



UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

ICTs IN EDUCATION FOR PEOPLE WITH SPECIAL NEEDS

SPECIALIZED TRAINING COURSE

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES IN EDUCATION



UNESCO
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ICTs in Education for People with Special Needs. Specialized Training Course

The international team of experts has prepared the specialized training course within the framework of the IITE project *Information and Communication Technologies in Education for People with Special Needs*.

The course is intended to provide the specialists involved in education of people with special educational needs (SEN), with an overview of main ways, methods, and principles of information and communication technology (ICT) usage in their professional activities.

Materials of the course represent the best international experience, supported by comprehensive training materials and special sections with references, summaries, glossary, assignments, and bibliography for supplementary readings. The course offers the opportunities to acquire knowledge and develop practical skills on specifics of ICT application in face-to-face and distance education meeting the needs of six main groups of disabilities: physical, visual, hearing, speech and language, cognitive, learning. Particular emphasis of the course is placed upon the basic aspects of ICT policy development in special needs education (SNE), including promotion of ICT infrastructure, integration of ICTs into curriculum, training and retraining of ICT specialists in SNE.

The materials presented in the course will be of interest to a wide range of specialists involved in education of people with SEN, from high-level policy- and decision-makers to researchers, teachers, programme planners, and curriculum developers.

The opinions expressed in this document are those of the authors and do not necessarily reflect the views of the UNESCO Secretariat.

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INTRODUCTORY NOTES

Relevance of Specialized Training Course

We live in the historic period when knowledge has turned out to be the most important basic resource. Rapid progress in knowledge and easy access to information are becoming a driving force of economic and social development. The Secretary-General of the United Nations Kofi Annan has defined the value of information technologies as follows:¹

The new information and communications technologies are among the driving forces of globalization. They are bringing people together, and bringing decision-makers unprecedented new tools for development. At the same time, however, the gap between information 'haves' and 'have-nots' is widening, and there is a real danger that the world's poor will be excluded from the emerging knowledge-based global economy.

Fast development of such modern sectors as telecommunications, media, and information technologies affects both the alterations in the technological sphere and the globalization of the economy, as well as *transforms* social relations, culture, and education. In the field of education, broad introduction of new digital technology presents great possibilities and initiates new pedagogical approaches apt to meet the overgrowing demands of modern society.

Information Society must be created on the principles of social engagement, i.e. involvement of all citizens, regardless of their abilities, background, social status, ethnicity, etc. The common grounds of this approach were expressed in Declaration of Principles of World Summit on Information Society in the intention “to build a people-centred, inclusive and development-oriented Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life, premised on the purposes and principles of the Charter of the United Nations and respecting fully and upholding the Universal Declaration of Human Rights”.²

Such vision of Information Society development assumes application of new pedagogical technologies and appropriate methods of education. In this connection, information and communication technologies (ICTs) have become the most suitable tool, which can help people with different learning demands exercise their right to education, employment, social life and leisure, and access to information and democratic channels. The use of new technologies in the sphere of education must enhance independence, integration, and equal opportunities for all people.

UNESCO is among the most active international organizations supporting modern approaches to education, which are related primarily to application of new technologies solving a wide range of problems and processing a vast number of information sources. UNESCO maintains a capacity to advise national governments on the use of technology for educational purposes and, in particular, on the optimal balance (given local circumstances) between ICTs and traditional educational technologies. Furthermore, UNESCO can assist countries in developing educational software and materials that reflect their national and regional cultures in support of the strategy to achieve the goal of ‘Education for All’.

In order to contribute to solution of these issues the UNESCO Institute for Information Technologies in Education (IITE) within the framework of its training programme has dealt with ICT application in the field of education of people with special educational needs (SEN) since 1999. Within the frame of this work the Institute held a number of international expert meetings and workshops in partnership with well-known experts from 13 countries, including the Australia, Japan, the Netherlands, the United Kingdom, and the USA. Recommendations of international experts provide the basis for development of information materials and analytical surveys, which show the current state, prospects, and main trends of ICT application in special needs education (SNE). The published materials were forwarded to National Commissions for UNESCO in 190 Member States and other organizations concerned.

¹ Kofi Annan, Secretary-General of the United Nations. On the Digital Divide. CNET Networks, Inc., 5 November, 2002. Online: <http://www.un.org/News/ossg/sg/stories/sg-5nov-2002.htm>

² World Summit on the Information Society. Geneva 2003 – Tunis 2005. Declaration of Principles. Online: http://www.itu.int/wsis/documents/doc_multi-en-1161|1160.asp

Aims and Outcomes of Specialized Training Course

The specialized training course *ICTs in Education for People with Special Needs* is intended to provide specialists involved in education of people with SEN with a view of the principles, ways, and methods of SNE design, taking into account the ICT diversity in all areas of education. The course is designed for the target groups to construct deep knowledge and high competencies regarding:

- importance of providing inclusive education to achieve equal opportunities for all;
- relevant aspects of education for students with SEN in Information Society;
- role of ICTs in providing inclusive education for students with SEN;
- critical and reflective selection and use of special technologies according to exclusive needs of students;
- appropriate educational conditions for successful application of ICTs in SNE;
- evaluation methods related to the educational use of ICTs in SNE;
- design and implementation of ICT policy in SNE.

The main objective of the course is focused on the development of motivation to use ICTs in SNE.

In this context, ‘knowledge’ implies theoretical and practical knowledge of the content to be learnt. ‘Competencies’ mean the ability to transfer and adapt the skills of the course into a real classroom situation. Having mastered this specialized training course, the trainees are expected to be able to use and apply the acquired knowledge and competencies in their daily educational practice.

Description of Trainees’ Competences formed within Specialized Training Course

The trainees of the course *ICTs in Education for People with Special Needs* are expected to be able to enhance their understanding and develop knowledge and skills in the following domains:

- Identification of learning barriers faced by students with a certain type of disability and assessment of the crucial role of ICTs in overcoming them and facilitating the inclusion education.
- Critical and reflective selection of ICTs for education according to:
 - the special needs of students with disabilities (considering their functional limitations and ICT potential in their compensation),
 - the educational goals (considering knowledge and competencies that students need to develop and ICT role to achieve these goals).
- Classification of different types of technologies used in distance education for students with SEN (considering the accessibility barriers to technologies in distance education faced by students with disabilities and main approaches to overcome them).
- Planning and implementing the ICT policy in SNE (considering the development of legal base and providing continuous monitoring of ICT usage in SNE).

Target Audience

This specialized training course will be of interest to the key stakeholders involved in education of people with SEN, in particular:

- SNE policy developers and decision makers;
- administrators and specialists of teachers’ training and retraining institutions;
- administrators and specialists of SNE institutions;
- SNE programme planners and curriculum developers.

Initial Level of Trainees’ Knowledge

Trainees are assumed to have basic ICT skills and prior training and experience in conventional face-to-face and distance learning environments.

Structure of Specialized Training Course

The specialized training course *ICTs in Education for People with Special Needs* consists of four training modules, each including two or three units covering general and specific issues of ICT applications in SNE. The units are supplied with comprehensive references, a summary of the main theses, detailed glossaries of terms, structured essay tasks and self-assessment questions. There is also a list of further readings for each module. Appendices at the end of the course contain the list of abbreviations, the glossary of terms, illustrations of major types of assistive technologies in education for people with SEN, the list of main Web resources, suggested questions and tasks for self-assessment, and final evaluation of the course.

Brief Description of Specialized Training Course

Module 1. Special Needs Education in Information Age

The module's goal is to show the impact of Information Age on the life of people with special needs, to explain the necessity of ICT implementation into SNE presenting extra opportunities, thus helping to build a more inclusive society. The module presents the issues of equal opportunities in education and information access to be provided for each and every member of a society, primarily for people with special needs. Particular emphasis is made on social drive toward inclusion in education; special attention – to SNE organization principles and its main characteristics.

Module 2. Assistive Technologies for Students with Special Educational Needs

Primarily, this module is designed to provide a short but comprehensive understanding of assistive technologies (AT), their theory, and description of application areas. The issues of choosing the right AT solutions are important when new services for students with SEN are paid special attention. After a general introduction to AT, the module discusses the use of assistive technologies for educational purposes in relation to the needs of five main groups of impairments: physical, visual, hearing, speech and language, cognitive, and learning.

Module 3. Distance Technologies for Students with Special Educational Needs

Module 3 introduces core features of distance education (DE) vital for education of students with SEN. The module begins with a short overview of DE evolution and main qualities of ICT-based DE. The first unit contains a description of key technologies used in DE and their benefits for students with SEN. The second unit focuses on accessibility barriers to educational resources and on ways to overcome them, as these issues have special emphasis on distant education of students with SEN.

Module 4. ICT Policy in Special Needs Education

The module provides an ample overview of ICT policy in SNE: objectives, principles, and means. The module starts with a brief introduction of the best international practice examples with respect to legislation affecting ICT policy in SNE. Then it presents the key activities of ICT policy implementation in SNE, including promotion of ICT infrastructure for SNE, integration of ICTs into SNE curriculum, training and retraining of ICT specialists in SNE. The module particularly emphasizes basic aspects of monitoring of ICT usage in SNE, including necessary and sufficient conditions of SNE quality improvement by means of ICTs. Also, the module describes the approaches to analysis and interpretation of evaluation results to further improve ICT policy development in SNE.

Recommendations for Training Organization

Brief Description of Instructional Methods

The training course can be delivered either in conventional classroom or via e-learning (learning via the Internet). Conventional provision is the most common type of in-service teaching, though requiring from the trainees to travel to the institution for the purpose of in-service education. In most cases, it is oral presentations of instructors, dialogue with trainees, tutorials and guidance, laboratory practice in computer classes and other labs. Often, it includes the study in libraries or media resource centres.

E-learning separates a teacher and trainees. Interpersonal face-to-face communication of conventional education is replaced by communication and guidance mediated by the Internet. This form of in-service education is considered a complimentary to conventional provision in many countries.

The instructional method of the training course is based on a common approach for both forms of learning, i.e. conventional classroom learning and e-learning. The basic instructional approach is a learner-centred approach – self-regulated and collaborative learning guided and supported by a trainer. In order to build the appropriate background both for knowledge accumulation in the sphere of ICT application in SNE, as well as for stimulation of skills’ application in the daily educational practice, there is a need to provide reflexive, pragmatic, and experiential approaches. In this case, the trainees will be placed at the centre of the teaching-learning process and will have to find their own individual access to information to construct their knowledge.

Recommendations for Training Organization

- The course should be held in classes with no more than 20 students.
- A qualified trainer should be able to guide the cognitive process of the target audience.
- Before the training session, a trainer must update the web links/information and provide the target audience with links according to the current situation.

Recommendations for Equipment

Having ICT tools available during the training session is the starting point of the training course. It is recommended to use a projector to present images from the computer.

Since the course deals with the materials from the Internet, Internet access is highly recommended. However, the training materials are developed in such a way that the training course is applicable without Internet access.

Time Requirements

Training session is assumed to take 72 hours, including face-to-face and distance learning. In practice, the required time and its distribution between face-to-face and online modes of instruction will depend on the trainees’ previous experiences with ICTs and specific requirements for organization of the training session.

Forms of Assessment

The specialized training course allows two modes of trainees’ assessment: interim and final.

Interim Assessment

Each unit contains several assignment tasks in form of structured essay tasks and self-assessment questions. The primary intent of interim assignment is to enable the trainees’ self-reflection of training outcomes. During the training sessions the trainers may use additional assignments and transformative reflection questions to evaluate their performance. During face-to-face training sessions the trainees are involved in discussions and project design, relevant to the attained knowledge and skills.

Final Assessment

The goal of the final assessment is to obtain overall understanding of the attained level of trainees’ knowledge and practical skills on ICT application in SNE, formed by the specialized training course. This procedure also includes structured essay tasks and self-assessment questions. The accomplishment of these tasks assumes overall assessment of all parts of the course. Suggested questions and tasks for self-assessment and final evaluation can be found in Appendix 5.

Evaluation of the Training Course

In order to provide general feedback for further course development a final evaluation of the course is planned. The recommendation for external experts and trainees is to collect the feedback concurrently. Expedient evaluation and further interpretation of its results is essential for successful improvement of the training materials, further research, and course development. Questionnaire to evaluate the specialized training course is presented in the Appendix 6.

MODULE 1 SPECIAL NEEDS EDUCATION IN INFORMATION AGE

Introduction

Building of a civil society requires an increased access to knowledge and education. The right to education is an essential human need and a basic human right, which is crucial to human development. Furthermore, the major social problems of individual countries and the world as a whole cannot be solved without high-grade level of education. In accordance with Universal Declaration of Human Rights, education is seen as a pre-requisite of facilitating democracy, and a means of promoting peace and respect for human rights and fundamental freedoms.

In view of the changed context of Information Society, the demands of education in adapting to new environments have risen. The most important human contribution to society development is its ability to generate new knowledge, to share and distribute it among communities, and to find innovative ways to utilize knowledge to further the prosperity of society. Sharing and strengthening of global knowledge for the sake of development can be enhanced by ensuring equitable access to information for all. In this way, access to quality education for community members determines their chances in scientific, economic, social, political and cultural activities, leading to active participation in civil society. Such issues are of primary importance for persons with special educational needs – defined most broadly as being caused by differences in gender, age, physical and mental abilities, levels of education, ethnicity, income level, etc. Considering a wide diversity of individual learners' capacities, the civil society must find the ways to remove barriers to learning and provide appropriate conditions for equal access to education.

Inherent in the development of democracy has been the conception of providing quality education and securing opportunities for lifelong learning for all learners, regardless of their individual background. The *inclusion* of students who have experienced barriers to learning in mainstream education has become a part of a global movement for human rights. Implementation of the inclusion principle encourages policy- and decision-makers to look at the barriers in education systems: why they arise and how they can be removed.

However, over the past two decades it has become clear that inclusion in a largely unchanged mainstream cannot secure equality and, correspondingly, quality of education for all learners. A more fundamental transformation concerning the creation of appropriate learning environments and pedagogical approaches is required.

ICTs offer a great potential to support lifelong learning for all groups of students, including those who have special educational needs. The application of ICTs must enhance independence, integration, and equal opportunities for such people and in this way will facilitate their inclusion in society as valued, respected, and contributing members.

Goal

The goal of the Module is to show the impact of Information Age on the life of people with special needs, to explain the necessity to implement information and communication technologies (ICTs) in special needs education (SNE) which present extra opportunities, thus helping to build a more inclusive society.

The Module presents the issues of equal opportunities in education and information access to be provided for each and every member of society, primarily, for people with special needs. Particular emphasis is made on social drive toward inclusion in education; special attention is given to SNE organization principles and presentation of its main characteristics.

Upon the broad overview of the topic, the Module goes into detail issues of ICT role in education of persons with special needs.

Objectives

Upon completing this module you will:

- ◆ understand main alterations of the educational system in Information Age;
- ◆ identify various barriers that people with special needs face;
- ◆ define the notion ‘inclusion’ in building a socially inclusive Information Society based on participation of all;
- ◆ acquire knowledge regarding main SNE approaches at the present stage of society development;
- ◆ understand the particular role of ICTs in SNE;
- ◆ appreciate the benefits of using ICTs to satisfy the needs of persons with different kinds of learning difficulties.

Readings for Module 1

Unit 1.1 Modern Stage of SNE Development: Implementation of Inclusive Education.

Jayne Pivik, Joan McComas, and Marc LaFlamme. *Barriers and Facilitators to Inclusive Education*. *Exceptional Children*, Vol. 69 (1), FALL 2002, pp. 97–107.

Online: http://journals.sped.org/EC/Archive_Articles/VOLUME69NUMBER1FALL2002_EC_Article_7.pdf

Unit 1.2 Role of Information and Communication Technologies in SNE.

Watkins, Amanda. *Towards the Barrier-Free Information Society*. 2nd European Conference on Information Technology in Education and Citizenship. A Critical Insight. Barcelona, 26–28 June 2002, pp. 1–24. Online: <http://web.udg.es/tiec/ponencies/pon5i.pdf>

UNIT 1.1 Modern Stage of SNE Development: Implementation of Inclusive Education

Objectives

Upon completing this unit you will learn the following:

1. Equal opportunities for all: the drive toward inclusion.
2. Groups of people supported by inclusion.
3. Main steps toward inclusive education.
4. Social approaches to disability issues.
5. Barriers to inclusive education for people with SEN.
6. Ways to overcome barriers and provide inclusive education.
7. Benefits of inclusive education.

1.1.1 Equal Opportunities for All: the Drive Toward Inclusion

The influence of broader political developments toward cultural diversity and more widespread democracy has reinforced the role of education in political socialization and facilitating active democratic citizenship.

UNESCO, 2003
Overcoming Exclusion through Inclusive Approaches in Education.
A Challenge and a Vision
Conceptual Paper

In view of a great variety of individual needs, education faces a wide range of cultural and social backgrounds of the groups making up the society. Sometimes cultural and social backgrounds can influence negatively and lead to *marginalization* and *social exclusion* of people from meaningful participation in life of their communities. Such exclusion, in its turn, reduces people's prospects to learn, grow, and develop.

A human rights approach to disability issues has significant implications for the way, in which education is provided. Educators tend to classify students with disabilities according to a disability type as defined by functional limitations. Students with disabilities are usually placed in special schools or classes, or totally excluded

from any educational opportunity on the grounds that they are 'too severely disabled'. Socially excluded groups of people are often exposed to discrimination; many have been denied access to education at all. This usually results in illiteracy and low skills, especially amongst adults with disabilities, contributing significantly to high levels of unemployment and poverty.

However, the democratic society has developed a concept, according to which all learners, regardless of their educational level, deserve nothing less but quality education and training that would provide them with opportunities for lifelong learning, the world of work and meaningful participation in society as productive citizens. Therefore, any education and training system must address equity and development challenges critical in improving the quality of life of all people. "Education has to take on the difficult task of turning diversity into a constructive contributory factor of mutual understanding between individuals and groups" (UNESCO).

The adjusted educational system facilitating the modern level of knowledge and skills is one of the most crucial components of positive change and successful development of a society. The use of technologies is not the only requirement of the new century. Educational planning and policy-making are also of great importance. Any educational policy must be able to meet diverse challenges and enable everyone to find his/her place in the community which they belong to, and at the same time be given the means to open up in other communities.

(...) by definition, people with disabilities are often restricted in the extent to which they can take a full part in the society in which they live, but many of those restrictions can be reduced by the good education they have received.

UNESCO IITE, 2001
Analytical Survey
Information and Communication Technology in Special Education

It is recognized that current strategies and programmes have been largely insufficient or inappropriate to meet the needs of the children, youth, and adults suffering from marginalization and exclusion. Currently, the international education and social policy tend to turn toward those, who are at risk of being excluded, to integrate them in the society and provide with the access and quality of basic education. In essence, this approach is based on the philosophy of *social inclusion*, which views diversity of strengths, abilities, and needs as natural and desirable, bringing to any community

Inclusive education is a strategy contributing towards the ultimate goal of promoting an inclusive society, one which enables all children and adults, whatever their gender, age, ability, ethnicity, impairment, or HIV status, to participate in and contribute to that society.

Stubbs S.
Publication online
What is Inclusive Education?
Concept Sheet

the chance to respond in the ways leading to learning and growth for the whole community, giving each and every member a valued role. Historically, the term ‘inclusion’ has often used to mean either the moving of disabled children into the mainstream settings, or reducing the exclusion of other students from school. It is now acknowledged that the inclusion of disabled children requires not only their integration without providing the support they need, but changes in the existing policies, practices, and attitudes of the society. In the first instance, the movement of inclusion is extended over the category of people, who are deprived of the opportunity to receive education, thereby to take a full-fledged part in the life of the society because of inborn or acquired impairments, socio-economic deprivation, war conflicts, or other negative factors – barriers to learning.

1.1.2 Groups of People Supported by Inclusion

The major impetus for inclusive education came from the 1994 World Conference on Special Needs Education in Salamanca. Inclusion is concerned with the learning, participation, and equal opportunities for all children, youth, and adults with a specific focus on the groups vulnerable to marginalization and exclusion from society life. It could apply to any or all of the following:

- girls and boys who have gender issues;
- ethnic and faith minority groups, travellers, asylum seekers, and refugees;
- children who need support in learning the language of instruction (second language);
- children with special educational needs, including those considered to have emotional, behavioural, sensory, physical, or mental disabilities;
- gifted and talented pupils;
- children with social difficulties, such as street children, prison inmates;
- people in disadvantaged, remote areas, poorly served by educational services;
- people who missed the opportunity to study in childhood;
- children in need, including those in public care, orphan children;
- other children, such as the ones with specific health needs, young carers, the children whose families are under stress, pregnant school girls, and teenage mothers;
- any pupils at risk of disaffection and exclusion.

... schools should accommodate all children regardless of their physical, intellectual, social, emotional, linguistic, or other conditions. This should include disabled and gifted children, street and working children, children from remote or nomadic populations, children from linguistic, ethnic, or cultural minorities, and children from other disadvantaged or marginalized areas or groups.

UNESCO, 1994
The Salamanca Statement and Framework for Action on Special Needs Education

These groups are usually excluded from the mainstream education. Therefore, education for them requires special approaches and techniques.

1.1.3 Main Steps Toward Inclusive Education

The inclusion of students with barriers to learning in ordinary schools is a part of the global movement for human rights. All learners have a right to education, regardless of their individual characteristics or difficulties.

Over the last few decades, the development of inclusion has become central to international education policy and has forced the major changes in national legislation in many countries. Starting in the 1980s, inclusive education has aimed to promote academic learning, social competence and skills, attitude change, and positive peer relations in inclusive settings for students’ with special needs.

Educational inclusion... is about equal opportunities for all pupils... it pays particular attention to the provision for, and achievement of, different groups of pupils.

OFSTED, 2000
*Evaluating Educational Inclusion:
Guidance for Inspectors and Schools*

In recent years the pace of inclusion has gathered momentum. A number of international human rights agreements support the view that compulsory segregation in education is against basic human rights of children and young people. These include the UN Convention on the Rights of the Child (1989)¹, the UN Standard Rules on the Equalisation of Opportunities for Persons with Disabilities (1993)², and the Salamanca Statement (UNESCO, 1994)³. Together, these documents recognize the human right of all learners to education being inclusive. One hundred and ninety three countries signed the Convention on the Rights of the Child, with Somalia being the latest in May 2002.

The Salamanca Statement on special educational needs (1994) called on governments to adopt the principle of inclusive education for all summarizing the aims and aspirations of the international community.

Recent definitions of inclusion have broadened still further. Booth and Ainscow (1998; 2002) state that policies on inclusion should not be restricted to the education of people thought to have special needs. Inclusion, according to them, is a process in which schools, communities, local authorities and governments strive to reduce barriers to the participation in learning for all citizens.

This training course has a particular focus on *students with special educational needs* (SEN), who still constitute the group of the most excluded from educational privileges, despite the consensus on the right to education.

(...) those with special educational need must have access to regular schools which should accommodate them within a child-centred pedagogy capable of meeting their needs. Regular schools within this inclusive orientation are the most effective means of combating discriminatory attitudes, creating welcoming communities, building an inclusive society, and achieving education for all; moreover, they provide an effective education to the majority of children and improve the efficiency and ultimately the cost effectiveness of the entire education system.

UNESCO, 1994
The Salamanca Statement and Framework for Action on Special Needs Education

1.1.4 Social Approaches to Disability Issues

World Health Organization (WHO) states that disability is “the outcome or result of a complex relationship between an individual’s health conditions and personal factors, and of the external factors that represent the circumstances in which the individual lives”.

WHO, 2001
International Classification of Functioning, Disability and Health

People are recognized as having *special educational needs* because they face various barriers to learning by reason of social, economic, or physical factors. Globally, almost 180 million young people between the ages of 10-24 live with a physical, sensory, intellectual, or mental health disability significant enough to make a difference in their daily lives. The vast majority of these young people, about 150 million (80%), live in the developing world. There are more disabled people today than there ever were in the past, and the numbers are likely to increase substantially over the coming decades – due to a variety of factors, including medical advances, the impact of polluted environment, ageing populations, spread of terrorism and war. Disabled people, in all parts of the world, experience discrimination and are widely excluded from the social, economic, and political life of the community.

Disability is often perceived in a very negative way due to cultural factors, ignorance, lack of essential knowledge, superstitions, and fear. In some places disability is seen as a curse or punishment from God; disabled people are perceived as being sub-human and unfit to participate in society’s mainstream activities.

The traditional way of addressing disability issues has been either through medical or charitable approaches, often based on the assumption that disability is an individual (bio-medical or functional) problem.

¹ The UN (1989). *The Convention on the Rights of the Child*. Geneva: The UN. Online: <http://www.unicef.org/crc/crc.htm>

² The UN (1993). *The Standard Rules on the Equalisation of Opportunities for Persons with Disabilities*. New York: The UN. Online: <http://www.un.org/documents/ga/res/48/a48r096.htm>

³ UNESCO (1994). *The Salamanca Statement and Framework for Action on Special Needs Education. World Conference on Special Needs Education: Access and Quality*. Salamanca, Spain, 7-10 June 1994. United Nations, Spain. Online: http://www.unesco.org/education/information/nfsunesco/pdf/SALAMA_E.PDF

Typical definitions, according to the medical model, are those put forward by the World Health Organization (WHO, 1980):

- **Impairment:** any loss or abnormality of psychological, physiological, or anatomical structure or function.
- **Disability:** any restriction or lack, resulting from impairment, of ability to perform any activity in the manner or within the range considered normal for a human being.
- **Handicap:** a disadvantage for a given individual, resulting from an impairment or disability, that prevents the fulfilment of a role that is normal depending on age, sex, social, and cultural factors for that individual.

The process of re-defining disability and challenging the dominant climate of ideas appears with the emergence of fresh thinking and new organizations controlled by disabled people themselves during the 1970s. After this the *medical model of disability*, which at times dominated thinking until the latter part of the 1990s, lost its supremacy.

(...) disability is not an attribute of a person, but a set of (potentially) restrictive conditions that arise, not as the result of impairment per se, but of society's failure to accommodate the needs of those with disabilities and to allow them to exercise their abilities.

IMPACT, 1999
*Increasing the IMPACT
of Assistive Technology*

In the last few decades, international policy initiatives around the world have been aimed at a human rights approach and an environmental approach to disability issues. These approaches are based on a *social model of disability* (Oliver, 1981). The emphasis is on overcoming economic, environmental, and cultural barriers confronting people with special needs (Orshot and Hivenden, 2001; WHO, 2001). Common understanding of disability has changed from the attitudes regarding disability as a mere personal problem related to a specific impairment, to a general social issue. The social model advocates acknowledgement that appropriate medical interventions are necessary and often beneficial, but maintains that these must not replace the radical social and environmental changes to facilitate disabled people's inclusion in everyday community life. The focus is on

disabled people's rights and on the need to change society, including education systems, information and communication systems, health and social support services, transport systems, and to create new environment, working, housing, and leisure industries. But the primary requirement concerns the changed attitudes of individuals and the community as a whole toward this category of people. The role of disabled people in the social life and attitudes toward these members of community are seen as an indicator of the democratic social development.

1.1.5 Barriers to Inclusive Education for People with SEN

People with SEN experience many difficulties in learning, which can be permanent, recently acquired, fluctuating, or circumstantial. The following social, economic, and physical barriers to learning must be considered when developing education initiatives.

1. Social barriers

External social barriers are caused by the society's unwillingness and/or inability to meet the needs of people with disabilities and to allow them to take part in the life of community.

Internal social barriers are caused by the perceptions of persons' disability influenced by cultural and ideological vision.

2. Economic barriers

External economic barriers are caused by the inability of society and/or the state to accommodate the needs of persons with disabilities in order to allow them to exercise their abilities.

Internal economic barriers are caused by impossibility for persons with special needs to get access to education by the reason of their limited finances.

3. Physical barriers

External physical barriers are caused by the inaccessible and unsafe design of environments.

Internal physical barriers are caused by the physical, mental, sensory, and other impairments of a person.

Table 1.1 Social, economic, and physical barriers to learning for people with SEN

Type of the barrier	External	Internal
Social	<ul style="list-style-type: none"> – Lack of awareness/knowledge and negative attitudes to differences – Inadequate policies and legislation – Inappropriate forms of communication – Inappropriate and inadequate support services and methods of teaching – Inflexible curriculum 	<ul style="list-style-type: none"> – A dependency syndrome – Inferiority complex – A sense of resignation – Feelings of isolation and exclusion from the society
Economic	<ul style="list-style-type: none"> – Inadequate policies and legislation – Limited finances – Lack of regional coordination in the field of educational policy 	<ul style="list-style-type: none"> – Impossibility to get access to education by the reason of their limited finances
Physical	<ul style="list-style-type: none"> – Inaccessible design of architecture and transport – Inappropriate and inadequate equipment and ICTs – Inappropriate format and methods of training materials delivery 	<ul style="list-style-type: none"> – Substandard and disordered development – Disruption of the learning process caused by the lack or insufficient level of basic body functions and skills – Impossibility of independent development and learning (i.e. without special assistance and curriculum modification) – Psycho-emotional and behavioural features – Poor life experiences

It is important to recognize that, as a rule, a lot of people with special needs face a combination of barriers.

1.1.6 Ways to Overcome Barriers and Provide Inclusive Education

Inclusion is seen to involve the identification and minimizing of barriers to learning and participation and the maximizing of resources to support learning and participation.

Booth et al, 2000
Index for Inclusion

There is another point to be made here. A mere inclusion of students with disabilities without support or appropriate education may not be beneficial.⁴ Waldron (1997) cautioned that a responsible inclusion requires sufficient support and resources. In many instances mainstream institutions face the barriers arisen since students with special needs have been included there.

Overcoming of barriers and providing for inclusive education for students with a wide range of special needs – physical, cultural, and educational – should be facilitated to enable them to play appropriate roles in the modern society, thus contributing to future knowledge society.

The process of changing requires financial, human, and intellectual resources. Policy-makers, administrators, and teachers in mainstream settings are primarily in charge of the successful inclusion of students with SEN.

Educational environment needs major changes. For them to happen there should be intervention and support at many levels in order to:

- provide a legal framework for successful development of inclusive education at national and regional levels;
- provide the means of access to information which are required to meet special educational needs, including ICTs and assistive technologies;
- organize the training of teachers and staff in order to instruct them in modern pedagogical methods and ways to use new hardware and software required to enhance the effectiveness of education;
- modify the curriculum appropriately;
- raise awareness of teachers, school/institute staff, parents, and peers regarding a change in culture and their attitude toward students with special needs to be educated within the communities;

⁴ Marston, 1987-88.

- involve parents in the development of inclusive education;
- create physical access to and in buildings, including transport and suitable interior design.

The proportion of students with special needs taught in mainstream schools depends on a number of factors: severity of impairment, availability of educational equipment and trained specialists. However, the primary factor is the national social and educational policy in special education (see Box 1.1).⁵

Box 1.1 Grading of European countries according to their policy for students with special educational needs included into mainstream schools

According to the European Commission's research (European Commission, 2002), countries can be divided in three categories according to their policy on integrating children with special educational needs:

- The first category (referred to as 'one-track category') includes countries that develop a policy and practices geared towards the integration of the majority of pupils within mainstream education. This type of integration is supported by a wide range of services focusing on the mainstream school. The percentage of pupils attending special (i.e. separate) classes or schools is less than 1%, and the children considered as having special needs do not generally constitute a large percentage of population.
- In the countries that belong to the second category ('two-track' category), there are two distinct education systems. These systems are (or at least, were until very recently) under separate legislation, with different laws for mainstream and *special needs* education. In these countries special education is fairly well developed and is generally treated quite separately. The percentage of pupils with special educational needs in mainstream schools is very small.
- The countries belong to the third ('multi-track') category have a multiplicity of approaches to integration. They do not offer one single solution (integration in mainstream education with the support of many different services) or a choice between two options (mainstream or special education), but rather a variety of services between these two systems. These range from special multiple classes (full-time or part-time) to different forms of inter-school cooperation, including 'exchange' activities (with teachers and pupils from mainstream and special schools arranging temporary or part-time exchanges). These countries sometimes have a considerable number of pupils with special educational needs and 1–5% of pupils in separate schools.

The situation is currently in the throes of change and the 'two-track' countries are tending to adopt a 'multi-track' approach. However, irrespective of differences in legislation in different countries, the major tendency of the policy approach regarding people with special needs is towards inclusive education.⁶

1.1.7 Benefits of Inclusive Education

Inclusive education means that all students in an educational setting, regardless of their strengths or weaknesses in any area, become part of the local community. The primary reason for promoting the attendance of students with special needs in mainstream schools is to increase their learning opportunities through interaction with peers and to encourage their participation in the life of community. This uniting process has a great impact on the societal development, which is backed up by research.

- **Benefits for people with special educational needs.** In a study comparing students with SEN in a special education environment to the ones in an inclusive environment, statistics showed that those in the inclusive setting made more academic progress.⁷ Improvements have been noted in the areas of social interaction, appropriate behaviour, self-

⁵ European commission (2002). Key Data on Education in Europe. Chapter B. Structures and schools. Online: http://www.mszs.si/eurydice/pub/eurydice/Key_Data_2002/B_en_Structures_2002_19-42b.pdf

⁶ As some countries prefer separate education for people with special needs, close collaboration between special and mainstream schools and other resourced provisions seems to be the most effective way of rehabilitation and education of these categories of people.

⁷ Brinker & Thorpe, 1984; Epps & Tindal, 1987; Peetsma, 2001.

esteem, and language development.⁸ Being involved in the same learning activities as their peers allows children with SEN to develop better interpersonal skills.⁹ Often such children are lonely, and increased social connections through contact with peers, friends, and teachers give them more chances to form relationships with community members.¹⁰ Furthermore, the longer the students with special needs are included, the more positive effect there is on educational, social, and occupational outcomes.¹¹ Self-esteem and social competence turn out to be significantly improved.¹²

- **Benefits for people without special needs.** The research points the benefits not only for students with SEN, but for their non-disabled peers as well, most of these benefits being social in nature. The most significant benefit attributed to inclusion practices seems to be the increased diversity awareness and tolerance. Students learn to be sensitive to the needs of others and can be ‘helpers – not superiors, but useful’.¹³ Serving students with special needs, their peers obtain such features as willingness to help, which remains with them for the rest of life.

Students without special needs also find that true affectionate friendships can be formed with their special needs classmates.¹⁴ If the students had not been included but rather set apart in a special classroom, these special relationships probably would not have been shaped.

Other benefits for ordinary students are the presence of an extra aid in the classroom as well as an adaptation to different learning styles. Often, even in a fully inclusive environment, a one-on-one assistant is necessary. A highly-qualified assistant or special education teacher can provide a valuable resource for the non-disabled classmates.¹⁵ In an inclusive environment, different teaching techniques must be used in order to educate all types of learners effectively.¹⁶ The students without special needs can benefit from different learning styles being taken into consideration in an inclusive environment, because every student, disabled or not, has his/her own style of learning. If as many various learning styles as possible are presented in the classroom due to the inclusion of special needs children, the benefits can reach everyone.

- **Benefits for teachers.** In spite of the widespread opinion among teachers, that they need special skills to teach children with special needs, research has shown that in most cases inclusion can be successfully implemented through good, clear, accessible teaching which encourages the active participation of all students. Such practices show teachers that all students have skills and strength, and create awareness of the importance of a direct individual way of instruction.

Inclusion has challenged teachers to develop more child-centred, participatory, and active teaching approaches – and this benefits all students. Such educational environments bring teachers to the necessity to apply new approaches and methods, and to acquire specific technological skills. The skills improve vocational competence of a teacher. In this connection, inclusive education can act as a catalyst in educational practice, thus improving the quality of education.

- **Benefits for society.** Inclusion also has a great benefit for the society, as it supports the social value of equality by providing a miniature model of the democratic process.

Inclusion can help overcome discrimination and break the cycle of exclusion. Discriminatory attitudes toward people with special needs persist in the society because of scarce awareness and information on how to live close with such people. It is difficult to break down the attitudinal barriers, but experience has revealed that, within the right context, people can be more tolerant and helpful and gain the skills of socialization and collaboration. It seems to be the only way to uphold the civil rights of disabled people.

⁸ Lewis, 1994.

⁹ Baker, Wang, & Walberg, 1994-5; Forrest & Maclay, 1997.

¹⁰ D’Alonzo, Giordano & VanLeeuwen, 1997.

¹¹ Ferguson & Asch, 1989; Wehman, 1990.

¹² Tompkins & Deloney, 1995; Waldron, 1997.

¹³ Forrest & Maclay, 1997; Peltier, 1997.

¹⁴ Peltier, 1997.

¹⁵ Hines, 2001.

¹⁶ Hines, 2001.

Key Terms

Marginalization: The process whereby certain groups suffering deprivation (e.g. the impoverished, unemployed, single parents, and the ones with limited formal education) are pushed to the edge of society where they have little say in decision-making and are denied the means to improve their position.

Social exclusion: The process whereby certain groups are pushed to the edge of society and are prevented from participating fully by virtue of their poverty, inadequate education or life skills. This distances them from job, income and education opportunities as well as social and community networks.¹⁷

Social inclusion: Ensuring that the marginalized and those, who feel disenfranchised, are allowed to improve their living standards and well-being.

Inclusive education: A process whereby students, who are in the special education programme, enrol in general education classes. They are officially included in the general education roster and are graded by a common education teacher, while continuing to receive support from a special education teacher.

Medical model of disability: According to the medical model of disability and ageing, people are disabled as a consequence of their own health condition; remedy is found through medication, rehabilitation, and surgery, or adaptive aids and equipment. Disability is a personal problem.

Social model of disability: In contrast, the social model, which has superseded the medical model, sees people as disabled or enabled by the social context, in which they function, and proposes that changes in the social context or environment can remove or alleviate disability.

Students with special educational needs: Students who – for a variety of reasons (intellectual, physical, social, psychological) – experience learning difficulties which are more significant than those experienced by the majority of learners of the same age. Such students need special educational help and assistance.

Special needs education: Specially designed instruction to meet the unique demands of a child with special educational needs, particularly the gifted or the ones with a disability. Support services include classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions.

Summary

- ◆ The current trend in international education and social policy is turning toward integration of those who are at risk of exclusion from society, providing them with the access to high-quality basic education.
- ◆ The movement for inclusion has been extended over the whole category of people who have been deprived of the opportunity to receive education. This includes those with inborn or acquired impairments, socio-economic deprivation, consequences of war and other conflicts, and other negative factors. These causes represent barriers to learning.
- ◆ A number of international human rights agreements support the view that compulsory segregation in education is against basic human rights of children and young people covered in the UN Convention on the Rights of the Child (1989), the UN Standard Rules on the Equalisation of Opportunities for Persons with Disabilities (1993), and the UNESCO Salamanca Statement (1994).
- ◆ The general understanding of disability has changed from the attitudes which regarded disability merely as a personal problem related to a specific impairment, to a common social issue. The first step is the recognition of the necessity of radical social and environmental changes to facilitate disabled people's inclusion in everyday life of the community.
- ◆ People with SEN experience many difficulties in learning caused by social, economic, and physical factors.
- ◆ Overcoming of barriers and providing for inclusive education of students with a wide range of special needs – physical, cultural, and educational – must be facilitated to enable them to play appropriate roles in modern society, thus contributing to future knowledge-based nation.
- ◆ The primary reason to promote the attendance by students with special needs of mainstream schools is to increase their learning opportunities through interaction with peers and to provide for their participation in the life of the community. This uniting process greatly impacts the societal development.

¹⁷ The difference can be made between the notions “marginalization” and “exclusion” with those, who are marginalized and seen as having very limited access to the networks and facilities society offers for the majority of people, while those, who are excluded, have no access to them at all (Spicker, 1998).

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 1.1

- 1.1 Describe the main groups of people who are really supported by inclusive education in your region/country. Give examples.
- 1.2 Describe the potential barriers to inclusion in mainstream education for students with SEN.
- 1.3 Define the main barriers to learning for a 10 year-old child with low vision and motor impairment caused by cerebral palsy.
- 1.4 What must policy-makers, administration staff, and teachers do to promote the successful inclusion of students with SEN?
- 1.5 Define main trends of policy initiatives for successful inclusion?

2. Self-assessment questions for Unit 1.1

2.1 Which of the following definitions is more appropriate for inclusive education?

- a. Special instruction for students with educational or physical disabilities, tailored to each student's needs and learning style.
- b. Instruction through correspondence, telecommunications, and other electronic media or provided throughout the year permitting a flexible schedule.
- c. A process whereby students, who are in the special education programme, are enrolled in general education classes.

2.2 On which issues does a social model of disability mostly focus?

- a. Overcoming of economic, environmental, and cultural barriers confronting people with special needs.
- b. Medical diagnostics and treatment.
- c. Development of charitable initiatives.

2.3 To which group of barriers to inclusive education does inaccessible design of architecture and transport refer?

- a. External economic barriers.
- b. External social barriers.
- c. External physical barriers.

2.4 Which is the primary goal of students with SEN inclusion into mainstream schools?

- a. To increase the diversity awareness and tolerance attitudes among students without SEN.
- b. To improve learning opportunities of students with SEN through interaction with their peers and to promote their participation in the life of the community.
- c. To stimulate teachers to use new approaches and methods in order to improve their vocational competence.

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UNIT 1.2 Role of Information and Communication Technologies in Special Needs Education

Objectives

Upon completing this unit you will learn the following:

1. Changes in the educational system in Information Age.
2. Equal opportunities for all: digital inclusion of people with SEN.
3. Identification of barriers to learning for students with SEN.
4. The role of ICTs in SNE.
5. Supporting the inclusive education through ICT implementation.
6. Benefits of ICT use in education for people with SEN.

1.2.1 Changes in the Educational System in Information Age

The current period of social development is characterized by the mounting role of information and knowledge which are becoming the main factors of the progress and prosperity of society. The development of *Information Society* is having a growing impact on every aspect of people's lives. Information technology becomes more and more accessible in daily life. It changes our society bringing a new cultural environment where information is present in every field. Not only the form of working or doing business is altering radically, but the ways of studying, accessing skills and knowledge, and interacting with other people as well.

Recent 20 years have brought some remarkable innovations in the delivery of education. Traditional text, sound, graphics, and video are merged into a single 'multimedia' document. The world is getting linked to an increasing extent via computer networks. Digital telecommunication systems are replacing analogue ones. Computer systems, telephones, and television are getting more integrated. Different applications of information and communication technologies have opened up – and will continue to open – more and more possibilities for home-working, Internet banking, e-commerce, e-medicine, and (not in the least) new opportunities in education and training. Technology rapidly turns out obsolete, requiring new skills and knowledge to be mastered frequently. Adaptation is possible only when based on a sound understanding of ICT concepts. The issue of ICT literacy is actively developed in the modern society. Many countries now regard understanding of ICTs, mastering of the basic skills as well as concepts of ICTs as a part of the core education, alongside with reading, writing, and calculating. Specialists are relied on to define the sets of skills required in the modern world of communication.

ICT offers possibilities of transforming the learning paradigm and bringing knowledge to those who have not earlier been able to participate in education.

