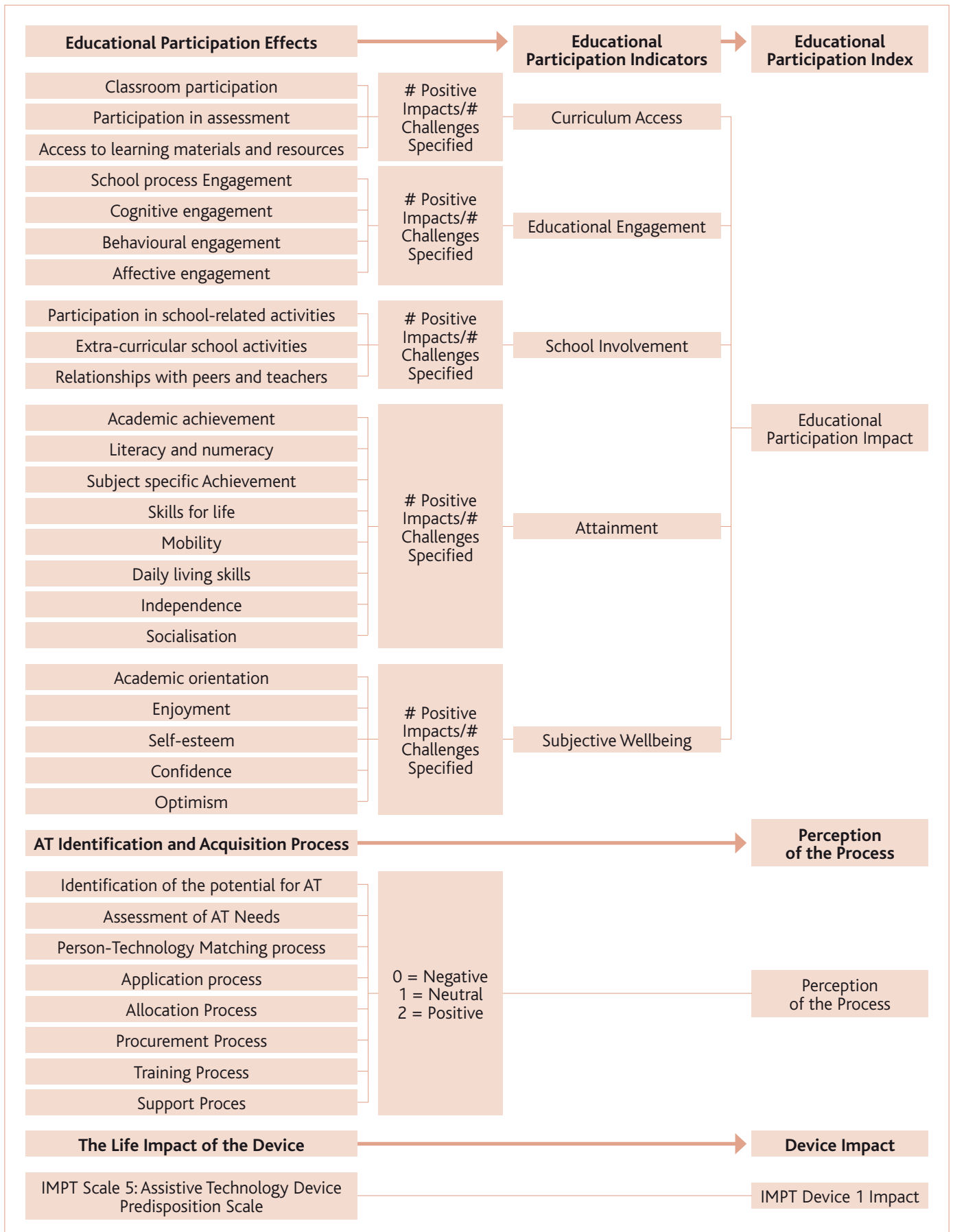
### Procedures for Generating the Education Participation Index

The results from section 1 of each interview were used to generate two variables: total challenges (spontaneous and prompted) and total positive impacts. These were used to calculate the percentage of respondents who reported that a challenge they faced had been positively addressed by their AT. This resulted in 23 indicators of educational participation in five domains<sup>52</sup> that were coded as not applicable, not met and met. These are presented in Table 5.7.

To generate the impact indicators for the five domains, all 'not applicable' responses were removed and the average of the remaining responses calculated. This was calculated as the number of positive impacts experienced divided by the number of challenges specified. For example, if a respondent specified one component as a challenge within a particular domain with a number of components, and reported that this was met, the indicator for that respondent was specified as 1. In contrast, if a respondent indicated that it was not met, then the indicator was 0. If, on the other hand, a respondent referred to a number of components, this was computed in terms of the number of positive impacts reported as a proportion of the number of challenges reported. So if all challenges were met, the indicator was 1.

<sup>52</sup> Curriculum access, educational engagement school involvement, attainment and subjective wellbeing.

**Figure A5.1: Procedure for generating dependent variables**



The AT Educational Participation Index was generated by combining the scores from the five domains. At the level of the five domains a variable was generated by dividing the number of positive impacts by the number of challenges identified for each individual. These domain scores were then combined into a single AT educational participation index by assigning an average based on the five domain scores. This meant a respondent specifying challenges in only one domain was assigned that score in the index whereas a respondent specifying challenges in all five domains was assigned the average of the five domain scores. The domain scores and the AT educational participation index ranged for 0 to 1 and a higher score represented a higher impact.

A principal components analysis (PCA) was carried out on the on the challenges reported data to assess the validity of the indices described above. This broadly confirmed the structure of the framework. Both curriculum access and school involvement emerged as unique factors. The three academic attainment variables (academic achievement, literacy and numeracy and subject specific attainment) loaded on a different factor to the non-academic attainment variables. The academic attainment variables loaded on a factor that included behavioural engagement, self-esteem, confidence and optimism. The non-academic attainment variable loaded on a factor that included all the educational engagement variables. A unique factor emerged that comprised two variables academic orientation and affective engagement. Subjective wellbeing did not emerge as a unique factor.

### **Covariates**

The educational goals scale of the IMPT was used to generate two of the covariate variables. Respondents rated the extent to which they aspired to meet educational goals (IMPT motivation) and their expectation that these were attainable (IMPT self-esteem) on a five-point scale ranging from 5 = completely agree to totally disagree.

The third covariate – IMPT capabilities – was generated using the current capabilities scale of the IMPT. Respondents rated their perception of their strengths and needs on a five-point scale ranging from excellent to none and the extent that they believed these would improve or disimprove in the future on a three-point scale (improve, static, disimprove). Only the capabilities ratings were used in the analysis.

The relationship between dependent variable and covariates is presented in Table 5.18. There were significant positive correlations between the AT Educational Participation Index and two of the IMPT scales – Device 1 Impact (assistive device predisposition scale) ( $r=0.55, p<0.001^{53}$ ) and self-assessed capabilities ( $r=0.34, p<0.01$ ) These were also significantly correlated with each other but not significantly related to perception of the process. This indicated that IMPT Device 1 Impact variable was measuring a similar construct to educational participation impact but from a broader perspective and was an indication of the validity of that variable.

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<sup>53</sup> R = correlation co-efficient, p = probability level.

**Table A5.1: Inter-correlations between dependent variables and covariates**

	Perception of Process	IMPT Device 1 Impact	IMPT Self-Esteem	IMPT Motivation	IMPT Capabilities
Educational participation impact	0.07	0.55**	0.15	0.00	0.34**
Perception of process		0.08	-0.02	-0.08	0.19
IMPT Device 1 Impact			0.32**	0.25*	0.29**
IMPT self-esteem				0.62**	0.11
IMPT motivation					-0.02

\* represents  $p < 0.05$  and

\*\* represents  $p < 0.01$

It was also clear that the perception of process variable was measuring a distinct construct from the other variables. The IMPT capabilities variable was not significantly correlated with the IMPT self-esteem or IMPT motivation variables which was an indication that these were also measuring different aspects of respondents' perceptions. The significant correlations between IMPT capabilities and educational participation and IMPT Device 1 Impact may be an indication that respondents with more complex and severe needs were experiencing fewer positive AT impacts.

### Independent Variable

The independent variable for the analysis was type of AT. This variable was generated through an interactive process with the NCSE in which the list of AT recommended in the dataset was assigned an ISO9999 code and then grouped into broad categories. These were submitted to the NCSE for review. Based on the feedback received, each AT specification in the data was assigned to one of six categories:

1. Visual aids and devices;
2. Audio systems;
3. Communication devices;
4. Software with and without computer;
5. Input, output and control devices, accessories and sundry equipment;
6. Laptops and computers.

Each record in the NCSE-recommended AT dataset was assigned code on the basis of this categorisation and on the basis of the most appropriate ISO9999 designation. Where more than one piece of equipment, device or software was specified, the item that most closely represented the functional purpose of the AT was coded. For example, where a laptop or computer was recommended with a screen reading software this was assigned the code 4.

Similarly, if a laptop or computer was recommended along with a control device then this was assigned the code 5. Code 6 was confined to recommended laptops, computers or other mobile devices with no accompanying device or software and for which there was no indication of the intended function.

## Appendix 6: School Staff Questionnaire

### Assistive Technology/Equipment In Supporting The Education Of Children With Special Educational Needs – What Works Best?

#### Experiences and Views of School Staff

##### Purpose of the Research

As part of its current research programme the NCSE has commissioned the Work Research Centre (WRC) to carry out research in the area of Assistive Technology.

The aim of this research is to:

- Review what assistive technology/equipment is most effective in supporting children with special educational needs who require supports to access the curriculum, engage in learning and enhance their educational experience so that the NCSE can build up an evidence base to support professionals and students and inform any future policy advice in this area.

The research project involves:

1. A review of the international research evidence for the effectiveness of AT in supporting educational engagement, an overview of current policy and provision and the identification of best practice guidelines in Ireland and internationally;
2. Interviews with AT users and their parents/guardians about the impact of AT on their educational participation and learning;
3. A survey of the views of school personnel about the process of identifying students who might benefit from AT, the current system for allocating AT to pupils with special educational needs (SEN); the educational impact of AT recommended by NCSE for those pupils and other relevant issues relating to the use of AT to support students with special educational needs;
4. Focus groups with professionals involved assessing student needs about their views of good practice and procedures.

School staff members have an important role to play in identifying children who might benefit from AT support and in ensuring that available AT is used effectively to support the educational and learning engagement and experiences of pupils with SEN. Consequently, this questionnaire has been designed specifically to ensure your views are taken into account.

## Directions

The questionnaire has five sections:

1. You and your school;
2. Your knowledge and experience in the area of AT;
3. Your views about the current procedures for obtaining AT support for pupils with SEN;
4. Your views about the impact of AT on the educational experience of pupils with SEN;
5. Your views about how current procedures for obtaining AT for pupils with SEN could be improved.

All information provided by you in this questionnaire will be confidential. Neither you nor your school will be identified or revealed to anyone outside of the WRC and the information will be stored and reported on in a way that prevents anyone other than the researchers from identifying you or your school.

The information you provide will be analysed along with the responses from all other school support personnel who complete the questionnaire and only a synthesis of the responses will be included in the final report.

If you agree to complete the questionnaire, please sign the attached consent form and complete the questionnaire using one of the options below. **Please note that you can complete the questionnaire and consent form electronically if you prefer and send back to me by email. In this case, you will type your name on the consent form rather than signing it by hand:**

- You can complete it electronically and return it to WRC by email to **Donal McAnaney** at [donalmcananey@gmail.com](mailto:donalmcananey@gmail.com)
- You can complete a printed version and return it by post to:  
Ms. Anne O’Herlihy  
Work Research Centre  
3, Sundrive Road  
Kimmage  
Dublin 12
- You can arrange to complete it over the phone by contacting me directly on the mobile number below.

If you have any questions or clarifications you can contact Dr. Donal McAnaney, Senior Research Consultant with the WRC, on his mobile **087 9370693** or by email at [donalmcananey@gmail.com](mailto:donalmcananey@gmail.com)

*Thank you for agreeing to complete this questionnaire*

<b>Name of School:</b>	
<b>Your Name:</b>	
<b>Roll No.</b>	
<b>Phone No.</b>	

<b>A. You and your school</b>			
<b>1. Type of School:</b>	Primary	Vocational	
	Secondary	Special	
	Community/Comprehensive		
<b>2.1. Does your school have DEIS status?</b>			
	Yes		
	No		
<b>2.2. If yes, which DEIS status does your school have?</b>			
	Urban band 1		
	Urban band 2		
	Rural DEIS		
<b>3. Is your school a Gaelscoil?</b>			
	Yes		
	No		
<b>4. How many years have you been working in education?</b>			
<b>5. How many years have you been in your current role?</b>			
<b>6. What is your role within your school? (tick all that apply)</b>			
	Classroom Teacher	Principal	
	Learning Support Teacher	Assistant Principal	
	Resource Teacher	Secretary	
	Special Needs Assistant	Other – Please specify	
<b>7.1. Is the issue of AT covered by school policy?</b>			
	Yes		
	No		
<b>7.2. Is it school policy that someone has formal responsibility for AT?</b>			
	Yes		
	No		

A. You and your school							
<b>7.3. If Yes, please specify that person's job role below?</b>							
<b>7.4. Briefly describe how a student's possible need for AT is identified in your school?</b>							
<b>7.5. Indicate, the people who can be involved in the initial identification that a pupil with SEN might benefit from AT? (You can specify more than one)</b>							
	Principal		Special Needs Assistant				
	Assistant Principal		Visiting Teacher				
	Classroom Teacher		Pupil's family				
	Learning Support Teacher		NCSE SENO				
	Resource Teacher		Other – Please specify				
<b>8. Please indicate for each of processes listed below the member or members of school staff (or others) who are primarily responsible. You can specify more than one</b>							
	Principal	Assistant Principal	Classroom Teacher	Learning Support Teacher	Resource Teacher	Special Needs Assistant	Other – Please specify
<b>8.1. Deciding on the specific piece of AT equipment that is appropriate to the student's need</b>							
<b>8.2. Submitting the application for AT</b>							
<b>8.3. Liaising with the NCSE SENO about AT</b>							
<b>8.4. Procuring the AT once it has been approved</b>							
<b>8.5. Maintenance and repair of the AT in the school</b>							

A. You and your school		
<b>8.6. Is the use and non-use of AT monitored?</b>		
	Yes	
	No	
<b>8.7. If Yes, please specify that person's job role below?</b>		
<b>9.1. Are pupils generally provided with training in the use of the AT with which they are provided?</b>		
	Yes	
	No	
<b>9.2. If Yes, please briefly describe who organises and how the training is delivered</b>		
<b>9.3. Are pupils generally provided with support in the use of the AT with which they are provided??</b>		
	Yes	
	No	
<b>9.4. If Yes, please specify that person's job role below</b>		
<b>9.5. Are staff generally provided with training in the use of specific AT devices or equipment and how to support the pupil using it?</b>		
	Yes	
	No	
<b>9.6. If Yes, please briefly describe who training is provided for, who organises it and how the training is delivered</b>		

A. You and your school			
10. If you are not the person responsible for co-ordinating applications for AT in your school, please describe the nature of your involvement in supporting AT use in the school?			
11. Please indicate the number of pupils in your school provided with NCSE (SENO) recommended AT, that you are aware of, under each of the categories of special educational needs			
	Hearing impairment		Emotional/Behavioural Disorders
	Visual Impairment		Specific Learning Disability
	Physical Disability		Specific Speech and Language Disorder
	Severe/Profound General Learning Disability		Multiple Disabilities
	Moderate General Learning Disability		Other – Please Specify
	Autism/Autistic Spectrum Disorders		
12.1. If you are in a mainstream school, does your school have an NCSE sanctioned special class?			
		Yes	
		No	
12.2. If yes, please specify the SEN designation of the special class below.			
12.3. Does your school have access to additional AT beyond that recommended by the NCSE (SENO)?			
		Yes	
		No	
12.4. If Yes, please indicate the other sources of AT to which you have access			