CEC, 2001

E-Inclusion: The Information Society's Potential for Social Inclusion in Europe

The technologies available today and those, which are about to emerge, have the potential to transform the educational system. Today we can see a lot of new ICT-based methods and forms of education. For many years educational institutions have been elaborating the educational content, structure, and methods to meet the demands of Industrial Age. The vision of education has now shifted to address the needs of Information Age. New approaches to teaching and learning are called for with a corresponding change in the roles of all parties to the educational

process. Easier access to global communication, including the Internet, the World Wide Web, consequently, widespread use of computers and interactive multimedia, means that:

- teaching and learning are becoming more independent from specific physical locations;
- the number of resources available to students outside the classroom has increased dramatically;
- the locus of control to initiate educational encounters has now passed to the learner. The learner begins the process on 'any time – any place' basis.

The table below illustrates some changes brought about by the new vision of learning and the educative role of ICTs.

Table 1.2 Progress of educational system impacted by ICT application

Variable	Traditional model	Emerging model
Teacher role	<ul style="list-style-type: none"> • Expert • Recalls facts • Sage on the stage 	<ul style="list-style-type: none"> • Collaborator • Resource person • Guide on the side
Learning	Focused on the teacher	Focused on the student
Criterion for success	Demonstrate full competence	Demonstrate growth and personal abilities
Type of knowledge	Acquisition, accumulation, or reproduction of data	Construction or mental representation of meanings
Assessment	Based on test	Based on the student's performance of real tasks
Instructional paradigm	<ul style="list-style-type: none"> • Content-oriented • Teacher-oriented 	<ul style="list-style-type: none"> • Processes-oriented • Student-oriented
Grouping	Homogeneous	Heterogeneous
Student activity	Personal work	Group work

The new vision of education highlights the need of effective learning and has shifted the emphasis of various elements involved in the education process. ICTs have not only an important addition to the curriculum content, they have added to the educational system a valuable set of new resources and didactical tools suitable to support the learning process. Box 1.2 contains some changes of the learning process in Information Age.

Box 1.2 Changes in the learning process caused by Information Age

From teacher-centered instruction to student-centered learning.

- The educational paradigm has gone from the 'instructional' paradigm that emphasized the roles of education and a teacher, to the 'personal' paradigm focused on the learning itself and the student who learns. Now the important thing is that the student learns, and all elements of the educative system are subordinated to this process of learning, including the teacher and education itself.
- The roles of a teacher and a student are interchangeable. Teachers become the facilitators of learning and are no more the sole authoritative source.

From content-based classes to process-oriented lessons.

- There has been a conceptual change that does not interpret the learning as acquisition, accumulation, or reproduction of informative data, but as construction of mental representations of meanings. This conception of education uses suitable strategies to relate, combine, and transform the knowledge. It is something dynamic; it is rather a question than an answer, a process than a product.
- Learners are engaged in tasks that are authentic and bear direct relationship to meaningful and relevant tasks in the 'real' world.

- Assessment is based on the student's implementation of real tasks. 'Alternative' answers are accepted, thus acknowledging that more than one answer is possible. Evaluation rubrics are used to demonstrate growth rather than expecting the learner to demonstrate full competence or optimum performance at the first attempt.

Toward a more collaborative learning.

- Children often learn better from other children. Small groups provide for dynamic interchange of dialogue, generation of ideas, formulation and experimentation with opinions as well as interpretation of data. In this way we promote cooperative learning. Students learn through collaboration with peers and experts.
- Students are no longer seen as passive recipients of information. They rather acquire knowledge and information by interaction with other learners and experts both at schools and from outside and by manipulation and critical analysis of facts and raw data.
- Students are now grouped heterogeneously so that each can contribute to the completion of a task collaboratively, exactly as in the real world. Each student contributes with his/her abilities: an excellent model to include students with SEN into the group.

1.2.2 Equal Opportunities for All: Digital Inclusion of People with SEN

Speedy development of Information Age brings possibilities and dangers to people with special needs. Whilst it can be very empowering, providing for a chance to be involved in the society otherwise inaccessible to the disabled, it can also create new threatening barriers excluding them even more. Those who have unequal access to information run the risk of losing some of the most basic rights. If the technology is inaccessible to the disabled, or the principal information is processed in such a way that some groups of people with special needs are excluded from its access, Information Society will finally turn out to be a threat for such people. Moreover, the digital divide¹⁸, on its own, will further intensify social exclusion.

There is a growing awareness that people with disabilities have the right to expect the same standard of service and access as every other member of the society. However, disabled people must overcome additional obstacles before they enjoy the information, services, entertainment, and social interaction offered by the ICTs to the full: blind people need appropriate hard- and software to be created, for example, a text as an alternative to images. The text can be translated into an audible format by specially designed screen-reading devices or made accessible by the means of printed Braille text; people with low vision may use technology with the help of large-format text and effective colour contrast; people who are dyslexic or have cognitive impairments may benefit, in particular, from the use of simpler language or alternative text formats, such as Easy Read, as well as from the clear and logical layout of an uncluttered structure of information; people, whose first language is Sign Language, may also find simple language indispensable; and people with manual dexterity impairments may navigate easier with a keyboard rather than with a mouse.

Information has become a social necessity and a fundamental aspect of human rights, and we cannot allow any group to be excluded from it. Therefore, we have to find ways to integrate these people into the current information and technological space. We have just started to explore and put into practice the potential of ICTs to support independent living and learning by persons with special needs. This potential exploited can lead to very important consequences for the equality of life of the disabled. In this connection, understanding of the barriers to learning faced by those who have SEN, is imperative if we aim to improve accessibility.

1.2.3 Identification of Barriers to Learning for Students with SEN

Barriers to learning refer to a situation in which certain functional limitations caused by different impairments become a significant obstacle to educational progress. The table below gives the main types and nature of impairments and functional limitations caused by them.

¹⁸ The differences in the levels of technology resources available to families and communities have been referred to as a "digital divide" — limited access to the networks and facilities society offers for the majority of people, while those, who are excluded, have no access to them at all (Spicker, 1998).

Table 1.3 The main types and nature of impairments, and functional limitations caused by them¹⁹

Types of impairments	Nature of impairments	Functional limitations hindering learning process
Physical impairments	<p>Neuromuscular impairments:</p> <ul style="list-style-type: none"> • paralysis (total lack of muscular control in part or most of the body) • weakness (paresis; lack of muscle strength, nerve enervation, or pain) • interference with control, via spasticity (where muscles are tense and contracted), ataxia (inaccuracy of motor programming and coordination), and athetosis (extra, involuntary, uncontrolled, and purposeless motion) <p>Skeletal impairments include joint movement limitations (either mechanical or due to pain), small limbs, missing limbs, or abnormal trunk size</p>	<ul style="list-style-type: none"> • Difficulty/inability to carry out fine and gross motor skills, including holding the body position and balance • Lack of control over and coordination of voluntary movements • Lack of supportive functions of arm or leg, right–left motor coordination, eye–hand coordination, eye–foot coordination • Poor sensations related to muscles and movement functions • Decrease of grasping (due to pain or weakness) • Restricted mobility, poor volume and force of movement • Weakness and expeditious fatigue • Difficulty of doing complex or compound manipulations (such as push and turn)
Sensory impairments	<p>Visual impairments:</p> <ul style="list-style-type: none"> • low vision • colour blindness • blindness <p>Hearing impairments:</p> <ul style="list-style-type: none"> • hard hearing • loss of sensor–neural hearing • loss of conductive hearing • deafness 	<ul style="list-style-type: none"> • Difficulty/inability to sense the presence of light, form, size, shape, and colour of visual stimuli • Difficulty/inability to sense the presence of sounds and to discriminate the location, pitch, loudness, and quality of sounds
Cognitive impairments	<ul style="list-style-type: none"> • Mental retardation • Age–related diseases (Dementia, Alzheimer’s disease) 	<ul style="list-style-type: none"> • Difficulties/inabilities of <i>global mental functions</i>: <ul style="list-style-type: none"> – state of awareness and alertness, including the clarity and continuity of the wakeful state–knowing and ascertaining one’s relation to self, to others, to time and to one’s surroundings (disorientation in time, place, and person) – general mental functions, required to understand and constructively integrate various mental functions, including all cognitive functions and their development over the life span – energy and drive functions (energy level, motivation, and impulse control) • Difficulties/inabilities of <i>specific mental functions</i>, such as: <ul style="list-style-type: none"> – attention (sustaining, shifting, sharing, and concentration; distractibility) – registering and storing of information in memory (troubles of short–term and long–term memory, immediate, recent, and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective, and dissociative amnesia) – control over both motor and psychological events at the body level (such as psychomotor retardation, excitement and agitation, quality of psychomotor function) – recognizing and interpreting sensory stimuli (functions of auditory, visual, olfactory, gustatory, tactile and visual–spatial perception) – higher–level cognitive functions (decision–making, abstract thinking, planning and carrying–out plans, evaluation of outcome, mental flexibility, and deciding which behaviour is appropriate under what circumstances) – recognizing and using signs, symbols, and other components of a language (reception and decryption of spoken, written, or other forms of language, such as sign language; functions or expressions of spoken, written, or other forms of language; integrative language functions, spoken and written) – determination, approximation, and manipulation of mathematical symbols and processes (addition, subtraction, and other simple mathematical calculations; functions of complex mathematical operations)

¹⁹ The material does not cover emotional and behavioural barriers to learning.

Types of impairments	Nature of impairments	Functional limitations hindering learning process
Cognitive impairments		<ul style="list-style-type: none"> Disorders related to: <ul style="list-style-type: none"> ideational component of the mind (pace, form, control, and content of thought; logical thought functions, thought block, incoherence of thought, etc.) feeling and affective components of the processes of the mind (emotional functions)
Speech and language impairments	<p>Speech disorders (developmental or acquired):</p> <ul style="list-style-type: none"> articulation disorders voice disorders fluency disorders <p>Language disorders (developmental or acquired):</p> <ul style="list-style-type: none"> expressive disorders receptive disorders mixed receptive and expressive 	<ul style="list-style-type: none"> Restriction or lack of ability to use <i>oral speech</i>: <ul style="list-style-type: none"> difficulties in enunciating, articulating of phonemes and their combinations difficulties in shifting of articulation position insufficiency of vocal functions (production of various sounds by the passage of air through the larynx) disturbance of fluency, rhythm, speed, and melody of speech Difficulties/inabilities related to the <i>expression, reception, and decryption of thoughts in language forms</i>: <ul style="list-style-type: none"> trouble using and/or understanding of meanings of words and their combinations (semantic skills) difficulties in using and/or understanding of grammar forms of words and their combinations (pragmatic skills)
Specific learning impairments	<ul style="list-style-type: none"> Dyslexia Dysgraphia Dyscalculia Attention deficit 	<ul style="list-style-type: none"> Restriction or lack of ability to acquire, organize, or express information: <ul style="list-style-type: none"> trouble with identification, decryption, and encryption of letters and syllables of a word poor auditory sequencing difficulty in identification of numbers and their combinations inadequacy of spelling difficulties/inabilities in calculation disorientation in spatial and temporal relations difficulty in focusing

Also, it must be mentioned that people with special educational needs may have a combination of impairments (multiple impairments). It is common when whatever is the ground for one impairment, it causes others. This is particularly true where a disease or trauma is severe, or when age is the cause of impairments. Deaf/blindness is a commonly identified combination. Most of these individuals are neither profoundly deaf nor legally blind, but are both visual and hearing impaired to the extent that separate strategies for deafness or blindness do not work. Diabetes, which can cause blindness, also provokes the loss of sensation in fingers. This makes Braille or raised lettering difficult to read. Cerebral palsy is often accompanied by visual impairments, hearing and language disorders, or cognitive impairments.

It stands to reason that the functional limitations described above impede students from getting a sufficient level of knowledge. Often their knowledge is underestimated by the teachers; that must be taken into consideration while selecting equipment and ICT tools for studies.

To prevent social exclusion we must clearly understand the role of ICTs in education for people with special needs.

1.2.4 The Role of ICTs in SNE

The educational needs of people with disabilities are vastly diverse. On the one hand, they must, as their peers, get knowledge and skills required in the society in which they live. On the other, they have (by definition) additional demands (often referred to as special educational needs) caused by functional limitations which affect learners' ability to access standard educational methods of instruction, therefore, prevent educational progress.

In this context, ICT application is very important as it plays an essential role in providing high quality education for students with disabilities. ICTs have been introduced into the teaching-learning process in order to improve quality,

support curricular changes and new learning experiences. In this way it is possible to meet the specific learning needs of different learner groups, including students with disabilities. Though specific applications of ICTs are extremely diverse and varied, they may be grouped into the following main categories:

- Compensation uses.
- Didactic uses.
- Communication uses.

With this in mind, the role of ICTs in special education will be described in accordance with the primary categories.

ICTs for Compensation Uses

That is the use of new technologies as a technical assistance that allows students with special needs to take active part in the process of interaction and communication: if a person has motor disability he may be helped to write, or to read if a person is with a visual deficiency (among many other possible examples). From this point of view ICTs develop the students' ability to control their environment, make choices about their experiences, support problem-solving, give access to information, thereby enhance communication with others both in the immediate environment and around the world. In other words, technology can recoup or substitute the lack of natural functions.

ICTs for Didactic Uses

ICTs used as a learning tool have prompted a new dimension of education and launched the transformation of the educational approaches. ICT application brings a variety of new teaching and assessment strategies for students with different educational needs.²⁰

Here we must note that information technologies as a didactical tool are suitable for implementing the inclusive education. In order to enhance personal development, educational initiatives within the inclusive curriculum must aim at meeting unique needs, differences, and abilities of an individual; hence they must be fully supported to achieve these goals at an appropriate pace. Information technologies, thereupon, will become a valuable resource for inclusion.

ICTs for Communication Uses

Technologies can mediate communication with people having disabilities (often referred to as *Alternative and Augmentative Communication*). Assistive devices and software to meet the needs of students with definite communication difficulties are specific to every disability. We talk about the computer as a resource that eases and makes the communication possible, allowing a person with communicative disorders to exhibit his/her abilities in a more convenient way, or people with motor and communicative disorders to start communication, show the needs and make the demands.

Furthermore, where teachers are in short supply (as in special education) distance teaching methods can help provide special services between geographically dispersed students and teachers.

1.2.5 Supporting Inclusive Education Through ICT Implementation

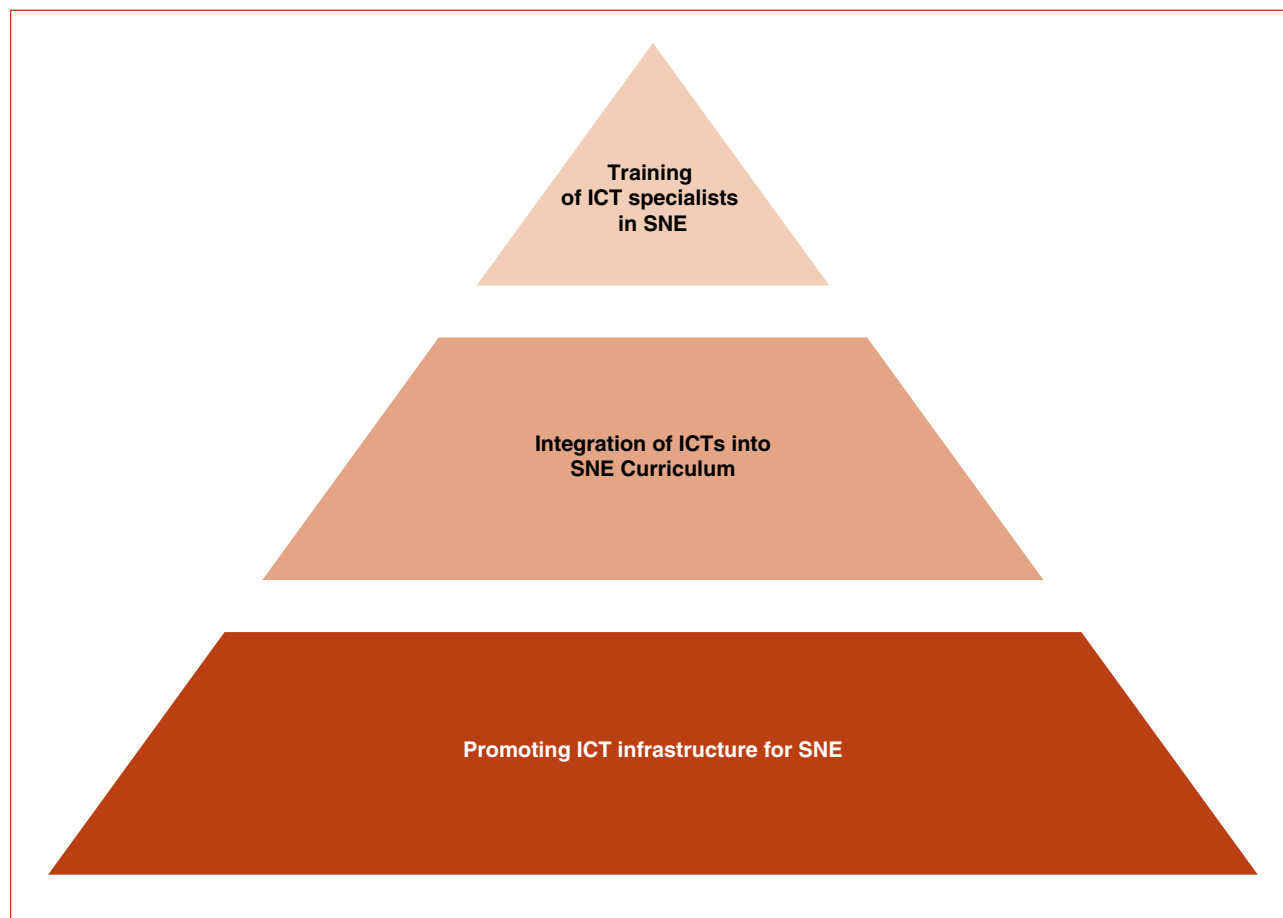
Inclusive education presents an opportunity for students with special needs to attend mainstream classrooms with their age-group peers. To realize this we need to provide for the relevant conditions of overcoming the barriers to the learning process. Particularly speaking, these conditions are attained via the facilitation of ICT infrastructure for SNE, integration of ICTs into SNE curriculum and training of ICT specialists in SNE (see figure 1.2).

The first step toward inclusive curriculum is taking full account of student learning needs and development with an awareness of appropriate teaching and learning methods, as well as application of appropriate tools and equipment within educational intentions and course content.

Promoting ICT infrastructure for SNE is necessary in order to provide for the appropriate conditions of teaching and learning in the SNE context. The conditions in every type of inclusive educational area cannot be successfully created without the appropriate ICT tools applied. Assistive tools must be used to allow students with SEN to participate in the educational process based on special techniques and equipment.

²⁰ Module 4 of the course presents the detailed information on ICT usage as a didactic tool and its integration into SNE curriculum.

Figure 1.2 The main arrangements for successful inclusion of students with SEN



For some students, a technological solution will be the only way to ensure that they can make their needs, opinions, and views known. For them, access to ICT-based solutions is a lifeline to inclusion. ICT support in inclusive education is important because it covers issues that apply to a spectrum of potential learning needs. The key ways in which ICTs can support educational opportunities for people with SEN are as follows:

- Identifying the preliminary level of personal development (experiences and skills), that is to say the starting point of a student;
- Assisting in personal development by shaping new skills or updating existing ones;
- Improving the access to information;
- Overcoming geographical or social isolation via communication support and networks;
- Improving the image/perception of an area by enhancing motivation and awareness regarding the ICT benefits in SNE.

It is also important to recognize that with ICTs alone we cannot solve all problems. The second step requires the willingness of educators to develop innovative teaching methods or to change and adopt the existing approaches to accommodate new concepts of special needs education and modern technologies. If a learner is unable to manage a particular activity (due to physical or sensory barriers), alternative activities must be designed or adapted, so that he/she gets a chance to receive the needed information and demonstrate the results. To implement this intention ICTs must be fully integrated in SNE curricula. Curriculum modification is not about its simplification for some students or lowering of academic requirements or standards. The modified curriculum must preserve the skills or knowledge required for a particular course and distribute knowledge and training resources in a more creative way and on a more equal basis.

In the new millennium, online delivery has become the most prevalent way of presenting the up-to-date information to students in the quickest, most flexible, and innovative ways possible. Educational courses can utilize a variety of

technologies to facilitate learning and interaction between participants: asynchronous and synchronous communication and collaboration tools (e-mail, bulletin boards, whiteboards, chat rooms, videoconferencing, and teleconferencing), interactive elements (simulations, immersive environments, and games), various testing and evaluation methods (self-assessment, multiple choice testing, etc.). Educational content can be presented in various media: text on a website, multimedia, such as digital audio, digital video, animated images, and virtual reality environments. This content can be created in a multiplicity of ways, utilizing a variety of authoring tools. As a result, ICTs transform educational dynamics by providing alternative, authoritative sources of information, which requires teachers to become facilitators and, in some cases, intermediaries between specific information sources and a learner. At the same time, ICTs can break teacher's isolation, providing them with prospects to communicate beyond the traditional school-management hierarchy.

1.2.6 Benefits of ICT Use in Education for People with SEN

According to the research of British Educational Communications and Technology Agency (BECTA, 2003), ICT usage in schools to support students with SEN can enable learners to communicate, participate in lessons, and learn more effectively. Key evidence is outlined below (see Box 1.3).²¹

Box 1.3 Benefits of ICT use in education of people with special needs

General ICT benefits:

- Enables greater learner autonomy;
- Unlocks hidden potential for those with communication difficulties;
- Enables students to demonstrate achievement in ways which might not be possible with traditional methods;
- Enables tasks to be tailored to suit individual skills and abilities.

ICT benefits for students:

- Computers can improve independent access for students to education (Moore and Taylor, 2000; Waddell, 2000);
- Students with special educational needs are able to accomplish tasks working at their own pace (ACE Centre Advisory Trust, 1999);
- Visually impaired students using the internet can access information alongside their sighted peers (Waddell, 2000);
- Students with profound and multiple learning difficulties can communicate more easily (Detheridge, 1997);
- Students using voice communication aids gain confidence and social credibility at school and in their communities (Worth, 2001);
- Increased ICT confidence amongst students motivates them to use the Internet at home for schoolwork and leisure interests (Waddell, 2000).

ICT benefits for teachers, non-teaching staff:

- Reduces isolation for teachers working in special educational needs by enabling them to communicate electronically with colleagues (Abbott and Cribb, 2001; Lewis and Ogilvie, 2002);

²¹ Source: BECTA ICT Research (2003). Online: http://www.becta.org.uk/page_documents/research/wtrs_ictsupport.pdf

- Supports reflection on professional practice via online communication (Perceval–Price, 2002);
- Improved skills for staff and a greater understanding of access technology used by students (Waddell, 2000);
- Enhances professional development and the effectiveness of the use of ICTs with students through collaboration with peers (Detheridge, 1997; Lewis and Ogilvie, 2002);
- Materials already in electronic form (for example, from the Internet) are more easily adapted into accessible resources such as large print or Braille (Waddell, 2000).

ICT benefits for parents and carers:

- Use of voice communication aids encourages parents and carers to have higher expectations of children's sociability and potential level of participation (Worth, 2001).

In conclusion, we must stress that there exists a considerable potential in the educational uses of ICTs alongside with many challenges and dangers. New technologies can provide the means to explore new forms of learning that break the traditional hierarchies of educational systems and develop genuine alternatives to rigid, passive approaches to learning of people with SEN. However, these technologies can turn up as obstacles to education if they are applied without a commitment to the principles of equality, participation, and responsibility.

Key Terms

Digital divide: A term which refers to the gaps between those who can effectively use new information and communication tools, such as the Internet, and those who cannot.

Digital inclusion: Several initiatives that work socially and technologically in order to reduce the existing gap in access to information and communication technologies and networks for people with special needs.

Information Age: The period of social development when the production of information is more important than the production of physical goods; the service sector is much larger than the manufacturing sector.

Information Society: Characterizes the level of community development being formed as a result of the fusion of information, media and telecommunications including far-reaching organizational and institutional changes in all aspects of human activity (e.g. workplace, leisure, shopping, commerce, education).

Summary

- ◆ The current period of educational system development is characterized by the increasing role of ICTs which have become an important new component of the curriculum, adding a valuable set of new resources and didactical tools suitable to support the learning process.
- ◆ Speedy development of the Information Age brings people with special needs a danger of losing their most basic rights, caused by new threatening barriers.
- ◆ In order to exploit the whole potential of the ICTs to provide for the equality, it is necessary to understand the barriers to learning faced by those who are seen to have SEN.
- ◆ Barriers to learning prevent students from getting sufficient level of knowledge as well as from giving a teacher a true evaluation of the students' competence. Though the applications of ICTs in education of people with special needs are extremely diverse, there are three main areas for their use – compensation uses, didactic uses, communication uses.
- ◆ In order to implement inclusion in education there is a need to create appropriate conditions for students with SEN.
- ◆ The achievement of conditions for successful inclusion in all areas of education can be realized by means of providing for appropriate technological infrastructure, modification of the curriculum, and training of new specialists in special education, capable to use ICTs.

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 1.2

- 1.1 Briefly describe changes in the educational system in your country/region caused by the new technologies.
- 1.2 Explain why people with SEN are at risk of being doubly disadvantaged if their access to appropriate ICTs is not supported. Give particular examples.
- 1.3 Choose and mark the types of ICT provision available in your country/region and indicate their assistance in promotion of inclusive education:
 - National dedicated agencies for ICTs in Education.
 - Support services that work directly with teachers and students within SNE.
 - Specialist resource centres where teachers obtain advice, materials and information.
 - Specialist support provided by special schools.
 - Specialist national and/or regional working groups.
 - Specialist websites and online networks.
 - In-school support.
- 1.4 Explain the importance of ICT application for persons with SEN in your regional context. In this you should give a clear indication of how you see ICTs enhancing teaching and learning within SNE. Give examples.

2. Self-assessment questions for Unit 1.2

2.1 Which is the most forceful factor for the adoption of new educational approaches?

- a. Financial support of educational institutions.
- b. Implementation of new technologies and easier access to global communication.
- c. Lack of traditional approaches.

2.2 Which educational area is affected by ICTs in the first instance?

- a. Forms of teaching and learning.
- b. Content of educational programmes.
- c. Aims of education.

2.3 When do the students with SEN experience barriers to learning?

- a. Functional limitations become a significant obstacle to educational progress.
- b. They can not use ICTs in the learning process due to their impairments.
- c. A teacher uses inappropriate instructional methods.

2.4 What does ICT-based curriculum modification mean for students with SEN?

- a. Deviation from training or academic requirements and standards.
- b. Adoption of training resources to facilitate the process of knowledge acquisition for SNE students.
- c. Integration of ICTs into the SNE curriculum.

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MODULE 2 ASSISTIVE TECHNOLOGIES FOR STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

Introduction

By now the technology has become a basic component of the educational process, the assistive technology being an integral part of the life of many individuals experiencing a disability.

Consequently, the assistive technology is the keystone of a fruitful, modern educational process including students with disabilities. AT can help and support the involvement of such students in the learning process by overcoming some of the effects of their impairment as well as possible barriers that traditional ways of educational technology may create.

Shortly, AT is one of the most relevant elements in making education more inclusive.

AT refers to any device, system, or service that enables persons with disabilities employ in their daily lives, education, work, or leisure.

The term *technology* indicates not just physical objects – devices or equipment; more generally it refers to products, organizational set-ups or ‘ways of doing things’ that encapsulate a number of technical principles and components. The adjective *assistive* is applied to a technology when used to compensate for functional limitations, to facilitate independent living, to enable the elderly and people with disabilities to realize their potential to the full. The abbreviation AT will be used in the Module, therefore, must be read as *assistive technology products or services*.

Being a wide field, AT includes very simple and well-known products, such as white canes for blind people or manual wheelchairs as well as sophisticated high-tech products, i.e. computers and powered wheelchairs with voice control.

In education, the technology supporting and helping students with disabilities increasingly implies computer-related applications. Information and communication technologies have expanded the AT field to new dimensions, opening new doors, broadening horizons and enabling autonomy for many individuals with special needs. Over the last few years, the computer has turned into a valuable resource for teaching students with an ample range of learning difficulties. Rapidly grown processing power has let manufacturers provide sophisticated hardware and software to get the access and meet the learning needs.

Using high-tech AT devices in educational activities allows students with SEN to be indispensable in the group of their peers, to participate in the learning process as protagonists, and to gain self confidence, social and communication skills.

The AT applied in education enable students with disabilities to exploit their cognitive potential, to interact with others, and to control certain aspects of their environment. AT gives the opportunities to access the curriculum at the adequate level, providing facilities as well as incentives for learning. Using the right AT device, suitable software, and appropriate educational methodology, children who can’t hold a pencil can nevertheless draw and write, for example. Similarly, children unable to speak can use the computer as a communication tool.

The range of AT devices and services is constantly changing; this Module of the specialized training course by no means gives full descriptions of all options. However, we hope that it will serve as a starting point and reference and will present enough basic information to those interested in how to meet individual student’s needs.

Goal

The primary goal of this module is to give a reader a brief but comprehensive understanding of assistive technologies (AT), theory and main related fields. Special attention is paid to the issues of choosing the right AT solutions and services for students with special educational needs (SEN).

After a general introduction to AT, the module presents the AT applications for educational purposes in relation to the needs of six main groups of impairments: physical, visual, hearing, speech and language, cognitive, learning.

Objectives

Upon completing this module you will:

- ◆ learn about AT and their main classifications;
- ◆ understand the relationships between AT and social approach to disabilities;
- ◆ acquire knowledge of the core sources of information on AT;
- ◆ realize the need of multidisciplinary approach to choose appropriate AT for education of students with SEN;
- ◆ identify different aspects regarding the choice of appropriate AT solution for various impairments;
- ◆ know main AT tools and options for different groups of students with SEN;
- ◆ be able to develop recommendations on ways to provide better AT support for the students with SEN.

Readings for Module 2

Unit 2.1 Description, Classification, and Application of Assistive Technologies

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UNIT 2.1 Description, Classification, and Application of Assistive Technologies

Objectives

Upon completing this unit you will learn the following:

1. International classification of functioning, disability and health.
2. AT as an instrument for the autonomy of people with disabilities.
3. Classifications of AT.
4. Technical, social and psychological aspects of AT application.
5. Choosing and using appropriate AT.
6. Sources of information on AT.

2.1.1 International Classification of Functioning and Disability and Health

It is a fundamental right of everyone to have an opportunity for individual growth and to take part in social, cultural, and political life. AT is concerned with the promotion of this right by facilitating active participation of people with disabilities in all areas of life, be it school, work, social activity, or leisure time. However, this is achieved as a consequence of a number of factors and circumstances (e.g. environmental accessibility, personal assistance, social provisions, affirmative legislation, cultural acceptance of diversity in the community, financial support), AT being one of them.

ICF describes how people live with their health condition. ICF is a classification of health and health related domains that describe body functions and structures, activities and participation. The domains are classified from body, individual and societal perspectives. Since an individual's functioning and disability occurs in a context, ICF also includes a list of environmental factors. ICF is useful to understand and measure health outcomes. It can be used in clinical settings, health services, or surveys at the individual or population level.

WHO, 2001
*International Classification of Functioning,
Disability, and Health*

The new International Classification of Functioning, Disability and Health (ICF) developed by the World Health Organization provides an overview of important life domains to be considered in the assessment of AT needs and evaluation of AT outcomes (WHO, 2001). The previous international classification – the well-known ICIDH (International Classification of Impairments Disabilities and Handicap) in force since 1980 (WHO 1980) – at its very beginning was largely based on a *medical model* of disability conceiving it as a personal problem, a mere consequence of health conditions. Due to the revision process, the classification has been changed radically (ICIDH-2, WHO 1999) and includes the new *social model* of disability, according to which the social environment has the main responsibility in turning a person who experiences a disability into a person who suffers from a disadvantage. This change mainly covers theoretical and social

conceptions as well as social and medical practices in the field of disability. People with disabilities advocating for their right to personal autonomy have launched the disability movement 'Independent Living' which has rapidly spread all over the world, thus putting the accent on individual and societal factors related to disability rather than on medical.¹

In respect of above-mentioned changes in social mind toward disability, ICF has been mainly based on the integration of the two opposing models (Scherer, 2002b).

The body (its functions and structure) can be viewed as the substrate that lets *activities* occur, which enable *social participation*. *Contextual factors* (environmental and personal) may facilitate or hinder the participation. Furthermore, these elements must be considered intertwined. The new model defines the disability as a consequence or a result of a complex relationship between an individual's health condition and *personal factors* on the one hand, and the *contextual factors* that represent the circumstances in which the individual lives, on the other.

¹ Additional information on approaches to disability can be found in Unit 1.2 of Module 1.

2.1.2 AT as an Instrument for the Autonomy of Persons with Disabilities

Autonomy is the ability to plan one's own life, to enter into relation with the others, and, together with them, to actively participate in the construction of society.

Andrich & Porqueddu, 1990
*Educazione all'autonomia: esperienze, strumenti,
 proposte metodologiche*
 Europa Medicophysica

Today the technology is widely recognised as one of the most important 'springs' to promote autonomy and independence of persons with disabilities. Meanwhile technological advancement has created a virtuous circle in favour of people with disabilities, who can now live autonomously and independently, thus enjoying a positive change in the social attitude toward disability.

When appropriately chosen and easily available, the right technology can maximize their autonomy, promote participation, academic and career success.

Nevertheless, the term *autonomy* is not a synonym of independence; it does not necessarily imply 'doing things without help', nor is restricted to persons with full cognitive ability only. It is rather an attitude toward life, in some way a personal characteristic that an individual can achieve and develop.²

Autonomy can be considered as a dynamic process which includes the perspectives of an individual, his/her family, the outer circle and the society.³ Since autonomy is consequently related to the quality of human relationships, AT becomes a tool for relationship, thus for constructing freedom.

Independence as a human right for people with disabilities has been strongly advocated by pressure groups since the last century seventies. The Independent Living movement, being effective all over the world, supports all kinds of initiatives in the field, with respect to social, political, economic, and cultural aspects.⁴ AT is seen to be the most powerful instrument to achieve this goal.

The interesting mixture of technological and human sides, that is inevitably involved in AT, is reflected in numerous studies in the field and reveals in the changes which have occurred in the AT definitions proposed during the last years.⁵

Within the new ICF framework, the role of AT is shifting from a mere tool to compensate for an impairment to an instrument enabling or facilitating the participation in the social life of persons experiencing certain impairments. Similarly, contextual factors (for example, societal or family negative/positive attitude toward technology or disability) can facilitate or hinder the acquisition and/or use of AT.

The new model of human functioning strongly supports the right of persons with disabilities to choose the technologies they need, so that they can live more independently; as Scherer (2002a) underlines, it also defines that the effects of an AT device must be assessed on an individual basis, selecting relevant features across the ICF domains and monitoring them for desirable (or undesirable) changes; it recognizes that a technology must be adapted to individual's needs and preferences.

2.1.3 Classifications of AT

Various classifications of AT exist to be used depending on the purpose (cataloguing, teaching, information exchange, organization of counselling services, etc.). The most widespread classification, the ISO 9999 Classification

² 'In some cultures, Asian for example, if an elderly person becomes disabled as a result of a stroke, his continued independence is not viewed as being important. The extended family now perceives their role in taking care of that person. In this situation, outside intervention including that provided by AT may not be seen as necessary.' (Cook & Hussey, 1995).

³ This definition comes from the HELIOS European programmes (1988 through 1996), devoted to the study of social and technological issues related to disability and handicap. For information about the HELIOS project visit <http://europa.eu.int/scadplus/leg/en/cha/c11405c.htm>

⁴ 'Independent Living is a philosophy and a movement of people with disabilities who work for self-determination, equal opportunities and self-respect.' The definition, together with more and deep information, can be found at the site www.independentliving.org. Another site rich in information and documents is managed by the University of California, Berkeley, <http://bancroft.berkeley.edu/collections/drilm/>

⁵ Cook & Hussey's definition is greatly influenced by the Independent Living thought: 'the term Assistive Technology [should be used] to refer to a broad range of devices, services and practices that are conceived and applied to ameliorate the problems faced by individuals who have disabilities' (Cook & Hussey, op. cit.).

of Technical Aids (2002), is product-oriented, cluster-assistive devices around 11 classes (each divided into sub-classes, which, in their turn, into divisions) based on their main objective (mobility, housekeeping, etc.). The numbers refer to the classes:

- 04. Aids for personal medical treatment.
- 05. Aids for training of skills.
- 06. Orthoses and prostheses.
- 09. Aids for personal care and protection.
- 12. Aids for personal mobility.
- 15. Aids for housekeeping.
- 18. Furnishing and adaptations to homes and other premises.
- 21. Aids for communication, information and signalling.
- 24. Aids to handle products and goods.
- 27. Aids and equipment for environmental improvements, tools and machines.
- 30. Aids for recreation.

There are also activity-oriented classifications like the MPT (Matching Persons and Technology), which approaches AT from the perspective of various tasks of daily living: household activities, health maintenance, recreation, self-care, employment, communication, mobility, vision, hearing, cognition, reading, writing, learning (Scherer, 1994).

However, these classifications may not be very useful in structuring educational programmes as they are primarily product- or service-oriented.

The best suited must be the one knowledge-oriented, like the HEART – Line E classification.⁶ It clusters AT knowledge around three components: technical (communication, mobility, manipulation, orientation), human (issues related to disability, AT acceptance and choice, advice on AT, personal assistance) and socio-economic (accessibility and design, AT quality and standardization, supply, legislation, information sources on AT).

Human and socio-economic components can be considered ‘horizontal’ aspects, as they refer to any kind of AT and are to be dealt with globally.

The theoretical framework has been reviewed and updated in TELEMATE European project⁷ that has confirmed its main lines and proposed the educational programme for AT professionals.

2.1.4 Technical, Social, and Psychological Aspects of AT Application

Technology can contribute greatly to building of a society in which each individual has the opportunity to participate actively within his/her potential and the related economic and market factors. However, technology can bring segregation to specific groups. The table below illustrates the key domains in this field.⁸

⁶ Produced in the framework of the HEART European Project, 1994/95 (Azevedo et al., 1994).

⁷ TELEMATE, TELEMatic Multidisciplinary Assistive Technology Education, 1998/2000, www.telemate.org

⁸ Most of the information given here has been inspired by the Manuals of the EUSTAT (Empowering Users Through Assistive Technology) European project: *Go for it! A Manual for Users of Assistive Technology* (1999a) and *Assistive Technology Education for End-Users. Guidelines for Trainers* (1999b), <http://www.siva.it/research/eustat>

Table 2.1 Technical issues of AT implementation

Topic	Definition	Issues
'Design for All' (DFA) or universal design	This principle tries to ensure benefit from technologies for a wider population. It takes into account a 'broader average' of users when designing mainstream products and services ⁹	It requires the agreement and adoption of general and international standards by manufacturers, and we are very far from this objective ¹⁰
Accessibility	It is a category of usability: a product unused by a particular user is inaccessible to this person. It must be defined with respect to the user's requirements and needs	Accessibility of web design is currently a hot topic, mainly for blind and physically impaired people. Many international initiatives have been launched to remedy the problem. See WAI ¹¹ and the initiative <i>e-access</i> within the <i>e-Europe</i> programme ¹²
Service Delivery System (SDS)	SDS covers national social laws, procedures, and regulations with respect to AT provision, including the related services such as information and training. ¹³ SDS is rooted in national legislation framework and is implemented through administrative procedures	The world situation moves from contexts where most AT is totally funded or can rely on a substantial funding, to contexts where little funding or even no funding is provided
Market Factors	AT market factors are as follows: 1) purchase costs, in some countries sustained by governments; 2) maintenance costs, that include both – technology-related (cleaning, electricity, repairs etc.) and human-assistance-related aspects. Some devices may also entail associated services. ¹⁴	The cost issue is related to the individual situation, and it is not high or low per se, but with respect to the individual's economic situation The extent of the availability of AT products is also important, as well as the kind of SDS adopted by the national legislation

Many social and psychological issues are related to the process of getting and using an AT product or service, which are briefly given in Table 2.2.

Table 2.2 Social and psychological issues of AT implementation

Topic	Issues
AT impact on the individual's life	To improve the quality of life, AT must facilitate the achievement of operational objectives it was intended for (competent) in the environment where they make sense (contextual), and consistent with the user's lifestyle and personality (consonant) ¹⁵
AT and attitudes toward disability	Negative attitudes (disability as weakness, dependence) are related to negative perceptions of AT devices: something unpleasant; even an exterior sign (stigma) of weakness Positive attitudes (mainly self-determination) ¹⁶ are related to positive perceptions of AT devices, as tools for extending abilities
AT and personal identity	The best ATs become 'invisible in their use' since a 'symbiotic match' has been established between a person and a device. ¹⁷ The AT device in this case becomes a part of the person's identity
Acceptance of AT	Acceptance of AT is related to the acceptance of one's own disability as well as to the wide societal attitude toward disability and technical aids

⁹ For deeper understanding of this topic see, for example, the debate published in – <http://www.aaate.net>.

¹⁰ On this topic see the EUSTAT publications and the publications produced within the European INCLUDE project – <http://www.stakes.fi/include/pam1.html>

¹¹ See – <http://www.uiaccess.com/index.html>; Web Accessibility Content Guidelines – <http://www.w3.org/TR/W/CAG10>; Stephanidis, 2001.

¹² http://europa.eu.int/information_society/eeurope/2005/index_en.htm

¹³ A more formal definition of SDS is the one proposed by the above-cited HEART project: the complexity of processes that act as an intermediary between the needs of an individual with a disability or impairment and existing resources and AT (Azevedo et al, 1994).

¹⁴ See EUSTAT, 1998a; 1999a; 1999b; Andrich & Ferrario, 1996.

¹⁵ See Mainini et al., 1982.

¹⁶ Besio & Roncarolo, 1996; Hales, 1987; Finkelstein, 1985; Yuker, 1988.

¹⁷ King, 1999.

2.1.5 Choosing and Using Appropriate AT

As many studies in this area have emphasized¹⁸, the process of AT choosing, getting, and using belongs mainly to the user. Users are the best judges of products and services addressed to them; on the other hand, a good service needs feedback and user's involvement. The process that gives people with disabilities increased autonomy, i.e. to act as an involved and demanding user, is called *empowerment*. An 'empowered' user in this context is an informed, demanding and responsible consumer of AT.

Choosing an AT device must always take place in a negotiation process, a constructive dialogue between one or more professionals (or peer counsellor/s) and the end-user (Besio, 2002a). The process is to be grounded on equality and co-participation of the actors involved and regulated by psychological techniques of a dialogue (Gadamer et al., 1996; Cecchin, 1987). Even if the main stress is on independent living and empowerment of people with disabilities, there is a long and rich international history of health and rehabilitation services which help them "achieve lifestyles that maximise their physical functioning, independence, employment, and quality of life" (Scherer, 2002b).

Different professionals (physicians, rehabilitation psychologists, physical and occupational therapists, etc.) have the competencies which vary from country to country and from area to area. They generally identify, assess, and evaluate the impaired function, afterwards they can propose and discuss with the user and his/her family what kind of AT is to be adopted. In some countries (mostly in the North-West area) the services are common which provide information, guidance, advice, and counselling on AT to individual end-users, family members, school and rehabilitation professionals. Some centres can provide assessment and recommendations, others can prescribe the AT devices, train the users, and ensure maintenance. Sometimes, 'peer counselling' in this field is carried out by persons with disabilities who have achieved good knowledge and experience in using AT and who can serve as a model.¹⁹

Choosing of AT for children

From the developmental point of view, the early manipulation of objects and use of tools are of particular importance. Thus, an assistive device provided to the motor actions of a child may enable his/her development.²⁰ According to the study of Verburg (1987), children who had a miniature powered vehicle showed very high gains in social and academic categories of development, while communication and physical aspects of development remained uninfluenced by the use of the vehicle. Parental over-protectiveness decreased as the children became more independently mobile.

The important role of AT to support play and cognitive development of children with motor impairment has been studied as well (Besio, 2002b; 2004).²¹ At a very early age (under 2) AT is useful to let a child use objects as tools to achieve a desired result (Brinker & Lewis, 1982; Cook et al., 1990). Later on (2-6 years) AT systems are designed and used so that children can deal with objects more symbolically. Older children (7-11 years) use AT more variably, since they are able to apply logical operations to specific problems. Finally, the design of AT devices for the adolescent can be based on problem-solving and decision-making but actual operations should be allowed, too.

The possibility of a cognitive impairment must be taken into account when evaluating the user's level of cognitive functioning: careful attention should be given to the evaluation of the cognitive demands that the AT device places on the person. Motivation is very important to support an effective use of AT; for this reason the goals of the potential user should be carefully defined, so that the device application can become meaningful and motivating to the person.

AT use and abandonment

Summing up, AT is candidate to be successfully used by the end-user when it is *appropriate*, i.e. effective (with respect to the expected tasks, i.e. it performs what it was expected), *contextual* (fitting the environment and the context of use well) and, *consonant* (consistent with the user's lifestyle and personality) (EUSTAT, 1999a; 1999b).

¹⁸ HEART, see note no. 6.

¹⁹ The EUSTAT study *Programs in Assistive Technology Education for End-users in Europe* (1998b) examined and described the best existing experiences in AT education over Europe and the US, some of which are based on the 'peer counselling' methodology.

²⁰ The work of the famous psychologist Jean Piaget (1954) is particularly useful to interpret the child's development in AT respect because of its emphasis on object manipulation in the early years.

²¹ The international scientific review *Technology and Disability* devoted a special issue to this topic in 2004. See the introduction by Besio & Salminen.

Interesting indicators of the relevance of user involvement can be drawn from the studies on AT *abandonment*. Low utilisation and early abandonment (i.e. before the device life-cycle is over) may suggest that the technology provided was poor or wrong, or for some reason perceived as ineffective, useless or unsatisfactory to the client. Four important *criteria* that help prevent AT abandonment are:

- effectiveness, or how well the technology enhances the user’s capability;
- affordability, or how much it costs to purchase, maintain, and repair;
- operability, or how easy the technology is to employ;
- dependability, or how long the technology operates without reduced performance or breakdown (Philips & Zhao, 1993).

The criteria, no doubt, form the ground for choosing the appropriate AT. Furthermore, these findings emphasize the idea that technology-related policies and services need consumers’ involvement and understanding of long-term needs.

2.1.6 Sources of Information on AT

The circulation of information about AT is not a trivial issue, especially if AT is based on the application of electronics. Accurate information about the existing AT – availability, capacities, and limitations – is unevenly spread across the countries, among public service professionals, or people with disabilities who often remain isolated from AT development.

However, in order to make the right choice of AT adequate information about them must be available. Information dissemination and awareness-raising are essential in encouraging wider acceptance of inclusive policies and good practice. AT users, policy-makers, and a wider audience must have access to accurate, digestible, and up-to-date information from researchers and providers of professional service.

Correct and useful information on AT can be obtained through the Internet, books, and catalogues. Valuable guides offering outlooks on AT topics are produced by research centres and information services. On-purpose databases are available in the countries, where governmental agencies are in charge of their development. They are the main source of information for advice and counselling services in the field.

Handynet system has been for the past years the largest European initiative devoted to AT information.²² In 2003 the new European project was launched, named EASTIN (European Assistive Technology Information Network), which includes the representative European organizations with experience in the field of AT catalogues and databases. Its scope is to create the widest and most comprehensive information network on AT products, based on the most known and reliable national information providers in Europe.²³

The table below includes the main international sources on AT research and information.

Table 2.3 International Associations for AT Research and Information

Name	Mission
AAATE, Association of the Advancement of Assistive Technology in Europe , http://www.aaate.net	To create awareness on AT, to promote research and development in this field, to contribute to knowledge exchange, and to promote information dissemination
ARATA, Australian Rehabilitation and Assistive Technology Association , http://www.arata.org.au	To serve as a forum for issues in rehabilitation and AT
RESJA, Rehabilitation Engineering Society of Japan , http://www.resja.org.jp	To promote mutual understanding among professionals in the AT field so that they can comprehend and serve the needs of people with disabilities who will benefit from rehabilitation engineering
RESNA, Rehabilitation Engineering and Assistive Technology Society of North America , http://www.resna.org	To improve the potential of people with disabilities in achieving their goals through the use of technology and by promoting research, education, development, advocacy, and provision of technology

²² It was run within the HELIOS programme of the European Commission (see note no. 3).

²³ For more information see <http://www.eastin.info>. Six organisations involved are: Rehadat from Belgium; SIVA from Italy; Hjælpemiddel-instituttet from Denmark; Disabled Living Foundation from Great Britain; CEAPAT from Spain; Kenniscentrum voor Revalidatie en Handicap from the Netherlands.

A good example of AT database development is presented in the case study below (see Case study 2.1).

Case study 2.1 European Assistive Technology Information Network

An 18 months transnational project to put the basis of a new, original framework. The guidelines of EASTIN, European assistive technology information network: by the experience of six relevant national partners a new web tool to find products, services, regulations, and good practices, useful for people with disabilities, health and social professionals, manufacturers and suppliers.

There are over 50,000 assistive technology products, nowadays available in Europe, with estimated turnover 30 billion Euros. Every European citizen can take advantage of these products for a variety of purposes (therapy, training, personal care, mobility, communication, home adaptation, education, work, leisure, etc.), but it's sometimes really difficult to find information far from each country.

Internet society is changing the way of thinking and working: thousands of people with disabilities, caregivers, health and social professionals, public administrators, manufacturers or suppliers try every day to find answers to their needs by using the Web. But we still don't have a unique access point for all people interested in information on assistive technologies all over Europe.

The EASTIN project has the ambition to answer a lot of questions. How many assistive technology products and in each country services are there in Europe? What are their technical specifications? Are they available? What are the regulations for public provision and financing in each country? In which way can we guide users for their appropriate choice and application? Can we contribute to awareness and empowerment of European people with disabilities, by giving information in each country language?

Within 18 months timetable, the networking of the six major European AT information providers will be carried out not only by exchanging the current national experience, but also by improving the capability of the overall network to meet the citizens' information needs.

The service provided by the network aims at making available – anywhere, at any time, in the user's language and in a user-friendly and accessible manner – a complete set of information, educational, and guidance tools.

First of all, we are going to pay attention to the market validation, through interaction with three main target groups: end users, health and social professionals, industry and AT suppliers. In the first stage we will act at national level, by testing various dimensions of our existing national systems (contents relevance, effectiveness, usability, accessibility, interoperability, multilingualism, transcultural validity, etc.).

Every step of this working process will be documented on this web-site.

However, since the start of the project we want to give to the web surfers a glimpse of what the final achievement will be: an easy-to-use tool that opens the doors of six national databases at the same time, thus giving, the opportunity to look up all the information contained, and have it translated on the spot if not already in the users' language. It is going to be the most comprehensive web-service in Europe on assistive technology, owing to the joint efforts of the six partners and the financial support of the European Commission.

A more thorough technical description is available in other pages of this site.

Empowering citizens with disabilities to choose an independent lifestyle is one of today's key issues in the European Society. Knowledge means power. Access to such knowledge empowers people in their everyday lives to make decisions that improve the quality of their lives, inform choices, and ensures full participation without any kind of discrimination. We are working for this. All together.

European Assistive Technology Information Network – <http://www.eastin.info/>

Key Terms

Assistive Technology (AT): Any product or technology-based service that enables disabled or elderly people to reach their full potential in their daily lives, education, work, or leisure.²⁴

Assistive Technology device: Any item, piece of equipment, or product system, whether acquired commercially, modified, or customized that is used to increase, maintain, or improve functional capacities of individuals with disabilities.

Assistive Technology service: Any service that directly assists an individual with a disability in the selection, acquisition, or use of an AT device.²⁵ Devices, strategies, services, and practices are included under the AT umbrella-term.

Medical model of disability: According to the medical model of disability and ageing, people are disabled as a consequence of their own health condition; remedy is found through medication, rehabilitation and surgery, or adaptive aids and equipment. Disability is a personal problem.

Social model of disability: In contrast, the social model, which has superseded the medical model, sees people as disabled or enabled by the social context, in which they function, and proposes that changes in the social context or environment can remove or alleviate disability.

Integrative model of disability: This is the model of disability as given in the new World Health Organization's International Classification of Functioning (ICF), in which the biological, social and psychological aspects of each person are taken into account; the model describes not a special group of persons but all people. It is of inclusive nature, aiming at full participation of each and everyone in the society.

Summary

- ◆ AT refers to products, services and practices that persons with disabilities use to minimize the impact of impairment and gain access to environments and activities, thus improving and increasing their full participation.
- ◆ Technology promotes autonomy and independence of persons with disabilities; technological advancement has greatly contributed to changing social attitudes toward disability.
- ◆ Various classifications of AT exist, and they can be used depending on the purpose (cataloguing, teaching, information exchange, organization of counselling services, etc.). The classification best suited for structuring educational programmes should be knowledge-oriented.
- ◆ Technological benefits for students with disabilities are evident in making them able to undertake regular school activities; nevertheless technological development sometimes can exacerbate segregation of such persons.
- ◆ The process of choosing an AT device must always take place in a negotiation process, a constructive dialogue between one or more professionals (or peer counsellor/s) and the end-user.
- ◆ AT is successfully used by the end-user when it is *appropriate*, that means effective (with respect to the expected tasks, i.e. it performs what it was expected), *contextual* (well fitting the milieu and the context of use) and *consonant* (consistent with the user's lifestyle and personality).
- ◆ The right and useful information on AT can be reached through databases, the Internet, books, catalogues, special agencies, and counselling services.

²⁴ This is the official definition of the AAATE (Association for the Advancement of Assistive Technology in Europe), <http://www.aaate.net>

²⁵ According to the United States Assistive Technology Act of 1998.

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 2.1

- 1.1 Describe the AT classes according to the ISO 9999 Classification of Technical Aids (2002). Search REHADAT databases (<http://db1.rehadat.de/rehadat/eng/index.jsp>) and give some examples of AT devices for classes 05 (aids for training in skills) and 27 (aids and equipment for environmental improvements, tools and machines).
- 1.2 Define the factors which should be taken into account to make the right choice of AT device.
- 1.3 Name the main types of issues regarding AT implementation. What issues dominate in your country/region?
- 1.4 Surf the assistive devices of class 21 (aids for communication, information and signalling) on the SIVA Portal (<http://portale.siva.it/>) within the guided search. Find the products that can be used for preschool children (2 – 6 years). Explain your choice.
- 1.5. What are the main sources which provide information about AT in your country/region?

2. Self – assessment questions for Unit 2.1

2.1 What does autonomy mean in respect of AT?

- a. An ability of doing things without help.
- b. A process which includes the perspectives of the individual, his/her family, the outer circle, and the society.
- c. A process whereby students, who are in a special education programme, can learn autonomously with a help of AT devices and without special assistance.

2.2 Which is the most useful AT classification to structure educational programmes?

- a. Product-oriented.
- b. Service-oriented.
- c. Knowledge-oriented.

2.3 Which kind of the most important AT issues does *accessibility* imply for persons with SEN?

- a. Technical issues.
- b. Social issues.
- c. Psychological issues.

2.4 Process of choosing an AT device must be based on mainly:

- a. Professional recommendations of specialists.
- b. End-user's opinion regarding usability of AT features.
- c. Constructive dialogue between one or more professionals and the end-user.

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UNIT 2.2 Assistive Technologies for Education

Objectives

Upon completing this unit you will learn the following:

1. Impact of AT usage on education of people with SEN.
2. AT for the educational needs of students with physical impairments.
3. AT for the educational needs of students with visual impairments.
4. AT for the educational needs of students with hearing impairments.
5. AT for the educational needs of students with language and speech impairments.
6. AT for the educational needs of students with cognitive impairments.
7. AT for the educational needs of students with specific learning impairments.

2.2.1 Impact of AT Usage on Education of People with SEN

School education is vital and equal opportunity for children to develop as human beings, to know and understand the rules of the civil life, to relate and cooperate with their peers in spite of the differences between them.

The fact, that the social right to an education for all must include children with impairments, has been clearly stated at the international level in the so-called Salamanca Statement (UNESCO, 1994): “Every child has a fundamental right to education...” and “those with special educational needs must have access to regular school which should accommodate them within a child-centred pedagogy capable of meeting these needs.”

Today the widespread movement over the world struggles to include students with disabilities into mainstream education, to realise the possibility that they have equal opportunities to education and development as their peers and together with them. Didactics and pedagogy must change and adapt to make this tendency come true, to build a school able to host all probable differences, to give all students suitable and personalized answers; as the famous Italian priest and teacher don Lorenzo Milani said: “There is nothing as unfair as to divide into equal parts among the unequal” (Milani, 1967).

The recent introduction of ICTs in public schools caused a revolution in education, giving the green light to new conceptual paradigms in teaching and learning processes, based on active participation and cooperation of students (Gooden, 1996; Lau, 2000; Rogers, 2002). The paradigms favour each student’s integration in his/her group of peers, thus supporting the inclusion of students with disabilities.²⁶

...every child has unique characteristics, interests, abilities and learning needs.
...education systems should be designed and educational programs implemented to take into account the wide diversity of these characteristics and needs.

UNESCO, 1994
*The Salamanca Statement
and Framework for Action
on Special Needs Education*

AT plays a fundamental role in carrying out the process of inclusion. Within the ICF framework²⁷, we might assert that AT can build the necessary bridge between the students’ functioning and participation in school activities, offering them the possibility to learn. Through facilitating functional abilities, overcoming some impairment, eliminating architectural barriers, supporting the student, AT is the best ally, sometimes the solution, to let children with disabilities take part in the educational process to the full.

²⁶ Additional information on the inclusion process can be found in Module 1.

²⁷ See Unit 2.1.

The process of school learning includes (but not only) the possibility to develop the traditional school activities; every child (if no impairment hinders this possibility) must have an opportunity to learn by playing, and later to learn traditional literacy: to write, draw, calculate, and read; these abilities, once acquired, will open his/her mind for the whole world.

In the next paragraphs of the Unit the educational needs of different populations of students (with physical, visual, hearing, communication, cognitive, and learning impairments) are described with respect to AT use. Given the objectives of this specialized training course, the emphasis will be on high-tech AT (precisely, AT to access ICTs); nevertheless, it must be obvious that a lot of low-tech and non-electronic AT devices exist to support learning of persons with various impairments.

2.2.2 AT for Educational Needs of Students with Physical Impairments

Persons with physical impairments caused by the damaged central or peripheral nervous systems, have difficulties in motor control because of a health condition or trauma during or after birth. Additional impairments can be associated with physical, for example cognitive, visual, or hearing impairments, verbal language difficulties. Such people may experience reduced or no movement; imprecise movement, low speed and muscular strength; fatigue or difficulties in hand-eye coordination. AT can make for each of these problems.

In some cases simple technical adaptations can let the student fully participate in school activities at the general learning rate. If the situation is more complex (e.g. including cognitive, visual, and/or language impairments), the teaching rate may be slower, while learning may require reinforcement time and activities.

Since AT makes possible the activities that would be otherwise impossible, the relation between the students with physical impairments and their AT devices is usually very clear; acceptance problems are very rare. On the contrary, if the tool — especially a computer — is overvalued, as it sometimes happens, the interest gets lost, if not disappear totally, consequently.

Simple AT solutions

Most solutions to the troubles experienced by people with physical impairments can be found as low-tech solutions in a very simple way. Altering the type of handle on many instruments for recreation and learning we can make them accessible, e.g. cameras with modified shutter releases, modified grips on scissors, modified grasping cuffs for racquets or paddles. A person with limited strength of manipulation can fly a kite by adding special hand cuffs to hold the string.²⁸ In addition, some commercial educational tools can be used as AT (i.e. wooden letters, enlarged calculators, etc.).

Various kinds of switches are available that can be connected with toys through a battery adapter and a 'latch and timer' switch. The more complex a toy is, the more complex the activity can be accomplished. Software systems based on an interface to create multimedia activities are also available to control electric toys at a distance.²⁹

Low-tech approaches to the problem of writing include modified grippers that are attached to the hand and clamped to the pen, enlarged pens to make them easier to grasp, and weighted pens that help reduce tremor. Furthermore, clips and magnets can be used to stick the paper to the desk.

AT for writing

Since the very beginning, the PC has been recognised as the possible virtual schoolbag of the students with physical impairments, above all to let them write and communicate. The main problems that students with motor impairments face accessing the computer relate to working the keyboards and mouse. The tables below illustrate possible ways to cope with these difficulties.

²⁸ More details and examples can be found in Cook & Hussey, 1995.

²⁹ Experiments carried out by the Italian research project managed by SIVA have been based on such system (Brusa, 2001; Besio, 2001; 2003; 2004).

Table 2.4 Available input devices for students with physical impairments: keyboards

Severity of impairment	Type of AT devices	Characteristics
Minor motor impairment: need to avoid the simultaneous pressing of more than one key, unwanted selections or need to manage key combinations	Keyguards (see Appendix 3, Picture 1.2)	Plastic or metal protections on a regular keyboard that facilitates the access to the keys
	Software to adapt the keyboard functions	Facilities provided by 'Access Windows': control of response and repetition times, management of key combinations for special characters and functions, mouse emulation through the numeric keypad
More severe impairment in control and movement: alternative keyboards	Enlarged keyboards (see Appendix 3, Picture 1.4)	A lower number of keys of larger dimensions facilitate key selection
	Reduced keyboards	With smaller and closer keys, mostly effective when the user cannot make large movements and is liable to tiredness
	Keyboard with overlays	Made of a touch-sensitive surface, subdivided in programmable areas, overlays can be exchanged
	Keyboard emulators	The keyboard is reproduced on the screen and can be controlled by the mouse or by a scanning technique ³⁰
	Voice command	The user's voice is recognised and transformed into commands to the computer. It is possible to control the operating system's functions or insert text by speaking

Table 2.5 Available pointing devices for students with physical impairments

Type of AT devices	Characteristics
Trackballs (see Appendix 3, Picture 1.1)	The movement of an upper sphere shifts the cursor on the screen; they are equipped with programmable keys
Touch pads	A flat-touch responding surface mainly used in laptop computers as well as in ordinary desktops
Joystick	The movement of a lever in different directions controls the cursor on the screen; the lever holder can differ according to the functional needs of a user
Electronic pointing devices	They allow the student to operate the cursor on the screen without hands; they include ultrasound, infrared beams, hand or eye movements, nerve signals, or brain waves
Touch screen (see Appendix 3, Picture 1.3)	A responsive and transparent surface on top of the screen performs all functions of the mouse; especially suited to children or persons with cognitive difficulties, as well as those who have difficulties of hand-eye coordination

Table 2.6 AT to support writing for students with physical impairments

Purpose	Solution
Accelerating writing to save time and avoid fatigue	Software techniques for <i>abbreviation expansion</i> , <i>word completion</i> , and <i>word prediction</i> (see Appendix 3, Picture 6.2.); a whole word or a sentence can be written by pressing only a few keys
Learning maths and writing maths symbols	Graphic communication devices and purpose-built software for mathematics exist; some special software products for computers give the opportunity to write special mathematical functions and algorithms, so that the young students can learn and practise mathematics and the older ones can calculate and deepen this subject

³⁰ The scanning technique is based on sequentially highlighting different selectable options (letters, mouse functions, menu, etc.) on the screen; these options are organized in tables. The user's choice is expressed through appropriate switches, which are available on the market in different shapes, sizes, degree of sensitivity; they may be activated by hands, feet, head, puff, voice, muscular movements, depending on the residual abilities of the user. This technique is slow and laborious, but sometimes it is the only possible way to access a PC.

AT for reading, drawing, and studying

Once the most suitable device to access the computer is found for a student with physical impairments, there are many software solutions to support him/her in other school activities. Some examples are given in Table 2.7.

Table 2.7 AT for other school activities of students with physical impairments

Type of AT devices	Characteristics
AT for reading and developing reading skills	Voice output to support and exercise the learning of reading for the youngest; electronic book – on computer disks and published on the Internet – can be automatically readable
AT for studying	Software tools to build cognitive and/or conceptual maps to present the lesson content logically (see appendix 3, Picture 6.3). Multimedia dictionaries and encyclopaedias on CD and on the Internet
AT for drawing and plotting	Commercial software is available to do drawing activities. The well-known programming language LOGO can be considered in learning geometrical concepts and drawing geometrical figures. Technical software (e.g. specially designed for architects) or purpose-designed software can avoid the difficulties in the use of some drawing and plotting instruments

General comfort and working conditions

To enable the student with physical impairments to participate in school activities, the school premises must be accessible, as well as the means of transport between home and school. It is also important to check the quality of the classroom lighting, since poor lighting can exacerbate mobility problems.

If the student makes use of a personal computer, he/she will need an additional desk for the PC that must be easily accessible and adjustable, particularly if he/she uses a wheelchair. It is important to evaluate these needs in a timely fashion, minding the electric sockets are in the right positions.

A clear and tidy screen desktop is useful and comfortable; consequently, it is better to avoid useless or rarely used icons. This makes the icons easier to find and reduces the selection time when a scanning technique is used. It is also useful to associate some rapid-choice hot-keys to the most used programmes.

Choosing the right positioning of the computer is one of the most important ergonomic issues; cooperation with a physiotherapist is essential, especially when a scanning technique is used. Embedding the monitor inside the desk or using a flat monitor with a touch screen on the horizontal plane can in some cases be helpful to let the student concentrate the eye gaze and the hand movement in the same area.

2.2.3 AT for Educational Needs of Students with Visual Impairments

When an individual’s primary disability is visual, his/her visual needs must be carefully evaluated in order not to underestimate the impact of the impairment on his/her daily life – especially in case of educational contexts – so that the AT solution can be rightly accommodated to them.

Several types of measurements are employed to assess visual capability: visual acuity (target size), visual range (field size), visual tracking (following a target), and visual scanning (finding a specific visual target in the field of several targets).

Vision loss or vision impairment can result from a variety of causes (diseases, trauma, and problems at birth...) that can lead to varying degrees of vision loss from total blindness to affected eyesight in one eye only. As Scherer refers, different degrees are described as partially sighted, low vision, legally blind, or totally blind: “It is important to note that as the vision loss becomes more complete, the individual typically needs to use more assistance as well as high-tech and complex technologies for reading, writing, and mobility.”³¹

³¹ Scherer, 2004, p.14.

The affect of visual problems on a child's development depends on the severity, type of loss, age at which the condition appears, and overall functioning of the child; visual handicaps can create obstacles to a growing child's independence.

In mainstream schools the most of academic work is structured so that vision is the primary sense through which information is given. Consequently, to assure equal possibility to learn for students with visual impairment, perceptive stimuli other than the visual ones must be provided being typically based on auditory or tactile senses. "Students with visual impairment may need additional help with special equipment and modification in the regular curriculum; students with low vision or those who are legally blind may need help in using their residual vision more efficiently and in working with special aids and materials."³²

In what follows the AT devices to access the computer will be predominantly described.

Simple AT solutions

A lot of special toys and games exist to support *play and development* of a visually impaired child. Almost any common board game is available in the enlarged format. There are also enlarged and tactually labelled playing cards, as well as Braille versions of common board games, dice, and computer games emphasizing text and sounds rather than graphics.³³

The process of *studying mathematics and algorithms* requires the use of technical aids to learn the numbers in Braille and to set them up in columns. *Talking watches* are used by blind individuals, but Braille watches exist, too (see Appendix 3, Picture 2.1). There are *portable devices* that read paper money and voice the denomination of the bill.

Traditionally the blind used the Braille code for reading and writing, and many special tools have been developed to support their studies with Braille. The development and spreading of the PCs have changed this trend greatly.

Learning to use the computer

Learning to use a computer is a long and difficult route for a blind person, but building a totally autonomous life is considered a must, not only by rehabilitation experts but by the communities of blind people, too. The most effective software for blind children is still written to run under DOS, so old PCs can be used; a student does not have to learn DOS rules and commands, a technician skilled in DOS and capable of solving would-be problems must be at hand instead.

Children might not have comprehensive knowledge of the computer to start the school curriculum, though for their future a well-formed specific training is needed, since this tool is likely to become their most important working instrument.

The advent of Graphical User Interface (GUI) has created particular problems for blind computer users. In GUI visual information indicating relative spatial positions of objects on the screen becomes highly significant. Interaction is mediated by a mouse, however for a blind person it is almost impossible to use it and to know where it is pointing. GUIs have been made accessible via the development of screen readers, which essentially translate the screen into speech pronounced by a synthesizer (Cook and Hussey, op. cit.).

AT for writing and reading with the PC

Two tables below illustrate some possible AT solutions to support traditional school learning for students with visual impairments.

³² Scherer, op. cit.

³³ Most of them were effectively presented at the 9th ICCHP (International Conference on Computers for Handicapped Persons), Paris, July 2004. Research has underlined that these games can be amusing and challenging for persons without any visual impairment as well, thus being an interesting means for contact among students and favouring both inclusion and personal growth. See, for example, Archambault, 2004; Velleman et al.2004.

Table 2.8 AT for writing and developing writing skills for students with visual impairments

Activities	Possible solutions
Using the keyboard	Reference keys should be marked (they are usually marked in standard keyboards) so that the user can touch-type
Writing words	Learn the ten-fingers technique: special software is available
Writing and amending texts	Acquire competence in amending mistakes, making changes and improvements, reformatting (the support of reading tools and of a Braille printer is preferable). See appendix 3, Picture 2.4
Doing school exercises	Teachers must make regular school exercises computer-adapted (questionnaires, cloze, etc.)
Printing material	Commercially available Braille printers or enlarged printouts is highly recommended for the very early school years

Table 2.9 AT for reading and developing reading skills for students with visual impairments

Severity of impairment	Objective	Possible solutions
Blind persons	Auditory output	Talking books, screen readers (including output for punctuation, spaces, and screen attributes)
	Tactile output	Braille or tactile images of letters ³⁴ (see appendix 3, Picture 2.2)
	Mixed solutions	Hardware and software designed for Braille users can be used together with the software developed for screen reading with speech synthesis or 'soft Braille'
Persons with low vision	Monitor: decoding the visual and written information	Built-in screen- and text-enlargement software, screen magnifiers (see Appendix 3, Picture 2.5.), purpose-built software for a wider range of magnification, use of techniques to vary foreground-background colours
	Printing material: decoding visual and written information	Electronic aids to read printed materials based on CCTV (closed circuit television) to enlarge text characters, manipulate and control the image, its brightness and contrast (see Appendix 3, Picture 2.3)

AT for drawing, plotting, and learning to draw

Some AT solutions are available for drawing and recognition of geometrical shapes, e.g. grids, on which segments can be built with wool threads or small sticks used as segments to be assembled in a geometrical shape.

Current embossing printers can produce a tactile paper representation of the graphical content of a document, while the textual content is translated into Braille. It is now possible to print directly from any application running in the Windows environments.

Some software prototypes support graphical activity of the blind on the computer by giving them an auditory feedback (Kamel and Landay, 2002).

General comfort and working conditions

Both the blind and people with low vision have movement and orientation difficulties, so the classroom must be appropriately structured, and the furniture firmly positioned. It is important to plan the interior design in advance to place electric sockets in the right positions. Furthermore, the schoolmates must be informed about these needs to cooperate with their peers having visual impairments.

³⁴ The Optacon, a tactile facsimile with vibrating pins, even if no longer manufactured, is still used by many blind and is widespread within their community, being sometimes considered an invaluable tool for tactile output.

Blind people

The blind student's work-station, at home and at school, should be easily accessible and sufficiently large to contain the most used devices. Two desks may be necessary, one for the PC and its devices, the other for the regular school activities.

The computer desktop must be simple and tidy; useless icons are to be eliminated, though the used ones must be in 'pole position', i.e. in upper left.

Keyboard shortcuts usage instead of menu selections make a lot of computer activities faster and more comfortable for blind students; it is also useful to associate auditory cues with certain keys.

A Braille printer is bulky and noisy but needed for a young student learning to write to get the printed version of the screen text immediately. Later on it may be easier to connect the computer to a printer located outside the classroom.

People with low vision

A large screen is always necessary for a student with low vision. The screen should also be of high quality with emissions as low as possible, that it can be safely explored at a very close distance. A high resolution screen is preferable, since it helps enlarge objects on the screen. The user is involved in finding the most fitting combination of colours, fonts, and dimensions for his/her residual vision.

The screen desktop must be simple and well-organised without decorative but uniform backgrounds instead.

The shape of the mouse pointer is crucial, as to its dimension, colour, borders, tail, contrast with the background; some pointers can be found in the Windows system, however free software also exists (downloadable from the Internet) giving a wider choice of mouse pointers.

2.2.4 AT for Educational Needs of Students with Hearing Impairments

Hearing loss occurs if any part of the auditory system is damaged, be it one ear or both. It is generally described as mild, moderate, severe, or profound depending on how well a person can hear the intensities or frequencies most associated with speech.

A conductive hearing loss related to a damage or obstruction is in the outer or middle ear; damage of the inner ear results in *sensorineural loss*. Conductive hearing losses usually do not end up with severe impairment: a person with this type of hearing loss can take advantage of a hearing aid. A sensorineural loss frequently ranges from mild to profound, and even with amplification the person hears sounds as distorted. In this case the ability to understand speech clearly is diminished because parts of words and sentences are missed; sometimes application of a hearing aid is impossible (Scherer, op. cit.).

Prosthetic technology has recently brought a revolutionary innovation to this kind of impairment – the cochlear implant and the digital hearing aid – i.e. “an electronic assistive listening device surgically implanted within the inner ear to stimulate hearing” and “... designed to provide useful sound information by directly stimulating the surviving auditory nerve fibres in the inner ear”; (...) “candidates for cochlear implants have severe to profound sensorineural hearing loss and do not benefit from high-powered hearing aids” (Scherer, op. cit.: 95). A child with a cochlear implant needs an intense auditory and language rehabilitation.

Impairments of auditory function have two major effects: loss of input information and inability to verify one's own speech output. The latter can cause significant impairment in oral communication and verbal language acquisition. Consequently, especially if the loss is severe, such children may experience serious difficulties in school learning: particularly linguistic – grammatical and syntactic – development (Marschark, 1993; Ripley et al., 2001) affecting both receptive and productive language. Later, these complications can create obstacles in certain logical and problem-solving activities, especially if they are mediated by the language use.

Literature in the field (Messing & Campbell, 1999) shows that this case manifests itself mostly in the cultural contexts where the rehabilitation tends toward an oralist approach, where the hearing impaired person is educated based on the verbal language. The adoption of a bilingual approach (national verbal *and* sign language), as it is becoming more common in the United States, has proven more effective to support learning, even the verbal language (Bialstok, 2001).

- There are several AT approaches to provide oral communication assistance to people with a hearing impairment. One approach grounds on a feedback, either visual or tactile, that represents the person's speech patterns to typical speech. Regarding the tactile feedback, two types of haptic devices could be applied – systems for vector force feedback and devices that convey distributed sensations. The work of such tools is based on the skin sensation of human organism.³⁵
- Another approach provides alternatives to oral communication, such as visual displays (subtitles) read by the listener, or translation in the national sign language (see Appendix 3, Picture 3.4).

AT for learning and for school activities

Automatic systems of speech recognition give teachers the possibility to arrange audio-visual materials with subtitles. Some of them facilitate the simultaneous translation of spoken language into written words on the screen, so that the teacher's verbal lesson can be supported by the written visual code. Unfortunately, these systems are expensive; their application may be justified if large groups, not a small number of students, are being coached.

- The computer systems allow to capture (convert the TV sound into written words) audio-visual materials. As it was mentioned above, the software that gives visual feedback of some characteristics of speech from the screen into a microphone (e.g. the tone and the pitch) is available; the interface can be serious or funny depending on the user's age. These systems can be regarded as educational and assistive technologies, but they are used for rehabilitation purposes mostly.

General comfort and working conditions

To improve listening in the large areas, such as classrooms, they may be equipped with wireless assistive listening systems being based on radio frequencies, infrared systems, or on audio induction loop (Scherer, op. cit.).

The more profound is the auditory impairment, the more demanding are the students' needs in terms of space planning. Since the possibility of communicating is restricted to their visual field, the desks should be set so that the interlocutors can look at each other; the natural and artificial light sources are also important to avoid back lighting.

For traditional software applications, the PC use by students with hearing impairments does not require specific adaptations. The situation is different in multimedia applications: sound (especially speech) in multimedia documents is significant, as it conveys a lot of information. In some cases it can be useful to transform the auditory hints of some software applications into visual flashing hints; it is achieved through 'Access Windows' within the Windows system.

2.2.5 AT for Educational Needs of Students with Language and Speech Impairments

Augmentative and Alternative Communication (AAC)

For those with limited or no speech because of severe cognitive, physical, neurological, or neuropsychological impairments, including people with autistic spectrum disorders, Augmentative Alternative Communication is a means of communicating with others.³⁶ "AAC is also useful for people with difficulty of understanding language, with specific language disorders, and as a bridge to literacy" (Cook & Hussey, op. cit.).³⁷

AAC can enhance the development of expressive and receptive language, may reduce frustration, and increase personal empowerment (Grassman, 2002), as it provides the person with a means of communication. Consequently, social interactions improve individual learning and emotional development. The literature demonstrates that the use of an AAC system also increases an individual's self-confidence and self-esteem.³⁸

³⁵ See, for example, Cholewiak, R.W. and Wollowitz, M., 'The design of vibro-tactile transducers', Tactile Aids for the Hearing Impaired, I. Summers, ed., Whurr Publishers Ltd: London, 1992. pp. 57-82.

³⁶ Literature in the field is huge. The works of von Tetchner (1996; 2002) are worthy of citation being important and circulating all over Europe; see Light et al. (2003) also.

³⁷ There are many disabilities that can affect an individual's ability to speak. *Dysarthria* is a disorder of motor speech control resulting from central or peripheral nervous system damage and characterized by weakness, slowness, and lack of muscle coordination necessary for speech (Yorkston & Dowden, 1984). *Apraxia* refers to motor control limitations caused by a central nervous system dysfunction that prevents coordination of peripheral muscles (Miller, 1981). Language disorders are referred to as *aphasias*, and there are many types affecting both expression and reception of spoken and written language (Cook & Hussey, op. cit.).

³⁸ See the special issue of the international review *Disability & Rehabilitation* dedicated to Augmentative Alternative Communication (2004), the introduction by Sigafoos & O'Reilly in particular.

AAC methodology is based on a communication rather than verbal code. Depending on the user's needs, the images, drawings, pictures, symbols, and symbolic and even written codes can be used (see Appendix 3, Picture 4.1).³⁹

Table 2.10 Examples of AAC codes

Communication code	Characteristics
PCS (Picture Communication Symbols) ⁴⁰ See Appendix 3, Picture 4.3	For people who can communicate at a very basic level of a limited vocabulary and a simple morpho-syntactic structure
Makaton ⁴¹	The most popular communication programme for students with learning difficulties in the United Kingdom, based on simple icons
Blissymbolics ⁴²	Addressed to those who can communicate at a complex level, it is a very large set of symbols that permits individuals to create novel utterances
Minspeak ⁴³	Mainly used in the United States; it is a rather complex generative vocabulary, but very effective for the people capable of learning it

AT to support communication

Activities of learning and using these communication codes have traditionally supported by foldable and easily portable paper sheets.

Amongst the high-tech methods of communication, Voice Output Communication Aids (VOCAs) are the most common (see Appendix 3, Picture 4.2). Typically they are battery-powered and operate like a simplified tape recorder. Most are the size of a notebook or smaller and have buttons or target areas which trigger the playback of recorded words or short phrases. Most VOCAs use digitized speech, a human voice recorded in the device. When the user presses or activates the message button, the VOCA plays a spoken message (Cook, 1998).

From the point of view of the chosen communication code, two main groups of devices to support AAC are the following:

- *alphabetic devices* supporting the user's communication through the alphabetic letters; the message may appear on a screen alone or be spoken by a speech synthesizer;
- *symbolic devices* based on a symbolic or graphical code; these range from very simple one-message VOCAs to very complex ones, with a large number of recorded messages.

Communication devices come in many sizes to suit different user's motor abilities. Some can work in a scanning mode, controlled by a simple switch.

There are software products, which help create one's own communication board on the computer screen by means of a symbolic or alphabetic code. Electronic vocabularies of the popular symbolic codes are available in the international specialized market. Obviously, there are users who employ a word processor as a communication device.

The research (Salminen, 2004a; 2004b) suggests that the use of AAC devices as a substitute for vocal communication can push the development of speech. Voice output devices reinforce language through visual, auditory, and motor techniques, encouraging those who have the functional potential to raise their language and communication.

³⁹ ISAAC is the international organisation dealing with development and dissemination of AAC techniques and resources: <http://www.isaac-online.org>. More information also at <http://depts.washington.edu/augcomm/index.htm>

⁴⁰ See among others: <http://www.acciiinc.com>

⁴¹ http://www.makaton.org/about/ss_modifying.htm

⁴² <http://home.istar.ca/%7Ebc/b-learning.html>

⁴³ <http://www.prentrom.com/printed/cefall99.pdf>

Choosing and using AT for communication

It is important to select a device based on each person's communication needs and desires via determining the appropriate method of access and choosing a suitable communication code.

A communication device can be difficult for users who suffer from multiple impairments, such as cognitive and/or physical impairment; in these cases a long training period is required how to operate these tools. The time for training can impact significantly the effectiveness of the educational programme. Another vital success factor is parental involvement (Schlosser, 2003).

Size and portability of the communication device should be considered, since it has to be mounted on a wheelchair or a walker, or carried in one's schoolbag. As the student becomes more proficient in using the device, the number of choices he/she is able to make with it can be increased.

Sometimes a device can be upgraded instead of another purchased, e.g. by building connections between various communication tables and by providing the student with a more complex technique. The upgrade of a device saves money and time for mastering another technique.

2.2.6 AT for Educational Needs of Students with Cognitive Impairments

Mental retardation can be caused by any condition which hampers development of the brain before or during birth and in childhood. Brain damages occurring in the adult age are defined with reference to the specific area or function damaged (aphasia, agnosia, problem-solving, or comprehension deficit, etc.) at any time in life. Several hundred causes have been discovered (though about one-third of the affected remain unaware of the cause): genetic conditions, troubles during pregnancy, problems at or after birth, poverty, and cultural deprivation. Three major causes of mental retardation are Down's syndrome, Foetal Alcohol syndrome, and Fragile X.

'Mental retardation' is a term applied to a person with certain limitations in mental functioning and in such skills as communication, taking care of himself/herself, and social. These limitations prevent a child from learning and developing as a typical child. Children with mental retardation may take longer to learn to speak, walk, and take care of their personal needs, e.g. dressing or eating. They are likely to have trouble learning in school, and there may be some things they are unable to learn.

The level of severity of such impairment is assessed by the standardized psychological tests (IQ measurement); it goes from a profound (IQ = 20-25) to a mild (IQ = 55-70) level. While students with mild or at most moderate degree of mental retardation can profitably approach educational and assistive technologies, the use of AT in the case of a severe mental retardation must be carefully evaluated and planned with regard to both the accessibility and educational objectives; positive experiences in this sense are, nevertheless, described in the scientific literature (Davies et al., 2005; Wehmeyer, 1998).

The computer can be a good starting point to motivate the students with cognitive impairments to learn, since it is considered to be a typical tool of adults and VIPs; it can promote the learning process and the acquisition of basic abilities, increase motivation and self-esteem.

However students with cognitive impairments facing the IT tools meet some obstacles in how to use the device. As Cook & Hussey (op. cit.) stress, "it is generally not our goal to make things *simpler* for someone with a cognitive deficit, but to make them *different*."

Using the computer

A keyboard or a mouse may be difficult to use for these students. They may experience slow and inaccurate hand-eye coordination, problems of response, and/or memory limitations.

Different solutions to decrease such difficulties are at hand and different access devices or access options can be adopted. The choice of the right solution obviously depends both on the student's competence and the educational objectives.

Table 2.11 Available input devices for students with cognitive impairments

Type of input devices	Possible solutions	Objectives	Advantages
Keyboards	Alternative keyboard	To provide a student unable to use a conventional keyboard with an equivalent access	Easy to understand and to use thanks to the reduced number of keys
	Touch-sensitive keyboard (see Appendix 3, Picture 5.1)	To develop customized exercises on interchangeable overlays	Complex learning activities can be split into short, easy, individualized ones
	Facilitated keyboard (see Appendix 3, Picture 5.2) ⁴⁴	To facilitate letter and icon recognition and use of a keyboard	Stimuli can easily be found and memorised
Pointing systems	Trackball (see Appendix 3, Picture 1.1)	To facilitate the control of the cursor for students who are unable to use a mouse	It does not require very refined hand movements; it separates the cursor movement from the icon selection, thus facilitating the 'drag and drop' action
	Touch screen (see Appendix 3, Picture 1.3)	To enable a direct control on the PC interface by means of a responsive and transparent screen surface	Direct pointing is cognitively the easiest means of selection

Problems related to the interface

A high complexity of the software interface (quality and type of text, graphic, sounds, feedback, and their interrelations) can be a problem for a student with cognitive impairments; backgrounds full of illustrations and colours, implicit and complex functioning techniques are unsuitable for such users. For this reason a careful selection and choice of the software is highly recommended: e.g. multimedia products are very attractive, but teachers have to verify and monitor carefully how the task is understood.

Although the individuals will bear certain differences, generally speaking, too many icons on any user's screen desktop are to be avoided. Similarly, it is better to keep away from (complex) background pictures. Images with clear borders and high contrast are easier identified and decoded. The cursor dimensions, colour, contrast can be matched to the user's needs as well. Furthermore, the convergence of multiple stimuli on the same icon (i.e. image, sound, written word) can favour the user's understanding (Besio and Ott, 1997).

General comfort and working conditions

The choice of a PC to be used individually might be attractive as well as more productive for a teacher working with a student with mental retardation and cognitive impairment. However, the PC placed secluded adds to the student's isolation; an educational setting of the computer to be shared with the classmates is preferable. This favours working in small groups/pairs establishing mutual-help relationships, linking all students in collective activities, where everyone – including the student with a disability – carries out his/her part of a common task.

New, more involving pedagogical methodologies, if regularly used, have proved to be successful in obtaining results of better socialization and raising individual motivation (Katz & Miranda, 2002; Norwich & Lewis, 2001).

2.2.7 AT for Educational Needs of Students with Specific Learning Impairments

The most common specific learning impairments are dyslexia, dysgraphia, and dyscalculia.⁴⁵ Students with these conditions experience a significant delay acquiring one or some of the learning skills: reading, writing, calculating, etc.;

⁴⁴ See <http://www.comfyland.com/new/>

⁴⁵ For further information, <http://www.interdys.org>, <http://www.dyslexiaonline.com>

and demonstrate a discrepancy between achievement and intelligence ability. The exact causes of specific learning disabilities are unknown.

Learning-impaired students may have problems with oral expression, listening, written expression, basic reading skills or comprehension, and maths. Moreover, this situation provokes complications in general schooling, e.g. acquisition and memorization, autonomous understanding of complex texts, problem-solving.