B. Your knowledge and experience in area of AT			
13.1. On a scale of 1 to 5, where 1=Not at all familiar and 5=Very familiar, how would you rate your familiarity with the AT that the pupils with SEN in your school are using?			
13.2. On a scale of 1 to 5, where 1=Very Little and 5=Extensive, how would you rate your practical experience ( <i>other than training or research</i> ) in working with pupils using AT?			
13.3. Please describe the nature of your practical experience in the space provided below			
14.1. On a scale of 1 to 5, where 1=Very Little and 5=Expert, how would your rate your knowledge in the area of AT?			
14.2. Please indicate whether you have used any of the mechanisms listed on the right to gain knowledge about AT by checking the relevant box (You can check more than one box; Leave a blank if you have not used a particular mechanism)			
	Attendance at academic courses	<input type="checkbox"/>	Information from other teachers
	Attendance at CPD courses	<input type="checkbox"/>	Information from the parents of AT users
	Advice from the SENO	<input type="checkbox"/>	Information from suppliers of AT
	Advice from other experts e.g. Visiting Teacher,	<input type="checkbox"/>	Other – Please specify below
	Advice from assessing professionals	<input type="checkbox"/>	
14.3. On a scale of 1 to 5, where 1=Limited and 5=Excellent, how would you rate the information you have gained?			
14.4. Please explain the reasons for your ratings in the space provided below			
15.1. Please indicate whether you have used any of the listed online resources or other websites to gain up to date information about the most appropriate AT to respond to particular special education needs? (You can check more than one box; Leave a blank if you have not used a particular website)			
	NCSE	<input type="checkbox"/>	Assist Ireland
	Department of Education and Skills	<input type="checkbox"/>	CRC Client Technical Services
	Special Education Support Service	<input type="checkbox"/>	Voluntary Organisations' Websites
	National Disability Authority	<input type="checkbox"/>	Other – Please specify below

B. Your knowledge and experience in area of AT			
<b>15.2. On a scale of 1 to 5, where 1=Limited and 5=Excellent, how would you rate the quality of the information you gained from each of the online resources that you indicated you used?</b>			
	NCSE	Assist Ireland	
	Department of Education and Skills	CRC Client Technical Services	
	Special Education Support Service	Voluntary Organisations' Websites	
	National Disability Authority	Other – Please specify below	
<b>15.3 Please explain the reasons for your ratings in the space provided below</b>			

C. Your views about current procedures for obtaining AT to support pupils with SEN	
<b>16. Based on you own experiences and observations, please describe below the main challenges, if any, in ensuring the AT is used effectively to support the education and learning of the pupils with SEN.</b>	
<b>17. Based on your observations and experience, how would you rate the current procedure for procuring AT for pupils with SEN (on a scale of 1 to 5, where 1=Substantial Improvement Required and 5=No Changes Require-Works Fine) in each of the areas listed below. (Leave blank if you do not feel you know enough to make a rating):</b>	
<i>17.1. The process, in the school and externally, through which pupils with SEN are identified as having the potential to benefit from using AT</i>	
<i>17.2. The procedures for assessing the AT needs of pupils with SEN</i>	
<i>17.3. The procedures for making an application to obtain a recommendation that AT is appropriate</i>	
<i>17.4. The process through which it is decided that AT should be allocated to a pupil with SEN</i>	
<i>17.5. The way in which AT is bought and delivered to the pupils with SEN</i>	
<i>17.6. The training that is provided to pupils with SEN, their parents</i>	
<i>17.7. The training that is provided to teachers in the effective use of AT</i>	
<i>17.8. The types of supports available to resolve problems that arise and to ensure the AT is working properly</i>	

<b>C. Your views about current procedures for obtaining AT to support pupils with SEN</b>	
<b>17.9. Please explain the reasons for your ratings in the space provided below</b>	
<b>17.10. Have any unexpected issues arisen in the identification of AT Needs, procurement of AT and the use and appropriate application of AT? If Yes, Please describe these below.</b>	
	Yes
	No

<b>D. Your views on the impact (positive or negative) of AT in supporting the education of pupils with SEN</b>
<b>18. Based on your own experiences and observations, please describe the impact of NCSE-recommended AT in supporting the education and learning of pupils with SEN in each of the following areas:</b>
<i>18.1. Curriculum access particularly in terms of participation in class, assessment of learning and accessing and using learning materials and resources. (Leave blank if you have not observed or experienced any evidence of this).</i>

**D. Your views on the impact (positive or negative) of AT in supporting the education of pupils with SEN**

18.2. **Educational and learning engagement** in terms of being involved and interested in all aspects of school life, being motivated and happy to get involved in learning activities, making an effort to do well in learning activities and being interested in gaining new knowledge. (Leave blank if you have not observed or experienced any evidence of this).

18.3. **Educational experiences** including participation in breaks, library time, recreation or assemblies, use of, and access to, school facilities and extra-curricular activities and relationships with fellow pupils and teachers. (Leave blank if you have not observed or experienced any evidence of this).

18.4. **Academic progress** in general, in specific subjects, in learning to read, write and calculate; in decoding print and producing written content and producing written texts. (Leave blank if you have not observed or experienced any evidence of this).

18.5. **Progress in other areas of school life** such as life skills and activities of daily living, mobility and independence. (Leave blank if you have not observed or experienced any evidence of this).

D. Your views on the impact (positive or negative) of AT in supporting the education of pupils with SEN		
<b>18.6. Have any unexpected issues for the school or for the student arisen in the process of the identification of AT Needs, procurement of AT and the use and appropriate application of AT? If Yes, please specify below</b>		
	Yes	
	No	
<b>18.7. In your experience is NCSE-recommended AT generally used by pupils for the purpose it is recommended? If No please specify below.</b>		
	Yes	
	No	
<b>18.8. Are you aware of instances where a pupil used NCSE recommended AT in other beneficial ways not anticipated in the original application? If Yes, please specify below</b>		
	Yes	
	No	

**E. Your views about how the current procedures for allocating AT to pupils with SEN could be improved**

**19. Based on your observations and experiences, what advice would you give to a colleague who had never been involved in the process of identifying and obtaining appropriate AT for a pupil with SEN.**

**20. If you have any suggestions about how the roles of the NCSE and Department of Education and Skills in the process of allocating AT to students with SEN could be improved, please provide these in the space below?**

**21. If you have any additional suggestions that you think would make the process operate more effectively please provide these in the space below**

*Thank you for completing the questionnaire*

## Appendix 7: Glossary of Terms

**Assistive technology (AT)** is any item, piece of equipment, or product system used to increase, maintain or improve the functioning of individuals with disabilities. It may be purchased commercially off the shelf, modified or customised. The term does not include a medical device that is surgically implanted or the replacement of such a device. AT devices range from low tech, such as a magnifying glass to high tech, such as a computer that responds to touch and allows a child to communicate more effectively.

**Accessibility features** are various options that exist within products that allow a user to adjust the settings to their personal needs. Products can come with various accessibility features that can adjust to the individual's visual, mobility, hearing, language, and learning needs.

**Access utility** is a software programme that modifies a standard keyboard to simplify its operation, replaces the mouse, substitutes visual cues for sound signals, or adds sound cues to keystrokes. Many basic modifications can be made through software that already exists on the computer. Altering font size, colour contrast and adding or modifying audio alerts can all be done without buying additional software

**Accommodations** refer to modifications in how a test is administered while not altering what the test measures or the validity of its result. Accommodations may include changes to presentation format, response format, test setting or test timing. Applications for such accommodations are considered by the State Examinations Commission.

**Activities of daily life** are everyday activities such as dressing, washing etc. Assistive technology devices can support ADL, which includes self-help aids to help people with disabilities eat, bathe, cook and dress.

**Adapted technology** – an adaptation is a modification made to a device or to a service or programme which renders it usable by or appropriate for a person with a disability. At school, a standard curriculum or lesson may be adapted, for example, to better meet the needs of a special education student. A modified device, programme or service modified is referred to as 'adapted'.

**Adjustable workstations** allow height adjustment for users that cannot access a standard computer workstation. Models include movement mechanisms to include: crank, spring assisted, and electronic. Electronic models are most ideal from an access standpoint as a user can adjust the height independently.

**Alternative access/input device** allows individuals to control their computers using tools other than a standard keyboard or pointing device. Examples include alternative keyboards, electronic pointing devices, sip-and-puff systems, wands and sticks, joysticks and trackballs.