According to the recent scientific publications (Kaufman et al., 2001; Silver & Hagin, 2002), such difficulties stay on throughout life, though some improvement or recovery may happen over time. For this reason, to support education and rehabilitation some tricks to overcome them as well as some AT tools to avoid them are handy. The computer can effectively alleviate and help the schooling of these students and become their AT tool for learning.

AT for writing and reading

Two tables below present the advantages of writing and reading with a PC for students with specific learning impairments.

Table 2.12 Possible AT solutions for writing and developing of writing skills

Activities	Related advantages
Using the keyboard	The availability of the whole range of letters shortens the time needed to remember the right letter shape and write it. To push digital keys is easier than to write with a pen, especially if a student makes frequent errors
Using the spelling corrector (see Appendix 3, Picture 6.1)	It prevents from making a huge number of mistakes in writing words; students can correct their document before printing it, and get advice from the built-in thesaurus
Using word prediction and word completion software (see Appendix 3, Picture 6.2)	Aids correct writing and can accelerate the writing rate ⁴⁶ ; some systems have practical features related to grammar and syntax
Using software to create conceptual maps and working plans (see Appendix 3, Picture 6.3)	To facilitate meta-cognitive activities of content planning and outlining in a logical structure to circumvent short, poor, and incoherent texts
Using voice recognition as input system	An alternative to the keyboard to avoid spelling mistakes, tiredness and to support long and complex writing activities

Table 2.13 Possible AT solutions for reading and developing of reading skills

Severity of difficulties	Possible solutions
Mild reading difficulties	Software to change the appearance of the text by modifying the font, dimensions, background colour and contrast, spacing between letters and between lines Rehabilitation and educational software to improve reading speed and accuracy
Severe reading difficulties	Speech synthesizers, OCRs (Optical Character Recognition Systems)

AT for drawing, plotting and studying

Some software solutions are also available to assist these students in other school activities (see Table 2.14) that can prove difficult as a consequence of the primary impairment.

⁴⁶ Some studies in the field (Newell et al., 1992) stress that the long-term use of such devices improve spelling and intelligibility of written work of young students with poor literacy skills.

Table 2.14 AT software for other school activities

Activities	Possible solutions	Advantages
Learning maths	Portable or electronic calculators, software tools to column figures and calculate algorithms	Avoid memory loading with mechanical aspects of math; release concentration for problem-solving
Studying	Electronic dictionaries and encyclopaedias, thematic Internet sites	Facilitate content understanding and memorization through information presentation in a logical hypertext format with accompanied multimedia texts, pictures, drawings, movies Support in managing the alphabetic order of words
Drawing, plotting, and learning to draw	Software for drawing, technical sketching (e.g. specially designed for architects)	Offer a facilitated, structured, and motivating working environment. Technical software can substitute some instruments that require profound planning and coordination abilities

General comfort and working conditions

Often these students have difficulties in organizing their material and keeping it tidy. For this reason teachers must carefully weigh up and monitor the use of multimedia and hypertext products, though desirable for their highly motivating value, to verify student's comprehension of the content and underlying logical connections.

It is very important to provide students with instruments, materials, and techniques that favour the development of classification and categorization skills, and to teach them how to maintain and arrange their exercise books, books and diskettes, as well as the computer desktop; an additional desk for the PC can be a positive solution.

A printer allows students to print neat copies of their text, free of errors and showing no signs of the great effort that may have gone into its production. This output will be considered worthy of being read not only by the authors but by their peers as well.

Key Terms

Alternative Keyboards (Keyboard Emulators): Hardware that replaces or works in addition to a standard keyboard. They may be larger than standard keyboards, may have the keys configured differently, or may be set up for one-handed typing. Alternative keyboards must be positioned to meet the specific needs of any user.

Augmentative/Alternative Communication: Any communication methodology and code used to enhance or substitute communication for persons who are non-verbal or who have limited functional speech. Communication devices that support the use of AAC are also known as Voice Output Communication Aids (or VOCAs).

Braille: The most widely used tactile substitution code for people with visual impairments. Each Braille character consists of a cell of either six or eight dots. Dots 7 and 8 can be used as a part of the character (mostly in European 8 dot Braille) or to show the position of the cursor in the text. They can be used for advanced mathematics work and computer coding too.

Braille Printer: Hardware that prints documents in Braille on embossed paper through a Braille translation programme.

Joystick: A device with four or five directional controls, joysticks can be used for mobility, to drive a wheelchair, or to access computers. Joysticks can be positioned for use with the hand, chin, foot, or head.

Screen Reader: Software that supports the generation of speech or Braille to enable a visually impaired user to navigate the computer screen by having the text spoken out loud or reproduced on a Braille display.

Speech Recognition/Voice Recognition: Software and hardware (microphone) that allows a user to control the computer through spoken commands rather than by a keyboard/mouse.

Speech Synthesizer: A device which presents artificial voices and uses either digitally stored vocabulary recorded by humans, or text-to-speech mechanisms that convert spelled text into spoken words.

Switches and Switch Software: Tools that offer ways to provide input to a computer when a more direct access method, such as a standard keyboard or mouse, is impossible. Switches come in various sizes, shapes, colours, methods of activation, and placement options. An interface device and software are required to connect the switch to the computer and to interpret the operation of the switch. Some programmes have been developed specifically for use with a switch and can employ on-screen scanning. With on-screen scanning, the computer highlights (either by sound, visual cue, or both) the options available to a user about what action he or she wants the computer to take. Using these specialized products, when a visual or auditory prompt indicates a desired keyboard or mouse function, the user activates the switch, and the desired function occurs.⁴⁷

Switch Mount: A device that allows a switch to be mounted in a variety of positions. A switch may be attached to a wheelchair and positioned to allow its easy activation. It may be positioned at the head, knee, chin, foot, elbow, or other site.

Trackballs: A device that looks like an upside-down mouse, with a movable ball on top of a stationary base. The ball can be rotated with a pointing device or hand.

Talking Calculators: Devices that give audio feedback.

Touch Screen: A device placed on the computer monitor (or built in it) that allows direct selection or activation of the computer by a touch of the screen.

Touch-Sensitive Keyboard: A pressure-sensitive membrane that responds to a touch. It can be fitted with various overlays customized with letters, words, or pictures.

Universal Design: An inclusive and proactive approach seeking to accommodate the diversity of users and usage contexts of interactive products, applications, and services. Universal Design starts from the design phase of the development life-cycle.

Summary

- ◆ AT plays a fundamental role in including students with some impairments and giving them the real opportunity to participate and to learn.
- ◆ The primary purpose of AT for students with physical impairments is to let them write and communicate. It is achieved with a wide range of input devices, pointing devices, and software to support writing, reading, drawing, and studying.
- ◆ To respond to the needs of students with visual impairments, we offer them non-visual forms of communication, using the auditory or tactile senses. At the same time we should take into account the specifics of visual perception for persons with low vision: visual acuity (target size), visual range (field size), visual tracking (following a target), and visual scanning (finding a specific visual target in the field of several targets).
- ◆ There are several AT approaches to assist persons with hearing impairments in oral communication. One approach is to provide feedback, either visually or tactually, that represents and relates the person's speech patterns to typical speech. A second approach is to provide alternatives to oral communication, such as visual displays, being read by the listener.
- ◆ Various AT solutions are created to meet the educational needs of students with language and speech impairments. An AAC methodology is based on a communication rather than verbal code: *alphabetic devices* support the user's communication through the alphabet letters; *symbolic devices* are based on a symbolic or graphical code. Software products also exist which help create one's own communication board on the computer screen by means of a symbolic or alphabetic code.
- ◆ The computer can be a good starting point to motivate the students with cognitive impairments to learn; it can support the learning process, acquisition of basic abilities, increased motivation and self-esteem. Various AT solutions can be found to overcome slowness and inaccuracy of the eye-hand coordination, difficulties in stimuli elaboration, memory, and/or motion. Alternative access devices or access options can be adopted.
- ◆ There are some AT tools to support learning skills (reading, writing, calculating, etc.) and other school activities for students with specific learning impairments. These students need assistance not only in learning but in organizing their material and computer desktop.

⁴⁷ Source: Computer and Web Resources for People with Disabilities, Alliance for Technology Access, 3rd Edition, 2000.

Assessment

To verify understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 2.2

- 1.1 Define the AT role for successful inclusion of students with SEN. Name the main types of educational needs which can be supported by AT tools.
- 1.2 For what kinds of students with SEN are specific modifications of traditional input devices required? Name the most widespread AT solutions in this field in your country/region.
- 1.3 What kind of issues regarding software interface can be an essential obstacle to learning? Give your examples of dealing with these issues for different impairments.
- 1.4 Think about the most essential AT solutions for persons with multiple impairments, e.g. for students with hearing and physical impairments. Give examples of AT solutions for students with multiple impairments.
- 1.5 Search via the Internet AT databases and list major developers (firms, manufacturers) of AT devices for education of students with visual and cognitive impairments in your country/region.

2. Self – assessment questions for Unit 2.2

2.1 Which are the main problems that students with physical impairments encounter using a PC for writing?

- a. The human–computer interface.
- b. The right positioning of the computer.
- c. The use of the keyboard and the mouse.

2.2 How can the visually impaired person access the information on the PC?

- a. Using screen reader software.
- b. Using enlargement software.
- c. Using a screen magnifier.

2.3 The use of the PC by students with hearing impairment:

- a. Does not require specific adaptations.
- b. Requires specific input devices.
- c. Requires specific output devices.

2.4 Augmentative and Alternative Communication (AAC) is mostly useful for:

- a. Students with hearing impairment.
- b. Students with language and speech impairment.
- c. Students with cognitive impairment.

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MODULE 3 DISTANCE TECHNOLOGIES FOR STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

Introduction

For many years instructors have taught students across great distances via correspondence courses based on written and printed materials. DE first stage was marked in late nineteenth century. Then known as correspondence courses generally provided students with study guides, textbooks, and sometimes supplemental reading lists (IITE, 2002). The early days of television witnessed the introduction of televised courses. Today, in a specially equipped facility, an instructor can teach several classrooms full of students brought together by interactive television.

Over the last decade there has been an explosion of new organizational forms in education, particularly at the post-secondary level and in vocational training. Early online courses via electronic mail were rapidly followed by web-based instruction. The lines were blurred between different types of distance learning courses as multiple modes of delivery were employed in a single course. For example, a class 'library' could be a web site; class discussions could be carried out via electronic mail; the content of some courses could be delivered through printed materials and television; and the final activity could be a place-bound proctored exam.

At present, the range and magnitude of DE courses available on the Internet have expanded tremendously. DE has gained credibility as a valid, educationally sound and viable alternative approach to teaching and learning, equal in standard to the traditional face-to-face interaction of a regular school. New information and communication technologies have the potential to offer immense opportunities to all societies and individuals of alternative and often cheaper ways of access to and dissemination of information (IITE, 2000). In this connection, DE has been a particularly successful model in the developing countries where affordability and geography are real barriers to access.

The progress in the DE field is exclusively relevant to education of students with SEN, as the technology-based DE provides them with the access to learning activities in any place throughout the world. However, the design of many distance learning courses erects barriers to comprehensive participation of students and instructors with certain types of impairments. The successful exploitation of these achievements in special needs education (SNE) depends on the provided appropriate legislative and regulatory environment as well as on the removal of barriers and restrictions. Only when these conditions are met, Information Society will realize its potential and attain the ultimate goal of empowering through access to knowledge for all its citizens, including those vulnerable to marginalization and exclusion.

To assure that individuals with SEN can wholly participate in the process of ICT-based DE, we must carefully analyze the demands of the specific group of SEN students and make recommendations on how to select the most appropriate technology, which will be adequate to their needs. For this purpose, sufficient knowledge of assistive technologies (the topic covered by the previous module), as well as specific knowledge regarding the technologies employed in DE for students with special needs must be mastered. It is also necessary to know the accessibility barriers, existing standards on DE accessibility and ways of meeting these standards. These issues are discussed in the Module.

Goal

The main goal of Module 3 is to describe main features of distant education (DE) which are important for education of students with special educational needs.

Module begins with a short overview of main stages of DE evolution and main features of ICT-based DE. Unit 3.1 contains a comprehensive picture of major technologies used in DE and their benefits for students with SEN.

Unit 3.2 focuses on the accessibility barriers to educational resources and approaches to overcome them, as these issues have a special emphasis on DE of students with SEN.

Objectives

Upon completing this module you will:

- ◆ learn about DE and appreciate its role in the digital society;
- ◆ understand DE benefits for students with SEN;
- ◆ appreciate different types of DE technologies that can be used for students with SEN;
- ◆ identify main accessibility barriers to DE for students with SEN;
- ◆ acquire knowledge regarding the standards of DE accessibility for students with SEN;
- ◆ appreciate the most suitable methods of overcoming the barriers and providing accessible DE for students with SEN;
- ◆ acquire knowledge regarding main techniques of accessibility checking.

Readings for Module 3

Unit 3.1 Distance Education: New Opportunities for Students with SEN

Creating Distance Learning Courses developed by the **Centre for Teaching, Learning, & Technology** and **UW Educational Outreach**. Lesson 3 – Using Technology to Encourage Communication. Online: <http://depts.washington.edu/ctltstaf/dl/lesson3.htm>

Unit 3.2 Distance Education for Students with SEN: Approaches to Overcome Accessibility Barriers

1. Edmonds C. (2003). Providing Access to Students with Disabilities in Online Distance Education: Legal, Technical, and Practical Considerations. Online: <http://www.ilru.org/html/training/webcasts/handouts/2003/02-19-CE/presentation.html>
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UNIT 3.1 Distance Education: New Opportunities for Students with SEN

Objectives

Upon completing this unit you will learn the following:

1. DE and its role in digital society.
2. DE benefits for students with SEN.
3. Different types of technologies to enjoy the benefits of distance education for students with SEN.
4. Synchronous communication and collaboration tools.
5. Asynchronous communication and collaboration tools.

3.1.1 Distance Education and Its Role in Digital Society

In recent years the importance of providing delivering information mechanisms for the potential users of the emerging Digital Society has increased significantly (Stephanidis, 1997). DE history demonstrates its ability to adjust in responding to new educational demands of the society. The grown social requests for information and knowledge as well as the sequential development of DE technologies are illustrated by the DE evolution through three generations (see Box 3.1).

Internet-based distance learning has the potential to constitute something entirely different. The speed with which participants communicate, the distances between participants and the multi-directional nature of these conversations stand in sharp contrast to previous methods of distance education.

Foley, 2003

Distance, Disability, and the Commodification of Education: Web Accessibility and the Construction of Knowledge

Technological developments of the past three decades have led to fundamental changes in the production, storage, and dissemination of materials and information. As new technologies have become available, the traditional way of learning has altered. The expanded use of modern technologies impacts the ways students and teachers interact as well as the approaches in which knowledge is constructed and pedagogies are enacted; certain types of knowledge become more amenable to these forms of presentation. DE has now gained credibility as an effective and viable alternative mode to teaching and learning, equal to the traditional face-to-face interaction in a regular school. Thus, ICT-based DE offers opportunities for teachers to have students all over the world and for students to participate in the activities

organized in any place throughout the world staying at home. Some of researchers (Alavi, Yoo, & Vogel, 1997; Millbank, 1994; Navarro & Schoemaker, 2000; Sankaran & Bui, 2001; Schutte, 1996; Sherry, 1996) have found web-based instruction more effective than regular.

The main strength of modern DE is *flexibility*, since it makes the learning process independent of space and time. Flexibility provides the whole range of options. By not requiring the student to be physically present at the same location and time as the instructor, DE is able to take advantage of Information Age and overcome the obstacles created by societal changes. It is very important that ICT-based DE has tremendous abilities to mediate the construction of knowledge, automating and monitoring instruction, and curriculum. While some courses offer independent study using a guide and comprehensive course manual, others require online participation, group work, and discussion between instructors and learners. The very nature of online technology has the potential to encourage learners to interact with the course material and subject matter in new and different ways, offering flexibility in terms of content presentation.

Within the context of rapid, global, technological change and volatile economic conditions, the educational systems in many countries are being challenged to respond with increased educational prospects without a consequential raise of funding. Many educational institutions address this challenge by developing DE programmes. As a matter of fact, DE has the capacity to reach many more people more cost-effectively than a traditional classroom instruction. Such programmes meet the demands of social justice and equal opportunity, especially, for groups who have difficulty in attending scheduled on-campus courses.

Box 3.1 Evolution of distance education

According to IITE Analytical Survey *Distance Education for the Information Society: Policies, Pedagogy, and Professional Development* (UNESCO IITE, 2000), one way of looking at the history and successive developments in distance education has been to describe them as belonging to different *generations*. Garrison (1985) and Nipper (1989) were among the first to use this term to describe three phases of distance education, “which are linked historically to the development of production, distribution, and communication technologies” (Nipper, 1989, p. 63).

The medium for the *first generation* was written and printed material. While writing had been in use for centuries, the introduction of new printing techniques enabled low-cost production of textbooks. From the middle of the nineteenth century the establishment of railway systems, fast and economical national postal services afforded the distribution of teaching materials among large numbers of geographically dispersed learners. In addition to generally available textbooks, special instructional materials were limited and may have included a reading list and sample questions which were marked by correspondence tutors.

The invention of radio in the 1920s allowed the beginning of radio-led courses consisting of a series of talks; occasionally a set book or other printed materials and local study groups were added. From the 1950s TV-led courses have been extensively used, often with print and local groups, occasionally student assessment.

The beginning of the *second generation* was marked by the Open University of the UK set up in 1969. This was the first time when a deliberately integrated multiple media approach was used for distance education, even though the dominating medium remained the print. The Open University developed large quantities of high-quality, specially designed distance learning materials. One-way communication, from university to students, was through the print integrated with broadcasts (audio cassettes were added later). Two-way communication between tutors and students was through correspondence tutoring, face-to-face tutorials and short residential schools. A characteristic of this model is high fixed costs associated with the course elaboration and low variable costs in that the cost of each additional student is low, once materials have been created.

The *third generation* of distance education uses information and communication technologies as its basis, offering two-way communication in various forms (text, graphics, sound, moving pictures), either synchronous (‘at the same time’, such as videoconferencing and audio-graphics; both popular in North American institutions) or asynchronous (‘not at the same time’, such as electronic mail, the Internet and computer conferencing). ICTs can be implanted in the courses characteristic of earlier generations or used as they are. In both cases they can facilitate greater interactivity between a tutor and a student, between a student and a student, and between a student and learning resources of various kinds. Discounting the initial costs of the technologies, this model may generate lower up-front fixed costs but higher variable costs (e.g. for a student) than the second generation model.

3.1.2 Benefits of Distance Education for Students with SEN

ICT-based DE has the potential to reduce isolation, link an individual with others, and increase access to learning for students with SEN. It is also likely to ensure that each student can access the appropriate learning course and assistance according to their needs.

ICT-based technologies can effectively support the DE of students with SEN in three main areas:

- Interactive communication between educators and learners.
- Delivery of resources.
- Access to learning resources.

There are groups of people who are unable to undertake traditional forms of learning, as they cannot go to college or university in the usual way. Many of them are unable to travel between home and campus, and/or sit in classrooms. In this connection, the interactive and asynchronous nature of ICTs provides useful options for the target group of students. The combination of distance-based methods and personal support is more accessible than traditional forms of study for most people with SEN.

New technologies play a crucial assistive role in delivery of educational resources for students with SEN, as they facilitate flexible access to a wide variety of information by incorporating the notions of navigation and tailored presentation. They allow for a courseware to be available on different platforms or operating systems, as well as the regimes of stand-alone, the Internet, or a combined mode of operation. Thus, digitally stored information is much better than analogue one for people with needs, because it can be manipulated and, if appropriate, converted in a more convenient format. In order to access digital information, a user has to employ a computer with diverse adaptations for persons with disabilities. These devices do not solve all problems, but digitally stored information and carefully designed user interfaces is a great step forward for people with SEN.

Designing online Internet-based courses that are accessible to all students, including students with disabilities, results in courses that are easier to use and understand for everyone.

Nielsen, J. 2000
*Designing Web Usability:
The Practice of Simplicity*

Access to information is one of the central issues in education of people with SEN, as information resources have to be tailored to the needs of different users. There is a variety of methods to meet the needs of DE students. For example, navigation tools help persons with low vision optimize the size of visual information on the screen and increase font size of the text; if students are unable to read print of any size, the screen reader software may become useful to make the text on the screen accessible through speech or Braille output. Individuals with mobility impairments can use unconventional input devices (e.g. alternative keyboards, voice recognition, etc.) to access computer technology. In fact, DE technologies are becoming increasingly practical as a method offering educational opportunities to an individual.

Several benefits of the ICT-based DE for learners with SEN are presented in Box 3.2.¹

Box 3.2 Benefits of ICT-based distance education for students with SEN

ICT-based Distance Education has particular advantages for students with SEN as it:

- removes barriers of place – physical classrooms become unneeded in the traditional sense and students can join classes from a place of their choice. This may be seen as irrefutable advantage, particularly, for ‘homebound’ students with a disability (Willing and Able, 2000);
- removes barriers of time – one aspect of learning style preference is accommodating, as students pursue learning with a more flexible schedule; asynchronous discussion via a chat room enables them to join ‘the class’ at personally convenient times;
- obviates dependence on a prescribed information source (mostly textbook) – resources may be derived from multiple locations, in varying formats, with the potential advantage of accessing more up-to-date and relevant information;
- decreases the assistance, for example, of library staff and others;
- increases opportunity of active engagement in the learning process. This can occur through ease of information access, greater choice of available materials, and contribution to group discussion in virtual reality;
- affords people with a range of disabilities an easier access to learning resources – e.g. students with vision, hearing, speech, or mobility impairments and learning disabilities have the opportunity to communicate with their peers using both better designed mainstream technologies available to those without disabilities and the appropriate assistive technology meeting their particular needs. Even those who prefer to communicate with others in the familiar environment at home may find electronic access a beneficial alternative.

Thus, ICT-based DE implies a great potential for people with SEN, as it helps overcome traditional barriers when moving long distances and get knowledge in an equal manner, considering the needs of different users.

DE has become a totally new prospect and great chance for people with SEN to receive high quality education, since it is adapted to the special needs of these groups of people. Thus, ICT-based DE must be exploited to include socially disadvantaged groups of people. However, modern technologies are so multifaceted that it may be difficult to identify the most suitable for individual requirements of a student or to get an overview of their huge possibilities. When planning DE it is

¹ Most of the information has been taken from the following sources:

Willing and Able: Online Learning and Students with Disabilities. The CanLearn Insider. Issue 1 February – March 2000. Online: http://www.canlearn.ca/english/café/insider/issue_1.shtr and

O’Connor, B.(no date). *E-learning and Students with Disabilities: From Outer Edge to Leading Edge*. Griffith University resources. Online: http://www.griffith.edu.au/ins/webdev/accessibility/resources/ac01m01_BarrieOConnor_Elearning.doc

essential to stick to the core intent of the programme. The planners must think in terms of learning and teaching: analyse students' and teachers' needs, consider the content of the educational programme, the objectives of learning and teaching, types of activities, teaching materials, etc. In this way a basis for selecting suitable technologies is created.

3.1.3 Different Technologies Used to Achieve Benefits of Distance Education for Students with SEN

ICT technologies used in DE can be divided into several types. Each type is defined by how an instructor and a learner transmit and receive educational instructions and materials. So, the means and media used play an important role in this process. DE programme offered by an accredited institution should consequently select appropriate technologies to respond to the mission and goals of its educational agenda.

People responsible for providing DE for students with disabilities must clearly understand the basic principles of a progressive DE programme and a model of categorizing the strategies employed in DE.

The model developed by Johansen et al. (1991) gives a categorization of various technologies, which includes both individual and group applications. 'The 4-Square Map of Groupware Options' states that all interaction is:

- Same Time/Same Place.
- Different Time/Same Place.
- Same Time/Different Place.
- Different time/Different Place.

Digital conversation may be synchronous or asynchronous, and its audience intimate or vast. Its persistence opens the door to a variety of new uses and practices: persistent conversations may be searched, browsed, replayed, annotated, visualized, restructured, and re-contextualized, with what are likely to be profound impacts on personal, social, and institutional practices.

Erickson & Kellogg, 2000
Social Translucence: An Approach to Designing Systems that Support Social Processes

The four categories are used to illustrate the technologies which currently support distance teaching and learning. However, nowadays the most popular way of describing the DE technology to support materials' delivery and interaction is to divide it in two main types: *synchronous* and *asynchronous*.² The asynchronous and synchronous teaching/learning processes can be accomplished in a place-dependent or in a place-independent manner.

The detailed list of possible technologies that might fall in each category is presented below.

3.1.4 Synchronous Communication and Collaboration Tools

When the course instructor and students come together at the same time, the teaching/learning process is described as 'synchronous'. Within the synchronous environment an instructor presents information, answers questions, and monitors discussions; students interact with each other and/or instructors in real time. Thus, everything is similar to traditional classrooms. Some technologies can visualize the participants so that the users could observe who they are making conversations with, and are able to react to their responses, and resolve misunderstandings, similar to traditional face-to-face conversations, i.e. a video conference (Prasolova-Forland et al., 2003). However, the synchronous mode of interaction requires linguistic agility and fast reaction. Students must be able to express their thoughts without a delay, which is not always appropriate for students with SEN, as their impairments or personal learning style impede quick communication. Furthermore, both students and instructors have to purchase different types of audio-visual equipment which may be moderately or very expensive, depending on the quality of a device. In addition, the participants must sit in front of the computer/TV or other device at a designated time slot.

Examples of synchronous DE technologies are described below.

Instant Messaging Service Instant messaging services (e.g. MSN Messenger³, ICQ⁴, etc.,) offer the opportunity to identify people who are online at the same time and exchange information in near real-time. Some instant messenger programmes include voice chat, file transfer, and other applications which can be essential for persons with SEN.

² Often the institutions prefer to provide mixed ways of communication: synchronous and asynchronous.

³ MSN Messenger <http://messenger.msn.com/>

⁴ ICQ <http://www.icq.com/>

Chat room Chat rooms are synchronous communication tools which allow the users to have a discussion via typed text in real-time without a need to be in the same place. In chat rooms the participants must type their comments and questions. Chat rooms are a component in every major course management system and are available for free on many web sites (such as *Talk City*⁵, *Yahoo Chat*⁶, etc.), where the instructors can create their own classroom area.

Whiteboard The whiteboard, as a graphical chat tool, allows users to draw, paint, and share existing graphical files in real time with a help of a mouse or specially designed pen, which has become a significant plus for those who cannot manipulate a mouse or see the learning material.

Audio conferencing Audio conferencing can be done via phones or the Internet. This way of interaction includes two or more participants collaborating via oral speech in real-time. Telephone-based audio conferences are the oldest and simplest form of interactive DE. A learner can access DE opportunities, interact with experts, receive information updates, as well as share ideas with other participants. With the advent of the mobile (cellular) telephone the number of locations to be reached has increased. Telephone may serve as an audio component of other distance learning technologies, such as video conferencing.

When used alone, audio technology presents critical verbal information: a visual component missing, facial expressions, gestures, and demonstrations do not help speakers make some points or enhance understanding of their listeners.

An important step forward is application of Text Telephones (TTY)⁷. These devices are popular among people with hearing, speech, and language impairments. TTY is a combination of telephone, keyboard and display facilitating the direct, point-to-point, text-based communication between the participants. However, such system is appropriate for one-to-one conversations with the instructor but cannot be used by a group of students.

Video conferencing Video conferencing allows two or more users to interact in real time via video and audio transmissions. Advances in video technology have dramatically expanded the technology's use and access to DE.

When learners and teachers see each other, new levels of interaction are achieved. Video enhances all types of interactive teaching and learning. Hence, the DE based on modern technology employ practices integral to all face-to-face class interactions – collaborative problem-solving, demonstrations, behaviour and skill modelling.

DE applications with video technology fall in two general categories: one-way broadcast video and two-way interactive video. One-way broadcast video means that video signals are transmitted in one direction: from teacher to learners. Components of a broadcast system include a facility to produce programmes and a site for learners to view the programmes on a standard television⁸. Two-way interactive video provides for video and audio communication in both directions between learners and teachers. It may include two-way-video and audio or one-way video/two-way audio transmission.

Now there exists a variety of video conferencing technologies: *Integrated Services Digital Network* (ISDN), satellite and cable broadcast, and *Instructional Television Fixed Service* (ITFS). It is important to be aware of *Telecommunication Relay Service* (TRS) and *Video Relay Services* (VRS) which support telecommunication between non-hearing and hearing people. TRS implements two-way translation between speech and text. The hearing user communicates orally, the non-hearing user communicates by typing on a TTY; a relay operator serves a liaison, responding by voice to the hearing party and by text to the non-hearing party. VRS is a similar service, except for the non-hearing user converses with the relay operator in the sign language.

⁵ Talk City, <http://www.talkcity.com/>

⁶ Yahoo Chat, <http://chat.yahoo.com/>

⁷ Sometimes Text Telephones are called Telecommunication Devices for Deaf (TDD).

⁸ Such way of video transmission is described in the next section which is devoted to asynchronous communication tools.

Multi-user domain Object Oriented Environments (MOOs) MOOs are virtual online environments designed for problem-solving, live interaction, and collaboration. A MOO is a synchronous text-based tool which gives the user a control over ‘avatars’ (computer-generated actors) moving through the virtual world, interacting and communicating via speech generated by user-typed instructions. The tool helps engage students in role-playing, critical thinking, and problem-solving activities. In order to be accessible, a text description of the virtual world and a real-time text transcript are required.

It is essential to remember that sometimes software for synchronous communication can pose scheduling challenges for students whose input manner is slow. Thus, students with limited hand capacity (who can input information very slowly) or students with specific learning impairments (for whom to compose a thought takes time) may be partially included in the discussion. In this case alternative means of participation (mainly asynchronously ones) must be employed (e.g. e-mail).

3.1.5 Asynchronous Communication and Collaboration Tools

When education is unfixed in time, the process is described as ‘asynchronous’. Inherently this way of communication is less difficult than synchronous types, as students are free to make up their own schedules. With asynchronous delivery of instruction, a student can review the online content several times and enjoy additional time to think over the learning material and to respond to it. It is vital for students with disabilities, because input/output of information, thinking, and conceptualization can take longer time due to their impairments. Moreover, instructors are available via e-mail and/or telephone, if a student has questions or concerns. The advantages of this way of interaction are: a relatively low cost and time flexibility. Nevertheless, the necessary large amount of writing and information exchange can present some problems. Examples of DE technologies asynchronous in nature are described below.

Electronic mail (e-mail) Electronic mail (e-mail) software is now so well-developed and user-friendly that even new users need very little training to get started. It is a fast and easy way of sending messages from one person to another or to a group (either by using multiple recipients, or through an e-mail distribution list). In both cases, a user may select application-specific client software depending on his/her needs and compatibility with the preferred AT software and hardware. The widespread use of e-mail makes it a common first step for instructors venturing in the world of online communication with their students.

Mailing list A mailing list is an automatic mailing system, which allows the group to communicate without having to send individual e-mails to everyone in the group. It addresses the entire class, so when someone sends mail to the mailing list, a copy is transmitted to all subscribers. Messages to and from mailing lists are sent and received the same way as any other e-mail messages. However, mailing lists do not provide a mechanism organizing the messages by subject. In fact, messages usually appear in the e-mail box unarranged. For this reason, most instructors prefer forums, not mailing lists.

Forum Forums are another kind of asynchronous communication. They are also known as bulletin boards and/or message boards. The main chronological difference between mailing lists and forums is that messages produced by the mailing lists are automatically sent to subscribers’ e-mail inboxes, while bulletin board users must visit a location on the web to read and post messages. However, some bulletin boards now provide the option of receiving copies of postings via e-mail. Another important difference is that in forums and bulleting boards, messages about a particular topic are grouped together, making discussions easy to follow. Users are able to reply and associate their message with a specific one already posted. In contrast, mailing list discussions usually are not “threaded” in this way, unless special message filtering and sorting are organized.

Web repositories Web repositories have become one of widely used media for delivery in DE. The most impressive advantage of the web technologies is their ability to provide *multimedia* and *hypertext*. Hypertext links allow the user to move from one information resource to another directly connected with the previous one. Physically linked information can be stored on another remotely located computer. Multimedia used to show dynamic changes of an object over time and graphically present textual information can enhance learning. A relatively low cost of delivery, ease of resource development and wide availability of student’s access make it an ideal instructional delivery resource. Learning resources are stored in the Internet in such a way that a student can access them any time. With the Internet-based DE

students easily gain advice and guidelines on learning from the instructor in synchronous and asynchronous mode.

Video transmission (pre-recorded) Pre-recorded video transmission involves the rebroadcast of a course segment which has been videotaped and includes no real time interaction between a student and an instructor. Asynchronous video tools, e.g. videocassettes, can convey supplemental information to learners or record lectures for later viewing. Pre-recorded materials may be broadcast on a local television channel. The nature of visual and audio information used in video transmission can pose certain accessibility difficulties for students with SEN.

The delivery of technology-assisted DE continues to grow and evolve. The processes were so rapid that it is difficult to outline common understanding of these new forms of DE practice. Despite the rapid technological evolution, the reality is that only a small minority of people with SEN has access to modern technologies and uses them for their benefit. One of the reasons is insufficient awareness of special demands of such categories of students among the people responsible for DE programme implementation.

Unit 3.1 only briefly overviews possible barriers to DE for students with disabilities and offers the ways of overcoming them. This information will be useful for the people in charge of DE programmes.

Key Terms

Synchronous: Communication in which interaction between participants is simultaneous.

Asynchronous: Communication in which interaction between parties does not take place simultaneously.

Integrated Services Digital Network (ISDN): Telecommunication standard allowing communications channels to carry voice, video, and data simultaneously.

Instructional Television Fixed Service (ITFS): Microwave-based, high-frequency television used for educational programme delivery.

Multimedia: Any document which uses multiple forms of communication, such as text, audio, and/or video.

Hypertext: A document which has been marked up to allow a user to select words or pictures within the document, click on them, and connect to further information.

Summary

- ◆ ICT-based DE has become an effective and viable alternative approach to teaching and learning, equal in standard to the traditional face-to-face interaction of a regular school.
- ◆ The main strength of DE in Information Age is flexibility, since it makes the learning process independent of space and time.
- ◆ DE based on ICT has great potential for people with SEN as it helps overcome traditional barriers to mobility and geographic distance and distribute knowledge equally.
- ◆ ICT-based technologies can effectively support DE for students with SEN in such areas as interactive communication between educators and learners; delivery of resources and access to learning resources.
- ◆ DE potential must be fully exploited to reduce isolation and increase access to learning materials for students with SEN.
- ◆ Depending on the style of instructions' delivery there are two main models of interaction between an instructor and a learner in DE: synchronous and asynchronous.
- ◆ A synchronous environment enables an instructor and a learner to interact in real time despite their locations. However, the synchronous mode of interaction is not always appropriate for students with SEN, as it requires linguistic agility and fast reaction. The most popular synchronous communication tools are: Instant Messaging Service, chat rooms and whiteboards, audio and video conferencing.
- ◆ Asynchronous communication is inherently less difficult than synchronous one, as students are free to make up their schedules. Nevertheless, large amount of writing and information exchange can present some problems. The most popular asynchronous communication tools are: electronic mail, mailing lists, forums, and web repositories.

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 3.1

- 1.1 List the arguments to prove the progressive role of DE in Information Age. Discuss main advantages of ICT-based DE over other forms of education. Describe main areas of social development in which DE are beneficial for your region/country.
- 1.2 Discuss main areas of DE in which ICT-based technologies effectively support education of students with special needs. In what areas of DE are ICT-based technologies successfully used for students with SEN in your country/region? Give examples.
- 1.3 Name main types of DE technologies used by students with SEN. What kinds of DE technologies are predominated in your country/region?
- 1.4 Compare synchronous and asynchronous environments used in DE for students with SEN. Name the most appropriate tools of instruction delivery (synchronous and asynchronous) for different groups of students with disabilities.

2. Self – assessment questions for Unit 3.1

2.1 The main strength of the ICT-based DE is:

- a. Simultaneous education of several groups of students.
- b. Delivery of instructional materials at a distance.
- c. Independence of the educational process from space and time.

2.2 In what areas of DE can ICT-based technologies be used most efficiently for students with visual impairments?

- a. Interactive communication between educators and learners.
- b. Delivery of resources.
- c. Access to learning resources.

2.3 Which is the most appropriate way of testing students with hearing impairments within synchronous environments?

- a. Audio conferencing.
- b. Chat rooms.
- c. Video conferencing.

2.4 Which kind of instruction delivery is the most appropriate for students with speech and language impairments?

- a. Chat rooms.
- b. Video conferencing.
- c. Web repositories.

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UNIT 3.2 Distance Education for Students with SEN: Approaches to Overcome Accessibility Barriers

Objectives

Upon completing this unit you will learn the following:

1. Accessibility barriers to DE for students with SEN.
2. Standards of accessibility in DE for students with SEN.
3. Supporting accessibility standards and providing accessible DE for students with SEN.
4. Main techniques to check accessibility of DE for students with SEN.

3.2.1 Accessibility Barriers to Distance Education for Students with SEN

Improving accessibility begins with increased awareness of the potential barriers.

Harrison, 2000

*Inclusion in an electronic classroom – 2000:
The role of the courseware authoring tool developer*

Rapid development of AT has simplified the access to DE for individuals with a wide range of disabilities with the help of computers, networking and telecommunication technologies, and multimedia products (Closing the Gap, 2001). However, the barriers to these technologies remain for people with certain types of disabilities. Many stakeholders are aware of potential technological barriers to access, though unaware of the extent of their own legal responsibility to provide access for students with various needs. Furthermore, with swift technological change, each new wave of technology introduces a new generation of access problems. The laws in this area, many of which were written before information technology got widespread, tend to be vague and confusing.

Understanding the barriers of DE faced by students with disabilities is an imperative if we are to improve accessibility. Box 3.3 reveals main problems of web accessibility for people with SEN.⁹

Box 3.3 Recurrent barriers to web access for people with SEN

Key problems experienced by users with disabilities are presented according to the Formal Investigation conducted by the Disability Rights Commission (Disability Rights Commission, 2004). The investigation represents the most frequently occurring problems, not all of which are obviously impairment related (e.g. text size for hearing impaired users). Instances are given in brackets.

Key problems experienced by blind users:

- Incompatibility between screen reading software and web pages, e.g. the assistive technology not detecting some links or proving impossible to highlight text using text-to-speech software (26);
- Incorrect or non-existent labelling of links, form elements, and frames (24);
- Cluttered and complex page structures (23);
- ALT tags on images non-existent or unhelpful (16);
- Confusing and disorienting navigation mechanisms (16).

Key problems experienced by partially sighted users:

- Inappropriate use of colours and poor contrast between content and background (20);
- Incompatibility between accessibility software (e.g. for magnification) and web pages (19);
- Unclear and confusing layout of pages (18);

⁹ Source: Disability Rights Commission (2004). The Web Access and Inclusion for Disabled People. TSO, London.
Online: <http://www.drc-gb.org/publicationsandreports/report.asp>

- Confusing and disorienting navigation mechanisms (16);
- Graphics and text size too small (10).

Key problems experienced by physically impaired users:

- Confusing and disorienting navigation mechanisms (20);
- Unclear and confusing layout of pages (19);
- Graphics and text size too small (11);
- Inappropriate use of colours and poor contrast between content and background (10).

Key problems experienced by hearing impaired users:

- Unclear and confusing layout of pages (23);
- Confusing and disorienting navigation mechanisms (12);
- Lack of alternative media for audio-based information and complex terms/language (10);
- Inappropriate use of colours and poor contrast between content and background (9);
- Graphics and text too small (9).

Key problems experienced by dyslexic users:

- Unclear and confusing layout of pages (41);
- Confusing and disorienting navigation mechanisms (32);
- Inappropriate use of colours and poor contrast between content and background (20);
- Graphics and text too small (14);
- Complicated language or terminology (7).

Minding a social model of disability, the research on DE accessibility has been especially linked to the difficulties which the environment can pose for people with SEN.

Course accessibility is the result of a combination of educational and technological design. The pedagogical method determines the technological media to be used in the course. [...] Just as the pedagogical method determines the use of technological media, the technological media determines the number of options available in the collaborative environment.

Schenker, K.T., Scadden, L. A., 2002
*The Design of Accessible Distance Education
 Environments that Use Collaborative Learning
 Information Technology and Disabilities*

According to the research of The Beep Knowledge System (2002-2003), accessibility issues include the barriers of physical environment (particularly, because of integration and adaptation of the existing technology with AT devices) in the first instance for students with sensory and mobility impairments¹⁰, and of information/knowledge environment (particularly, because of the content design of the DE course) primarily for students with sensory, cognitive, speech and language, and specific learning impairments.

There is an increasing need in hardware and software products that will help accomplish accessible development, transmission, and reception of DE content. Frequently the accessibility of ICT-based DE for people with SEN concerns the integrated application and adaptation of existing information technology with AT devices.¹¹ Thus, hardware and software are two critical elements determining whether users with special needs can fully access education in an independent and self-sufficient manner. Moreover, such integrated applications must be accessible for users with disabilities as well as correspond to their learning styles, at the same time addressing the needs of a user without disabilities.

Hardware and software are two critical elements determining whether users with special needs can fully access education in an independent and self-sufficient manner. Moreover, such integrated applications must be accessible for users with disabilities as well as correspond to their learning styles, at the same time addressing the needs of a user without disabilities.

AT include hardware, e.g. scanners, adapted keyboards, hearing aids, and software, e.g. speech recognition software or thought-organizing tools. Integration and adaptation of technologies intended for general use, such as PCs, microphones, televisions, or cameras with AT devices sometimes present accessibility problems for students with SEN. Moreover, software difficulties can arise regarding content, instructional applications, video conferencing, closed captioning technologies, etc.

¹⁰ In literature the terms 'physical', 'mobility', or 'motor', impairments are also used.

¹¹ A comprehensive review of appropriate AT for a wide range of people with disabilities is given in Module 2.

When addressing accessibility challenges in DE initiatives the focus is often on making particular elements technically handy for students with SEN. However, AT devices alone cannot eliminate all access barriers in DE for students with SEN. Courses designed for DE but excluding the students who use AT may accidentally end up with certain barriers for these students, e.g. inaccessible design of coursework. Poorly elaborated DE courses easily slip in a mess for students with SEN unable to participate in education process or career training as equals (Burgstahler, 2002). Different strategies are needed to accommodate students with various impairments, who use different types of information technology.

Thus, the important concept of accessibility concerns the specific features of DE course content designed for people with SEN. A design difficult to get to web can block the access to information for anyone using AT. For example, the information set in bitmapped text or images without appropriate alt-text will be missed by people working with Braille displays, screen readers, and text browsers. Hyperlinks embedded in the bullets of a list (instead of list items) may be insufficiently small for those who use alternative pointing devices to target. Overuse of frames and tables can needlessly complicate the page for people with learning disabilities (Nguyen, no date).

Worth noting that at present one of the major troubles in the development of content accessibility is insufficient authoring tools which help course content developers adhere to the existing accessibility guidelines. Obviously, courseware authoring environments are being increasingly used to make the process more efficient, and could easily include utilities to support developers in making their online resources accessible as well (Harrison, 2000). Even if the Content Management Systems (CMS) provide flawlessly accessible content by default, accessibility can be compromised by poor quality of the content. To resolve this, authoring tools can evaluate accessibility and repair functionality (May, 2003).