**Alternative format** refers to the transcription of books or other content (such as notes or newspapers or magazines) into a format other than standard print, i.e. large print, HTML Braille, audio, talking books.

**Alternative keyboards** – these and other enhancements allow people who experience difficulty with conventional keyboard designs to use computers. The products available range from key guards that prevent accidental key activation, to alternative keyboards with differing layouts, sizes, etcetera for people with specific needs, to alternative input systems which require other means/methods of getting information into a computer.

**Alternative pointing devices**, trackballs and keypads are used to replace the traditional computer's mouse.

**Assessment** refers to the gathering and interpretation of information related to a pupil's learning abilities, learning attainments, learning strengths and learning needs. In the school situation assessment processes can be formal or informal and information obtained can measure pupil progress and achievement in addition to providing valuable information for use in planning for learning and teaching.

**Assistive listening devices (ALDs)** are used to aid individuals with hearing impairments to hear more clearly in public situations. The system can be set up to amplify things such as televisions, radios, doorbells, and PA systems. The Springfield system is commonly used in schools. ALDs can be used with or without hearing aids.

**Assistive technology assessment** is designed to identify appropriate AT devices and services, the user must be central to the assessment which must be cognisant of the person's environment, characteristics

**Assistive technology abandonment** refers to the failed attempt at implementing technology with a particular student resulting in the technology not being used. Causes of assistive technology abandonment include inappropriate match of technology to student need, ineffective staff and student training and lack of time for technology integration.

**Assistive technology devices** can be anything from a simple tool with no moving parts (eg, a toothbrush with a built-up handle) to a sophisticated mechanical/electronic system (eg, a robotic arm). Simple, mechanical devices are often referred to as 'low tech' devices while computer-driven or complex assistive technology may be called 'high tech'.

**Assistive technology interventions** refers to the use of various types of technology to make things more accessible to individuals with disabilities as well as help them with various academic tasks. AT interventions can be used to help students access reading, writing, math, and other instructional curriculum.

**Augmentative and Alternative Communication (AAC) System** increases or improves the communication abilities of individuals with receptive or expressive communication impairments. The system can include sign language, graphical symbol systems, synthesised speech, dedicated communication devices and computer applications. AAC technology spans a wide range of products, from low-tech picture boards to high-tech speech recognition programmes.

**Braille** is a raised dot printed language used by many people with visual impairments. Each raised dot arrangement represents a letter or word combination.

A **Braille embosser or translator** is a hardware device for 'printing' a hard copy of a text document in Braille. A Braille translation software programme is required to translate the text from the computer into Braille. Most Braille translation software programmes can translate material into several grades or versions of Braille.

**Captioning** is a text transcript of the audio portion of multimedia products, such as video and television, synchronised to the visual events taking place onscreen.

**Digitised speech** has been digitally recorded for later playback. It may be used in CD-ROMs for talking stories, in encyclopaedias and in software packages where teachers and students are able to record sounds, words and sentences themselves. Digitised speech has a finite, predetermined vocabulary and so does not offer full access to mainstream software.

**Education For Persons With Special Educational Needs Act 2004** was passed to ensure that persons with special educational needs can be educated where possible in a inclusive environment, that they can have the same rights to education as persons without special educational needs and to ensure that such persons are equipped by the education system with the skills they need to participate in society and to live independent and fulfilled lives.

**Early intervention team** refers to a team of health sector specialists who work as a multidisciplinary or transdisciplinary team and provide services to children with special developmental needs from birth to six years and to their families.

**Electronic pointing devices** allow the user to control the cursor on the screen using ultrasound, an infrared beam, eye movements, nerve signals, or brain waves. When used with an onscreen keyboard, electronic pointing devices also allow the user to enter text and data.

**Eye gaze systems** are eye-operated communication and control devices designed for use by children and adults with multiple disabilities. Users make selections by looking at keys displayed on the screen for a fraction of a second (eye gaze). A small camera mounted under the eye gaze screen takes 60 pictures per second of the user's eye. Those images are analysed by a processor that interprets where the user is looking. Users generate speech by using an on-screen keyboard or pre-programmed phrases.

**Environmental Control Unit (ECU)** enables individuals to control electronic devices in their environment through a variety of alternative access methods, such as switch or voice access. ECUs can control lights, televisions, telephones, music players, door openers, security systems and kitchen appliances. These systems are also referred to as electronic aids to daily living (EADL).

**Ergonomic keyboards** address positioning of the user to allow for more neutral arm, wrist and hand positioning. Most address wrist deviation and some address pronation.

**E-text readers** are hardware devices specifically designed to read electronic text.

**FM systems** are assistive listening device worn by the speaker to amplify his/her voice and transmit it directly to the listener's ears via an electronic receiver and special earphones or the listener's own hearing aids. An example of the device is the Springfield system. The device reduces the problem of background noise interference and the problem of distance between speaker and hearing-impaired listener.

**Individual education plan (IEP)** is a written document prepared for a named student which specifies the learning goals to be achieved by the student over a set period of time and the teaching strategies, resources and supports necessary to achieve those goals.

**Irish Matching Person with Technology (IMPT)** is a validated instrument (self-report checklists about consumer predispositions to and outcomes of technology use) adapted from the Matching Person with Technology (MPT) which takes into account the environments in which the person uses the technology, the individual's characteristics and preferences, and the technology's functions and features.

**ISO 9999** Assistive products for persons with disability – Classification and terminology classifies assistive products based on a product's function. At its highest level, ISO 9999 defines 12 functional areas called 'classes', each of which is subdivided into 'subclasses'. Within most subclasses, more specific categories called 'divisions' are listed. ISO 9999 is produced by the International Organization for Standardization (ISO), an international federation of national standards bodies.

**Joysticks** are alternative input devices which can be plugged into the computer's mouse port to control the cursor on the screen. Other joysticks plug into game ports and depend on software designed to accept joystick control.

**Keyboard emulator** is connected to or resides in a computer and imitates the computer's keyboard in function and performance.

**National Council for Special Education** was set up to improve the delivery of education services to persons with special educational needs arising from disabilities with particular emphasis on children. The NCSE is responsible through its network of local special educational needs organisers for allocating resource hours and special needs assistants to support children with special needs.

**Onscreen keyboards** are software-generated images of a standard or modified keyboard placed on the computer screen. The keys are selected by a mouse, touch screen, trackball, joystick, switch or electronic pointing device.

**Optical character recognition (OCR)** software works with a scanner to convert images from a printed page into a standard computer file. With OCR software, the resulting computer file can be edited. Pictures and photographs do not require OCR software to be manipulated.

**PDST Technology in Education** promotes and supports the integration of ICT in teaching and learning in first and second level schools. It is part of the national support service, the Professional Development Service for Teachers, which operates under the aegis of the Department of Education and Skills. The functions of the PDST Technology in Education were previously the responsibility of the National Centre for Technology in Education (NCTE)

**Personal assistants** support people with disabilities complete daily tasks needed for successful participation in school, work, and community living.

**Pointing or typing aid** is typically a wand or stick used to strike keys on the keyboard. They are most commonly worn on the head, held in the mouth, strapped to the chin or held in the hand.

**Screen magnification software** is used by people with visual disabilities to access information on a computers screen. The software enlarges the information on the screen by pre-determined incremental factor. Most screen magnification software has the flexibility to magnify the full screen, parts of the screen or provide a magnifying glass view of the area around the cursor or pointer. These programmes also often allow for inverted colours, enhanced pointer viewing and tracking options.

**Screen magnifier** is a hardware device placed externally on a monitor to enlarge the image on the screen. It will only allow one to two times enlargement of the original. Some also incorporate anti-glare features. Some users complain of distortion.

**Screen readers** are software programmes using synthesised speech to 'speak' graphics and text aloud. These type of programmes are used by people with limited vision or blindness or with a print disability, such as dyslexia. Hardware and software produce synthesised voice output for text displayed on the computer screen, as well as for keystrokes entered on the keyboard.