Table 3.1 illustrates main accessibility barriers (caused by physical and information/knowledge environments) regarding DE synchronous communication and collaboration tools.¹²⁻¹³

Table 3.1 Accessibility barriers of synchronous communication and collaboration tools for students with SEN

DE technologies	Accessibility barriers
Instant message service and Chat room	<ul style="list-style-type: none"> • Complex and non-standard user interfaces • Often mouse-driven functions exclusively are required • Included background images obscure the text for low-vision users • Simultaneously user’s attention is dispersed to multiple areas (i.e. message composition and message monitoring) • Fast pace of conversation limits the access of slow communicators
Whiteboard	<ul style="list-style-type: none"> • Exclusively graphical workspace inaccessible to people with visual impairments • With text tools available, the text is produced inaccessible for screen readers • Many exclusively mouse-driven functions
Audio conferencing	<ul style="list-style-type: none"> • Audio output is inaccessible to users who are deaf or have profound hearing loss • Speech input may be difficult for users with speech and language impairments • Some exclusively mouse-driven functions • Fast pace of conversation limits the access of slow communicators
Video conferencing	<ul style="list-style-type: none"> • Users who are blind cannot obtain visual information, i.e. graphs and charts which classmates display to the camera • Audio output is inaccessible to users who are deaf or have profound hearing loss • Speech input may be difficult for users with speech and language impairments • Video-conference systems often encode stationary rather than dynamic elements of a scene, disrupting effective transmission of sign languages (which depend on movement) • Some exclusively mouse-driven functions • Fast pace of conversation limits the access of slow communicators
Multi-User Domain Object-Oriented Environments (MOOs)	<ul style="list-style-type: none"> • Visual information in the MOO, including the appearing physical environment and other avatars, is missed by blind users • Audio output is inaccessible to users who are deaf or have profound hearing loss • Some exclusively mouse-driven functions • Complex spatial navigation of the MOO • Fast pace of conversation limits the access of slow communicators

¹²⁻¹³ Most information is from IMS Guidelines for Developing Accessible Learning Applications (2001). Version 1.0 White Paper. Online: <http://ncam.wgbh.org/salt/guidelines/>

Table 3.2 presents main accessibility barriers (caused by physical and information/knowledge environments) regarding DE asynchronous communication and collaboration tools .

Table 3.2 Accessibility barriers of asynchronous communication and collaboration tools for students with SEN

DE technologies	Accessibility issues
Electronic mail (e-mail) and mailing list	<ul style="list-style-type: none"> • Styled text components included in the body of the e-mail, i.e. HTML mark-up for fonts, colours, and bold formatting • Included background images obscuring the text for users with low vision • Non-standard attached file formats inaccessible by a recipient of the e-mail
Forum	<ul style="list-style-type: none"> • Navigation systems with complex framesets that lack a title or name attributes • No ALT text on the buttons operated with JavaScript to expand or contract threaded discussions (i.e. blue triangles are commonly used) • Form fields that do not accommodate keyboard navigation • Illogical tab sequence between elements on the page
Web repositories	<ul style="list-style-type: none"> • Indexing or navigation systems with complex frames that lack a title or name attribute • Form fields in the search utilities that do not accommodate keyboard navigation • Display options difficult to locate or access with the keyboard navigation
Video transmission (prerecorded)	<ul style="list-style-type: none"> • Blind users miss visual information, i.e. graphs and charts which other trainees display to the camera • Voiced output is inaccessible to users who are deaf or have profound hearing loss

In addition to the above-mentioned barriers caused by physical and information/knowledge environments we must mind a range of socio-economic barriers which hinder students with SEN from getting high quality DE. Any society has to account how education is provided as a function of existing socio-economic conditions. According to Moodley (2002), effective learning depends on availability of educational resources to meet the needs of a society. In many developing countries, there are inadequate quantities of facilities satisfying educational needs of numerous learners engaged in distance studies. In most cases, inadequacies of provision relate to other inequalities in the society, such as urban/rural disparities and discrimination on the grounds of gender, race, and disability.

3.2.2 Standards of Accessibility in Distance Education for Students with SEN

In spite of the fact that law obliges all educational institutions to grant reasonable accommodations and ensure equal access for students with disabilities to enjoy educational opportunities, there exists the internal divide between learners who do and who do not have access to the Internet as a means of education (Rowland, 1999). In order to understand clearly what educators, web designers, and personnel in charge must do to make DE accessible to people with SEN, adequate standards must be in force and respond to specific demands of the end-user in due time.

Web accessibility means access to the Web by everyone, regardless of disability.

World Wide Web Consortium

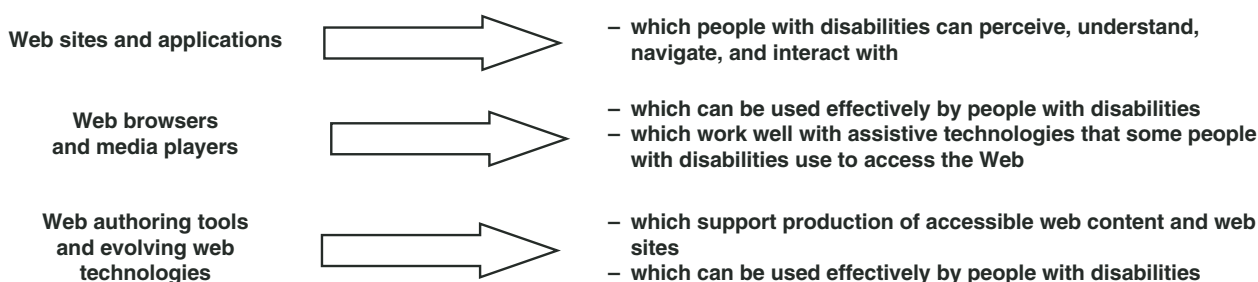
Various non-profit organizations made web accessibility their primary target. Stephanidis and Emiliani (1999) listed several on-going efforts to promote accessibility in national and international standardization bodies as well as industrial consortia. According to their research, the major standardization activity tends to “formulate accessibility guidelines as either general (e.g. HFES/ANSI Draft, Section 5)¹⁴, platform specific (e.g. for Graphical User Interfaces or the Web)¹⁵, or domain-specific (e.g. for text editing, graphic manipulation)¹⁶. Such guidelines are usually paper documents and reflect the previous experience gained and best practice available to design accessible interactive software (including content as well). The systematic collection, consolidation, and interpretation of the guidelines is currently pursued in the context of international collaborative initiatives (e.g. W3C-WAI

¹⁴ The following is an example of general guidelines: software must enable as many input and output alternatives as possible (HFES/ANSI, 1997).
¹⁵ The following is an example of platform specific guidelines concerning the Web: *Document Conversion Technology & Disability Journal*, 1999, 10 (1), 21-44.
¹⁶ The following is an example of domain-specific guidelines concerning graphic manipulation: software must enable users to change graphic attributes of visual codes used to represent data leaving its meaning unchanged (HFES/ANSI, 1997).

Initiative¹⁰, ISO TC 159 / SC 4 / WG 5)¹⁷, national projects, such as the Universal Design Project (Story, 1998), and international scientific forums”¹⁸.

One of the most comprehensive sources for standards in the field of electronic accessibility is World Wide Web Consortium (W3C)¹⁹. World Wide Web Consortium is the voluntary organization which elaborates official standards of web technology, including mark-up languages, e.g. HTML and XML (eXtensible Markup Language). Web Accessibility Initiative (WAI) proposes standards to amplify the web usability by people with disabilities and publishes guidelines, checklists, and descriptions of techniques to comply with the standards.

According to the W3C, web accessibility includes:



The W3C made the first major effort to establish guidelines for web design; since 1999 its Web Accessibility Initiative (WAI) has published the Web Content Accessibility Guidelines (WCAG)²⁰ to reduce potential difficulties. The WCAG explain what web content developers have to do to make web sites accessible to the widest range of people possible, including people with disabilities. Box 3.4 summarizes main WCAG positions.

BOX 3.4 Summary of Web Content Accessibility Guidelines (WCAG) 1.0

Guideline 1. Provide equivalent alternatives to auditory and visual content

Provide content that, when presented to the user, conveys essentially the same function or purpose as auditory or visual content.

Guideline 2. Don't rely on colour alone

Ensure that text and graphics are easily understood when viewed without colour.

Guideline 3. Use mark-up and style sheets and do so properly

Mark-up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.

Guideline 4. Clarify natural language usage

Use mark-up that facilitates pronunciation or interpretation of abbreviated or foreign text.

Guideline 5. Create tables that transform gracefully

Ensure that tables have the necessary mark-up to allow a user's browser to display them correctly.

Guideline 6. Ensure that pages featuring new technologies transform gracefully

Ensure that pages are accessible even when newer technologies are not supported or are turned off.

¹⁷ International Standards Organization, Technical Committee 159 (Ergonomics), Subcommittee 4 (Ergonomics of human-system interaction), Working Group 5 (Software Ergonomics and human-computer dialogues).

¹⁸ For example, International Scientific Forum 'Towards an Information Society for All' (Stephanidis and Emiliani, 1999).

¹⁹ This organization is responsible for the standardization of a wide variety of web-related technologies such as Hypertext Markup Language (HTML). The project known as Web Accessibility Initiative (WAI) is coordinated by the W3C as well. More detailed information is on its web site: <http://www.w3.org/>

²⁰ Web Content Accessibility Guidelines, <http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/>

Guideline 7. Ensure user control of time-sensitive content changes

Ensure that users can pause or stop moving, blinking, scrolling, or autoupdating objects or pages.

Guideline 8. Ensure direct accessibility of embedded user interfaces

Ensure that the user interface follows principles of accessible design: device independent access to functionality, keyboard operability, self-voicing, etc.

Guideline 9. Design for device-independence

Use features that enable activation of page elements via a variety of input devices.

Guideline 10. Use interim solutions

Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.

Guideline 11. Use W3C technologies and guidelines

Use W3C technologies (according to specification) and follow accessibility guidelines. Where it is not possible to use a W3C technology, or when doing so results in material that does not transform gracefully, provide an alternative version of the content that is accessible.

Guideline 12. Provide context and orientation information

Provide context and orientation information to help users understand complex pages or elements.

Guideline 13. Provide clear navigation mechanisms

Provide clear and consistent navigation mechanisms, such as orientation information, navigation bars, a site map, etc., to increase the likelihood that an individual will find the desired information in a site.

Guideline 14. Ensure that documents are clear and simple

Ensure that documents are clear, simple, and easily understood

3.2.3 Supporting Accessibility Standards and Providing Accessible Distance Education for Students with SEN

The primary responsibility of DE developers and providers for students with SEN is to meet their learning demands and preferences. To achieve the aim, they must follow the accessibility standards.

According to the study of National Center for Education Statistics (NCES), 95% postsecondary institutions use the Web to offer DE programmes, however only 18% institutions make the content accessible to students with disabilities.

NCES, 2003
*Distance Education at Degree-Granting
Postsecondary Institutions: 2000-2001*

Accessible web design starts at the policy level. People in charge of providing DE for students with disabilities must be aware of potential challenges and have practical command of the techniques. Accessibility requirements are tied with adaptation and integration of existing information technology with AT devices, on the one hand, and with the development and application of accessibility standards in the course content, on the other. Such learning conditions allow students to select the most appropriate and preferred mode meeting their specific learning needs. Therefore, a central aspect of the approach toward accessibility is to get over the physical and information/knowledge barriers of DE

to exploit all advantages of the web-based DE for targeted groups of students. The sections below introduce some approaches to overcome accessibility barriers to DE for students with disabilities.

Coding

Creation of web content written in acceptable HTML is one of the first requirements in reaching its accessibility in DE. It is necessary to accompany a web page with a statement on the version of HTML used. The W3C sets and publishes standards for most web mark-up languages, including HTML 4.01, XHTML 1.0, CCS level 1&2, DOM, and SMIL. For example, use <h1> tags to identify top-level headings rather than apply font-size or bold formatting commands.

Cascading Style Sheets (CSS)²¹ used in formatting tends to facilitate the proper application of HTML to identify document structure. Style sheets used to set formatting text styles and organize the layout help assistive technologies interpret the organization of the page and navigate through it. In this case pages will be displayed uniformly on different browsers.

Web pages should be platform-independent, i.e. they should be accessible for users regardless of their platform and settings. A link that says “click here” is useless to anyone without a mouse and when a link anchor is read aloud or printed at the end of a document as a summary. Instead, a term, e.g. “More information about it”, should be used. Authors must avoid phrases like “see below”, since “below” is meaningless when a document is spoken aloud and there is no description of what the link is or where it will take you.

Validation of one’s HTML documents is, perhaps, the most important and easiest thing that a designer can do to aid accessibility. A validator checks the HTML documents against a document type definition to ensure that the syntax of the HTML is correct. For this purpose such validators as W3C HTML Validation Service²² and W3C CSS Validation Service²³ may suit.

Navigation

Web site navigation must offer adequate navigational choices for users to find what they want, at the same time not to overload a user with too many options. The placement and design of the navigation menu or menus will help determine the overall usability of the site and can greatly influence its accessibility for people with various needs. There are no rules stating where the navigation controls should appear on the page, and over the time web designers and usability specialists have tried and tested various combinations of different possible locations for navigation menus (Hudson, R., 2004a).

Web pages must have unambiguous titles and, where possible, a hyperlink text must be consistent with titles and headings on the destination page. Headings help describe information on a page since they establish the relative importance of a content for those using screen readers. They also benefit sighted users who can see the hierarchy more explicitly and content writers who are compelled to present information logically.

Page Appearance

Use images with appropriate alternate text (ALT text) instead of ASCII art. Whenever possible, apply actual text instead of text images. Style sheets can be used to achieve specific sizes, colours, or effects.

Set font sizes using relative measurements, avoid setting font sizes altogether. The Vischeck website²⁴ checks readability of websites or images if they are accessible to persons who are colour blind.

Graphic and Multimedia

Although some people cannot use movies, sounds, audio enhancements, etc. directly, they may still use pages that include equivalent textual information to the visual or auditory content. Captioning is essential to provide access to videos for students with hearing impairments. A track with audio descriptions of the action included in the video enables students with visual impairments to access the video content that may come handy to understand important concepts in a course.

Three main streaming video formats have built-in tools that allow adding captions to the videos. There are free and purchasable third-party applications that can help with captioning video. Both Real’s RealPlayer and Apple’s QuickTime use Synchronized Multimedia Integration Language (SMIL) to combine the text track and video, while Microsoft’s Windows Media Player employs Synchronized Accessible Media Interchange (SAMI).

²¹ Cascading Style Sheets (CSS) is a formatting language designed to complement HTML. While HTML intends to identify a document’s structure, CSS is meant for formatting and presentation.

²² <http://validator.w3.org>

²³ <http://jigsaw.w3.org/css-validator>

²⁴ <http://www.vischeck.com/vischeck/>

Table 3.3 describes useful items of such tools.²⁵

Table 3.3 Examples of tools for captioning and describing video

Tools for captioning and describing video	Characteristics
MAGpie, Media Access Generator ²⁶	Produced by National Center for Accessible Media (NCAM) at WGBH (PBS) in Boston, Massachusetts. This is a tool to make closed captions, descriptive video, and outputting files in multiple formats, including QuickTime, RealPlayer, SMIL, and SAMI
Apple QuickTime Pro ²⁷	Supports multiple tracks for video, audio, closed captioning, description, etc. The limitation of the current version is that captions and other accessibility functions are part of one QuickTime file, therefore, are not read by screen readers
SMIL, Synchronized Multimedia Integration Language ²⁸	A W3C specification for coordinating synchronized display of multiple media tracks, such as video, audio, captions, descriptions, and other accessibility functions. SMIL is an XML application. RealPlayer can play SMIL documents, allowing users to toggle audio descriptions and captions on and off
SAMI, Synchronized Accessible Media Interchange ²⁹	Microsoft Windows Media Player's format for closed captioning

A good example of providing accessibility of the images for visually impaired people is presented in the case study below (see Case study 3.1).

Case study 3.1 Providing Enhanced Content Accessibility to Images for Visually Impaired Users

Foreword and motivations

Several web sites allow users to learn at a distance. They are made “accessible” and more navigable for (visually) impaired users. However, for specific learning contexts access to images and graphics that carry significant meanings, which are hardly translatable into words, is barren to visually impaired users. A solution to this problem is offering the image information in a multimodal way, enriching the graphical information with haptic (tactile) feedback and with aural (audio) cues. In a multimodal version of an image, it could be possible to allow feature identification with a correlation to vibration patterns, with corresponding voice annotations, so when, for example, the user hovers on a city in a map, the corresponding tactile cue is felt, and a voice reads the name of the city.

A special device for image exploring

During this study, we created a device called “AudioTact” (patent pending), which uses two stereo audio channels to offer a combination of audio and tactile stimuli during touch–screen exploration of an image downloaded via the web. The Web Image is pre–prepared so that it can generate sounds which are produced on the left channel by regular audio headphones and on the right channel by a haptic transducer which has to be worn on the finger or attached to the pen of a graphical tablet. Following a given exploration method, the visually impaired user can autonomously extract information from the features of the image.

The innovative issue in our approach is that we use an audio output separated in two channels of a stereo signal to provide concurrent audio and tactile cues, the tactile cues being created by a mechanical vibration cell controlled by an audio signal. In this way it is easy to transmit over the web the necessary signals without adding other software at the user's side. Moreover, by moving the vibration cell from a relative pointing device directly on the user or on the pen,

²⁵ Source: Office of Academic Technology (University of Florida) (2004). Online Accessibility Course. Online: <http://www.at.ufl.edu/accessibility>
http://www.at.ufl.edu/accessibility/accessibility_cd/Tools/captioning.html

²⁶ Media Access Generator, <http://ncam.wgbh.org/webaccess/magpie/>

²⁷ QuickTime Pro, <http://www.apple.com/quicktime/products/>

²⁸ Synchronized Multimedia Integration Language, <http://www.w3.org/AudioVideo/>

²⁹ Synchronized Accessible Media Interchange, http://msdn.microsoft.com/library/default.asp?url=/library/en-us/wmplay10/mmp_sdk/addingclosedcaptionstodigitalmedia.asp

we provide a completely different concept on how to use vibration cues: not as “a force feedback” output, but as a means to drive autonomous exploration of images. Another main advantage of this approach is that images are downloaded via the web and explored autonomously. A blind user trained in this technique can visit a learning site rich with graphic contents (e.g. geography or art sites) and extract relevant information from the graphics.

Experimentation and results

This approach was tested in the case study which involved ten blind students of the Institute of the Blind in Milan. The test provided a training phase, in which the student could get confident with the method, and a second part which required the application of the system to extract new information from unknown images. During the training stage, we explained to each student how the method works, and announced that he/she was going to explore a simple shape: a square. Then we let the student practice with the pen, the tabled and the vibration feedback until he/she was able to re-trace correctly the square shape on the table. In the second step of the training, we changed the image to a map of the region in which the students live and study. At the end of the training session, we asked them to extract information from two images autonomously, a simple shape of a triangle and another geographical map, representing a region of which they did not have any previous knowledge (the map of Perm region in the Russian Federation). All users except one easily recognized the square (in about 4 minutes). In average the students replied correctly to more than 80% of questions about the geography of the region they explored. One user declared that she did not like the tablet being smooth and that she could explore using relief only. Shape exploration proved to be more difficult than map exploration. For this reason most students indicated image exploration (map, pictures) as a better application for the method than contour recognition.

Conclusions and future work

The method looks promising and it was welcomed by most students. It is, however, a method which requires good concentration during exploration in order to be able to form a correct mental map of the image. It is true that the time needed for vibro–aural exploration is several times longer than the one with relief exploration. However, relief exploration with cardboards does not provide interactive aural cues and always requires:

- a) coverage of production and material cost of the cardboard;
- b) availability of a tutor describing the features which are currently touched on the relief.

Therefore, it lacks the possibility to extract autonomously information which can be potentially created in real–time and distributed remotely via the web.

To improve the transition between the virtual stimuli provided by vibro–aural exploration and physical stimuli of relief exploration, we propose to use the pen and tablet in combination with a swell paper sheet which can be engraved with the pen during the exploration. Other improvements will cover the possibility to add/remove quantity of information from the image or control the nature of information contained by the image.

Authors: Thimoty Barbieri, Licia Sbattella.

Authoring Tools

There are many different authoring tools available to designers: from simple code-based ones to complicated WYSIWYG (What You See Is What You Get). Most of newer tools provide options and helpers for accessibility. With each new version of software, more tools to design accessibility and validation are integrated in major authoring packages.

The W3C have produced Authoring Tools Accessibility Guidelines (ATAG) which attempts to facilitate a checklist ensuring that the content of the web page meets accessibility requirements.³⁰ However, support of the ATAG is inconsistent.

The main online accessibility resources available for many providers of web content authoring tools are presented on the following product accessibility sites:

³⁰ W3C Authoring Tools Accessibility Guidelines. Online: www.w3.org/TR?ATAG10, <http://www.w3.org/TR/2004/WD-ATAG20-20040224/>

- Macromedia (*Dreamweaver, Ultradev, Cold Fusion, Flash, Director*)³¹
- Microsoft (*FrontPage*)³²
- Adobe (*GoLive, Acrobat*)³³
- IBM (*Homepage Builder*)³⁴
- *Blackboard Accessibility*³⁵
- *WebCT Accessibility*³⁶

Table 3.4 adds the information about commonly-used DE elements, identifies the difficulties to be addressed by educators, and recommends on achieving the accessibility for these elements.³⁷

Table 3.4 Access problems in distance education

Element	Potential barriers	Suggested solution
Slide presentations (Microsoft PowerPoint)	Online presentations utilize a JavaScript plug-in which presents slides as graphic files inaccessible to blind users; automatic conversion to HTML results in non-usable pages	Provide legible text for the headings and body text; ensure that the background does not distract; provide text equivalents for graphic elements: use guideline 1 ³⁸ and guideline 2 ³⁹
Animations (Macromedia Flash, Java)	Video multimedia animations generally inaccessible to people with sensory impairments, may require a mouse to be used for control	Provide captioning or text equivalent for deaf users; audio-describe animation for blind users. Current versions of Macromedia Flash contain some accessibility features ⁴⁰
Audio files	Issues for people with hearing disabilities	Provide captioning or text equivalent
Video files (Windows Media Player, Real Audio)	Video files (such as lectures) pose access problems for people with sensory impairments	Captioning or text equivalent for sound, audio-description of video: free Media Access Generator (MAGpie) software is a good resource ⁴¹
Word Processing Documents (Microsoft Word, WordPerfect)	Documents may use colour or highlighting to denote information, making it more difficult for people with visual impairments; documents may include inaccessible features, e.g. images, charts, graphs, and maps	Ensure that information can be conveyed without the use of colour; provide text equivalents for graphic elements
Spreadsheets (Lotus 1-2-3, Microsoft Excel)	Spreadsheets may contain inaccessible charts or graphs	Give text description of charts and graphs
Adobe Portable Document Format (PDF)	Some PDF files generated from original documents with scanners are incompatible with screen-readers; documents in columns may be read incorrectly; documents may contain inaccessible elements	Consider providing a text equivalent; test PDF files with online tools at Adobe website ⁴²
Whiteboards	Most whiteboard software is incompatible with screen-readers	Consider providing textual or audio equivalent of whiteboard content
Chat and Message Boards	Some software for online chat rooms or message boards may fail to meet accessibility standards	Consider alternative accessible means of student discussion

³¹ Macromedia, <http://www.macromedia.com/macromedia/accessibility/>

³² Microsoft (FrontPage), <http://www.microsoft.com/enable/>

³³ Adobe (GoLive, Acrobat), <http://www.adobe.com/enterprise/accessibility/main.html>

³⁴ IBM (Homepage Builder), <http://www-3.ibm.com/able/>

³⁵ Blackboard Accessibility, <http://www.blackboard.com/products/index.htm>

³⁶ WebCT Accessibility, http://www.Webct.com/products/viewpage?name=products_accessibility

³⁷ Source: Edmonds, (2003).

³⁸ Kelly, B. *What's Happened To My Slides: Giving Presentations at Conferences*, Cultivate Interactive, issue 3, 29 January 2001. Online: <http://www.cultivate-int.org/issue3/presentations/>

³⁹ Edwards, A. *Giving Presentations with Accessibility in Mind*, Cultivate Interactive, issue 8, 15 November 2002. Online: <http://www.cultivate-int.org/issue8/accessibility/>

⁴⁰ <http://www.macromedia.com/macromedia/accessibility/>

⁴¹ <http://ncam.wgbh.org/webaccess/magpie/>

⁴² <http://access.adobe.com/>

3.2.4 Main Techniques of Accessibility Checking in Distance Education for Students with SEN

Checking includes functional tests of assistive technology, browser and operating system, as well as automated testing software. Furthermore, sometimes it will be helpful to do user testing by people with disabilities. According to the methodology of assessing web sites for accessibility presented by Sloan et al⁴³, the checks for accessibility barriers include:

- Free accessibility checking tools, such as Bobby, A-Prompt, or TechDis Accessibility and Usability checker (see Table 3.4).
- Manual checking resources. Can a user with a browser adjust the text size and style? Is the site still readable when style information is removed? Can the resource be used without a mouse?
- Testing in different browsing environments, including non-graphic browsers, such as Lynx. This is particularly important where the resource is used as a web application accessible from diverse browsing environments.
- Using the resource with assistive technologies, i.e. screen readers, speech browsers, or screen magnifiers. Tools, such as *Vischeck*⁴⁴, provide simulations of certain visual impairments as well as useful feedback.
- Evaluating the resource with disabled people. While the above checks help identify most accessibility problems, certain drawbacks can become evident when a disabled person uses the resource.

At present there is a number of valuable free accessibility checking tools available on web sites, which can be downloaded. W3C Web Accessibility Initiative gives a detailed list of tools.⁴⁵ Some useful tools in this field are in the following table.⁴⁶

Table 3.5 Examples of accessibility checking tools

Accessibility checking tools	Description
Bobby ⁴⁷	The original and, probably, best-known web accessibility checking tool is free and allows one page checked at a time. In the past this software version, which checks a whole site in one go, could be downloaded free of charge but now costs \$ US 99 for a single-user copy
A-Prompt ⁴⁸	An excellent alternative available from the Adaptive Technology Research Project at the University of Toronto. A-Prompt can be downloaded free of charge. It not only identifies access problems but accomplishes limited repairs
The WAVE ⁴⁹	Useful free web-based accessibility checker, adding text and icons to a page, alerts the developer about potential accessibility problems. It is supplied with highly informative documentation and gives examples of poor design
Page Valet and Site Valet ⁵⁰	Free, Web-based validation tool which concentrates on validation of HTML code but includes an optional accessibility checker
W3C HTML Validator ⁵¹	Not an accessibility checker as such, but since many accessibility problems stem from invalid HTML, this is a vital component in accessibility checking. W3C HTML Validation service offers validation of individual pages against various specifications of HTML and includes a validator for Cascading Style Sheets (CSS)
HTML Tidy ⁵²	This is not specifically accessibility checker either. It identifies and repairs invalid HTML and can be downloaded free of charge
TechDis Accessibility and Usability Validator ⁵³	Presents seven precepts of usable and accessible design, against which pages can be checked. A semi-automatic tool is available upon registration
Vischeck ⁵⁴	Checks readability of web sites, or images for their accessibility to persons who are colour blind

⁴³ Sloan, D., Rowan, M., Gregor, P., and Booth, P. (2000) Accessible. In: Accessibility in Scholtz, J. and Thomas, J. (Eds.) *Proceedings of Conference on Universal Usability (CUU 2000)*. Association for Computing Machinery Inc. (ACM), pp 96-101.

⁴⁴ Vischeck Colourblindness simulator, <http://vischeck.com>

⁴⁵ W3C Web Accessibility Initiative, <http://www.w3.org/WAI>

⁴⁶ Source: Phipps, Sutherland and Seale (2002).

⁴⁷ Bobby, <http://www.cast.org/bobby>

⁴⁸ A-Prompt, <http://aprompt.snow.utoronto.ca>

⁴⁹ The WAVE, http://www.temple.edu/inst_disabilities/piat/wave

⁵⁰ Page Valet and Site Valet, <http://valet.webthing.com>

⁵¹ W3C HTML Validator, <http://validator.w3.org>

⁵² HTML Tidy, <http://www.w3.org/People/Raggett/tidy> and <http://tidy.sourceforge.net>

⁵³ TechDis Accessibility and Usability Validator, <http://www.techdis.ac.uk>

⁵⁴ <http://www.vischeck.com/vischeck/>

In addition to these checking tools, there are some single-purpose packages developed to ensure accessibility of software. Table below illustrates some examples of such packages.⁵⁵

Table 3.6 Examples of packages to check software accessibility

Accessibility software	Description
<i>InFocus</i> ⁵⁶	SSB Technologies accessibility checking and retrofitting software. SSB Technologies offer free 'Ask Alice' accessibility checking service. Insight LE is available as a free plug-in for the Adobe GoLive Web authoring tools
<i>AccVerify, AccRepair, and AccMonitor from HiSoftware</i> ⁵⁷	AccVerify SE is available as a free plug-in free for users of Microsoft FrontPage
<i>Lift Accessibility and Usability Checker from UsableNet</i> ⁵⁸	Lift is available as an online subscription service and a version for Macromedia Dreamweaver and UltraDev

Key Terms

World Wide Web (WWW): A graphical hypertext-based Internet tool that provides access to pages of individuals, businesses, and organizations.

Browser: Software that allows a user to find and see information on the Web.

Hyper-Text Mark-up Language (HTML): The code used to create a web page.

Courseware: A term resulting from the combination of the words 'course' and 'software' is broadly defined as pre-packaged computer-based educational materials in which the computer mediates the educational experience. This course uses the term specifically to refer to such software as WebCT, BlackBoard, and the like, which facilitate computer-based distance education via the Internet.

Authoring Tool: A software application used by teachers and instructional designers to create e-Learning courseware. Types of authoring tools include instructionally focused authoring tools, web authoring, and programming tools, template-focused authoring tools, knowledge capture systems, as well as text and media tools.

Summary

- ◆ Accessibility issues include the barriers caused by *physical environment* (particularly, by integration and adaptation of existing technology with AT devices) and by *information/knowledge environment* (particularly, by DE course content design).
- ◆ The goal of accessibility standards is to make the web more accessible for people with SEN through improving integration and adaptation of existing information technology with AT devices and development of content accessibility.
- ◆ Clear and simple languages, understandable and consistent mechanisms of navigating within and between pages, as well as orientation information in pages maximize accessibility and usability for everyone.
- ◆ Checking of DE courses includes functional tests of assistive technology, browser and operating system, as well as automated testing software. Sometimes it is helpful to accomplish user testing with people with SEN.

⁵⁵ Source: Phipps, Sutherland, Seale (2002).

⁵⁶ InFocus, <http://www.ssbtechnologies.com>

⁵⁷ AccVerify, AccRepair, and AccMonitor from HiSoftware, <http://www.hisoftware.com>

⁵⁸ Lift Accessibility and Usability Checker from UsableNet, <http://www.usablenet.com>

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 3.2

- 1.1 Why is understanding of DE barriers faced by students with SEN imperative?
- 1.2 Define the environmental factors which can prevent full access of students with SEN to DE programmes.
- 1.3 Describe main accessibility barriers of synchronous and asynchronous ways of instruction delivery for students with SEN.
- 1.4 Briefly describe main approaches providing accessible DE for different groups of students with SEN.
- 1.5 Name main accessibility checking techniques in DE for students with SEN.

2. Self – assessment questions for Unit 3.2

2.1 Which of the following presents accessibility barriers to synchronous instruction delivery?

- a. Need of simultaneous user attention to multiple areas.
- b. Lacking ability to communicate with several people simultaneously.
- c. Need of advanced language skills for communication via text.

2.2 Which of the following presents accessibility barriers to asynchronous instruction delivery?

- a. Need of advanced information exchange.
- b. Lacking ability to revise submitted information.
- c. Need of fast reaction.

2.3 Which kind of course accessibility features should be especially modified for students with physical impairments?

- a. Coding.
- b. Navigation.
- c. Graphics and Multimedia.

2.4 Which kind of ICT–based product requires text equivalents to be accessible for students with visual impairments?

- a. Chat and Message Boards.
- b. Word Processing Documents (*Microsoft Word, WordPerfect*).
- c. Animations (*Macromedia Flash, Java*).

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MODULE 4. ICT POLICY IN SPECIAL NEEDS EDUCATION

Introduction

Scientific and technological progress of the last few decades has brought not only the economy globalization and worldwide expansion of technologies but changes in social relations, culture, and education as well. Fast development of telecommunications, media, and information technologies bears huge potential of improving the quality of life. It is particular vital for those, who cannot obtain an appropriate level of education without assistance of educational and technology specialists, i.e. people with special educational needs. Technological advance has unveiled meaningful social opportunities for such citizens by providing a more convenient access to information and communication tools. Thereby, it gives a chance to enhance skills and involve everyone in active social life.

High level of modern technology goes along with fundamental transformation of community in Information Society, in which information and knowledge become the main resource and product effecting continued economic well-being and social progress. In this connection, the prosperity of the emerging society is determined, to a large extent, by its ability to engage ICTs in education.

Presently, the governments of most countries undertake tremendous efforts to modernize their educational systems on ICT basis, which are perceived as a key to such modernization. To that end many policy-makers search for the ways in which ICTs can be used to meet current social demands: ensuring equal participation of all members of the society, including those with SEN. However, the increased production and dissemination of new ICT devices alone may be misleading. Hence, it becomes apparent that various actions are required to stimulate services and infrastructure in the field of SNE. Engendering ICT policy is an area of great value, perhaps, the most important in securing the benefits of Information Age for people with SEN.

Decades of experience have shown that equal education for people with SEN must be supported not only by upgrading ICT infrastructure of special education in compliance with accessibility and usability requirements but by integrating ICTs in SNE curriculum, as well as by quality training and retraining of Special Needs ICT specialists. Finally, implementation of the policy must be monitored to decide whether it provides the support required to achieve its goals, to analyse and interpret its results in improving general benefits from SNE policy.

Goal

The goal of Module 4 is to overview comprehensively ICT policy in special needs education, its main objectives, principles, and means. Module 4 starts with a brief introduction of the best international practice with respect to legislation affecting ICT policy in SNE. It looks at the key implementation activities of ICT policy in SNE, including promotion of ICT infrastructure for SNE, integration of ICTs in SNE curriculum, training and retraining of ICT specialists in SNE. Module 4 particularly emphasizes the basic aspects of monitoring the ICT usage in SNE, i.e. identification of necessary and sufficient conditions to improve SNE quality with ICTs. Lastly, Module 4 describes the approaches to the analysis and interpretation of evaluation results to advance ICT policy in SNE.

Objectives

Upon completing this module you will:

- ◆ understand main principles and means of ICT policy development in SNE;
- ◆ acquire knowledge regarding legal basis of ICT policy development in SNE;
- ◆ identify essential ways of promoting ICT infrastructure for SNE;
- ◆ understand major stages of ICT integration in SNE curriculum;
- ◆ learn about basic standards and factors of quality teachers' training;
- ◆ realize the impact of ICTs on SNE quality;
- ◆ determine necessary and sufficient conditions to improve SNE quality;
- ◆ comprehend the ways of ICT policy upgrade in the field of SNE.

Readings for Module 4

Unit 4.1 Planning of ICT policy in SNE

European Commission (2003), *Access to Assistive Technology in the European Union*. Publication online: http://europa.eu.int/comm/employment_social/publications/2004/cev503003_en.pdf

Unit 4.2 Implementation of ICT policy in SNE

1. Dolan, Robert P., Hall, Tracey E., Banerjee, Manju Chun, Euljung, & Strangman Nicole, (2005). Applying Principles of Universal Design to Test Delivery: The Effect of Computer-based Read-aloud on Test Performance of High School Students with Learning Disabilities. *The Journal of Technology, Learning and Assessment*. Online: http://www.bc.edu/research/intasc/jtla/journal/pdf/v3n7_jtla.pdf

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Unit 4.3 Monitoring of ICT usage in SNE

1. UNESCO IITE (2002). *Basic ICT Usage Indicators in Secondary Education in the Baltic and CIS Countries*. Statistical Report. Moscow.

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UNIT 4.1 Planning of ICT Policy in SNE

Objectives

Upon completing the Unit you will learn about:

1. Objectives, principles, and means of ICT policy in SNE.
2. Legal basis of ICT policy improvement in SNE.

4.1.1 Objectives, Principles, and Means of ICT Policy Development in SNE

ICT potential benefits must be made available to everybody, therefore, care must be taken to ensure that access is as equitable as possible. The inclusion of users with SEN in new educational environments based on ICT usage is a necessary prerequisite for any nation to grow and prosper, not to lag behind in the digitized world economy. Correct policy solutions in this sphere can offer greater leverage to support equal educational opportunities for such people. Nevertheless, policy initiatives often happen to provide only a rationale for technology investments, not a basis for successful ICT integration.

While governments elaborate programmes intending to engage people with disabilities in society and design strategies of their rehabilitation on the principles of *equality* and *non-discrimination*, comprehensive SNE policy initiatives should focus on the facilitation of *accessibility* of the ICT-mediated special education. The broad *objectives* of the policy framework to support ICT integration in SNE are as follows:

- to develop an integrated management system to coordinate planning, implementation, and monitoring in all spheres of ICT integration in SNE;
- to work out capacity-building strategies aimed at creating equitable access to ICT-mediated education for people with disabilities;
- to raise the awareness forming fundamental social attitude to the role of ICTs in education and rehabilitation of people with disabilities;
- to set up local structures, e.g. a disability council, and pilot projects linking strategy and policy efforts with operational planning initiatives involving all role-players (schools, institutions, teachers, students, etc.), government and private sector (businesses and services).

In order to achieve the policy objectives, it is necessary to undertake actions in key areas. European Agency for Development in Special Needs Education identified the following trends of ICT policy in education for students with SEN:

- to promote basic and specific training of teachers in the use of ICTs;
- to ensure that adequate hardware and software infrastructure is available for all users;
- to support research, innovation, and exchange of information and experiences;
- to make the educational community and wider society aware of ICT benefits for special needs education.¹

In compliance with such vision, ICT integration in special education must be seen as a complex proposition based on the principle that technology is only a tool to shift the focus from technology provision to design of learning environments. Previously the focus of policy initiations has been on establishing infrastructure to enable ICTs to be effectively applied in special education settings. Most countries now acknowledge that the emphasis of policy should be placed on appropriate ICT usage in different educational

According to the research provided by European Agency for development in Special Needs Education in 2003, “the use of ICT in special needs education settings is not always considered within [...] high profile agendas and access to appropriate ICT solutions for some pupils with special needs, their families and their teachers, is often problematic. Special strategies and steps therefore need to be taken if access to appropriate ICT for all pupils is to be achieved across Europe.”

European Agency for Development in Special
Needs Education (2003)
Special Needs Education in Europe
Thematic Publication

¹ European Agency for Development in Special Needs Education (2003). *Special Needs Education in Europe*. Thematic Publication. Online: http://www.european-agency.org/publications/agency_publications/SNE_europe/SNE.html

Policy implementation can be usually achieved in several ways: simply market mechanisms, standards/guidelines availability, or regulation/legislation. It must, however, be assessed which are the ones more appropriate/efficient for the domain of accessibility or inclusion, one of the key point being to avoid fragmentation of the efforts at national levels, as it would be detrimental to EU citizens and industry.

Europe's Information Society. Thematic portal

contexts. The components, which must be combined in this holistic approach, include: a school/institute in which integration is to take place, the availability and accessibility of the technologies provided, the technical support for the installation, maintenance and upgrading of hard- and software, pedagogical preferences and skills of teachers, and the students' level of skills and motivation.

In order to identify the specific ICT policy in SNE, there is a need to determine a range of issues influencing ICT applications in education of students with disabilities. There

are common themes where issues are evident: infrastructure (hardware, software, and Internet access), links to educational theory (pedagogical ways of ICT integration in curriculum), and quality of teachers' training.

Figure 4.1 Stages of ICT policy implemented in SNE



Initiatives must, therefore, define ways of ensuring that individuals have access to the equipment and connections needed, and that service providers are encouraged to supply useful and desirable services. The objective to improve educational environments for people with SEN should be pursued at a national level through the development of clear *strategy* of ICT policy in special education. The strategy implies a plan of action which outlines the primary activities to be undertaken to achieve the policy goals.

In order to integrate successfully ICT-mediated approaches in SNE, it is essential to develop a comprehensive planning model of the process. Although the models of integration abound, the majority follow the same basic stages of design, development, assessment, and improvement (see Figure 4.1).

The above-mentioned stages of ICT policy in SNE assume a diversity of activities to achieve its intentions. The table below summarizes the structure of the activities to integrate ICT in special education and introduces key indicative sources of evidence to monitor the process.

Table 4.1 Structure of policy activities toward ICT integration in SNE

Stages	Activities	Indicative sources of evidence
The design stage	<ul style="list-style-type: none"> Identify requirements of ICT-based learning environments meeting learners' needs and educational levels Determine professional level and technology skills of staff involved in education, including SNE teachers and technology specialists Assess the existing ICT infrastructure Review national and international legal bases of ICT integration in SNE Review and assess previous traditional educational approaches and define necessary conditions to gain instructional goals/objectives Define the budget: predict the expenses and identify the sources of funding 	<ul style="list-style-type: none"> Established learners' benchmarks regarding learning needs, accessibility and usability, computer literacy and language skills Established teachers' benchmarks regarding skills of general and specific usage of ICT hardware and instrumental software, experience in pedagogical/didactic methods of curriculum upgrade to meet learners' needs Established infrastructure benchmarks reflecting the adequacy of the ICT-based learning environment to the demands of students with SEN Predicted costs regarding: <ul style="list-style-type: none"> Promotion of ICT infrastructure for SNE Implementation of appropriate strategies for ICT-based learning environment, including the content, methods of delivering and assessment Training and retraining of ICT specialists in SNE

Stages	Activities	Indicative sources of evidence
The development stage	<ul style="list-style-type: none"> • Create a working team • Develop an input funding model for ICT implementation in SNE • Develop/provide appropriate infrastructure • Select/elaborate materials, delivery, and assessment methods • Organise qualitative teacher training and support • Develop an evaluation plan 	<ul style="list-style-type: none"> • Carefully managed alliance/working team with independent experts to implement appropriate ICT-related capacities in SNE • The provided ICT capacity-building in every area including infrastructure and curriculum development, training of ICT specialists in SNE • Carefully developed criteria/principles of ICT infrastructure design for SNE based on students' learning needs considered • SNE programmes, employed ICT capacities of content, delivery and assessment methods rated by the type of disability and age • Established requirements of professional certification in the field of ICT usage in SNE • In-service training programmes for staff awareness and development regarding ICT implementation in SNE • Support structures offering interrelated ICT services for teachers engaged in SNE • Established benchmarks for every area of evaluation plan, including infrastructure and curriculum development, training of ICT specialists in SNE
Assessment stage	<ul style="list-style-type: none"> • Analyse and evaluate all areas of integration • Collate the policy measures regarding their conformity with objectives and strategy plans • Assess cost-effectiveness to improve ICT integration • Identify key areas to be modified • Determine key obstacles and hindering factors 	<ul style="list-style-type: none"> • Accessibility and usability of the ICT-based learning environment (for learners and specialists) • Level of learners' computer literacy for every age or/and disability group • Level of learners' experience and skills acquired for ICT usage • The number of certificated ICT specialists working in SNE • Level of cost-effectiveness based on the combination of the following components: <ul style="list-style-type: none"> – Time and resources necessary for the process (including, among others, time requirements for ICT training of learners and specialists; time and specialist resources needed to develop an ICT-based curriculum for SNE, etc.) – Finances needed to provide appropriate ICT infrastructure, curriculum alteration, and training of specialists – Achievements in the area of <i>knowledge and skills</i> developed by means of ICTs (for learners and specialists) • Evaluation report on effectiveness of ICT integration in SNE which must be based on the description of key areas to be improved and analysis of the factors which hinder and advance it
Improvement stage	<ul style="list-style-type: none"> • Revise carefully the plans and resources • Overcome the obstacles and improve ICT integration in SNE 	Developed strategies to improve policy of ICT implementation in SNE

Prior to detailed identification of main policy strategies in the key areas of ICT integration in SNE, i.e. *infrastructure*, *curriculum*, and *teacher training*, the course will focus on the legal basis of ICT policy development in SNE.

4.1.2 Legal Basis of ICT Policy Development in SNE

Access to information has become a social demand and a fundamental aspect of human rights. If people with disabilities are to be genuinely integrated in society, then we cannot let this group be deprived of this major human right. The new technologies of information and communication are essential tools to advance social inclusion, as they provide capacities for people with SEN to access and use information, to interact, therefore, to enjoy educational, training, and employment opportunities. Thereupon, the access to Information Society products and services, including ICTs, has become vital in enabling and facilitating the integration of people with disabilities in society. However, if the technologies fail to match the needs of end-users, they can turn into a new and insuperable barrier for people with disabilities. Hence, special policy activities are required to assist the progress of communication networks and to perfect quality of education.

Policy- and decision-makers will play a key role in maintaining these developments through proactive strategies, which promote investment and allow SNE to benefit from the rapid pace of technological innovation. In order to realize this

intention, direct policy initiatives are to be undertaken in the field of *legislation* facilitating equal education for people with disabilities. The nature and specificity of policy toward ICT integration in special education in any country will be shaped by the peculiar socio-cultural and economic conditions of a country. While most policy regulations are in effect in high-income states, general principles are applicable in any context where ICTs are used.

The principles of *equality* and *non-discrimination* are reinforced internationally in many ways, starting with Universal Declaration of Human Rights adopted by the General Assembly of the United Nations in 1948. More specific interpretations and provisions are enacted in several human rights agreements. It must be noted that in the educational context the human rights legislation focuses on the access to education without specifying the approaches to its quality. *Convention on the Rights of the Child* lays the most important legal basis for the quality of education expressing enduring and systematic commitments about the aims of education².

The objective of increasing equality of the learning outcomes as well as access and retention has become the central concern of human rights legislation in the educational context. This intention “reflects a belief that all children can develop basic cognitive skills, given the right learning environment” (UNESCO, 2005). The principle of *accessibility* was developed as an interpretation of non-discrimination, bearing in mind a huge diversity of technological devices. The research paper *Communication Towards a Barrier-Free Europe for People with Disabilities* published by the Commission of the European Communities in 2000³ presents the holistic policy perspective and acknowledges that environmental barriers are a greater impediment to participation in society than individual functional limitations. Barrier removal by legislation, provision of accommodations, universal design, and other means has been identified as the key to equal opportunities for people with disabilities⁴.

In line with the consensus of the international community, many countries have adopted and enforced the inclusive policies with standards and laws. So it will be informative to collate the legal bases of some countries in the field of equal treatment for people with disabilities regarding ICT access⁵.

Argentina In September 1998 Centros Tecnológicos Comunitarios created the programme *Argentin@internet.todos*⁶ to promote the universal access to the Internet and information technologies. However, it does not specifically mention people with disabilities.

Australia *Disability Discrimination ACT 1992 (DDA)*⁷ obliges Commonwealth departments and agencies to grant the access to online information and services to people with disabilities. DDA Section 31 allows the Federal Attorney-General to introduce disability standards of employment: services and/or facilities of the employees present equal opportunities in the workplace.

*Telecommunications Act 1997*⁸ and *Telecommunications (Consumer Protection and Service Standards) Act 1999*⁹ are among the most significant, of relevance being their sections on Universal Services Obligations, the National Relay Service and Industry Development Plans, as well as *Telecommunications (Equipment for the Disabled) Regulations 1998*¹⁰.

Canada *Canadian Human Rights Act of 1977*¹¹ gives effect to the principle that “all individuals should have an opportunity equal with other individuals to make for themselves the lives that they are able and

² Appendix to General Comment No 1, Article 29 (1), *Convention on the Rights of the Child*, United Nations, 2000.

³ Commission of the European Communities (2000). Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions: *Towards a Barrier Free Europe for People with Disabilities*. Brussels. Online: http://europa.eu.int/comm/employment_social/equ_opp/com284f/com_284f_en.pdf

⁴ Gubbels, A., Kemppainen, E. (2002). *A Review of Legislation Relevant to Accessibility in Europe*. eEurope - eAccessibility expert group. Online: http://europa.eu.int/information_society/policy/accessibility/regulation/a_documents/eaccess2002_legis_review_report.html

⁵ The following data is from *Guidelines for the Design of Accessible Information and Communication Technology Systems*. Online in the Tiresias – International information on Visual Disability: <http://www.tiresias.org/guidelines/index.htm>

⁶ <http://www.integracionrosario.com.ar/pag5.htm>

⁷ http://www.austlii.edu.au/au/legis/cth/consol_act/dda1992264/

⁸ http://www.austlii.edu.au/au/legis/cth/consol_act/ta1997214/

⁹ <http://scaleplus.law.gov.au/html/pasteact/3/3267/top.htm>

¹⁰ <http://scaleplus.law.gov.au/html/pastereg/2/1459/top.htm>

¹¹ http://canada.justice.gc.ca/chra/en/chrareview_report_2000.pdf

wish to have and to have their needs accommodated, consistent with their duties and obligations as members of society, without being hindered in or prevented from doing so by discriminatory practices based on race, national or ethnic origin, colour, religion, age, sex, sexual orientation, marital status, family status, disability, or conviction for an offence for which a pardon has been granted.”

The government of Canada has the policy (effective since July 1999) of providing technical aids, anthropometrics equipment, attendant, and other specialized services to ensure that the identified employment-related needs of employees with disabilities are met within reason; that is, to make the required accommodations so that the employees can fulfil their tasks and functions without significant additional effort or risk, thereby eliminating barriers that would obstruct their employment opportunities in the federal Public Service. This may include adjustments to the task and working environment of these employees.

Denmark *The Freedom to Choose – Action Plan for Use by People with Disabilities*¹² follows up the Government’s IT Policy Action Plan of 1995. It says that the state should ensure that new computerized information and service systems offered to the general public are either initially accessible or adapted to be made accessible to people with disabilities.

European Union In December 1996, EU Member States politically endorsed the Communication entitled *Equality of Opportunity for People with Disabilities – A New European Community Disability Strategy*¹³ in the resolution of the Council of Ministers. The resolution now serves a framework to identify Member States’ common goals and to determine best-practice procedures in creating policies to attain full participation of disabled people in all aspects of life. High Level Group of Senior Officials from the Member States was consequently set up, who meet regularly to monitor developments pertaining to the resolution throughout the Union.

In May 2000, the European Commission adopted *A Communication Towards a Barrier-Free Europe for People with Disabilities*¹⁴ intending to build the framework to improve the access for disabled people to the workplace and beyond. The Communication outlines key objectives, which the Commission believes, the European Union should pursue.

According to *Directive on Radio Equipment, Telecommunications Terminal Equipment and the Mutual Recognition of Their Conformity (99/5/EC)*¹⁵, the Commission may decide that apparatuses in certain equipment classes or of particular types shall be constructed so that they bear certain features facilitating their use by people with disabilities.

In 2002 the telecommunications legislation package was enacted, including five directives and the regulation, i.e. *Directive of the European Parliament and of the Council on Universal Service and User’s Rights Relating to Electronic Communications Networks and Services*¹⁶ (OJ L 108, 24.4.2002, p. 51-77).

Finland *Constitution Act (731/1999)*¹⁷ contains the explicit prohibition against discrimination. Section 6(2) of the Act states that without acceptable grounds no one may be afforded a different status on account of sex, age, origin, language, religion, conviction, opinion, state of health, or disability. The rights of those who use sign language and those who require interpretation or translation services because of disability are guaranteed by the act of Parliament. The amended Penal Code (1995) prohibits the discrimination on the basis of disability.

¹² <http://www.fsk.dk/fsk/publ/1997/freedom/>

¹³ http://europa.eu.int/comm/employment_social/soc-prot/disable/index_en.htm

¹⁴ <http://www.icdri.org/Employment/eudisab.htm>

¹⁵ <http://europa.eu.int/comm/enterprise/newapproach/standardization/harmstds/reflist/radiotte.html>

¹⁶ http://www.fs.dk/jura/lovereagl/mfl/eu/pdf/fsp_02.en.pdf

¹⁷ <http://www.om.fi/21910.htm>

- Germany** With the adoption of Book Nine of the Social Code – *Rehabilitation and Participation of People with Disabilities* – and *Act on Equal Opportunities for Disabled Persons (German Disability Discrimination Act)* the labour market of people with disabilities has been improved as well as their position in relation to German public authorities. Equality implies the barrier-free access to the Internet. For this purpose the government enacted the ordinance providing for the establishment of barrier-free IT design. Its objective is to guarantee people with disabilities the access to all Internet resources of federal institutions without any restrictions. The information service on disability, and the Internet, and the hotline advising on a barrier-free web design are available.
- India** *The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995*¹⁸ states that government and public sector establishments shall set up schemes to ensure the employment of disabled people, for example by granting training and welfare, health and safety measures, creating non-disabling environments at workplaces.
- Ireland** *The Employment Equality Act 1998*¹⁹ and *Equal Status Act 2000*²⁰ outlaw discrimination in employment, vocational training, advertising, collective agreements, supply of goods and services, and other opportunities to which the public generally have access on nine distinct grounds, including disability.
- Japan** *e-Japan Priority Policy Program* (March 2001)²¹ is committed to reduce the ‘digital divide’ caused by geographical, age-related, and physical constraints.
- Portugal** Article 71 of *Constitution of the Portuguese Republic*²² of 1976 (revised in 1982 and 1997) determines that citizens with disabilities “enjoy the rights and are subjected to the obligations contained in the Constitution, with the exception of the exercise of compliance with those for which they are incapacitated”. The Constitution stipulates that “the State shall implement a national policy for the prevention of disability, and for the treatment, rehabilitation and integration of citizens with disabilities and support for their families, shall educate the community to be aware of its duties of respect for them and solidarity with them, and shall ensure that they enjoy their rights to the full extent subject to the rights and duties of their parents.” Item №3 of the above-mentioned Article declares that “the State supports citizens with disabilities”. With regard to education, Article 74 of the Constitution reads that in the enactment of education policy the State is committed to “promote and support access of citizens with disability to education and to support special education, provided it is necessary. [The State is also committed] to protect and encourage Portuguese sign language as a cultural expression and instrument facilitating access to education and equal opportunities.”
- The Resolution of Parliament №23/98 recommends that the Institute for the Media make TV companies aware of the need to include sign language in the main national and international news. Law №31-A/98 of 14 July 1998 (TV Law), Article 45, makes it compulsory for TV companies to guarantee progressively the access to television broadcasting to deaf people or people with hearing disabilities by captioning or sign language as well as by specific programmes aimed at these people.
- National Initiative for Citizens with Special Needs in the Information Society – August 1999*²³ is to guarantee access to new information technologies to citizens with special needs (elderly and handicapped).

¹⁸ <http://disabilityindia.org/pwdacts.cfm>

¹⁹ <http://www.irishstatutebook.ie/ZZA21Y1998.html>

²⁰ [http://www.justice.ie/80256996005F3617/vluFileCode2/flJWOD4RYH9V/\\$file/act8-00.pdf](http://www.justice.ie/80256996005F3617/vluFileCode2/flJWOD4RYH9V/$file/act8-00.pdf)

²¹ <http://www.kantei.go.jp/foreign/it/network/priority/index.html>

²² http://www.parlamento.pt/ingles/cons_leg/crp_ing/crp_97_1.html

²³ <http://www.mct.pt/novo/legislacao/despachos/incne.htm>

*ACESSO – Accessibility to Citizens with Special Needs in the Information Society*²⁴. ACESSO is a support unit affiliated to the Ministry of Science and Technology to reach the objectives set by the National Initiative for Citizens with Special Needs in Information Society and the related item of the Digital Portugal Programme. It is responsible for monitoring government policies in this area as well as testing accessibility of web pages for citizens with special needs.

South Africa The anti-discrimination clause in the National Constitution of 1996 includes disability policies. The government’s policy is described in the white paper *Integrated National Disability Strategy of 1997*²⁵. The White Paper stipulates that Technology is required that will ensure the inclusive use of public amenities by all consumers (sign Language and subtitles on television, documents available in Braille and/or on cassette, communication boards for non-speaking people, assistive listening gadgets and systems for deaf people, e.g. TTYs and closed caption decoders). The white paper does not cover information technology.

Spain Article 49 of *Constitution (1978)*²⁶ determines that public authorities must carry out policies to integrate people with disabilities, specially providing them with equal rights as granted for all citizens.

The General Telecommunications Law (1998) establishes (Article 3) that the government should promote the development of new services, networks, and technologies and may impose conditions to ensure that all citizens can access them under equal conditions. It states (Article 15) that “access to telecommunication services by people with disabilities and special needs” can be a condition for granting licenses for telecommunication networks.

The universal service concept is developed in Article 37 which says that disabled users or users with special needs should have access to the fixed phone network under equal conditions as other users. Among the general obligations for universal service are to ease the communication among certain groups that are in special circumstances and insufficiently covered.

The Law 34/2000 on Services of Information Society and e-Commerce provides the following as far as disabilities is concerned: “Public Administrations will take the necessary means to guarantee that disabled and elderly people will be able to access their web pages, according to accessibility criteria previously recognized. In the same way, accessibility facilities will be provided by software and equipment manufacturers, so as to ensure an easy access to digital contents for disabled and elderly people.”

Sweden The ordinance *On the Agencies’ Responsibility for Accomplishing the Disability Policy (SFS 2001:526)* states that government agencies shall work to afford the disabled people full participation in society and equality of life. In particular, agencies shall work to make their premises, activities, and information accessible by disabled people.

There is in place intended to counteract discrimination in working life against people with functional impairments. Employers must treat a functionally impaired applicant or employee as favourably as they would treat persons without impairments, unless the employer can show that the unfairness has no connection to the impairment. An employer must not treat an applicant or employee with certain functional impairments less favourably by applying a rule, a criterion or a procedure that may seem neutral but in reality is unfair to persons with an impairment compared to persons without it (Act Concerning Prohibition of Discrimination in Working Life of People with Functional Impairments, SFS 1999:132).

*The Electronic Communications Act (SFS 2003:389)*²⁷ was enacted on 25 July 2003.

²⁴ <http://www.acesso.umic.pcm.gov.htm>

²⁵ http://www.polity.org.za/html/govdocs/white_papers/disability1.html?rebookmark=1

²⁶ http://www.igsap.map.es/cia/dispo/ce_ingles_art.htm

²⁷ http://www.tiresias.org/guidelines/legislation_sweden.htm

Thailand

The Rehabilitation for Disabled Persons Act of 1991 provides for the protection of the right of the disabled to rehabilitation through medical care, education, and vocational training. The Thai *Constitution*²⁸ adopted in 1997, guarantees the elimination of barriers to participation of people with disabilities in civil society. Specifically, the Constitution ensures voting rights, access to public facilities, freedom from discrimination, and overall equal rights. *The Declaration on Rights for People with Disabilities in Thailand*, which His Excellency, the former Prime Minister of Thailand, approved and signed on 3 December 1998 on the occasion of the 50th Anniversary of the Universal Declaration of Human Rights further defined the rights of people with disabilities and raised national awareness.

United Kingdom

There are two acts that ensure discrimination against disabled people is prevented: *Disability Discrimination Act (DDA) 1995*²⁹ and *Disability Rights Commission (DRC) Act 1999*³⁰.

The DDA was passed to introduce new measures aimed at ending the discrimination which many disabled people face. It protects disabled people in the areas of:

- employment;
- access to goods, facilities and services;
- management, buying, or renting of land or property;
- education.

The Disability Rights Commission Act of 1999 led to Disability Rights Commission (DRC) set up in April 2000, which defines the DRC's statutory duties:

- to work to eliminate discrimination against disabled people;
- to promote equal opportunities for disabled people;
- to encourage good practice in treatment of disabled people;
- to advise the Government on disability legislation – Disability Discrimination Act (DDA) of 1995 and Disability Rights Commission Act of 1999.

Codes of Practice

The government has generated a number of Codes of Practice explaining legal rights and requirements under the Disability Discrimination Act of 1995 since the Disability Rights Commission³¹ was established. The Codes intend to be practical guidance – particularly for disabled people, employers, service providers, and education institutions – rather than definitive statements of the law, however, courts and tribunals must take them into account, where relevant.

- Employment: *Code of Practice for the Elimination of Discrimination in the Field of Employment Against Disabled Persons or Persons who have had a Disability*³².
- Rights of access: *Code of Practice – Rights of Access – Goods, Facilities, Services and Premises*³³.
- Education – Schools: *Code of Practice for Schools – DDA 1995: Part 4*³⁴.
- Education – Post 16: *Code of Practice for Providers of Post 16 Education and Related Services – DDA 1995: Part 4*³⁵.

²⁸ <http://www.parliament.go.th/files/library/b05-b.htm>

²⁹ <http://www.legislation.hmso.gov.uk/acts/acts1995/1995050.htm>

³⁰ <http://www.legislation.hmso.gov.uk/acts/acts1999/19990017.htm>

³¹ <http://www.drc-gb.org/>

³² http://www.drc-gb.org/uploaded_files/documents/2008_227_copemployment.rtf

³³ http://www.drc-gb.org/uploaded_files/documents/2008_223_drc%20cop%20rights%20of%20Access.doc

³⁴ http://www.drc-gb.org/uploaded_files/documents/2008_220_schoolscop2.doc

³⁵ http://www.drc.org.uk/uploaded_files/documents/2008_187_DDA%20Pt4%20Code%20of%20Practice%20for%20Post%2016%20education.doc

Regulations

- *The Disability Discrimination (Employment) Regulations 1996*³⁶.
- *The Disability Discrimination (Services and Premises) Regulations 1996*³⁷.
- *The Disability Discrimination (Services and Premises) Regulations 1999 (SI No 1191)*³⁸.
- *The Disability Discrimination (Providers of Services) (Adjustment of Premises) Regulations 2001*³⁹.

The Disability Discrimination Act 2005⁴⁰, which received Royal Assent on 7th April 2005, amends the Disability Discrimination Act 1995 (DDA) in a number of ways concerning public authorities, transport and other matters.

United States of America

*The American with Disabilities Act (ADA)*⁴¹ prohibits discrimination on the basis of disability in employment, state and local government, public accommodations, commercial facilities, transportation, and telecommunications.

*Section 508 of The Rehabilitation Act*⁴² establishes requirements for electronic and information technology developed, maintained, procured, or used by the Federal Government. Section 508 demands federal electronic and information technology to be accessible to people with disabilities, including employees and members of the public.

An accessible information technology system is one that can be operated in a variety of ways and does not rely on a single sense or ability of the user. For example, a system that provides the output only in visual format may be inaccessible for people with visual impairments, and a system that provides the output only in audio format may be inaccessible for people who are deaf or hearing-impaired. Some individuals with disabilities may need accessibility-related software or peripheral devices in order to use the systems that comply with Section 508.

*The Voting Accessibility for the Elderly and Handicapped Act of 1984*⁴³ generally requires polling places across the United States to be physically accessible to people with disabilities during federal elections. Where no accessible location is available to serve as a polling place, a political subdivision must offer an alternative means of casting a ballot on the day of election. The law requires the state to make registration and voting aids available for disabled and elderly voters, including information by telecommunications devices for the deaf (TDDs) known as text telephones (TTYs).

Section 255 and Section 251(a)(2) of the Communications Act of 1934 as amended by *Telecommunications Act of 1996*⁴⁴, require manufacturers of telecommunications equipment and providers of telecommunications services to ensure that such equipment and services are accessible to and usable by people with disabilities, if readily achievable. These amendments ensure that people with disabilities will have access to a broad range of products and services, i.e. telephones, cellular phones, pagers, call-waiting, and operator services, often inaccessible to many users with disabilities.

The information above shows that several countries have developed policies regarding accessibility. Some policies specifically aim at development of national accessibility standards on information technology and web sites (Australia and the United States of America); others provide generic accessibility coverage (India); still others cover only the

³⁶ http://www.hmso.gov.uk/si/si1996/Uksi_19961456_en_1.htm

³⁷ http://www.hmso.gov.uk/si/si1996/Uksi_19961836_en_1.htm

³⁸ <http://www.hmso.gov.uk/si/si1999/19991191.htm>

³⁹ <http://www.hmso.gov.uk/si/si2001/20013253.htm>

⁴⁰ <http://www.disability.gov.uk/legislation/dda/dda.asp>

⁴¹ <http://www.usdoj.gov/crt/ada/adahom1.htm>

⁴² <http://www.usdoj.gov/crt/508/508home.html>

⁴³ <http://www.usdoj.gov/crt/ada/cguide.htm#anchor64292>

⁴⁴ <http://www.fcc.gov/telecom.html>

access to technology for all, with no mention of people with disabilities (Argentina). The focus of legislation regarding ICT integration in special education should be on equal opportunities in social life, education, and access to ICT. Therefore, any *new legal policies aimed at equal education of people with disabilities must be initiated based on three important principles combined: inclusion, education for all, and accessibility*. Only taking these principles into account we can remedy daily problems of people with disabilities.

International experience has revealed that very often specific legislation is ignored due to conflicting demands and priorities. But even if the state policy legislation is controlled carefully, adequate promotion of ICT access and legislative enforcement are not enough to guarantee full involvement of the disabled in society. Creating the awareness of disability issues and daily problems of the disabled is a much more demanding but, eventually, more successful route to achieve equality.⁴⁵

In order to gain genuine social integration for such categories of people and provide them with the access to education which meets modern demands, policy- and decision-makers have to identify exact needs of the end-users, to assess the national state-of-the-art in such spheres as ICT infrastructure in SNE, vocational training of ICT specialists in SNE, as well as methodology demands of ICT integration in SNE curriculum. To improve ICT policy in special education the essential analysis should be undertaken on the basis of the quality standards of special education in Digital Age, which is enunciated in Unit 4.3 of the Module.

Summary

- ◆ While governments develop programmes to include people with disabilities in society and design strategies of their rehabilitation based on the principles of *equality* and *non-discrimination*, broad SNE policy initiatives must focus on accessibility of the ICT-mediated special education.
- ◆ ICT integration in special education should be seen as a complex proposition, where technology is only a tool to shift the focus from its provision to design of learning environments.
- ◆ The components, which must be combined within this holistic approach, include: a school/institute in which integration is to take place, availability and accessibility of the technologies provided, technical support to install, maintain and upgrade hard- and software, pedagogical preferences and skills of teachers, as well as students' level of skills and motivation.
- ◆ Successful integration of ICT-mediated approaches in SNE assumes the development of a model of ICT integration in SNE. Although the integration abound, the majority follow the same basic stages of design, development, assessment, and improvement.
- ◆ In order to provide successful integration of ICTs in SNE, direct policy initiatives are to be undertaken in the field of *legislation* for equal treatment of people with disabilities.
- ◆ The objective to increase the equality in learning outcomes has become the central concern of human rights legislation within educational context.
- ◆ The principle of *accessibility* was developed as an interpretation of non-discrimination in a view of a huge diversity of technological devices.
- ◆ Legislation, provision of accommodations, and universal design applied to remove the barriers have been identified as the keys to reach equal opportunities for people with disabilities.
- ◆ In line with the consensus of the international community, many countries have adopted and enforced inclusive policies with standards and laws.
- ◆ Laws on ICT integration in special education should focus on the potential for people with disabilities – equal opportunities in social life, education, and ICT access. Therefore, a new legal policy aimed at equal treatment of people with disabilities must be initiated being based on three important principles combined: inclusion, education for all, and accessibility. Only taking into account these principles can practically remedy daily problems of people with disabilities.

⁴⁵ European Commission (2003). *Access to Assistive Technology in the European Union*, European Communities. Online: http://europa.eu.int/comm/employment_social/publications/2004/cev503003_en.pdf

Assessment

To verify the understanding of the material presented in the Unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 4.1

- 1.1 Name main objectives and activity trends of ICT policy in SNE. What policy actions are of primary importance in your country/region?
- 1.2 Describe main stages and corresponding policy activities of ICT integration in SNE. Define main indicative sources of evidence for every stage of the structure.
- 1.3 Prove that equal education of people with disabilities cannot be realized without a reliable *legal basis* accounting the particular socio-cultural and economic conditions of a particular country. Characterize main strengths and weaknesses of legislation regarding the education of people with SEN in your country/region.
- 1.4 Describe desirable changes in legal policy toward equal education of people with disabilities in your country/region.

2. Self-assessment questions for Unit 4.1

- 2.1 Which of the following is the main role of ICTs in SNE policy improvement?
 - a. A technical instrument that allows students with disabilities to interact, communicate, and get instruction materials in suitable format.
 - b. A tool for shifting the focus from technology provision to design of learning environments.
 - c. A technical means for training and retraining of specialists in SNE.
- 2.2 Which of the following structural stage(s) of policy activities toward ICT integration in SNE requires most careful consideration and assessment of developmental level for all components in SNE?
 - a. Design and developmental stages.
 - b. Developmental stage.
 - c. Design and assessment stages.
- 2.3 Which international legal mandate provided the principles of *equality and non-discrimination* for people with disabilities for the first time?
 - a. Universal Declaration of Human Rights, 1948.
 - b. Convention on the Rights of the Child, 1989.
 - c. The International Covenant on Civil and Political Rights, 1966.

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UNIT 4.2 Implementation of ICT Policy in SNE

Objectives

Upon completing the unit you will know the importance of:

1. Promoting ICT infrastructure for SNE.
2. Integration of ICTs in SNE curriculum.
3. Training and retraining of ICT specialists in SNE.

4.2.1 Promoting ICT Infrastructure for SNE

Most policy- and decision-makers agree that the access to appropriate ICTs can reduce inequalities in education, and ICTs can be a powerful tool in supporting educational inclusion. However, despite huge potential benefits of ICT usage in SNE, only occasionally it meets our expectations. Inappropriate or limited access to ICTs seems to reinforce inequalities in education faced by some learners, including those with special educational needs. In many cases, the unsatisfactory experiences of technology application bring teachers to conclusion that the disadvantages of new technologies far outweigh their advantages. Much of this dissatisfaction can be attributed to the quality of the driving policy content and support, rising directly from the inflexibility of the underlying learning (technical) platforms, i.e. hardware, software, and Internet access, for all potential users.

ICT infrastructure implies the telecommunication and information networks which transmit, store and deliver the information⁴⁶. The infrastructure in the special education context embraces a wide range of devices. Traditional corporate approaches to ICT management are too inflexible to satisfy the needs. It is vital that the infrastructure is designed from the user's viewpoint. In order to ensure that the ICT devices used in SNE are suitable and appropriate for the needs of individual students, it is very important to assess regularly the level of training and support provided for students and teachers.

'Learning platform' is a generic term to describe a broad range of ICT systems which are used to deliver and support learning. A learning platform usually combines several functions, such as organizing, mapping and delivering curriculum activities and the facility for learners and teachers to have a dialogue about the activity, all via ICT.

Becta, 2005
An Introduction to Learning Platforms

Students with special needs must have access to ICT-based equipment being a part of the general school programme. The main role of ICTs in the special needs education setting can be considered as meeting a variety of individual learners' needs via an apt technical infrastructure. Any educational activity – planning the curriculum, delivering instruction material, managing assessment, and communicating with students – can be extended and enhanced through the use of an appropriate *learning platform*. This asset providing the personalised learning can be applied in a variety of educational settings. The research by Becta, 2005⁴⁷, states that “a key feature of a learning platform is that it has different user interfaces, and thus offers each user a personalised access point to their work and learning

environment. Tutor interfaces have personalised working spaces, with daily management tools plus access to communication tools and learning resources. Some tutor interfaces also offer opportunities to personalise “learning offers” and structure the resources and activities associated with them. Student interfaces provide personalised home pages, learning management tools and access to study units, collaborative tools and learning materials.” (Becta, 2005)

However, introduction of a learning platform in special education is not as simple. In order to provide effective implementation of the learning platform in educational practice, it must be ensured that it meets a diversity of needs of the users involved in special education.

In view of the fact that there is no unique set of tools and no single learning platform that will suit each and every institution, this section primarily focuses on the *design principles* which drive technology, and the *functional criteria* with which the technology can and must help specialists improve learning environment. While the policy principles may be

⁴⁶ World Bank (2002). *Information and Communication Technologies. A World Bank Group Strategy*. The world bank group, Washington, D.C. Online: <http://info.worldbank.org/ict/assets/docs/SSP.pdf>

⁴⁷ Becta (2005). *An Introduction to Learning Platforms*. Online: http://www.becta.org.uk/page_documents/leas/introduction_learning_platformsJan05.pdf

relatively immutable, i.e. inclusion and equality of educational opportunities must always be the focus as well as quality and efficiency must always be improved, the priorities for sub-sectored allocation of resources can vary from one country/region to another depending on economic and social circumstances.

Minding that today's user demands turn out to be much more complicated than a plain imperative to cut costs⁴⁸, the key user needs can be listed under the following broad headings:⁴⁹

Usability It is clear, that if people can't use it, they won't use it. A well-designed educational ICT platform has to provide a consistent interface across its functions: inter-operation with various AT devices, easy access and navigation to the required content, a single ID and log-on, and a single point of contact for technical support and course-related enquiries. For managers and administrators, a simple means of tracking individual user performance and viewing individual user records is also needed. The most appropriate way to ensure the usability of applied technologies is through involvement of end-users. Initiatives must, therefore, include social assessment as a central dimension.

Accessibility Facilities of information access must embrace all users, regardless of their physical ability. One of the central issues in education of people with SEN is that technologies providing the access to information resources should be tailored to the needs of various users. In many countries legal frameworks requiring reasonable accommodations and equal access to information for a wide range of users with SEN have already been established. The applied design-for-all principles starting with the invention phase in the development life-cycle play a major role in improving the accessibility of living environments for people with disabilities. In many cases, governments have enacted compulsion as a principle and develop specific standards and codes of practice to realise the intention.

Flexibility The ability of the product design to accommodate changes of design criteria that may occur after the design has been completed. Designers may over-design by choosing equipment at the high end of available alternatives to accommodate future advance of support equipment. The technical platform must inherit the capacity to alter and integrate with non-standard products when necessary. Learners, for example, must be able to access the platform from the widest possible range of computing and communications equipment and, once online, customise their operating environment to the way they work and choose from a range of routes through the learning material. Course designers must be able to customise their workflow, enjoy an unrestricted choice of media and freely adapt core material to local needs. Teachers must be able to deal with learners as individuals, or assemble them into whichever groupings best suit a particular course module. Service providers or administrators must be free to choose which parts of the platform they source from which supplier, and which hardware they use to run which applications.

Affordability Due to the fact that disabled people often have low incomes and many of them are still at risk of poverty, public financial support is an important factor. Initiatives must, therefore, actively address the financial dimension and ensure that lack of income does not exclude those who could benefit the most.

Cost-effectiveness Successful ICT implementation in special education will depend to a large extent on faster and more reliable access and lower communication costs. However, it is known that equipping SNE with new technologies requires additional financing, as simple ICT devices must be adapted to the needs of users with disabilities. Furthermore, a technological platform must be powerful and feature-rich. Required characteristics, therefore, will include:

- inter-operability for quick, low-cost connection to existing data stored and information systems;
- re-usability and portability of courseware to maximize return of investment and promote competitiveness among vendors;
- manageability to ensure maximum system productivity at any time;
- user accessibility to ensure the best use of available working hours;
- durability to avoid costly technology obsolescence.

⁴⁸ Although, evidently, the cost-effectiveness is still one of the most important driving forces of marketplace development in this field.

⁴⁹ Most information is from *Principles and Practice in e-Learning Platform Architecture*. UK e-Universities Worldwide, November 2002. Online: http://ets.berkeley.edu/etstandards/ukey/ukey_platform_architecture.pdf

In many countries the present-day infrastructure fail to satisfy these requirements, therefore, must be upgraded.

According to the research of European Commission in 2003⁵⁰, the ICT infrastructure promotion “is the actual process in a given country that starts when the expression or recognition of a need is identified for a person with a disability and goes up to the time when the adequate technical aid is fully operational and useable by the same person.”

Below different steps in the process are shown from the HEART study published in 1993⁵¹. The steps make possible the detailed characteristics of various phases of the delivery system:

- initiative: initiation of all service delivery process;
- assessment: recognition of the need for a technical aid;
- classification: recommendation for a type of technical aid;
- selection: final choice of the technical aid among different types available;
- financing: organization of the payment for the technical aid;
- delivery: physical delivery of the technical aid to the disabled person, including training and setup, if required;
- follow-up: maintenance and, in longer term, continuous monitoring if the technical aid still meets individual requirements of the disabled person.

Table 4.2 illustrates a number of criteria to evaluate an infrastructure delivery system. The answers to the following questions contribute interesting elements that help assess the development level of national procuring system⁵².

Table 4.2 Comparative analysis of national delivery systems

Delivery system steps	Questions/Criteria
Initiative	Who takes the initiative to start a procedure? How much support/advice is provided to a requestor starting a procedure?
Assessment	Who performs the assessment? How 'AT-aware' is the assessor? Is the prescription sufficiently detailed? How long does it take to complete the assessment? What is the degree of uniformity of the assessment procedure? How much are special/individual needs taken into account during the assessment?
Classification	How many independent centres provide the information about technical aids? How many of the centres have exhibition halls where the technical aids can be tested? How are the centres distributed geographically? Is there a central database of technical aids that can be accessed by all centres? To what extent is the end-user involved in the classification process?
Selection	What are the criteria most often used for final choice of the technical aid? Who has the power of the final decision? Can the user try the equipment or get it for a trial period? Is documentation available in the local language?
Financing	What is covered by official funding? If official funding is impossible, are there any alternatives? How efficient are they? To what extent is financing a barrier to receive a technical aid?
Delivery	Who delivers the technical aid? Are training and setup systematically included in the delivery?
Follow-up	What is the frequency of the re-assessment of the solution provided? How is repair/maintenance performed? Who pays for it?
Overall process	What is the time of the process? What are the bottlenecks? How many people with disabilities benefit from the system? How satisfied are the users? What is the cost percentage borne by official funding?

⁵⁰ European Commission (2003). Access to Assistive Technology in the European Union, European Communities. Online: http://europa.eu.int/comm/employment_social/publications/2004/cev503003_en.pdf

⁵¹ Horizontal European Activities in Rehabilitation Technology (HEART). Online: <http://www.w3.org/WAI/TIDE/FinalReport>

⁵² European Commission (2003). Access to Assistive Technology in the European Union. Online: http://europa.eu.int/comm/employment_social/publications/2004/cev503003_en.pdf

The appropriate technical infrastructure to educate people with SEN takes a consideration of the key principles of learning and teaching as well as the identification of individual learning styles and approaches. The Course will focus on the development of a clear, evidence-based rationale of using ICTs in special education and empowering teachers with necessary skills and competence to introduce the rationale in their practice.

4.2.2 Integration of ICTs in SNE Curriculum

Rapid technological development in recent years has made possible many new services and assistive devices which ease the daily life and perfect learning results of people with disabilities. However, lack of awareness, knowledge, and skills in the field of appropriate technology applications reduces the benefits of technology advances. However, necessary education and training of the multidisciplinary staff involved in special education services has not always accompanied pedagogical approaches to ICT integration in daily practice.

Curriculum is what is learned and what is taught (context); how it is delivered (teaching – learning methods); how it is assessed (exams, for example); and the resources used (e.g. books used to deliver and support teaching and learning).

UNESCO (2004)
*Changing Teaching Practices, Using Curriculum
Differentiation to Respond to Students' Diversity*

Students with disabilities have a range of skills and needs, therefore, require a variety of teaching and assessment strategies. In this regard, a special needs policy must primarily focus on curriculum planning and monitoring of students' progress.

First and foremost, a curriculum accounting for a diversity of students' needs must be *flexible and adaptable*, designed to reduce environmental barriers of students who may disadvantage from regular education. Evidently, such students must have a chance to:

- access and fully participate in the curriculum;
- gain positive learning outcomes and demonstrate them appropriately.

The arrangements to provide for equal learning opportunities are not a matter of diminutive changes any teacher may have to do in terms of methods and contents. It is rather a reorganization of a pedagogical vision of the education system, considering necessary ICT integration. UNESCO research accomplished in 2004 states that curriculum differentiation is “the process of modifying or adapting the curriculum according to the different ability levels of the students in one class”.⁵³

Many students with learning disabilities or a functional disability have a greater need than other students for a planned, individually adapted teaching situation. Planning must take into account individual ability, adaptations must be made to the student's degree of functional incapacity, and plans must encompass both didactic development and the student's social development.

European Agency for Development
in Special Needs Education
ICT in Education for Children with Disabilities in Sweden

Curriculum areas (see Table 4.3) are to be identified, when you start developing a curriculum structure for both teachers and students to improve their ICT knowledge and skills. This model provided by UNESCO, gives four curriculum areas tied up with four stages of teaching and learning.⁵⁴

In order to make the instruction clear for students with SEN the appropriate strategies to model new learning environments must be developed. Such new models cannot emerge without apt changes and modifications of all curriculum components, i.e.:

- Content;
- Methods of content delivery;
- Methods of students' progress assessment.

With that in mind, ICT integration in SNE curriculum is described in these primary categories.

⁵³ UNESCO (2004). *Changing Teaching Practices Using Curriculum Differentiation to Respond to Students' Diversity*, Paris. Online: <http://unesdoc.unesco.org/images/0013/001365/136583e.pdf>

⁵⁴ UNESCO (2002). *Information and Communication Technology in Education: a Curriculum for Schools and Programme of Teacher Development*, Paris. Online: <http://unesdoc.unesco.org/images/0012/001295/129538e.pdf>

Table 4.3 Curriculum areas for ICT improvement

Curriculum areas	Characteristics
ICT literacy – ICT skills are taught and learned as a separate subject	The curriculum area covers the use of ICTs as encountered in the daily life of many communities. Specific units include basic concepts of ICTs, using computers and managing files, word processing, spreadsheets, databases, creating presentations, finding information, and communicating with computers; social and ethical issues, jobs using ICTs
Application of ICTs in subject areas – ICT skills are developed within separate subjects	The area of the curriculum covers the application of ICT tools within specific subjects such as languages, natural sciences, mathematics, social sciences, and art. Specific units include measurement, modelling and simulation, robots and feedback devices, statistics, graphics, spreadsheet, and database design
Infusing ICTs across the curriculum – ICTs are integrated or embedded across all subjects of the curriculum	Examples of projects included in this area of the curriculum demonstrate the use of ICTs across subject areas to work on real-world projects and to solve practical problems. Some examples show how, within a particular course, ICTs help students integrate several subject areas, such as mathematics, science, and art. Other examples present larger projects that cut across several subjects, or how a number of schools integrate ICTs in community or global projects
ICT specialization – ICTs are taught and learned as an applied subject to train for profession	The area of the curriculum is designed for students who plan to go into professions that use ICTs, such as engineering, business, and computer science, or for students who plan to advance to higher education. Content covers the use of advanced tools and techniques of an ICT specialist. Specific units include basic and advancing programming, planning information systems, designing process control systems, and project management

Design of SNE curriculum content based on ICT usage

Before we make decisions on how we are going to teach, and what we need to modify, we first need to identify the content. Content is what we teach. Content is what the student is expected to learn, that is, to know, understand or be able to do. It includes facts, concepts, and skills that students will acquire within their learning environment.

UNESCO (2004)
Changing Teaching Practices, Using Curriculum Differentiation to Respond to Students' Diversity

To help students in reaching their learning goals certain arrangements must be undertaken. The first stage of the curriculum design for students with disabilities is identification of meaningful and adequate content. Obtaining the information about individual students is a key to incorporation of the technology in a modified curriculum successfully.

The first point of policy strategy of ICT integration refers to changing the complexity and nature of the content and making it highly flexible and accessible for students. ICT tools support this process, since they increase independence,

personal productivity and empowerment. Technological options transform static curriculum resources into flexible digital media and tools following the principles of a universal design.

Box 4.1 presents key concepts regarding content adaptation for students with disabilities⁵⁵.

Box 4.1 Adapting curriculum content

The third category of adaptations deals with varying what is taught, i.e. the complexity and nature of the content presented in the course of a unit of study. The curriculum adapted in this way adjusts the cognitive demand of a learning task against a particular learner(s).

Adapting curriculum content may include the applications as straightforward as: reduced vocabulary assigned to an individual child; only odd-numbered problems in a mathematics assignment; three facts about one animal to be learned instead of two about each of five different species; or learners' choice of taking a spelling pre-test to opt out of spelling for a particular week. Individualized adaptations of content can, also, be achieved by restructured concept-based teaching. Adjustment of the cognitive demand of a lesson typically involves the adapted requirements of attention, thinking, and/or memory associated with the particular content. In partnership with hierarchical questioning techniques, this approach can result in a larger number of students meaningfully participating in a lesson drawn from the general curriculum.

⁵⁵ Source: Bashinski, S.M. (no date), *The Issues: Adapting the Curriculum to Meet the Needs of Diverse Learners*. Online: <http://www.pbs.org/teachersource/prek2/issues/702issue.htm>

The range of solutions that can help modify a curriculum in this way may vary widely from dedicated communication devices (assistive technologies) to conventional personal computers with designed-in accessibility features, e.g. those found in Microsoft’s Windows operating system.

Development of SNE curriculum delivery methods based on ICT usage

If we accept that all students are different, we need to recognize that their styles of learning are also different. Theories regarding learning styles are numerous, but all share the same idea: individuals learn in different ways. These include the modes used to gather information: observing, reading, listening, and doing. Some students prefer concrete learning, while others feel more comfortable with abstractions. Many students learn best through reading and writing, whereas others learn by listening, speaking, visualizing, or ‘learning by doing’. This approach can help a teacher find the most suitable way of satisfying the unique needs of students. Thus, improvement of learning outcomes can be realized through a wide range of methods supported by varied and differentiated learning materials and resources. In this regard, the modified delivery methods for SNE curriculum must cover *multiple modality* methods of presentation, which can be designed to appeal to kinaesthetic and tactile sensory systems, in contrast to materials addressing visual or auditory processes only.