**Single subject experimental designs** refers to experimental designs which alternate and compare experimental conditions within a single group or even individual. They aim to introduce some experimental control into studies that otherwise might take place as case studies. There are many possible designs for a single subject study and one example referred to in the text is an ABBABAAB-BAABABBA design (where A refers to a baseline condition and B an experimental condition). In this example, the design is a mirror image of interventions and non-interventions which also controls for length of intervention (A and AA, B and BB).

**Special educational needs officers (SENOs)** are appointed by the NCSE to provide a direct local service to the parents of children with special educational needs and to schools within geographical areas.

This involves identifying the needs of children and deciding on the level of resources schools require to provide them with an appropriate education service. A SENO deals with applications for additional teaching and special needs assistant support for children with special educational needs from all schools. The SENO also assists with applications for transport and AT.

**Special Education Support Service (SESS)** has a role to enhance quality of learning and teaching in special educational provision. The service co-ordinates, develops and delivers a range of professional development initiatives and support structures for school personnel working with students with special educational needs in mainstream primary and post-primary schools, special schools and special classes. The SESS operates under the remit of the Teacher Education Section (TES) of the Department of Education and Skills.

**Special educational needs** means, in relation to a person, a restriction in a person's capacity to participate in and benefit from education on account of an enduring physical, sensory, mental health or learning disability, or any other condition which results in a person learning differently from a person without that condition and cognate words shall be construed accordingly (EPSEN Act 2004)

**Special needs assistant** acts in a care and support role that is non-teaching in nature and works under the guidance and supervision of the principal and/or class teacher. An SNA's role and duties are more clearly defined in DES Circular 10/76 and Circular 07/02.

**Speech recognition programmes** are software applications which convert words spoken aloud to text. Speech recognition is designed to respond to a wide range of voices, without prior 'training' of the software. Voice or speaker recognition, on the other hand, involves the training of a device to recognise a specific individual's voice. Both speech and voice recognition programmes may be used to create written documents without the use of a keyboard, to control specially adapted equipment, and to operate telephone, cell phone and PDA (personal digital assistant) applications.

**Speech synthesisers** – An external speech synthesizer is a hardware device used for speech output. Typically, they are used with screen readers or OCR/scanning software (optical character recognition) programs for people who are blind or visually disabled.

**Spell checkers** are handheld with an option of a visual display or visual display with auditory output. Most have a thesaurus.

**Switches and switch software** offer an alternative method of providing input to a computer when it is not possible to use a standard keyboard or mouse. Switches come in various sizes, shapes, methods of activation and placement options. Some software programmes have been developed specifically for use with a switch and can employ onscreen scanning. With the latter, the computer highlights the options available to the user who then selects the desired action. When a visual or

auditory prompt indicates a specific keyboard or mouse function, the user activates the switch and the desired function occurs. Other programmes have built-in options for switch use.

**Text to speech programmes** software converts written text, including Word documents, Web pages, PDF files, and emails into audio files that play on a computer, CD-ROM player, MP3 device, iPod or other digital audio playback equipment. Developed for individuals with low vision or blindness, text to speech technology has improved greatly, with natural sounding voices, greater conversion speed, and improved ease of use.

**Touch screens** are devices that are placed on or built into the computer monitor that allow direct activation of the computer or selection of a programme, through a touch on the screen.

**Universal design** refers to the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people, regardless of their age, size or disability (Disability Act, 2005).

**Universal Design for Learning (UDL)** is the design of instructional materials and activities that make learning goals achievable by individuals with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organise engage and remember. Universal Design for Learning is achievable via flexible curricular materials and activities that provide alternatives for students with differing abilities. These alternatives are built into the instructional design and operating systems of educational materials; they are not added on after-the-fact.

A **voice output communication aid (VOCA)** is an electronic device that generates spoken language for individuals who are unable to use natural speech to express their needs and to communicate with others during a conversation. These devices are intended solely for communication purposes.

**Voice recognition** (see also speech recognition) allows a user to use his/her voice as an input device. It may be used to dictate text into the computer or to give commands to the computer (such as opening application programmes, pulling down menus, or saving work). Continuous speech voice recognition applications allow a user to dictate text fluently into the computer. These new applications can recognise speech at up to 160 words per minute. While the accuracy of voice recognition has improved over the past few years some users still experience problems with accuracy either because of the way they speak or the nature of their voice.

**Web accessibility** – universal accessibility to the world wide web means all people, regardless of their physical or developmental abilities, have access to web-based information and services. Making web pages accessible is accomplished by designing them to work with adaptive technologies, such as screen readers. It also means making colour, font size, and page design decisions that make it possible for the widest range of individuals to access the information.

**Word prediction programmes** allow the user to select a desired word from an onscreen list in a prediction window. The computer-generated list predicts words based on the first or second letter(s) typed by the user. The word may then be selected from the list and inserted into the text by typing a number, clicking the mouse, or scanning with a switch.

## Appendix 8: Parental Consent Form

**Title of Project:** Assistive Technology/Equipment In Supporting The Education Of Children With Special Educational Needs – What Works Best?

**Principle Researcher:**

Dr. Richard Wynne, Director, Work Research Centre, 3 Sundrive Rd. Kimmage, Dublin 12

Email: [r.wynne@wrc-research.ie](mailto:r.wynne@wrc-research.ie)

Phone: 01 4927042

Please tick the box to indicate your consent	Yes
I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	
I understand that my participation and that of my son/daughter is voluntary and that I am free to withdraw at any time.	
I am over the age of 18 years and I agree to take part in this study and I agree to my son/daughter's participation in this study	
I am happy that the interview will be recorded on audiotape	
Indicate the interview arrangements that would suit you best	
I would be happy to meet with the interviewer with my son/daughter at the school or another location at a time that suits me.	
The interviewer can meet with my son/daughter on his or her own at the school and I will talk to the interviewer by telephone later.	
I wish to nominate a special needs assistant or teacher to attend the interview in my place.	
My son/daughter will need special arrangements to participate in the study	
Please specify below the special arrangements that your son/daughter will need to participate in the interview:	

I understand that data collected during this study will be anonymised before publication and that no identifying information about me, my son/daughter or their school will be included in the report.

I understand that if I have any questions on this research, I can contact the investigators listed above.

<b>Name of pupil:</b>	
<b>Name of person granting consent:</b>	
<b>Signature of person granting consent:</b>	
<b>Date:</b>	
<b>Indicate your relationship to the AT User i.e. parent or legal guardian.</b>	

## Appendix 9: NCSE AT Story-Based Inquiry System

The researchers were trained in the procedures for administering the interview, piloted with pupils in primary, secondary and special schools. Before carrying out an interview independently, they shadowed an experienced interviewer in a pilot administration interview. The interpretation of interview narratives was included in the training. In this part of the training, researchers were provided with a set of 58 sample responses and were required to assign them to specific component. The results were analysed in terms of frequency of concurrence and the appropriate category for each response was agreed. This resulted in a set of full definitions of each domain and component, illustrated with examples. This was included in the procedures manual provided to the six researchers who carried out the interviews.

NCSE AT Story-Based Inquiry Coding System			
Category	Required Reference		
Curriculum access	<ol style="list-style-type: none"> <li>1. Activities, materials, equipment or resources through which learners normally access information, knowledge or skills that are central to the educational curriculum</li> <li>2. An implied desire, need or intention to gain access to, take part in or use these</li> <li>3. A barrier to gaining access including attitudinal, physical, technical, institutional or competency barriers or negative experiences</li> </ol>		
	Sub-Category	Examples	
Curriculum access	<ol style="list-style-type: none"> <li>a. <b>Classroom participation:</b> being able to take part in all activities in the classroom including listening, asking questions, carrying out tasks, sustaining attention, acting appropriately, not interrupting, responding appropriately to correction, learning from instruction</li> </ol>	<ul style="list-style-type: none"> <li>• A lot of times I just talk to my friend beside me</li> <li>• I found it very difficult to get up the courage to ask a question in class</li> <li>• I found that if I listened very carefully I would not need to read the textbook</li> <li>• I really found it hard to hear the teacher</li> <li>• I really thought that my teachers could be more helpful in the classroom</li> <li>• I would get annoyed during the class because I kept missing what the teacher was saying</li> <li>• My teachers never asked me anything in class</li> <li>• They had to move classes to the ground floor so I could attend</li> </ul>	
		<ul style="list-style-type: none"> <li>• Classroom participation; learning engagement behavioural</li> <li>• Classroom participation; confidence</li> <li>• Classroom participation; access to learning materials and resources</li> <li>• Classroom participation; access to learning materials and resources</li> <li>• Classroom participation; relationships with teachers</li> <li>• Classroom participation; enjoyment</li> <li>• Classroom participation; school involvement relationship with teachers</li> <li>• Classroom participation; mobility</li> </ul>	