The table below illustrates main characteristics of three learning styles – visual, auditory, and tactile – and introduces the appropriate ICT-based activities.⁵⁶

Table 4.4 Visual, auditory, and tactile learning styles

Learning style	Characteristics	ICT tools
Visual style	<ul style="list-style-type: none"> • Use visual materials, i.e. pictures, charts, maps, graphs, etc. • Have a clear view of your teachers when they are speaking so you can see their body language and facial expression • Use colour to highlight important points in text • Take notes or ask your teacher to provide handouts • Illustrate your ideas as a picture or brainstorming bubble before writing them down • Write a story and illustrate it • Use multimedia (e.g. computers, videos, and filmstrips) • Study in a quiet place away from verbal disturbances • Read illustrated books • Visualize information as a picture to aid memorization 	ICTs stimulate visual learning with graphics, animations, and simulations. Interactive whiteboards and PowerPoint presentations enable teachers to present concepts in a visual way
Auditory style	<ul style="list-style-type: none"> • Participate in class discussions/debates • Make speeches and presentations • Use a tape recorder during lectures instead of taking notes • Read text out aloud • Create musical jingles to aid memorization • Create mnemonics to aid memorization • Discuss your ideas verbally • Dictate to someone asking them to write down your thoughts • Use verbal analogies, and story telling to demonstrate your point 	Auditory learners prefer to learn through sound and speech. Many PCs and all Tablet PCs can record speech and sound. These files can then be embedded into slides or documents. ICTs encourage conversation-based collaboration, for example, through video conferencing
Tactile style	<ul style="list-style-type: none"> • Take frequent study breaks • Move around to learn new things (e.g., read while on an exercise bike, mould a piece of clay to learn a new concept) • Work in a standing position • Chew gum while studying • Use bright colours to highlight reading material • Dress up your work space with posters • If you wish, listen to music while you study • Skim through reading material to get a rough idea what it is about before settling down to read it in detail 	Kinaesthetic or tactile learners prefer active forms of learning, i.e. writing, drawing, and producing animations, or making models and doing practical experiments. They benefit from using devices that involve touch, like mice and joysticks or a Tablet PC, which enables users to write or draw on a computer using a pen

⁵⁶ Sources:

1. *Learning Styles & Multiple Intelligence*. Online: http://www.ldpride.net/learning_style_work.html
2. *Learning styles and ICT*. Online: <http://www.microsoft.com/uk/education/learning/learning-styles/#visual-learning>

Having in mind the diversity of students' learning styles, it is very important to provide the curriculum content with the means other than traditional written text, i.e. to use alternative ways of material delivery. In this connection, ICT delivery methods must be carefully selected. ICTs offer the potential of delivering personalized curriculum content to individual learners correlated with his/her unique learning needs.

The individual approach based on multiple modality education to be involved, covers not only the methods of presentation, but methods of assessment of students with SEN as well.

Ways of modifying assessment for SNE curriculum based on ICT usage

Achieving positive outcomes for learners with SEN requires effective arrangements for monitoring and evaluating provision. Promoting partnerships between schools, local policy-makers and parents also requires those arrangements to be transparent so that there is greater accountability for the services provided, particularly within a decentralised system. Independent evaluation of the quality of education for learners with SEN should therefore be part of any arrangements for monitoring, evaluation, and accountability.

European Agency for Development in Special Needs Education (2003)
*Key Principles for Special Needs Education
Recommendations for Policy Makers*

The final category to be taken into account refers to alterations in the assessment through which a teacher gets information on the students' learning progress. This component focuses on the methods used to assess whether the students have learned the required concept or skill. By continuously assessing individual differences, teachers can acquire more knowledge about the students, which contributes to their learning profiles. Later this information will assist teachers in understanding when and how to modify the curriculum content, activities, and products for the students. Unfortunately, the guidelines and information resources regarding ICT-based assessment for students with SEN are insufficient.

Assessment is an essential part of effective teaching and learning. Educators need to ensure that the assessment methods are equitable for all students. Concerning students with disabilities it may mean equitable opportunity to demonstrate their learning outcomes.

Meanwhile, ordinary methods of assessment are usually inadequate for students with disabilities due to their inability to access and perceive the test material or carry out a response (Abedi, Leon, & Mirocha, 2001; Sireci, Li, & Scarpati, 2003; etc.). Therefore, the prime attention must focus on providing highly flexible and customizable assessment environments for such students. In this regard, ICTs are seen as the most appropriate instrument to assess the modification of SNE curriculum.

At the same time, assessments designed and implemented for students with disabilities should be aligned with national content standards. In this connection, alternative ICT-based assessments must be of a clearly defined structure, guidelines as to which students may participate, as well as evaluation criteria and procedures.

Special arrangements involve a practical adjustment of how the task is presented and/or how the students are expected to respond in order to demonstrate knowledge and skills. When determining the type of special arrangements required, teachers must consider the student's individual needs. For example, not all students with disabilities, learning difficulties, and learning disabilities may require additional time for an examination. When making such decisions principals and teachers should request advice from specialist teachers in the impairment area (AVT or Support Teacher), Support Teachers: Learning difficulties and learning disabilities and Speech-language pathologists.

Education Queensland
Guidelines for Special Consideration in Assessment

UNESCO research conducted in 2004, gives the examples of key assessments used to help teachers differentiate the curriculum in response to the particular learning needs of their students. It suggests that to gain "the best results when learning about students' profiles, teachers should invite students to work together in their assessment. The types of assessment we will look at are as follows: observing students, entry level indicators, error analysis, record keeping (anecdotal records, portfolios/folders, and journaling), performance assessments, and student-led conferences."⁵⁷

In order to provide the appropriate assessment for students with diverse needs, policy-makers must consider and integrate in practice suitable principles of assessment arrangements. To this end, the primary attention focuses on the

⁵⁷ Source: UNESCO (2004). *Changing Teaching Practice Using Curriculum Differentiation to Respond to Students' Diversity*. Paris. Online: <http://unesdoc.unesco.org/images/0013/001365/136583e.pdf>

development of assessment methods that do not discriminate against people with disabilities. This is particularly applicable in the design of any kind of automated or online assessments for students with SEN.

The principles of assessment for students with SEN developed by the national awarding body for Scotland, Scottish Qualifications Authority (SQA), are summarized in the box below⁵⁸.

Box 4.2 Assessment principles for students with SEN

1. Candidates with disabilities and/or additional support needs, for whom adjustments are requested, should be potentially able to achieve the national standards but unable to do so using the published assessment arrangements.

For some candidates with disabilities and/or additional support needs, accessing the questions in an external examination question paper or presenting written responses may not be possible. Reasonable adjustments, such as the use of assistive technologies or a reader and/or scribe, can be made to alleviate a candidate's substantial disadvantage. The aim, wherever possible, is to change the delivery or method of the assessment to make it accessible without compromising the standards.

2. Any adjustment to the published assessment arrangement should not compensate for a candidate's inability to meet the set standards. There should be no change to the published assessment criteria which state the standards for a Unit or Course.

Centres have a responsibility to ensure that a candidate is entered for a qualification which is at the right level, given his/her general level of ability and attainment. SQA has a responsibility to ensure that the process of assessment leading to certification of attainment is rigorous and fair. SQA also has a responsibility to ensure that its qualifications are, by design, accessible to as many candidates as possible. This means making key decisions and being clear about the essential skills and competences required for awards.

3. Any adjustment to the published assessment arrangements requested should be tailored to meet the individual needs of candidates.

The individual needs of candidates should be the basis for making a request for an adjustment to the assessment arrangements. As part of the overall support offered to them, candidates with disabilities and/or additional support needs should have an assessment plan, considered subject by subject with no assumption that the same kind or level of support will be required in every case. For example, a candidate with writing difficulties might not be placed at any substantial disadvantage in a subject assessment which involves limited writing, for example, a multiple choice question paper or a practical assessment. However, the same candidate might experience difficulties in an assessment which requires the production of an essay. The test is whether the candidate is placed at a substantial disadvantage.

4. Any adjustment to the assessment arrangements should reflect as much as possible the candidate's normal way of learning and producing work.

The method used to facilitate access to an assessment should usually be the method that has been used by the candidate in the classroom. For example, if a candidate with dyslexia is comfortable with the use of ICT to overcome writing difficulties, it is likely that this should be the requested adjustment (rather than a scribe, for instance) providing it ensures that the candidate is not placed at a substantial disadvantage. However, there may be situations where the method of support in the classroom is different from that requested in an assessment. For example, a candidate might be starting to use ICT to produce work but not feel confident enough to use them in the external assessment in the time available. Similarly, in a school where resources are limited, access to a reader or scribe on a regular basis might not be possible and other strategies would have to be used to overcome the difficulties — work might be done in the Learning Support base, or the subject lecturer might have to dedicate individual time to the candidate.

⁵⁸ Scottish Qualifications Authority (2003-2004). *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*. Hanover House, Glasgow. Online: http://www.sqa.org.uk/files_ccc/Alt_Assessment_Arrangements_final.pdf

Additionally, it must be noted that ICTs in the sphere of special education must be in the focus of specialist training. It is unreasonable to expect teachers to use ICTs effectively in special needs education if they are initially untrained in ICTs. Consequently, appropriate teachers' training is one of the most promising ways to improve the provision of students with disabilities with genuine access to the curriculum.

4.2.3 Training and Retraining of ICT Specialists in SNE

Political, cultural, technological, and economic changes in a society determine continual development of learning advances and competencies needed to live actively in Knowledge and Lifelong Learning society. The new societal demands impact the teaching, therefore, must go along with the teacher's role as a subject specialist and expert in corresponding content. Hence, the role of a teacher in Knowledge society can be characterized by "greater levels of social cohesion and more active citizenship practice and the competencies they require in order to effectively respond to these changed dimensions."⁵⁹

As there are very many people with SEN, Inclusive Society is heterogeneous. In the first instance, the diversity of individual learning needs is affected: it requires the educators' ability to teach based on a variety of academic and behavioural features. Therefore, the staff involved in special education, have to master different vocational knowledge and skills to analyse carefully every learning situation, choice of objectives, applications of educational means and methods, monitoring and evaluation of learning progress, and personal or collective reflection of the process.

Modern technological devices applied in special education to improve the learning outcomes require the specialists' experience and qualification to be enriched continually, a wider access to more expert knowledge, guidance, and professional advice to provide for individual-based education. Special programmes to train and retrain ICT specialists involved in education of people with SEN are of paramount importance to keep the staff informed on progressive inventions and abreast with the world developments.

The currently broadened ICT capabilities encourage the students to compensate for functional limitations and to enhance acquisition and mastering of academic skills (Peterson-Karlan, 2003). In this connection, according to Bray, Brown, and Green (2004), all technologies to support diverse learners can be divided in two major categories: assistive/adaptive and learning support. Assistive/adaptive technologies make something physically accessible that would otherwise be inaccessible (e.g. screen magnifiers, voice-recognition software, and modified mice or keyboards), while learning support technologies assist learners through remediation, compensation, or extension.

Evidently, the technologies can be powerful tools of students' education; however, their value depends on how efficiently teachers employ them to support instructions. Accordingly, qualitative education of students with disabilities who fail to benefit from regular school education is impossible without appropriate teachers' training allowing them to integrate new technologies easily and effectively in their daily practice. In order to accomplish the required teachers' training both common-core and cross-disciplinary educations are required. Common-core education gives basic knowledge and skills in the field of ICT usage in SNE, while cross-disciplinary education – awareness and some practical knowledge of non-professional background (e.g. medicine, social economy, and technology).

Let alone other trends of training, the planning must carefully correlate with the skills and competencies of the target group of specialists. Perfected skills will help teachers gain the proficiency in new learning environment of Digital Age.

Among the policy trends in training of ICT specialists in SNE the following are of prime importance:

- Identification of requirements and quality standards of training ICT specialists in SNE;

Support for individual teachers in using special ICTs can be provided at national, regional, local, school, or colleague levels. While this can lead to a range of flexible information, advice, and practical support services, it also presents problems in terms of split responsibilities, difficulties in accessing funding and potential lack of coordination in provision of services. Coordination and rationalisation of support, based on clear information about needs and requirements of teachers and their pupils, appear to be very important.

European Agency for Development in Special Needs Education (2003)
Special Needs Education in Europe
Thematic Publication

⁵⁹ European Commission (2003). *Implementation of "Education & Training 2010" Work Programme*. Progress Report. Online: http://europa.eu.int/comm/education/policies/2010/doc/working-group-report_en.pdf

- Development of special teachers' training programmes;
- Promotion of service delivery methods and suitable conditions to implement teachers' training programmes;
- Monitoring and evaluation to upgrade a training policy.

To work out consistent and reliable teachers' training programmes, educational requirements and quality standards must be identified. On the one hand, it is assumed that requirements for ICT specialists in SNE must satisfy the quality standards of professional teachers' excellence (including the excellence of special needs teachers); on the other, they should meet the technology standards of teachers' excellence. Some countries are very experienced in this field. For example, the USA has established National Board for Professional Teaching Standards (NBPTS)⁶⁰ in charge of the quality of teaching and learning. Box 4.2 summarises major recommendations of the specialists from this organisation.⁶¹

Box 4.3 Recommendations on standards of professional teaching excellence

National Board for Professional Teaching Standards seeks to identify and recognize teachers who effectively enhance student learning and demonstrate high level of knowledge, skills, abilities, and commitments reflected in the following five core propositions.

Proposition 1: Teachers are committed to students and their learning

- Teachers recognize individual differences in their students and adjust the practices accordingly
- Teachers have an understanding of how students develop and learn
- Teachers treat students equitably
- Teachers' mission extends beyond developing the cognitive capacity of their students

Proposition 2: Teachers know the subjects they teach and how to teach the subjects

- Teachers know how knowledge of their subjects is created, organized, and linked with other disciplines
- Teachers have a command of techniques how to convey a subject to students
- Teachers generate multiple paths to gain knowledge

Proposition 3: Teachers are responsible for managing and monitoring students' learning

- Teachers call on multiple methods to meet the goals
- Teachers orchestrate learning in group settings
- Teachers place a premium on students' engagement
- Teachers regularly assess students' progress
- Teachers are mindful of the principal objectives

Proposition 4: Teachers systematically estimate their practice and learn from experience

- Teachers continually make difficult choices to test their judgment
- Teachers seek the advice of others and draw on educational research and scholarship to advance practice

Proposition 5: Teachers are members of learning communities

- Teachers contribute to effective schooling via professional collaboration
- Teachers cooperate with parents
- Teachers take advantage of community resources

Wide spread of ICTs and their large potential in the field of education have resulted in the technology integration in the programmes of professional teacher training. In the USA major of ICT standards applied to teachers' education, including SNE, are developed by International Society for Technology in Education (ISTE) and adopted by the national organizations to support technology integration in professional teachers' training programmes.⁶²

⁶⁰ For additional information see <http://www.nbpts.org/about/coreprops.cfm>

⁶¹ The data is from the NBPTS website <http://www.nbpts.org/about/coreprops.cfm>

⁶² Sources:

1. International Society for Technology in Education (2004). *ISTE/NCATE Program Standards*. Retrieved February 19, 2004 from www.cnets.iste.org/ncaten_overview.html
2. International Society for Technology in Education (2004). *The National Educational Technology Standards Project*. Retrieved February 19, 2004 from www.cnets.iste.org

Table 4.5 presents the categories of current technology standards in the USA with the links to sites containing specific information on these standards.⁶³

Table 4.5 Technology standards related to teachers training

National Educational Technology Standards (NETS) ⁶⁴	ITPS-9: Assistive Technology Standard (All teacher education candidates) ⁶⁵	Core Technology Standards (ISU) ⁶⁶	Advanced Technology Standards (ISU) ⁶⁷
<ul style="list-style-type: none"> • Demonstrate sound understanding of technology operations and concepts • Plan and design effective learning environments and experiences supported by technology • Implement curriculum plans as well as methods and strategies of applying technology to maximize students' learning • Apply technology to facilitate a variety of effective assessment and evaluation strategies • Use technology to enhance productivity and professional practice • Understand social, ethical, legal, and human issues of technology use in PK-12 schools⁶⁸ and apply these principles in practice 	<ul style="list-style-type: none"> • Demonstrates the ability to use a range of AT to work effectively and equitably with disabled students 	<p>The following presents a synthesis of knowledge and performance standards:</p> <ul style="list-style-type: none"> • Understand legal, educational, and societal issues regarding technology and AT • Demonstrate skills using a range of AT devices or materials, educational software, and AT product systems that promote accessibility and independence • Understand roles of special educators, related service providers, general educators, and families in collaborative service delivery addressing assessment, selection, and matching to learner's needs and preferences • Understand potential funding sources, implementation of AT, curriculum integration, and periodic evaluation associated with assistive technology provided in K-12⁶⁹ learning environments 	<p>The following presents a synthesis of knowledge and performance standards:</p> <ul style="list-style-type: none"> • Understand AT concepts and relationship to diversity, educational technology use, assessment, diagnosis, evaluation, equity; ethical, legal, and human issues • Understand and use AT funding sources and processes of acquisition, maintenance, security, and ergonomic implementation • Develop personal philosophy and goals of using technology in special education • Match a learner, technology, tasks, and environmental factors via team activities to determine a need of comprehensive assistive or instructional technology evaluation • Utilize best-practice strategies to acquire information and technology with subsequent effective implementation in a classroom, including data management strategies with students/others to master and maintain AT • Provide culturally-sensitive technology to students receiving instruction in regular classrooms, professionals, and family members • Participate in best-practice AT teaming and advocacy activities, including the in-service training • Maintain AT professional knowledge and skills

⁶³ Source: Wojcik, B.W., Peterson-Karlan, G., Watts, E.H., and Parette, P. (2004). Assistive Technology Outcomes in a Teacher Education Curriculum. *Assistive Technology Outcomes and Benefits*. Fall 2004, Vol. 1(1). Online: <http://www.atia.org/atob/ATOBWeb/ATOBV1N1/Documents/ATOBV1N1A4.pdf>

⁶⁴ <http://cnets.iste.org/>

⁶⁵ <http://www.itps.ilstu.edu/>

⁶⁶ <http://www.isbe.net/>

⁶⁷ <http://www.isbe.net/> and <http://www.cec.sped.org/>

⁶⁸ PK-12 (from pre-kindergarten till 12th grade): a common term in the US Education system. Early childhood education generally refers to the education of infants and children prior to formal schooling in the first grade. Other terms commonly used in the United States at this education level are kindergarten, nursery school, and pre-school. The age range thus covered is 3-6 year olds.

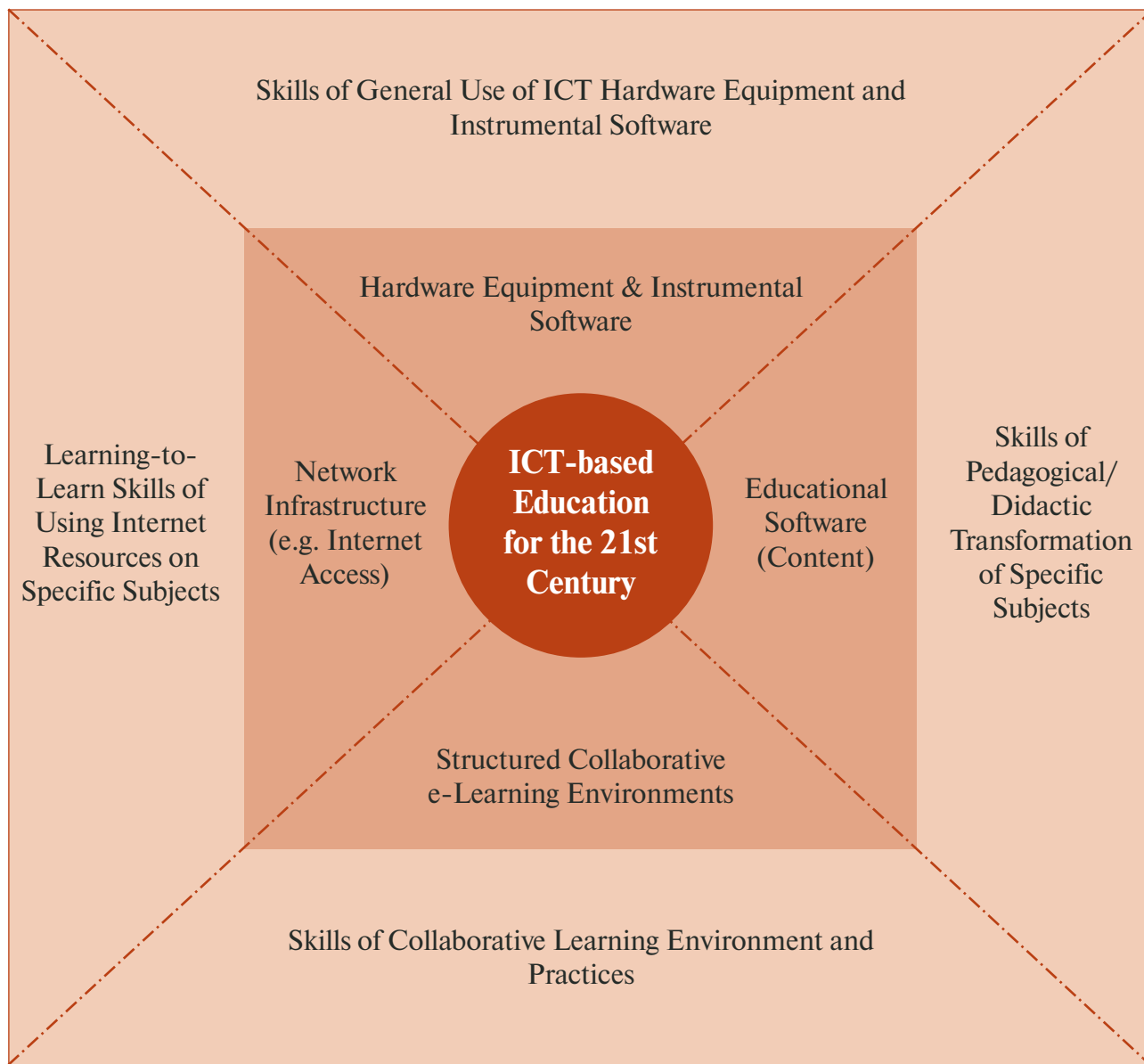
⁶⁹ K-12 (from kindergarten till 12th grade): a common term in US Education system. Elementary and secondary education in the United States generally spans 12 academic years, or grades.

The variety of above-mentioned pedagogical and technical standards must be included in *special teachers' training programmes*.

To elaborate the teachers' training programmes meeting the demands of Digital Age and relating to key principles of inclusion-oriented pedagogy, a comprehensive model of teachers' training must be worked out, which will define basic ICT-based educational/pedagogical skills of ICT specialists teaching students with disabilities.

The figure below illustrates ICT-based educational/pedagogical skills to be included in the model⁷⁰.

Figure 4.2 ICT-based educational/pedagogical skills



Firstly, basic and advanced training must be provided for 'no-tech' or 'low-tech' audience. Secondly, training initiatives will encourage special programmes to emerge regarding the application of appropriate AT devices and introduction of new didactical approaches to new learning environments. In this connection, training initiatives must differ in thematic scopes according to the goals to be achieved. Some programmes narrowly focus on ICT skills, while others treat ICT only as a tool of gaining educational goals.

⁷⁰ The scheme is from the research of A. Molina *ICT-based Education for the 21st Century*. Online: http://www.gioventudigitale.net/_doc/Breaking%20Down%20Barriers%20and%20Walls.pdf

Appropriate and flexible forms of support for teachers working with learners with SEN should be the aim and result of policies. The availability of support from specialised teachers plays a crucial part, as it cannot be expected that all classroom teachers have the knowledge and expertise to meet every specific need. Policy makers must ensure that the content of teacher support systems is diverse and responsive to local level and individual needs.

European Agency
for Development in Special Needs
Education (2003)
*Key Principles for Special Needs
Education Recommendations
for Policy Makers*

Anyway, in all scenarios, training must aim at helping teachers include ICTs in their daily practice and individual plans of students specifically. In addition, any training to use ICTs must cover methodology, didactics, and organisation of learning with clear links between theory and practice.

Adequate support is crucial for teachers involved in SNE if they are to use ICTs to meet individual students' needs. Limited or lacking access to certain facilities may hinder the equality of educational opportunities for people with SEN, thus inhibit the inclusion.

To realise proper conditions of teachers' training in the field of special education, the measures like incentives, capacity-building, and technical assistance must be put in effect.

There exists a variety of ICT support arrangements in special needs education: services, centres, resources, and personnel being politically directed and practically facilitated in the countries.

The report of *European Agency for Development in Special Needs Education* specifies support structures offering inter-related ICT services for teachers working in SNE⁷¹:

- National agencies for ICTs in education.
- Support services working directly with teachers and students.
- Resource centres where teachers receive advice, materials, and information.
- Regional working groups.
- Web sites and online networks.
- In-school support.

It is very important to review and renew teachers' training programmes continually to ensure that they meet the changing expectations and take advantage of the opportunities offered for teaching and learning by ever more powerful technologies.

Therefore, careful *monitoring and evaluation* are needed. In this regard, policy- and decision-makers must focus their attention on granting that teachers receive the knowledge and skills adequate to teacher's changing roles and working conditions assist teachers in performing their roles. Specific information about special education teachers' progress in ICT application in their practice can help policy- and decision-makers plan appropriate professional development activities.

Continued attention is to be paid to the following in the training policy: *identification of guiding assessment principles and development of evaluation strategy*.

Appropriate assessment is essential in successful implementation of policy measures. Without this data policy- and decision-makers will remain unaware of how their actions support the accomplishment of qualitative training of ICT specialists in SNE.

In order to monitor the policy in the field of teachers' training efficiently, the principles of assessment must be analysed and introduced in practice. Some principles of assessment developed by NBPTS⁷² for teacher trainers are summarized in Box 4.4.

⁷¹ European Agency for Development in Special Needs Education (2001). *Information and Communication Technology (ICT) in Special Needs Education (SNE)*. Online: http://www.european-agency.org/ict_sen_db/docs/ict_in_sne_sum.doc

⁷² <http://www.nbpts.org/standards/dev.cfm#pilot>

Box 4.4 NBPTS principles of assessment for teacher trainers

Teacher Assessment Development Teams, comprised of accomplished teachers in the field, standards committee members and National Board staff, work with a general contractor for assessment development to develop assessment exercises and pilot tests them with groups of teachers active in the field in question.

The National Board's assessments are based on standards that define accomplished teaching for the content area and development level of students. All NBPTS standards share a common vision of accomplished teaching, one that values conscious and deliberate pedagogical decisions that are based on a deep knowledge of the particulars of content and context. The underlying principles in the assessment development process are that:

- tasks should be authentic and, therefore, complex;
- tasks should be open-ended, allowing teachers to show their own practice;
- tasks should provide ample opportunity and encouragement for analysis and reflection;
- subject-matter knowledge should underline all performance;
- tasks should encourage teachers to exemplify good practice;
- each task should assess a cluster of standards;
- each standard should be assessed by more than one task.

In its assessment development work, the National Board uses technology for assessment, where appropriate; ensures broad representation, in all stages of the process, of the diversity that exists within the profession; engages pertinent disciplinary and specialty associations at key points in the process; collaborates closely with appropriate state agencies, academic institutions, and independent research and education organizations; establishes procedures to detect and eliminate instances of external and internal bias with respect to age, gender, and racial and ethnic background of teacher candidates; and elects the method exhibiting the least adverse impact when given a choice among equally valid assessments. The National Board strives to assure that every assessment meets five requirements known as the APPLE criteria:

- Administratively feasible
- Professionally credible
- Publicly acceptable
- Legally defensible
- Economically affordable

The following step toward efficient monitoring and evaluation of the training process is expected to form an *evaluation strategy*. Although some promising models of evaluation strategy are elaborated, it should be noted that there is still insufficient evidence that the policy measures taken are ample to encourage special needs education regarding the training of specialists capable of using the ICTs effectively.

Box 4.5 shows the model of evaluation strategy which represents consequential steps of the evaluation process and can be useful in fostering ICT policy in SNE.⁷³

Box 4.5 Model of evaluation strategy

The following model of an evaluation strategy developed by D. Baume and C. Baume (1995), though based on a more general educational evaluation mode proposed by Nevo (1986), represents a ten-stage evaluation process:

1. Identify the **object(s) to be evaluated**. What you wish to evaluate may be a policy, a development unit or service, a programme, an event, activity, or a project.

⁷³ Source: Baume, D. (2003). Monitoring and Evaluating Staff and Educational Development. In *A Guide to Staff and Educational Development*. Kahn, P. and Baume, D. London, Kogan Page.

2. Identify the main **stakeholders** in the objects(s) to be evaluated. The main stakeholder groups are likely to be intended clients and users of the development activity, and their managers, policy-makers, staff development unit managers, individual developers, and project staff.
3. Identify the **questions or concerns** of each major stakeholder or group. A good way to identify their questions or concerns is to ask them!
4. A particularly valuable step is to go beyond stakeholder questions to stakeholder **criteria for a satisfactory answer to the questions**. For example:
 - How much are the expressed stakeholders' needs satisfied?
 - How far are broader institutional or national policy goals achieved or supported?
 - How are agreed standards, norms, and processes met and followed?
 - How effective are the methods compared to other possible methods?
5. Plan and pilot the **methods and instruments** to be used.
6. **Carry out** the evaluation.
7. Seek to **understand** the object(s) being evaluated, to make sense of why what was done had the effect it had.
8. **Report to stakeholders** on answers to their questions and concerns.
9. **Change staff and educational develop practice** as appropriate.
10. Periodically **review** evaluation methods and processes.

Thus, the training of ICT specialists capable of delivering appropriate services to students with disabilities is a complex issue requiring systematic support and commitment.

Summary

- ◆ Main role of ICTs in a special needs education setting can be considered to meet a variety of individual learners' needs via an appropriate technical infrastructure. Any educational activity - planning a curriculum, delivering instruction material, managing assessment, and communicating with students - can be extended and enhanced through the use of appropriate learning platforms.
- ◆ Promoting ICT infrastructure for special education should be based on the design principles (which drive technology) and the functional criteria by which technology can help specialists improve learning environments: usability, accessibility, flexibility, affordability, and cost-effectiveness.
- ◆ Students with disabilities have a range of skills and needs, therefore, require a variety of teaching and assessment strategies. In this regard, a special needs policy must primarily focus on curriculum planning and monitoring of students' progress.
- ◆ A curriculum that takes a diversity of students needs into account, first of all, must be *flexible and adaptable, though with preserved content*. It should be designed with the general goal of reducing environmental barriers for students who may be disadvantaged in mainstream education.
- ◆ Integration of ICTs in SNE curriculum must be carefully elaborated in its every component: content, methods of content delivery and reception (methods of teaching and learning), and methods of students' progress assessment.
- ◆ Staff involved in special education have to have varied vocational knowledge and skills to analyse carefully each learning situation, choice of objectives, application of suitable educational means and methods, monitoring and evaluation of learning progress, and personal or collective reflection on the process.
- ◆ Application of modern technological devices in special education to perfect learning outcomes requires continual upgrade of specialists' experience and qualifications, access to more expert knowledge, guidance, and professional advice to provide individual education.
- ◆ Among policy trends in training of ICT specialists in SNE the following are of prime importance: identification of requirements and quality standards; development of special teachers' training programmes; promotion of appropriate service delivery methods and suitable conditions to implement teachers' training programmes; monitoring and evaluation to improve a training policy.

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 4.2

- 1.1 List main components of ICT infrastructure in special education.
- 1.2 Name principles and functional criteria for ICT integration in SNE. Discuss whether all principles are used in the educational policy of your country/region.
- 1.3 List the main phases that make up the ICT infrastructure delivery system. Compare this model with the experience of your own country/region in this field.
- 1.4 Characterize possible changes in every curriculum component for successful ICT integration in SNE. Give examples based on the pedagogical approaches developed in your country/region.
- 1.5 Define main policy trends in training of ICT specialists in SNE. Determine the policy trends that must be reinforced in your national/regional policy context.
- 1.6 Compare main requirements and quality standards of training ICT specialists in SNE in the USA with your country/region.

2. Self – assessment questions for Unit 4.2

- 2.1 Which of design principles assumes that technologies should be tailored to various user needs?
 - a. Usability.
 - b. Accessibility.
 - c. Flexibility.
- 2.2 For which kind of learning styles will a conversation-based collaboration (e.g. through video conferencing) be an appropriate tool to delivery the curriculum content?
 - a. Visual.
 - b. Auditory.
 - c. Tactile.
- 2.3 Which requirements must the assignments designed for students with disabilities meet?
 - a. The assignments must be aligned with national content standards for students without disabilities.
 - b. The assignments must be highly flexible and customizable.
 - c. The assignments must be based on methods that do not discriminate against people with disabilities and be compatible with the national content standards.
- 2.4 Which quality standards must ICT specialists in SNE satisfy?
 - a. Professional teachers' excellence (including excellence of special needs teachers).
 - b. Technology standards of teachers' excellence.
 - c. Both professional and technology standards of teachers' excellence.

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UNIT 4.3 Monitoring of ICT Usage in SNE

Objectives

Upon completing the unit you will know the importance of:

1. How to identify quality standards of SNE in Digital Age.
2. Conditions of SNE quality improvement by means of ICTs.
3. Analysis and interpretation of evaluation results to improve ICT policy in SNE.

4.3.1 Identifying SNE Quality Standards in Digital Age

An inevitable consequence of increasing globalization and restructuring of political and economic systems in the world is the grown requirements of knowledge and information. This, in turn, has generated new demands on education in terms of structure, function, curriculum, and approach. High status of education in economic and social development is shaped by the central role of knowledge in Information Society, where it is not only the means of social evolution and improvement but a positive product of the economy. In this regard, the level of social development is directly linked with the education quality, which dictates the rules of knowledge accumulation and exchange.

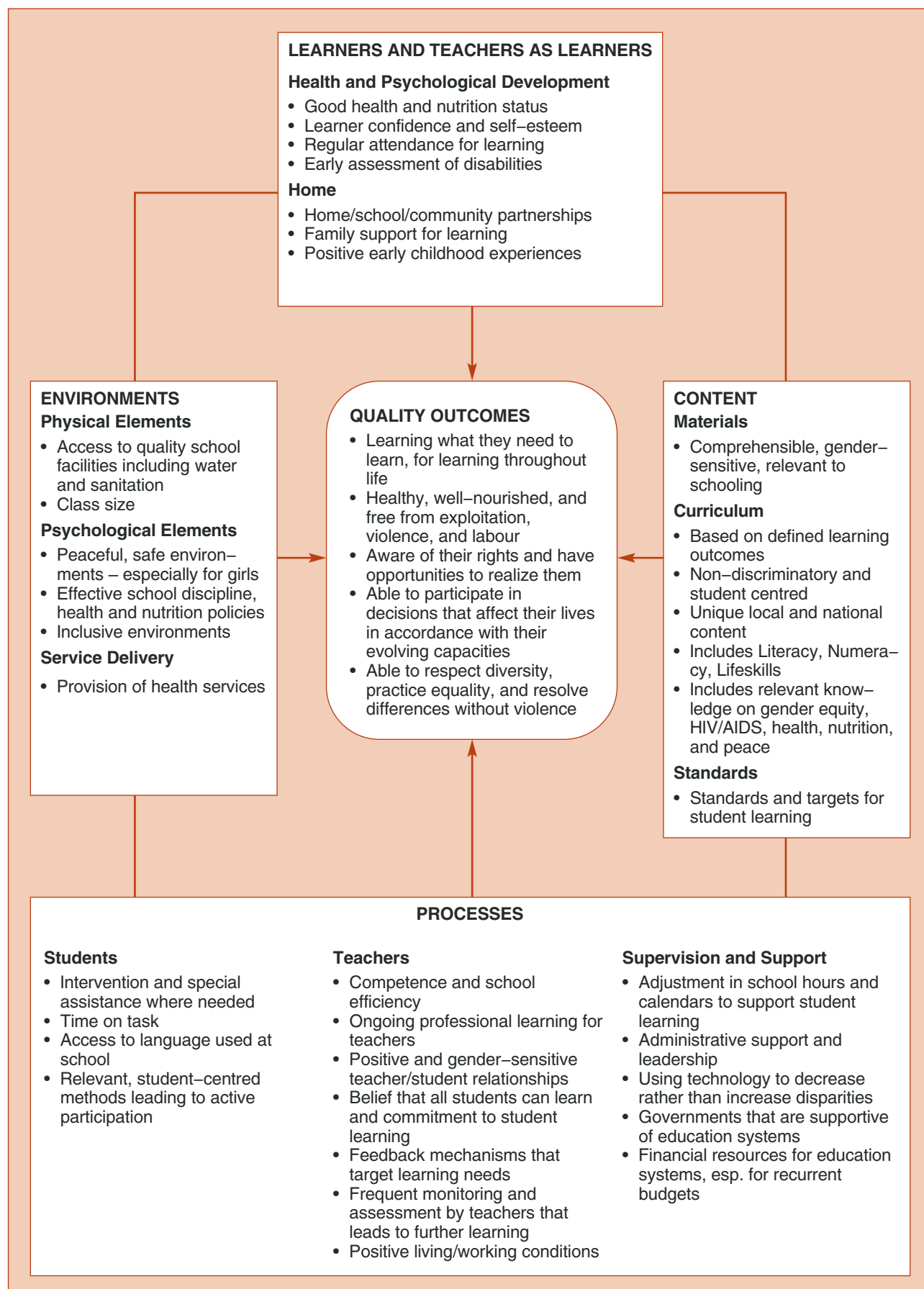
In spite of the growing unanimity on the need to perfect the quality of education, there is much less agreement on what the term actually means. Many definitions of quality education exist, testifying to the complexity and multi-faceted nature of the concept. The terms *efficiency*, *effectiveness*, *equity*, and *quality* have often been used synonymously (Adams, 1993). *Education for All Global Monitoring Report 2005*⁷⁴ stated three principles regarding the approaches to quality in education - “the need for more relevance, for greater equity of access and outcome, and for proper observance of individual rights.”

UNICEF research undertaken in 2000⁷⁵ reported that main dimensions of quality in the context of education cover five basic components: learners, environments, content, processes, and outcomes. Figure 4.3 illustrates the UNICEF ‘rights-based approach’ to quality in education.

⁷⁴ UNESCO (2005). *Education for All Global Monitoring Report*. Online: http://portal.unesco.org/education/en/ev.php-URL_ID=35939&URL_DO=DO_TOPIC&URL_SECTION=201.html

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Figure 4.3 UNICEF approach to quality in education



Education for All Global Monitoring Report 2005 informs on the evolution of UNESCO understanding of education quality. Brief description of its position is given in Box 4.6.

Box 4.6 Evolution of UNESCO concept of quality

One of UNESCO's first position statements on quality in education appeared in *Learning to Be: The World of Education Today and Tomorrow*, the report of International Commission on the Development of Education chaired by the former French minister Edgar Faure. The commission identified the fundamental goal of social change as the eradication of inequality and establishment of an equitable democracy. Consequently, it reported, "the aim and content of education must be recreated, to allow both for the new features of society and the new features of democracy" (Faure et al., 1972: xxvi). The notions of 'lifelong learning' and 'relevance', as stated, were particularly important. The report strongly emphasized the role of science and technology as well. Improving the quality of education, it declared, would require systems in which the principles of scientific development and modernization could be learned in ways that respected learners' socio-cultural contexts.

More than two decades later came *Learning: The Treasure Within*, the report to UNESCO of International Commission on Education for the Twenty-First Century, chaired by another French statesman, Jacques Delors. This commission saw education throughout life as based on four pillars:

- *Learning to know* acknowledges that learners build their knowledge daily, combining indigenous and 'external' elements.
- *Learning to do* focuses on the practical application of what is learned.
- *Learning to live together* addresses the critical skills for a life free from discrimination, where all have equal opportunity to develop themselves, their families, and their communities.
- *Learning to be* emphasizes the skills needed for individuals to develop their potential to the full.

This concept of education provides an integrated and comprehensive view of learning, therefore, of what constitutes education quality (Delors et al., 1996).

The importance of quality education was resolutely reaffirmed as a priority for UNESCO at the Ministerial Round Table on Quality of Education in Paris in 2003.

UNESCO promotes access to quality education as a human right and supports a rights-based approach to all educational activities (Pigozzi, 2004). With this approach, learning is perceived to be affected at two levels. At the level of a *learner*, education needs to seek out and acknowledge learners' prior knowledge, to recognize formal and informal modes, to practice non-discrimination, and to provide a safe and supportive learning environment. At the level of a *learning system*, a support structure is needed to implement policies, enact legislation, and distribute resources and measure learning outcomes to have the best possible impact on learning for all.

Common standards of quality in special education must be based on the above-mentioned non-discriminatory approaches to education, promoted by the international organizations like UN, UNICEF, and UNESCO. In line with such vision, it is assumed that students with disabilities should have the same right to be covered and assessed by national standards of educational quality as other students. Otherwise, it is impossible to evaluate how well public educational settings facilitate the inclusion and serve the needs of such students.

4.3.2 Conditions of SNE Quality Improvement by Means of ICTs

New social demands of the emerging Information Society have changed the traditional paradigm of education. The new environmental context characterized by rapid and ongoing transformations in every sphere of life, creates a fundamentally innovative approach to teaching and learning and establishes other standards of education quality. Inasmuch as Information Society needs competent and knowledgeable citizens, massive efforts should be undertaken

[...] scientific knowledge and professionalism as products of quality education should provide a successful participation of an individual in the development of the evolving societies.

UNESCO IITE (2004)
*Information and Communication Technologies in
 Secondary Education*
 Position paper

to modernize national educational systems, including special education.

To improve the quality of life for people with disabilities and contribute to the economic and cultural development of the society they belong, it is very important to make available the lifelong access to high quality education and training for their vocational, social, and personal needs.

ICTs have become not only the means providing the access to learning but they promote the continuous learning process, which is a base for successful integration of all population groups in Information Society. Digital technologies are now widely available and can be used relatively easily for a range of educational purposes.

In this context ICTs are handy in designing new learning environments with a variety of space, time, portability, connectivity, and flexibility formats for teachers and students. ICTs offer teachers and learners opportunities of creativity in every area of the curriculum through engaging learners in a range of activities, beginning with interactive whiteboards and wireless portable computers and finishing with joint work in virtual spaces exchanging and building ideas and projects. Case-study 4.1 illustrates the approach.

ICTs radically extend possibilities for visualization, including visualization of the invisible, visualization in changed colours and shapes. Colourful images of architecture, sculpture, or painting, grouped thematically and accompanied by well-written texts and beautiful music have a strong emotional effect on the student, develop his or her artistic taste, and at the same time enable the student to learn more about culture, art and nature.

UNESCO at the World Summit on the Information Society (2003)

Case Study 4.1 Digital Technologies Supporting Creativity (UK: England)

1. Aims

At Mere Oaks School in Wigan in the north of England, the art teacher has exploited the power of new digital technologies to enable his pupils, who have physical disabilities and some complex medical needs, to engage in the National Curriculum for English.

The creation of the film was designed to develop a range of skills in a number of areas including English, information and communications technology (ICTs), communication and collaboration. The overall process should support the particular curriculum objectives and enhance and extend the skills of the pupils.

2. Outline

The students at Mere Oaks all have physical disabilities and use ICTs every day to provide them with access to communication and the curriculum. To create digital video they use the technology they would normally use to access communication and to write, such as switches and communication aids. In addition they use new technologies, digital video cameras, and video editing software. This provides on the one hand a challenge but on the other significant motivation to develop their existing skills to access and use these technologies.

Filming involved the use of a tripod to steady the video camera while switch access to the video camera controls allowed pupils to start and stop filming as required. Pupils with limited fine motor skills inevitably found the buttons on a digital video camera and small keyboards difficult to use so alternative access was provided and they were also provided with pre-shot footage to edit.