NCSE AT Story-Based Inquiry Coding System			
Curriculum access	<p>b. <b>Participation in assessment:</b> being able to successfully demonstrate acquired learning or knowledge in a formal written or oral examination, to read and understand questions, to complete answers within the required time, to produce understandable responses</p>	<ul style="list-style-type: none"> <li>• I couldn't get all the questions answered in exams</li> <li>• I did ok in class but I never got good marks on my tests</li> <li>• The main problem I had was understanding what the questions meant in my exams</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in assessment</li> <li>• Participation in assessment</li> <li>• Participation in assessment</li> </ul>
Curriculum access	<p>c. <b>Access to learning materials and resources:</b> being able to read written texts, to copy from the blackboard, white board or work sheets, to use learning materials, equipment and technologies, to obtain the materials required for learning in the classroom and at home</p>	<ul style="list-style-type: none"> <li>• I found that if I listened very carefully I would not need to read the textbook.</li> <li>• I liked my computer but I found the keyboard hard to manage</li> <li>• I really found it hard to hear the teacher</li> <li>• The hardest thing was doing the readings for my homework</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom participation; access to learning materials and resources</li> <li>• Access to learning materials and resources</li> <li>• Classroom participation; access to learning materials and resources</li> <li>• Attainment literacy &amp; numeracy; access to learning materials and resources</li> </ul>

NCSE AT Story Based-Inquiry Coding System			
Category	Required Reference		
Educational engagement	<ol style="list-style-type: none"> <li>1. Involvement, interest or motivation towards learning and education</li> <li>2. Essential educational and learning activities that occur outside the classroom or at home</li> <li>3. Difficulty or lack of interest in becoming involved, occupied, or participating in these</li> </ol>		
	Sub-Category	Examples	
Educational engagement	<p>a. <b>School process engagement:</b> being involved in all <b>formal</b> aspects of school life both within and outside the classroom, taking an interest in school life and activities, being aware of what's going on in school and keeping up-to-date and being involved in breaks, library time, recreation or assemblies, use of, and access to, school facilities</p>	<ul style="list-style-type: none"> <li>• I have to say that I always found school to be a real drag</li> <li>• The hardest thing is remembering which classroom I should be in at what time.</li> <li>• I wasn't really able to get involved in school assembly with the other students</li> <li>• I used to spend my recreation time in the library for fear I would get hurt.</li> </ul>	<ul style="list-style-type: none"> <li>• School process engagement, academic orientation</li> <li>• School process engagement</li> <li>• School process engagement</li> <li>• School process engagement; confidence</li> </ul>
Educational engagement	<p><b>Learning engagement:</b> being motivated and happy to get involved in learning activities in school and at home, wanting to do homework, making an effort to do well in learning activities, being curious and interested in gaining new knowledge and information</p>		
Educational engagement	<p>b. <b>Cognitive engagement</b> such as remembering, thinking, problem solving or concentrating,</p>	<ul style="list-style-type: none"> <li>• I used to get very tired by the end of the day and it is really hard to concentrate</li> <li>• Sometimes my mind wandered when I was in class</li> <li>• I often lost my place when I was trying to study</li> </ul>	<ul style="list-style-type: none"> <li>• Learning engagement-cognitive</li> <li>• Classroom participation; learning engagement-cognitive</li> <li>• Learning engagement-cognitive</li> </ul>
Educational engagement	<p>c. <b>Behavioural engagement</b> such as sitting down to work, being organised, managing time or sustaining effort,</p>	<ul style="list-style-type: none"> <li>• A lot of times I just talk to my friend beside me</li> <li>• I always found it difficult to get down to my homework.</li> <li>• I couldn't finish all my homework without any help from my mother</li> <li>• I used to forget to bring in my copies in to school a lot</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom participation; learning engagement behavioural</li> <li>• Learning engagement behavioural</li> <li>• Learning engagement behavioural; independence</li> <li>• Learning engagement – behavioural</li> </ul>

NCSE AT Story Based-Inquiry Coding System			
<b>Educational engagement</b>	d. <b>Affective/emotional engagement</b> such as interest, motivation, liking learning, tolerating frustration, wanting to do better	<ul style="list-style-type: none"> <li>• Doing my homework was the worst thing</li> <li>• I couldn't wait for school to be over each day</li> <li>• I didn't like school, it was really dull</li> <li>• I really did not care about doing well in school</li> <li>• I used to be really worried about going to secondary school</li> <li>• I used to feel like getting sick on Sunday night.</li> <li>• I used to pretend I had a tummy ache to avoid school</li> <li>• My Mum tried to help me with my school work but we always ended up fighting,</li> </ul>	<ul style="list-style-type: none"> <li>• Learning engagement affective/emotional</li> <li>• Learning engagement affective/emotional; academic orientation</li> <li>• Learning engagement affective/emotional; academic orientation</li> <li>• Learning engagement affective/emotional; academic orientation</li> <li>• Learning engagement affective/emotional; enjoyment</li> <li>• Learning engagement affective/emotional; enjoyment</li> <li>• Learning engagement behavioural; academic orientation</li> <li>• Learning engagement affective/emotional</li> </ul>

NCSE AT Story-Based Inquiry Coding System			
Category	Required Reference	Could Also Include	Does Not Include
<b>School involvement</b>	<ol style="list-style-type: none"> <li>1. All other aspects of being in school, education or learning that most learners take for granted and which is not directly related to the curriculum but to a broader educational experience</li> <li>2. Implied desire, need or intention to being involved or take part</li> <li>3. A barrier or negative experiences in attempting to participate including attitudinal, physical, technical, institutional or competency barriers</li> </ol>		
	<b>Sub-Category</b>	<b>Examples</b>	
	a. <b>Participation in school-related activities:</b> Getting involved in school activities outside the classroom such as hobby clubs, yard games or after school activities	<ul style="list-style-type: none"> <li>• I always have to wait until the SNA was finished with the other kids before I could go out into the yard</li> <li>• The other kids would go to chess club but I had to go straight home</li> <li>• When there was no one to help me with the wheelchair I couldn't go out in the playground</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement participation in school related activities; independence</li> <li>• School involvement participation in school related activities; independence</li> <li>• School involvement participation in school related activities; independence</li> </ul>

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	<p>b. <b>Extra-curricular activities</b> offered to pupils such as sports, school trips, debating societies, science clubs or drama</p>	<ul style="list-style-type: none"> <li>• I couldn't go on school tours because my wheelchair wouldn't go on the bus</li> <li>• I did not go for a part in the school play because I couldn't remember my lines.</li> <li>• I really wanted to take part in the debating team but my speech wasn't clear enough.</li> <li>• I would have liked to be able to go on school trips with my friends</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement extra-curricular activities; mobility</li> <li>• School involvement extra-curricular activities</li> <li>• School involvement extra-curricular activities</li> <li>• School involvement extra-curricular activities</li> </ul>
	<p>c. <b>Relationship with peers:</b> Informal aspects such as play, socialising, meeting up or communicating, relationships with fellow pupils</p>	<ul style="list-style-type: none"> <li>• I didn't have too many friends in school</li> <li>• I rarely got to go out with my friends after school</li> <li>• I wished that I could be in the same class as my friends</li> <li>• It was really hard making friends with the other kids</li> <li>• Some of the other kids would call me a 'Spa' but my Dad said they were the ones who needed help.</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement relationships with peers</li> <li>• School involvement relationships with peers</li> <li>• School involvement relationship with peers</li> <li>• School involvement relationship with peers; socialisation</li> <li>• School involvement relationships with peers</li> </ul>
	<p>d. <b>Relationship with teachers:</b> communicating and relationships with teachers, support from teachers, trust in teachers, positive regard and respect from teachers</p>	<ul style="list-style-type: none"> <li>• I didn't like my teachers, they were always giving out to me</li> <li>• I really thought that my teachers could be more helpful in the classroom</li> <li>• My teachers never asked me anything in class</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement relationships with teachers</li> <li>• Classroom participation; relationships with teachers</li> <li>• Classroom participation; school involvement relationship with teachers</li> </ul>

NCSE AT Story-Based Inquiry Coding System			
Category	Required Reference		
<b>Attainment</b>	<ol style="list-style-type: none"> <li>1. Doing well, achieving, getting good grades, learning things, accomplishing, ability or competence academically or in life</li> <li>2. Explicit or Implied desire, need or intention to achieve or do better</li> <li>3. Reference to disappointment, frustration, discontent, wanting to do better,</li> </ol>		
	Sub-Category	Examples	
	a. <b>Academic attainment:</b> a reference about generally not achieving in school that does not specify a particular academic subject or skill	<ul style="list-style-type: none"> <li>• I wasn't doing very well in school.</li> <li>• I used to come last in the class</li> <li>• My mother told me that I wasn't a very academic student</li> </ul>	<ul style="list-style-type: none"> <li>• Academic attainment</li> <li>• Academic attainment</li> <li>• Academic attainment</li> </ul>
	b. <b>Literacy or numeracy:</b> learning to read, write and calculate; reading, writing and calculating at the appropriate age level, struggling decoding print and producing written content	<ul style="list-style-type: none"> <li>• My writing was all over the place my homework came back covered in red pen</li> <li>• The hardest thing was doing the readings for my homework</li> <li>• Writing essays was very difficult because of the spelling</li> </ul>	<ul style="list-style-type: none"> <li>• Attainment literacy &amp; numeracy</li> <li>• Attainment literacy &amp; numeracy; access to learning materials and resources</li> <li>• Attainment literacy &amp; numeracy</li> </ul>
	c. <b>Specific subjects</b> such as history, geography, art, woodwork, PE	<ul style="list-style-type: none"> <li>• I found history was very difficult but I liked maths</li> <li>• I really struggled with languages</li> <li>• I was not very good at art or practical subjects</li> </ul>	<ul style="list-style-type: none"> <li>• Subject specific attainment</li> <li>• Subject specific attainment</li> <li>• Subject specific attainment</li> </ul>
	d. <b>Skills for life</b> such as team work, cooperation, assertiveness, persistence, taking correction, coping with stress, dealing with problems, handling disagreements, managing money, developing hobbies, following rules	<ul style="list-style-type: none"> <li>• When I was in a project group the others would always ignore what I said</li> <li>• I really didn't have any real hobbies</li> <li>• When I got something wrong I just gave up</li> <li>• I used to get really stressed out when I had answer a question in class</li> </ul>	<ul style="list-style-type: none"> <li>• Skills for life; relationships with peers</li> <li>• Skills for life</li> <li>• Skills for life</li> <li>• Classroom participation; skills for life</li> </ul>
	e. <b>Mobility</b> such as getting around the school, commuting to and from school, accessing all areas of the school	<ul style="list-style-type: none"> <li>• I couldn't go on school tours because my wheelchair wouldn't go on the bus</li> <li>• I needed one of my friends to help if I wanted to go out by myself</li> <li>• They had to move classes to the ground floor so I could attend</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement extra-curricular activities; mobility</li> <li>• Mobility; independence</li> <li>• Classroom participation; mobility</li> </ul>

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	<p>f. <b>Daily living skills</b> such as grooming and hygiene, self-care, toileting, doing household chores, tidying the classroom work space, taking care of books and copies, eating, drinking</p>	<ul style="list-style-type: none"> <li>• I needed a lot of help in doing things like going to the shops at break time</li> <li>• I needed an awful lot of help taking care of myself</li> <li>• I wasn't really able to take care of myself in school</li> </ul>	<ul style="list-style-type: none"> <li>• Daily living skills; independence</li> <li>• Daily living skills; independence</li> <li>• Daily living skills; independence</li> </ul>
	<p>g. <b>Independence</b> in doing things or carrying out tasks with needing to be reminded or having the support of another person</p>	<ul style="list-style-type: none"> <li>• I always have to wait until the SNA was finished with the other kids before I could go out into the yard</li> <li>• I couldn't finish all my homework without any help from my mother</li> <li>• I needed a lot of help in doing things like going to the shops at break time</li> <li>• I needed an awful lot of help taking care of myself</li> <li>• I needed one of my friends to help if I wanted to go out by myself</li> <li>• I wasn't really able to take care of myself in school</li> <li>• When there was no one to help me with the wheelchair I couldn't go out in the playground</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement participation in school related activities; independence</li> <li>• Learning engagement behavioural; independence</li> <li>• Daily living skills; independence</li> <li>• Daily living skills; independence</li> <li>• Mobility; independence</li> <li>• Daily living skills; independence</li> <li>• School involvement Participation in School related activities; Independence</li> </ul>
	<p>h. <b>Socialising</b>, making friends, handling interpersonal relationships, being part of a group, being involved in informal play or activities</p>	<ul style="list-style-type: none"> <li>• It was really hard making friends with the other kids</li> <li>• It wasn't easy to join in with the joking and backchat that went on in the playground</li> <li>• I never felt I was really part of the gang</li> </ul>	<ul style="list-style-type: none"> <li>• School involvement relationship with peers; socialising</li> <li>• School involvement relationship with peers; socialisation</li> <li>• School involvement relationship with peers; socialisation</li> </ul>

NCSE AT Story-Based Inquiry Coding System			
Category	Required Reference		
Subjective wellbeing	1. Feelings, emotional reactions, sense of satisfaction or fulfilment, desires, perceptions: 2. An explicit reference to feelings or emotions		
	Sub-Category	Examples	
	a. <b>Academic orientation:</b> a desire, motivation, interest in learning, education or doing well in school	<ul style="list-style-type: none"> <li>I couldn't wait for school to be over each day</li> <li>I didn't like school, it was really dull</li> <li>I have to say that I always found school to be a real drag</li> <li>I just did not think I would be able to do well as a student.</li> <li>I really did not care about doing well in school</li> <li>I really did not think of myself as a good student</li> <li>I really did not think that I was someone who could do well in school</li> <li>I really don't think I am an 'A' student, I am probably just average.</li> <li>I used to pretend I had a tummy ache to avoid school</li> </ul>	<ul style="list-style-type: none"> <li>Learning engagement affective/emotional; academic orientation</li> <li>Learning engagement affective/emotional; academic orientation</li> <li>School process engagement, academic orientation</li> <li>Academic orientation; self-esteem</li> <li>Learning engagement affective/emotional; academic orientation</li> <li>Academic orientation; self-esteem</li> <li>Academic orientation; self-esteem</li> <li>Academic orientation; self-esteem</li> <li>Learning engagement behavioural; academic orientation</li> </ul>
	b. <b>Enjoyment:</b> feelings of pleasure, happiness, having a good time, getting the best out of life in school, feeling entertained	<ul style="list-style-type: none"> <li>I used to be really worried about going to secondary school</li> <li>I used to feel like getting sick on Sunday night.</li> <li>I would get annoyed during the class because I kept missing what the teacher was saying</li> </ul>	<ul style="list-style-type: none"> <li>Learning engagement affective/emotional; enjoyment</li> <li>Learning engagement affective/emotional; enjoyment</li> <li>Classroom participation; enjoyment</li> </ul>

NCSE AT Story-Based Inquiry Coding System		
	<p>c. <b>Self-esteem:</b> positive sense of self, pride, self-worth, self-respect as a person and as a learner</p>	<ul style="list-style-type: none"> <li>• I really don't think I am an 'A' student, I am probably just average.</li> <li>• I just did not think I would be able to do well as a student.</li> <li>• I really did not think of myself as a good student</li> <li>• I really did not think that I was someone who could do well in school</li> </ul> <ul style="list-style-type: none"> <li>• Academic orientation; self-esteem</li> <li>• Academic orientation; self esteem</li> <li>• Academic orientation; self-esteem</li> <li>• Academic orientation; self-esteem</li> </ul>
	<p>d. <b>Confidence:</b> belief in oneself, trust in one's own abilities, feeling of being good enough, belief that one can achieve, not being afraid to try, being able to speak out</p>	<ul style="list-style-type: none"> <li>• I used to spend my recreation time in the library for fear I would get hurt.</li> <li>• I found it very difficult to get up the courage to ask a question in class</li> <li>• It took me ages to get up to courage to tell my parents that I didn't want to do honours</li> </ul> <ul style="list-style-type: none"> <li>• School involvement participation in school related activities; confidence</li> <li>• Classroom participation; confidence</li> <li>• Academic orientation; confidence</li> </ul>
	<p>e. <b>Optimism:</b> a positive view on the world, hope, belief that things will get better, a sense that challenges can be overcome, looking forward to a brighter future, belief in the good intentions of others</p>	<ul style="list-style-type: none"> <li>• I always expected that the things would go wrong and I was rarely disappointed</li> <li>• I honestly never believed that I would be able for chess</li> <li>• I had no hope that I would be able to read and write like the rest of the class</li> </ul> <ul style="list-style-type: none"> <li>• Optimism</li> <li>• School involvement participation in extra-curricular activities; optimism</li> <li>• Literacy &amp; numeracy; optimism</li> </ul>

## Appendix 10: Analysis of Potential Outcome Measurement Instruments

### Selection of a suitable standard interview tool

It was decided to complement the semi-structured interview developed specifically for the study with an established internationally recognised questionnaire. A systematic approach was adopted to the selection of the tool and a set of requirements for a suitable tool were developed in consultation with the international consultative group. These are presented in Table A4.5.

**Table A4.5: Criteria for selection of a standard interview tool**

<b>Focus: impact on learning and education:</b>	The instrument should concentrate primarily on the impact of AT in education.
<b>Scope: relevant across all functional impairments:</b>	The tool should be applicable to people with a range of functional needs including physical and sensory, cognitive and communicative impairments.
<b>Addresses all dimension relevant to the study:</b>	The content of the instrument should provide data on the five primary dimensions of interest in the study.
<b>Credibility requirements:</b>	The instrument should be widely used and recognised internationally and data to support its validity and reliability should be available. It should be internationally recognised, widely used, theoretically sound, validated and reliable.
<b>Practical requirements</b>	The instrument should meet the pragmatic requirements of the study.
<b>Tool vs manual only:</b>	The tool should have a usage manual. A set of guidelines would be inadequate.
<b>Current versions available:</b>	The tool should be available in a version that is less than five years old.
<b>Retrospective rather than prospective:</b>	The instrument should be able to be used retrospectively to evaluate impact
<b>Summative rather than diagnostic:</b>	The instrument should provide a summative result rather than a profile of needs.
<b>Produces a score:</b>	The tool should produce a quantitative score (or set of scores) amenable to statistical analysis.
<b>Reasonable administration time:</b>	It should be possible to administer the tool in a single sitting not exceeding 45 minutes.
<b>Flexible modes of administration:</b>	The instrument should be available in a number of formats including a proxy version and/or an easy read version.
<b>Usability across levels of impairment:</b>	It should be possible to use the tool with respondents with severe and complex needs as well as those with less severe needs.
<b>Usability across student age groups:</b>	It should be possible to use the tool with respondents aged four to 18 years of age.

The criteria were applied to a selection of instruments identified in the international literature. The ATOMS (Assistive Technology Outcomes Measurement) database provided the most complete list of outcome measurement tools in education (15 models and instruments) (Edyburn, 2003)<sup>54</sup>. Research carried out during the ATOMS Project suggested construct of 'outcome' in the domain of AT was multidimensional and included:

- Change in performance/function;
- Change in participation;
- Usage;
- Consumer satisfaction with processed, devices;
- Goal achievement;
- Quality of life;
- Cost.

The instruments listed on the ATOMS database specifically related to education and which had an associated rating scale were:

- Functional Independence Measure (FIM);
- Individually Prioritised Problem Assessment (IPPA);
- Quebec User Evaluation of Satisfaction with AT (Quest 2.0);
- Psychosocial Impact of Assistive Devices Scale (PIADS);
- Life-H: Assessment of the Quality of Social Participation;
- Matching Person with Technology (MPT) model;
- Irish Matching Person with Technology (IMPO);
- School Functional Assessment.

Instruments listed on the ATOMS database that did not have a rating scale but provide a manual and model were:

- SETT – student, environment, task and technology (SETT);
- Assessing Students Needs for Assistive Technology (ASNAT);
- PATINS: Partnership for Assistive Technology with Indiana Schools;
- Wisconsin Assistive Technology Initiative – W.A.T.I. Assessment Package.

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<sup>54</sup> ATOMS (Assistive Technology Outcomes Measurement System <http://www.r2d2.uwm.edu/atoms/>)

The application of the criteria to each of the tools is presented below. In a systematic review of the literature published between January 1990 and September 2011 on models and instruments developed to measure AT for children with multiple disabilities, Desideri *et al* (2013) found that of the eight models and tools which matched the criteria of their study, only one model fully satisfied the criteria, the Technology Team Assessment Process (TTAP). However, the TTAP model is part of an assessment process and does not have a rating system. A model was defined as a framework that makes the organisation of the different elements and phases involved in the AT assessment process more systematic. An instrument was defined as a tool (eg, observation scales, questionnaires, checklists, forms). The study concluded there was a lack of empirically sound models and instruments for AT assessment focusing on children with multiple disabilities, however, it was found that the Matching Person and Technology process (MPT) instrument was the most tried and tested client-centred approach to AT provision found in the literature. On this basis it was decided to adopt the IMPT as the instrument of choice for the user interview as it met more of the criteria than any other potential instrument.

### Application of the selection criteria to possible tools for use in the study

Criteria for Selection	SETT	MATCH/MPT	IMPT	SFAAT	QUEST	PIADS	FIM	IPPA	SFA	ASNAT	ATEN	WATI	ATA	ATP	FEAT	PATINS
Focus: impact on learning and education	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Scope: relevant across all functional impairments	?	+	+	?	?	?	?	?	+	+	+	+	+		+	
<b>Addresses All Dimension Relevant to the Study:</b>																
Curriculum access	+	+	+	+	-	-	-	+	+	+	-	+	+	?	+	?
Educational engagement	+	+	+	+	-	-	-	-	+	+	+	+	+	?	+	?
Enhanced school involvement	+	+	+	+	-	-	-	-	+	+	+	+	+	?	+	?
Academic attainment	+	-	+	?	-	-	-	-	+	+	+	-	-	?	-	?
Subjective wellbeing	+	+	+	+	-	-	-	-	+	?	?	-	-	?	+	?
<b>Credibility Requirements</b>																
Internationally Recognised	?	+	+	?	+	+	+	+	+	?	-	?	?	?	?	?
Widely used	?	+	?	?	+	+	+	+	?	?	-	?	?	?	?	?
Theoretically sound	+	+	+		+	+	+	+	+	?	-	-	-	?	+	?
Validated	+	+	+	+	+	+	+	+	+	?	-	-	-	?	+	?
Reliable	+	+	+	+	+	+	+	+	+	?	-	-	-	?	+	?
<b>Practical Requirements</b>																
Tool (T) vs manual (M) only	T	T	T	T	T	T	T	T	T	M	M	M	M	M	?	M
Current versions available	+	+	+	+	+	+	+	+	+	+	-	-		-		-
Retrospective (R), prospective (P), both (B)	P	B	B	P	R	R	R	B	P	B	P	P	P		P	
Summative rather than diagnostic	+	+	+	+	+	+	?	+	?	?	+	+	+	-	+	-
Produces a score	-	+	+	+	+	+	?	+	-	-	-	-	-	-	+	-
Reasonable administration time	-	+	+	-	+	+	+	+	+	-	-	-	-	-	+	-
Flexible modes of administration	-	+	?	?	?	?	?	?	+	?	-	-	-	-	+	-
Usability across levels of impairment	+	+	+	+	+	?	?	+	+	+	+	+	+	-	+	-
Usability across student age groups	-	+	+	+	+	+	?	+	+	+	+	+	+	-	+	-

+ indicates instrument meets criterion, - indicates instrument does not meet criterion and ? indicates it is unclear if instrument meets criterion.