Pupils exploited the technology available in the school's multi-sensory environment room to produce some of the visual and sound effects for the film. This area is equipped with sensory stimulation equipment, such as light bubble tubes, plastic fibre optics, and sound systems and lighting equipment activated by pressure or motion. Electronic sound equipment was used by the pupils to create the film's soundtrack and musical effects.

The digital video editing software was connected to an interactive whiteboard so that all pupils could participate in the editing and viewing process. To support one another, pupils always worked in pairs. Pupils selected and placed the digital video clips in correct order on the time line, helping to assist in the development of their temporal sequencing skills. They quickly became confident with the video editing software. As part of their record of achievement and to assist the teacher in assessing pupil progression all the pupils kept a record of how each task progressed and completed a self assessment sheet.

3. Outcomes

Pupils’ physical disabilities can often provide barriers to being involved in live performances. Digital video went a considerable way to overcoming that barrier and provided an opportunity for every pupil to be fully included. Using the technology, pupils were able to repeat performances in a non-threatening manner until it was as they wanted it to appear. They could edit and re-sequence activities without the pressure of time constraints a ‘live’ performance can bring. For some pupils the use of slow motion enabled them to give the audience a better understanding of the pupils’ intentions – movements were made fluid and the deliberate intention behind them transparent to the viewer.

The whole experience of film making opened new routes to learning for the children at Mere Oaks. It had an impact on pupils’ learning, from general motivation and engagement to resourcefulness and other generic skills. Digital video supported and encouraged the development of the pupils’ social skills: communicating, negotiating, problem solving, and working together as a team. The children became more literate in the moving image and although they had no previous experience of making films, they quickly became competent and confident with the camera, both in front of it and behind it. Digital video and the task of making a short film, showed significant potential to motivate pupils to develop the technology skills they need every day to access the curriculum.

4. Overview of reasons for inclusion of the case study

This case study of the use of digital video by pupils with complex physical difficulties for creative film making illustrates clearly how powerful technology can be when put in the hands of children. Digital video technology, with the appropriate tasks and skillfully facilitated, can clearly support this learning approach for all pupils. For pupils with special educational needs it provides a real opportunity to be involved and create outcomes of equal quality as their peers.

Source: Information Society Technologies (IST) for Special Educational Needs (SEN) Project.

Online: <http://131.246.30.23/ita/senistnet/cs10.php>

In the context of continuous improvement of quality for different categories of students, UNESCO IITE has focused on defining the appropriate conditions facilitating the key objective of education – successful participation of an individual in the development of the evolving society. To determine the *necessary* and *sufficient conditions* of high quality in special education implies a variety of educational components and aspects of social, economic, and physical context. The box below summarizes the concept of necessary and sufficient conditions which UNESCO IITE developed in 2004.⁷⁶

At present, the issue of providing appropriate conditions for high quality education, including special, has progressively shifted from financing of education

Modern level of ICT development significantly broadens opportunities available to students and teachers for gaining access to educational and professional information; improves operational ability and management effectiveness at specific educational facilities and the educational system in general; facilitates integration of national information educational systems into the world network; considerably assists in accessing international information resources in the areas of education, science, and culture.

UNESCO IITE (2004)
*Information and Communication Technologies
in Secondary Education
Position Paper*

⁷⁶ UNESCO at the World Summit on the Information Society (2003). *Towards Knowledge Societies*. Geneva, Switzerland 10-12 December 2003.

Box 4.7 Necessary and sufficient conditions in education

According to UNESCO IITE, high quality in education depends on the necessary and sufficient conditions to be created.

The necessary conditions include educational components as well equipped classrooms and lecture halls, highly professional administrators in managerial positions in educational institutions, highly qualified teaching personnel, easy access to quality textbooks and professional literature, as well as to modern teaching aids and supplementary information for students and teachers.

The sufficient conditions are related to a person's ability to transform the knowledge and skills received into education, i.e. into a customized system of ethical, cultural, and professional values, and to the ability to apply this system in various areas of intellectual and practical activity.

(economic context) and infrastructure development (physical context) to achievements and competences of teachers and learners (social context). However, these elements are interrelated, and serious deficit of one will lower the quality of others. Therefore, the necessary and sufficient conditions attained will contribute to improved education quality and develop the individual's ability to meet the demands of contemporary society.

In this connection, the modern level of ICTs presents a unique opportunity to perfect the quality of education for people with disabilities creating the necessary and sufficient educational conditions.

Technologies can be a bridge to accessible education for students with special educational needs. The compensatory role of ICTs helps them take an active part in the learning process, in spite of their functional limitations. Modern technologies allow for compensation and even substitution of mental, sensory, and physical activity limitations, thereby realisation of their learning potential. When students with disabilities apply ICTs, they overcome the barriers to learning as they are offered multiple means of receiving curriculum materials in appropriate formats as well as of demonstrating their learning outcomes. In this way ICTs help students develop effective learning strategies suitable for their unique learning needs and engage students in the learning process more. In order to make high quality education accessible for students with disabilities, policy- and decision-makers must focus on the following *necessary conditions*:

- establishment of appropriate ICT infrastructure satisfying the principles of usability, accessibility, flexibility, affordability, and cost-effectiveness;
- modification of curriculum components (including methods of content creation and delivery, ways of students' progress assessment) with due account for educational needs of students;
- training and retraining of ICT specialists in special education to satisfy quality standards of professional teachers' excellence (including excellence of special needs teachers) and meet the technology standards of teachers' excellence.

Therewith, ICT usage in special education becomes a platform for personality development of students with disabilities. The potential of digital technologies to enable new forms of engagement, access, and educational achievement reveals in the interactive access to arts and cultural resources of the Internet and digital television. It is especially important for people with disabilities, as they usually lack the access to works of art and cultural achievements. Such limitations do not contribute to the versatile personality development, which is 'a must' in Information Society requiring active interaction between people, creative processes, knowledge domains, and wider social contexts.

In order to realise the ICT potential in raising the quality of education, including education of students with SEN, adequate policy measures must be worked out, which assume proper assessment of the educational quality. However, the request of system quality assessment can hardly be isolated from various economic aspects that go together in terms of teaching load, equipment, and innovation support. Since many quality aspects are difficult to measure, there are different facts, including quality indicators and descriptive information, to ground on. During the past decade the

countries have expended abundant efforts to develop system quality indicators in their national educational systems. Indicators vary from identification of an average number of students per computer to description of ICT-related learning achievements.

More detailed research of UNESCO IITE shows that systematic analysis and quantifiable measurement are applicable only to the components which describe the necessary conditions of education quality.⁷⁷ In the area of ICT usage in education these indicators constitute several groups, including:

- State documents regulating ICT usage in schools;
- ICT integration in curriculum;
- Hardware of educational institutions;
- Available system and educational software;
- Access to the Internet and global communications;
- Training and upgrading of computer competence of educational personnel.

Assessment of the educational system for people with disabilities must be based on the informative indicators which reflect the special environments and arrangements to improve its quality. For this purpose the above-mentioned system of indicators can be supplemented with a number of relevant components, including:

- characteristics of ICT infrastructure for special education (see Section 4.2.1 of Unit 4.2);
- conformity of curriculum modifications with unique needs of students with disabilities (see Section 4.2.2 of Unit 4.2);
- measurements of specialists' qualification regarding their excellence in education (including excellence in special needs education) and educators' level of excellence in technological area (see Section 4.2.3 of Unit 4.2).

As for the sufficient conditions of quality education, they can be considered only as a result of inter-dependent integral processes of economic, scientific, technological, and cultural development where ICTs play only a partial role.

The present level of education requires the combination of knowledge and skills, i.e. creating, acquiring and sharing, disseminating, delivering, aiding, and appreciating. Inasmuch no two personalities are the same, the diversity of acquired knowledge and experience of an individual forms his/her unique educational profile. Accordingly, evaluation system in some aspects of educational progress can not be limited to the quantitative assessment and will include descriptive methods. In the first place we mean personal characteristics being shaped by education. A personality can be defined by the ability to meet the demands of a contemporary society. So the primary attention regarding the development of quality assessment methods in education must focus on a personality as an imperative of the 21st century.

In this connection, it must be emphasized that the ICTs afford the unique opportunity to facilitate both necessary and sufficient conditions of receiving quality education as well as effectively contribute to harmonization of individual's relations with nature, society as a whole, and its members. Such challenges are of prime importance for people with disabilities, as sometimes they have limited interactions with external entities due to their functional limitations. Among the diversity of inclusive strategies for such people, ICTs have become the most appropriate instrument enabling to develop a holistic view of the world and gain a foothold in Information Society.

4.3.3 Analysis and Interpretation of Evaluation Results to Improve ICT Policy in SNE

Since educational policy must satisfy the demands of Information Society, it needs continual improvement in order to guarantee that the changes correlate with the varying socio-economic environment, on the one hand, and individual needs of people with disabilities, on the other. Educational policy is to be upgraded to create the conditions broadening education and employment options for people with disabilities in order to narrow the social gap between non-disabled and disabled people.

Achieving equal access to ICT-based special education services that satisfy the demands of Information Society may be a challenge without legislation, government funding, or national standards. Furthermore, unambiguous information re-

⁷⁷ UNESCO IITE (2002). *Basic ICT Usage Indicators in Secondary Education in the Baltic and CIS Countries*, Statistical Report. Moscow.

The central issue facing countries in relation to SEN and the use of ICT is the lack of coherent support structures – available to pupils, teachers, parents, and support staff – underpinned by a clear ICT in SNE policy.

European Agency for Development
in Special Needs Education (2001)
*Technology (ICT) in Special Needs Education
(SNE)*

Regarding the strengths and weaknesses of ICT usage in special education should advance technological development as well as the formation and implementation of educational policy in this field. However, information of the correct type, format and focus on different aspects of ICT usage in special education is often unavailable at national and international levels: it may not have been created and disseminated yet.

In this connection, monitoring and evaluation have become the key instruments to uphold ICT policy in special education. Such activities are necessary not only to coordinate and foster policy implementation but to impact the support of human rights for people with disabilities in general.

Monitoring and evaluation has several important *objectives* within ICT policy in SNE:

- Guiding the progress of policy measures.
- Ensuring that policy measures are carried out as planned and that goals are achieved.
- Re-assessing the appropriateness of goals and plans in the light of experience.
- Identifying the benefits and cost-effectiveness of ICT usage in SNE development.
- Improving future policy in the field of ICT usage in SNE.

It is worth noting that the essential objective of obtaining evaluation results is to enable continuous upgrading of ICT policy in SNE, hence, the quality of education for people with SEN. In this regard, it is expected that such improvement will depend not only on accurate feedback information obtained, but on how the evaluation results can be analyzed and introduced to the policy practice. Careful analysis allows reflecting on and learning from the received experience. The analysis and interpretation of evaluation results can be done with relation to the following issues of ICT policy in SNE:

- **Conformity of ICT policy in SNE with an unambiguous philosophy of meeting individual learners' needs and fundamental principles of equality and inclusion**

Policy initiatives in the field of special education are not only about appropriate and accessible learning environment to be created for students with disabilities rather than about a fundamental change in the way we view the diversity in a classroom and in a broader society. In view of the social trends toward inclusion, policy-making must focus on identifying and removing barriers to learning and involvement. However, the barriers go further than technological hurdles of accessibility, inappropriate content or delivery methods of curriculum, negative attitudes to and stereotypes of new educational technologies, etc. Barriers to learning can arise from socio-economic factors (e.g. lack of funding). In this connection, educational policy must focus on moving or removing the barriers to institute Education for All.

- **Reliability of indicators reflecting the development of ICT policy in SNE at all educational levels and areas**

There is a need to promote monitoring and evaluation at all educational levels from pre-schooling to higher and vocational education of people with disabilities. Moreover, in this process all activity areas must be involved, including infrastructure development, curriculum modification, and teachers' training.

- **Conformity of ICT policy in SNE with local socio-economic context, national, and local government policies**

ICT policy in SNE cannot attain its objectives in full without careful account of local conditions, i.e. socio-economic development, labour market, and demography of a country/region. Moreover, any policy initiatives in this field have to be correlated with national legislation and priorities of general government policy.

- **Capacity of ICT policy in SNE to improve national/regional educational strategies in education of people with disabilities, developing standards of educational quality and models of policy implementation**

International experience demonstrates that most fundamental issues regarding the development of educational policy, and much less in the field of special education, cannot be resolved without a continual monitoring of policy

achievements. Careful analysis and interpretation of evaluation results can be a powerful instrument in setting and revising the goals and priorities to reform education of people with disabilities at the governmental level via a national education policy.

Intellectual, organizational, and practical frameworks must be put in place to perfect the ICT policy in SNE. Continual monitoring and evaluation of policy actions must encourage collaborations aiming at progress changes in the complex and multivariate nature of a policy in the area of special education. The necessity of such changes in educational policy is incontrovertible, as they are significant for future empowerment and rising of economic and social status of people with disabilities.

Summary

- ◆ Many definitions of quality education exist, testifying to the complexity and multi-faceted nature of the concept. The terms *efficiency*, *effectiveness*, *equity*, and *quality* have often been used synonymously (Adams, 1993).
- ◆ *Education for All Global Monitoring Report 2005* stated three principles regarding the approaches to quality education as “the need for more relevance, for greater equity of access and outcome, and for proper observance of individual rights”.
- ◆ UNICEF declared that main dimensions of quality in the context of education cover five basic components: *learners*, *environments*, *content*, *processes*, and *outcomes*.
- ◆ Common standards of quality in special education must base on the above-mentioned non-discrimination approaches to education of the international organizations like UN, UNICEF, and UNESCO. In line with such vision, it is assumed that students with disabilities must have the same right to meet the state standards of education quality and to be assessed as other students.
- ◆ In order to improve the quality of life for people with disabilities and contribute to economic and cultural development of the society they belong, it is important to provide appropriate conditions of quality education. The definition of *necessary* and *sufficient conditions* providing for high quality in special education includes a variety of educational components and social, economic, and physical aspects. The conditions will meet the key objective of education – successful participation of an individual in the development of evolving societies.
- ◆ In order to implement ICT potential of improving the quality of education, including education of students with SEN, appropriate policy measures must be developed, which assume suitable quality assessment of an education system. The research of UNESCO IITE shows that systemic analysis and quantifiable measurement are applicable only to the components that describe necessary conditions providing for education quality. The sufficient conditions of quality education are considered only as a result of inter-dependent integral development of economic, scientific, technological, and cultural processes, where ICTs play only partial role.
- ◆ Monitoring and evaluation have become the key instruments of upholding ICT policy in special education. Such activities are necessary not only to coordinate and improve the policy implementation but to influence the support of human rights for people with disabilities.
- ◆ The improvement depends on the accurate feedback obtained, and on how such evaluation results can be analysed and employed in the policy practice.

Assessment

To verify the understanding of the material presented in this unit you are recommended to answer the following questions:

1. Structured essay questions for Unit 4.3

- 1.1 Briefly characterize the essence of approaches toward quality education, developed by the international organizations like UNICEF and UNESCO.
- 1.2 Which international covenants on quality in special education are employed in your country/region? Describe approaches and policy measures regarding the quality in special education in your national context.
- 1.3 Define necessary and sufficient conditions providing high quality in special education according to UNESCO IITE approach. Analyse the situation on the necessary and sufficient conditions in SNE in your country/region. Give examples.
- 1.4 List and briefly characterize the key objectives of monitoring and evaluation of ICT policy in SNE. Discuss whether these objectives are realized in your country/region.

2. Self – assessment questions for Unit 4.3

2.1 Which field of education quality assumes the development of the indicative approach?

- a. Necessary conditions.
- b. Sufficient conditions.
- c. Any field of education quality.

2.2 What policy measures must be developed to define sufficient conditions providing for high education quality?

- a. Indicative approach.
- b. Methods of observation.
- c. Methods of description.

2.3 Which is the key objective of obtaining evaluation results of ICT policy in SNE?

- a. Revisiting the appropriateness of goals and plans in the light of experience.
- b. Identifying the benefits and cost–effectiveness of ICT usage for SNE development.
- c. Continuous improvement of ICT policy in SNE.

2.4 Which potential issues of ICT policy in SNE could not be realized without careful identification and removal of barriers to learning for all people?

- a. Conformity of ICT policy in SNE with an unambiguous philosophy of meeting individual learners' needs and fundamental principles of equality and inclusion.
- b. Conformity of ICT policy in SNE with local socio–economic context, national and local policies.
- c. Capacity of ICT policy in SNE to improve national/regional strategies for education of people with disabilities, developing standards of education quality and models of policy implementation.

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CONCLUSION

Responding to the need of equal opportunities to be provided in education of people with disabilities, thus to open more opportunities of their social inclusion, UNESCO IITE has developed the specialized training course *ICTs in Education for People with Special Needs*.

Primarily the course is to present main creative training options to satisfy the increasing need of new skills and qualifications in Information Society.

Since the ability to acquire, process, store, retrieve, and use information is becoming a critical element of successful learning, the appropriate learning environments must be facilitated for all students, including those with special educational needs. Furthermore, it is important to make training flexible to suit the unique demands of special education and, finally, to improve its quality.

In this regard, the training course gives creative options to develop a totally new paradigm in education, based on equality and accessibility for all. The IITE approach is based on ICT applications: technology-mediated learning has an enormous potential of delivering a unique learning experience to every learner with account of his/her individual characteristics. ICT-based learning environments for students with disabilities have become a vital necessity, as new technology with its revolutionary accessibility features and interactive characteristics is capable of compensating for the lack of natural functions, thus contributing to appropriate learning environments to be created for these students.

However, the ICT implemented is no panacea to all troubles of special education. Through profoundly improving the access to information and supporting communication they can become a powerful key – didactic and communication means – which, in turn, would lay the basis for major progress in personal development allowing the participation of people with SEN in community life.

APPENDIX 1 **List of Abbreviations**

AAATE	Association of the Advancement of Assistive Technology in Europe
AAC	Augmentative and Alternative Communication
ACE	Adaptive Communication Environment (trade mark)
ARATA	Australian Rehabilitation and Assistive Technology Association
AT	Assistive Technologies
ATAG	Authoring Tools Accessibility Guidelines
BECTA	British Educational Communications and Technology Agency
CCTV	Closed Circuit Television
CMS	Content Management Systems
CSS	Cascading Style Sheets
DE	Distance education
DFA	Design For All
EASTIN	European Assistive Technology Information Network
EC	European Commission
EENET	Enabling Education Network
E-mail	Electronic mail
EU	European Union
EUSTAT Project	Empowering USers Through Assistive Technology
HEART Project	Horizontal European Activities in Rehabilitation Technology
HTML	Hypertext Markup Language
ICF	International Classification of Functioning, Disability, and Health
ICIDH	International Classification of Impairments Disabilities, and Handicap
ICTs	Information and communication technologies
IITE	Institute for Information Technologies in Education
INCLUDE	Inclusion of Disabled and Elderly People in Telematics

APPENDIX 1 **List of Abbreviations**

IQ	Intelligence Quotient
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISTE	International Society for Technology in Education
IT	Information technology
ITFS	Instructional Television Fixed Service
MOOs	Multi-User Domain Object Oriented Environments
MPT	Matching Persons and Technology (classification)
OCR	Optical Character Recognition
OFSTED	Office for Standards in Education
PC	Personal computer
PCS	Picture Communication Symbols
RESJA	Rehabilitation Engineering Society of Japan
RESNA	Rehabilitation Engineering and Assistive Technology Society of North America
SAMI	Synchronized Accessible Media Interchange
SDS	Service Delivery system
SEN	Special educational needs
SMIL	Synchronized Multimedia Integration Language
SNE	Special needs education
TDD	Telecommunication Devices for the Deaf (the US name for TTY because they originated in the technology of teletypewriters)
TELEMATE	TELEmatic Multidisciplinary Assistive Technology Education
TTY	Text telephone
UD	Universal design
UN	United Nations
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
VOCA	Voice Output Communication Aid
W3C	World Wide Web Consortium

WAI	Web Accessibility Initiative
WCAG	Web Content Accessibility Guidelines
WHO	World Health Organization
WWW	World Wide Web

APPENDIX 2 **Glossary of Terms**

<i>Alternative keyboards (Keyboard emulators)</i>	Hardware that replaces or works in addition to a standard keyboard. They may be larger than standard keyboards, may have the keys configured differently, or may be set up for one-handed typing. Alternative keyboards must be positioned to meet the specific needs of any user.
<i>Assistive Technology device</i>	Any item, piece of equipment, or product system, whether acquired commercially, modified, or customized that is used to increase, maintain, or improve functional capacities of individuals with disabilities.
<i>Assistive Technology service</i>	Any service that directly assists an individual with a disability in the selection, acquisition, or use of an AT device. ¹ Devices, strategies, services and practices are included under the umbrella-term of AT.
<i>Assistive Technology</i>	Any product or technology-based service that enables disabled or elderly people to reach their full potential in their daily lives, education, work, or leisure. ²
<i>Asynchronous</i>	Communication in which interaction between parties does not take place simultaneously.
<i>Augmentative/Alternative Communication (AAC)</i>	Any communication methodology and code used to enhance or substitute communication for persons who are non-verbal or who have limited functional speech. Communication devices that support the use of AAC are also known as Voice Output Communication Aids (or VOCAs).
<i>Authoring tool</i>	A software application used by teachers and instructional designers to create e-Learning courseware. Types of authoring tools include instructionally focused authoring tools, web authoring and programming tools, template-focused authoring tools, knowledge capture systems, as well as text and media tools.
<i>Braille printer</i>	Hardware that prints documents in Braille on embossed paper through a Braille translation programme.
<i>Braille</i>	The most widely used tactile substitution code for people with visual impairments. Each Braille character consists of a cell of either six or eight dots. Dots 7 and 8 can be used as a part of the character (mostly in European 8 dot Braille) or to show the position of the cursor in the text. They can be used for advanced mathematics work and computer coding too.
<i>Browser</i>	Software that allows a user to find and see information on the Web.
<i>Courseware</i>	A term resulting from the combination of the words ‘course’ and ‘software’ is broadly defined as pre-packaged computer-based educational materials in which the computer mediates the educational experience. This course uses the term specifically to refer to such software as WebCT, BlackBoard, and the like, which facilitate computer-based distance education via the Internet.
<i>Digital divide</i>	A term refers to the gaps between those who can effectively use new information and communication tools, such as the Internet, and those who cannot.

¹ According to the United States Assistive Technology Act of 1998.

² This is the official definition of the AAATE (Association for the Advancement of Assistive Technology in Europe).

<i>Digital inclusion</i>	Several initiatives that work socially and technologically in order to reduce the existing gap in access to information and communication technologies and networks for people with special needs.
<i>Hyper Text Mark-up Language (HTML)</i>	The code used to create a web page.
<i>Hypertext</i>	A document which has been marked up to allow a user to select words or pictures within the document, click on them, and connect to further information.
<i>Inclusive education</i>	A process whereby students, who are in the special education programme, enrol in general education classes. They are officially included in the general education roster and are graded by a common education teacher, while continuing to receive support from a special education teacher.
<i>Information Age</i>	The period of social development when the production of information is more important than the production of physical goods; the service sector is much larger than the manufacturing sector.
<i>Information Society</i>	Characterizes the level of community development being formed as a result of the fusion of information, media and telecommunications, including far-reaching organizational and institutional changes in all aspects of human activity (e.g. workplace, leisure, shopping, commerce, education).
<i>Instructional Television Fixed Service (ITFS)</i>	Microwave-based, high-frequency television used for educational programme delivery.
<i>Integrated Services Digital Network (ISDN)</i>	A telecommunications standard allowing communications channels to carry voice, video and data simultaneously.
<i>Integrative model of disability</i>	This is the model of disability as given in the new World Health Organization's International Classification of Functioning (ICF), in which the biological, social, and psychological aspects of each person are taken into account; the model describes not a special group of persons but all people. It is of inclusive nature, aiming at full participation of each and everyone in the society.
<i>Joystick</i>	A device with four or five directional controls, joysticks can be used for mobility, to drive a wheelchair, or to access computers. Joysticks can be positioned for use with the hand, chin, foot, or head.
<i>Marginalization</i>	The process whereby certain groups suffering deprivation, e.g. the impoverished, unemployed, single parents, and the ones with limited formal education, are pushed to the edge of society where they have little say in decision-making and are denied the means to improve their position.
<i>Medical model of disability</i>	According to the medical model of disability and ageing, people are disabled as a consequence of their own health condition; remedy is found through medication, rehabilitation and surgery, or adaptive aids and equipment. Disability is a personal problem.
<i>Multimedia</i>	Any document which uses multiple forms of communication, such as text, audio, and/or video.
<i>Screen reader</i>	Software that supports the generation of speech or Braille to enable a visually impaired user to navigate the computer screen by having the text spoken out loud or reproduced on a Braille display.

<i>Social exclusion</i>	The process whereby certain groups are pushed to the edge of society and are prevented from participating fully by virtue of their poverty, inadequate education, or life skills. This distances them from job, income, and education opportunities, as well as social and community networks. ³
<i>Social inclusion</i>	Ensuring that the marginalized are <i>not</i> disenfranchised, helping them improve the living standards and well-being.
<i>Social model of disability</i>	In contrast to the medical model, the social model of disability sees people as disabled or enabled by the social context in which they live and develop; changes in the social context or environment can remove or prevent a handicap occurring; thus, disability is a social problem.
<i>Special needs education (SNE)</i>	Specially designed instruction to meet the unique demands of a child with special educational needs, particularly the gifted or the ones with a disability. Support services include classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions.
<i>Speech recognition/ Voice recognition</i>	Software and hardware (microphone) that allows a user to control the computer through spoken commands rather than by a keyboard/mouse.
<i>Speech synthesizer</i>	A device which presents artificial voices and either uses digitally stored vocabulary recorded by humans, or text-to-speech mechanisms that convert spelled text into spoken words.
<i>Students with special educational needs (SEN)</i>	Students who – for a variety of reasons (intellectual, physical, social, psychological) – experience learning difficulties which are more significant than those experienced by the majority of learners of the same age. Such students need special educational help and assistance.
<i>Switch mount</i>	A device that allows a switch to be mounted in a variety of positions. A switch may be attached to a wheelchair and positioned to allow its easy activation. It may be positioned at the head, knee, chin, foot, elbow, or other site.
<i>Switches and switch software</i>	Tools that offer ways to provide input to a computer when a more direct access method, such as a standard keyboard or mouse, is impossible. Switches come in various sizes, shapes, colours, methods of activation, and placement options. An interface device and software are required to connect the switch to the computer and to interpret the operation of the switch. Some programmes have been developed specifically for use with a switch and can employ on-screen scanning. With on-screen scanning, the computer highlights (either by sound, visual cue or both) the options available to a user about what action he or she wants the computer to take. Using these specialized products, when a visual or auditory prompt indicates a desired keyboard or mouse function, the user activates the switch, and the desired function occurs. ⁴
<i>Synchronous</i>	Communication in which interaction between participants is simultaneous.
<i>Talking calculators</i>	Calculating devices that give audio feedback.
<i>Touch screen</i>	A device placed on the computer monitor (or built in it) that allows direct selection or activation of the computer by a touch of the screen.

³ The difference can be made between the notions ‘marginalization’ and ‘exclusion’: those, who are marginalized, are seen as having very limited access to the networks and facilities a society offers for the majority of people, while those, who are excluded, have no access to them at all (Spicker,1998).

⁴ Source: Computer and Web Resources for People with Disabilities, *Alliance for Technology Access*, 3rd Edition, 2000.

<i>Touch-sensitive keyboard</i>	A pressure-sensitive membrane that responds to a touch. It can be fitted with various overlays customized with letters, words, or pictures.
<i>Trackball</i>	A device that looks like an upside-down mouse, with a movable ball on top of a stationary base. The ball can be rotated with a pointing device or hand.
<i>Universal Design</i>	An inclusive and proactive approach seeking to accommodate the diversity of users and usage contexts of interactive products, applications, and services. Universal Design starts from the design phase of the development life-cycle.
<i>Voice recognition technology</i>	See <i>Speech recognition</i> .
<i>World Wide Web (WWW)</i>	A graphical hypertext-based Internet tool that provides access to pages of individuals, businesses, and organizations.

APPENDIX 3 Illustrations of Main Types of Assistive Technologies in Education for People with SEN

1. AT for educational needs of students with physical impairments

Picture 1.1 Trackball

Source: <http://www.oucs.ox.ac.uk/enable/index.xml?style=printable>



Picture 1.2 Key guards

Source: <http://www.gawds.org/show.php?contentid=96>



Picture 1.3 Touch screen

Source: http://cgi.ebay.com/7-VGA-Touch-Screen-TFT-LCD-Car-Home-PC-Monitor_W0QQitemZ5808082177QQcategoryZ67771QQcmdZViewItem



Picture 1.4 Enlarged Keyboard

Source: <http://atto.buffalo.edu/registered/ATBasics/AdaptingComputers/KeyboardOptions/enlarged.php>



2. AT for educational needs of students with visual impairments

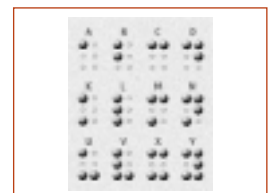
Picture 2.1 Braille watches

Source: <http://www.sadcom.com/pins/watches/Raketa/braille.html>



Picture 2.2 Braille letters

Source: http://www.gesta.org/braille/braille_letters.gif



Picture 2.3 Full colour closed-circuit television (CCTV) system

Source: http://www.visioncue.com/products_07_02.asp



Picture 2.4 Braille display

Source: http://www.tiresias.org/equipment/eb7_b.htm



Picture 2.5 Low-vision software for magnification, screen and document reading

Source: http://www.tiresias.org/equipment/eb7_b.htm



3. AT for educational needs of students with hearing impairments

Picture 3.1 Teletypewriter (TTY) or telecommunications device for the deaf (TDD)

Source: http://www.michdhh.org/assistive_devices/text_telephone.html



Picture 3.2 Wireless Assisted Listening systems for individual usage

Source: <http://www.phonicear.com/learnintrokids.asp>



Picture 3.3 Wireless Assisted Listening systems for batch usage

Source: http://www.listentech.com/solutions/solution_educ-cla-assi.php



Picture 3.4 Software for learning and communicating in American Sign Language

Source: <http://www.abilityhub.com/hearing/>



4. AT for educational needs of students with language and speech impairments

Picture 4.1 Augmentative and Alternative Communication, NON-Customized Vocabulary for Context-Dependent Communication

Source: http://depts.washington.edu/augcomm/01_vocab/vocab3b_non_custom.htm



APPENDIX 3 Illustrations of Main Types of Assistive Technologies in Education for People with SEN

Picture 4.2 Voice Output Communication Aids

Source: <http://cap.becta.org.uk/catalogue/details.php?id=743&PHPSESSID=e7fcd06f406414122b442cc7a46fa8ba>



Picture 4.3 Graphics database of Picture Communication Symbols

Source: <http://www.acciinc.com/software/boardmak.ht>



5. AT for educational needs of students with cognitive impairments

Picture 5.1 Touch-sensitive keyboard

Source: <http://www.nsnet.org/trc/atlibrary/akboards.html>



Picture 5.2 Facilitated keyboard

Source: <http://www.comfyland.com/new/>



Picture 5.3 Specialized picture-based web browser

Source: http://www.ablelinktech.com/_desktop/productview.asp?ID=5



6. AT for the educational needs of students with specific learning impairments

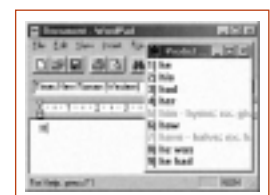
Picture 6.1 Spelling correction software

Source: http://www.no1down.com/Macintosh/BUSINESS/SPELLING_CORRECTOR_.htm



Picture 6.2 Word completion software

Source: <http://www.aurora-systems.com/pages/awin3.html>



Picture 6.3 Planning/Organization Software

Source: <http://www.inspiration.com/>



APPENDIX 4 List of Main Web Resources

General Resources on ICT Applications for Students with SEN

ICT and Special Needs on the Shambles

Shambles web site, which was designed to support the international school communities (teachers, support staff, administrators, students, and families) in 17 countries in South East Asia, contains an extensive list of Internet resources on ICT applications for people with SEN.

<http://www.shambles.net/pages/staff/ITSEN/>

Special Education Resources on the Internet (SERI)

The web site provides a collection of accessible information resources in the Internet for those involved in education of people with disabilities – links are grouped per disability or per issue (psychology, legal, products, parents, etc.).

<http://www.seriweb.com/>

Inclusion and Special Educational Needs on Becta web site

British Educational Communications and Technology Area (Becta) contains a collection of practical and policy support materials on ICT in education of people with SEN.

<http://www.becta.org.uk/teachers/display.cfm?section=1>

The Special Needs Opportunity Windows (SNOW)

The project is a provider of online resources and professional development opportunities for educators and parents of students with special needs. Online workshops, curriculum materials, open discussion forums, and other resources are available to assist people involved in special education in using new technologies to benefit the learners.

<http://snow.utoronto.ca/>

Inclusion and Special Educational Needs

Inclusive Education on the UNESCO Education Portal

The portal contains information on UNESCO's efforts to promote inclusive education policies and practices.

<http://portal.unesco.org/education/>

United Nations and Disability

Primary mission of this international organization is to promote effective measures regarding disability, rehabilitation, and realization of the goals of full participation of the disabled in social life and development on the basis of equality.

<http://www.un.org/esa/socdev/enable/>

International Classification of Functioning, Disability, and Health

The UN World Health Organization gives the detailed typology of people's abilities and disabilities in several languages. The web site contains checklists, training materials, and a guide for beginners.

<http://www3.who.int/icf/icftemplate.cfm>

European Disability Forum

The mission of this European organization (which represents more than 37 million disabled) is to ensure disabled citizens' full access to fundamental human rights through their active involvement in policy development and implementation in the European Union.

<http://www.edf-feph.org/>

Inclusion

The web site provides extensive resource catalogue and comprehensive advice information on inclusion and SEN.

<http://inclusion.ngfl.gov.uk/>

Inclusion in Science Education for Students with Disabilities

This site presents accommodation and inclusive strategies for students with disabilities. Topics are teaching strategies, learning environments, and assistive/adaptive technologies. It also presents related information on Internet resources concerning special education and inclusion.

<http://www.as.wvu.edu/~scidis/>

Assistive Technologies**Association of the Advancement of Assistive Technology in Europe, AAATE**

The primary mission of this scientific and research association is to contribute to knowledge exchange in this field, to promote information dissemination, and to create awareness on AT within European region.

<http://www.aaate.net/>

Australian Rehabilitation and Assistive Technology Association, ARATA

This national association serves a forum on rehabilitation and AT. It contains information and links to a variety of resources relating to rehabilitation and assistive technology, including networking opportunities, research, problem-solving, and education.

<http://www.arata.org.au/>

Center for Applied Special Technology, CAST

This non-profit organization works to expand learning opportunities for all individuals, especially those with disabilities, through research and development of innovative, technology-based educational resources and strategies. The web site contains information on research and a list of ICT options for people with disabilities.

<http://www.cast.org/>

European Assistive Technology Information Network, EASTIN

Some of the best known and most reliable information providers in Europe have united to create what will become the world biggest, most comprehensive information network on assistive technology (AT) serving elderly and disabled people, their families, and carers.

<http://www.eastin.info/>

Rehabilitation Engineering Society of Japan, RESJA

This organization promotes research, education, development, advocacy, and supply of technology to improve the potential of people with disabilities of achieving the goals through the use of technology.

<http://www.resja.org.jp/>

Rehabilitation Engineering and Assistive Technology Society of North America, RESNA

The main purpose of this inter-disciplinary association is to increase the opportunities for people with disabilities to achieve the goals through the use of technology.

<http://www.resna.org/>

Distance Technologies for Special Needs Education**Association on Higher Education and Disability, AHEAD**

The professional association committed to facilitate full participation of people with disabilities in post-secondary education. As an international resource, AHEAD dynamically addresses current and emerging issues on disability, education, and accessibility to reach universal access.

<http://www.ahead.org/>

Equal Access to Software and Information, EASI

It is the premiere provider of online training on accessible information technology for people with disabilities. The web site contains comprehensive information on e-learning accessibility, including description of courseware and content accessibility.

<http://www.rit.edu/~easi/index.htm>

World Wide Web Consortium – Web Content Accessibility Guidelines 1.0

These guidelines explain how to make web content accessible for people with disabilities and are elaborated for web developers (page authors and site designers) and designers of authoring tools. The primary goal of these guidelines is to promote accessibility.

<http://www.w3.org/TR/WAI-WEBCONTENT/>

DO-IT Centre

A project of the University of Washington which helps succeed in academics and careers for individuals with disabilities, sponsors programmes on assistive technology, and hosts professional training for educators and administrators.

<http://www.washington.edu/doi/>

Georgia Tech Research on Accessible Distance Education, GRADE

The goal of the project is to improve the accessibility of distance education for students with disabilities throughout the nation. It informs on training and technical assistance, information dissemination, and research.

<http://www.catea.org/grade/>

WebABLE

The authoritative web site contains disability-related Internet resources with a goal to stimulate education, research, and development of technologies that will ensure accessibility of people with disabilities to advanced information systems and emerging technologies. It has two main sections – *Library* and *Tools and Utilities*.

<http://www.webable.com/>

ICT Policy in Special Needs Education**European Agency for Development in Special Needs Education**

The web site presents comparative information about special (formal) education in 18 countries (EU, EFTA, some PECO countries) participating in it, as well as in-depth, country-specific details and contacts, a variety of publications and reports.

<http://www.european-agency.org/>

ICTs in Education on UNESCO Bangkok web site

The policy component of the UNESCO programme assists countries to elaborate relevant ICTs education policies and strategies through capacity-building initiatives and development of policy tools. UNESCO Bangkok web site contains a section devoted specifically to ICT application in SNE policy.

<http://www.unescobkk.org/index.php?id=494>

SEN and Inclusion on ICT Advice web site

The SEN and inclusion area of the ICT advice web site presents information on how the use of ICTs can support inclusive approaches to meeting the needs of students. The sections *Support for Learning*, *Access and Delivery* contain recommendations on successful ICT implementation in special education.

<http://www.ictadvice.org.uk/>

APPENDIX 5 Suggested Questions and Tasks for Self-Assessment and Final Evaluation

1. Structured essay questions

- 1.1** Define main barriers to learning of a 16-year-old youth with inborn physical impairment (total paralysis of limbs) and speech impairments (articulation and voice disorders). Identify the most appropriate AT and ICT tools that can compensate for or substitute functional limitations. Specify the most appropriate forms and methods of education for such person, including time and place/space conditions as well as major curriculum modifications.
- 1.2** Describe main infrastructure adjustments that would be appropriate to accommodate the needs of a group of 17-21-year-old students with visual impairments. What are the particular factors that must be taken into account?
- 1.3** Name main external and internal barriers to providing inclusive education for students with hearing and specific learning impairments. Define the role of ICTs in facilitating appropriate learning environments for these students.
- 1.4** Compare the legal basis of ICT policy in SNE in your country/region with international examples in this field (in the first instance with legislations of European Union and USA). Define whether your country's law encourages modernization of special educational systems on ICT basis. Work out the recommendations how to improve the legal basis of ICT policy development in the context of special education in your country/region.
- 1.5** Identify main arrangements for special education quality improvements by means of ICTs (in your national/regional context). Determine main stages of ICT policy development; indicate recommended activities and sources of evidence.

2. Self-assessment questions

2.1 The primary role of ICTs in providing inclusive education for students with disabilities consists of the following:

- a. Affording access to training materials for students with disabilities and reducing students' isolation through enhanced communication.
- b. Increasing the efficiency of teachers' and staff training and providing opportunities for support in educational activities.
- c. Facilitating appropriate teaching and learning environments through easier access to information, curricular modifications, and qualitative teachers' training and support.

2.2 Which main problems do students with speech and language impairments meet in reading and writing with the PC?

- a. Adequate input and output of information.
- b. Use of keyboards and a mouse.
- c. Software interface.

2.3 What technologies would be most appropriate to involve students with hearing impairments in video conferencing?

- a. Alternative input devices (to replace keyboards and mice).
- b. Video Relay Services (VRS) or Telecommunication Relay Services (TRS).
- c. Augmentative and Alternative Communication (AAC).

APPENDIX 6 Questionnaire for Specialized Training Course Evaluation

Feedback of experts

Name _____
First name *Last name*

Date and name of the seminar _____

Please evaluate the training course according to the 5-score system (1 – bad, 2 – relatively bad, 3 – satisfactory, 4 – relatively good, 5 – good):

1. Structure of training materials:

1.1 The content of the course explanatory note (objectives of the thematic study, target auditory, the extent of the knowledge given during the training, information about the course authors):

1	2	3	4	5
---	---	---	---	---

1.2 Structuring of the themes under study with indicated duration and forms of work:

1	2	3	4	5
---	---	---	---	---

1.3 List of tasks for practical individual/team work:

1	2	3	4	5
---	---	---	---	---

1.4 Glossary:

1	2	3	4	5
---	---	---	---	---

1.5 List of support literature and web resources:

1	2	3	4	5
---	---	---	---	---

2. Organization of practical activities based on the following:

2.1 Available descriptions of tasks for practical individual/team work that require integrated knowledge and research:

1	2	3	4	5
---	---	---	---	---

2.2 The goals of task performance:

1	2	3	4	5
---	---	---	---	---

2.3 Instructions on the task accomplishment and suggested stages of its development with indicated results for each stage:

1	2	3	4	5
---	---	---	---	---

2.4 Available evaluation criteria for the results of practical work:

1	2	3	4	5
---	---	---	---	---

Feedback of trainees

Name _____
First name *Last name*

Date and name of the seminar _____

Please evaluate the seminar according to the 5-score system (1 – bad, 2 – relatively bad, 3 – satisfactory, 4 – relatively good, 5 – good):

1. Results of the seminar:

1	2	3	4	5
---	---	---	---	---

2. Training materials as follows:

2.1 Amount of the support materials:

1	2	3	4	5
---	---	---	---	---

2.2 Presented methods to evaluate the task accomplishment:

1	2	3	4	5
---	---	---	---	---

2.3 Glossary:

1	2	3	4	5
---	---	---	---	---

2.4 List of support literature and web resources:

1	2	3	4	5
---	---	---	---	---

3. Practical activities of the seminar trainees:

3.1 Instructions on the task accomplishment and suggested stages of its development with indicated results for each stage:

1	2	3	4	5
---	---	---	---	---

3.2 Available evaluation criteria for the results of practical work:

1	2	3	4	5
---	---	---	---	---

3.3 Available instructions and support materials for task development:

1	2	3	4	5
---	---	---	---	---

4. Instructors' ability to adapt course materials in accordance with specific requirements of a team:

4.1 Ability to establish friendly relations with the audience:

1	2	3	4	5
---	---	---	---	---

4.2. Ability to organize the training process, to direct a dialogue, and to involve every member of the team in problem-solving:

1	2	3	4	5
---	---	---	---	---

4.3 Skills of effective self-presentation (particularly, the body language):

1	2	3	4	5
---	---	---	---	---

4.4 Ability to use and combine various training methods (lectures, discussions, case studies, written tasks) and means (video, game playing, etc.):

1	2	3	4	5
---	---	---	---	---

4.5. Ability to analyse and to evaluate the achievements of the team members:

1	2	3	4	5
---	---	---	---	---

5. Organization the seminar (rooms, meals, facilities, coordination):

1	2	3	4	5
---	---	---	---	---

6. What would you suggest to change in seminar organization?

7. Describe the useful practical ideas you received from the training course:
