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UNESCO INSTITUTE FOR INFORMATION TECHNOLOGIES IN EDUCATION

**INFORMATION AND COMMUNICATION
TECHNOLOGY
IN SPECIAL EDUCATION**

Analytical Survey

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**INFORMATION AND COMMUNICATION TECHNOLOGY
IN SPECIAL EDUCATION**
Analytical Survey

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ANALYTICAL SURVEY OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SPECIAL EDUCATION

Executive Summary

Promotion of education is a fundamental objective of UNESCO. 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 their receiving good education.

The most important educational resource is people — teachers. However, it has to be recognized that in the present and the foreseeable future, economic and political restrictions are unlikely to be such that adequate supplies of suitably trained teachers will be available to completely fill the need for them. When human resources are inadequate, it is often easier to procure and provide technological solutions and it is most fortunate that in special education, technology can play a highly beneficial role. Although economic restrictions can affect access to technology, it can represent a good investment.

This document outlines the role that information and communication technology (ICT) can achieve in special education, with the objective of getting it more widely adopted and used in UNESCO Member States. It establishes some definitions and then outlines the role ICT can play in education in three identifiable roles:

Prosthetic

Technology can substitute or compensate for the lack of natural function. This is important for all people with disabilities and has a particular importance in education.

Educational

Again, ICT is growing in importance in all forms of education but can have a particularly valuable role for this with special educational needs.

Communication at a distance

Technology can mediate communication between people with disabilities. Furthermore, where teachers are in short supply (as in special education) distance teaching methods can help to share what expertise there is. A mapping of technologies to communication needs is presented.

Educational and other cultural challenges may be difficult to address because of economic, social and political constraints and sometimes technology is the easiest way around some of those constraints. This is the case in special education where ICT can have a significant role to play and this can apply in many different environments regardless of their level of educational, technological and economic development.

ANALYTICAL SURVEY OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SPECIAL EDUCATION

Preface

In 1988 UNESCO published the Review of the Present Situation of Special Education, presenting information gathered in 1986-1987, covering issues related to policies, legislation, administration and organization, teacher education, financing and provision for special needs education. The Review was widely disseminated and served as a reference to a number of studies, seminars and other national activities.

In view of the incessant demand for information of this nature, reflecting on trends and developments in this domain, UNESCO carried out an up-date of the review in 1993-1994. Ninety Member States were initially contacted to contribute to this exercise, sixty-three of which responded. Replies were received from countries representing the different world regions as follows: thirteen from Africa, seven from Arab States, twenty-one from the Europe Region, thirteen from Latin America and the Caribbean, and nine from Asia and the Pacific.

UNESCO's action also focuses on reducing the educational inequalities to which some groups having only limited access to traditional forms basic education are exposed, such as street children, children who are the victims of war, refugees and displaced persons, the handicapped, and all those who have special educational needs. With the assistance of a variety of partners, the Organization brings together administrators, decision-makers and educators at regional and sub-regional seminars in a bid to come up with answers to the special needs of these children. It provides support for pilot activities, organizes training workshops, fosters exchanges of experience, and produces guides and other types of material to help educators and national officials make better provision for everyone to have equal access to education.

Although some countries have made major strides in education of people with disabilities, the fact remains that, for the majority of countries, especially developing countries, the reality is bleak, both in terms of access and quality education for disabled persons. The findings of the UNESCO survey conducted in 1986/87 revealed that 34 out of the 51 countries supplying information had fewer than 1% of all pupils for whom special educational provision had been made.

The world-wide discrepancy between needs and provision has stimulated a reappraisal of educational strategies. Many countries, after the World Conference on Education for All, are taking steps to enhance services for children with special educational needs within mainstream education and community-based programmes.

The main thrust of UNESCO activities today is on policy and planning and teacher training within mainstream education. To this end, UNESCO organized a series of five regional seminars to mobilize support of education policy- and decision-makers for ensuring wider access for children with special educational needs into the regular school system, and to encourage reorientation of education strategies.

The scarcity of materials and literature at the disposal of teachers, parents, and community workers in developing countries has prompted UNESCO to publish a series entitled «Guides for Special Education». More recently, in connection with training, UNESCO has ventured into the production of video materials for parent education and early intervention.

In 1994, more than 300 participants representing 92 governments and 25 international organizations met in Salamanca, Spain, at the World Conference on Special Needs Education: Access and Quality, to further discuss the objective of Education for All by considering the fundamental policy shifts required to promote the approach of inclusive education. *The Salamanca Statement and Framework for Action on Special Needs Education* adopted unanimously at the Conference, are based on the principle of inclusion that **ordinary schools should accommodate all children, regardless of their physical, intellectual, emotional, social, linguistic or other conditions**. It reaffirms the commitment to Education for All, recognizing the necessity and urgency of providing education for all children, young people and adults.

“Regular schools with this inclusive orientation are the most effective means of combating discriminatory attitudes, creating welcoming communities, building an inclusive society and achieving education for all...”

(Article 2, Salamanca Statement)

“Educational policies at all levels,... should stipulate that children with disabilities should attend their neighbourhood school that is the school that would be attended if the child did not have the disability”

(Article 18 Salamanca Framework for Action)

The Salamanca Statement and Framework for Action called upon UNESCO:

- To ensure that special needs education forms part of every discussion dealing with education for all in various forums;
- To mobilize the support of organizations of the teaching profession in matters related to enhancing teacher education as regards provision for special educational needs;
- To stimulate the academic community to strengthen research and networking and to establish regional centres of information and documentation; also, to serve as a clearing house for such activities and for disseminating the specific results and progress achieved at country level in pursuance of this Statement;
- To mobilize funds through the creation of an expanded programme for inclusive schools and community support, which would enable the launching of pilot projects that showcase new approaches for dissemination and to develop indicators concerning the need for and provision of special needs education.

Furthermore, the 28th Session of the General Conference also invited the Director-General to take steps in ensuring that the concerns of person with disabilities will be reflected throughout the Education Sector Activities, especially in policy and planning, as well as in the Culture and Communication Sectors. It also called for reinforcing the inter-agency collaboration with ILI, UNICEF and WHO.

In pursuance of the implementation of the 28C Resolution 1.5 adopted by the 28th Session of the General Conference, and in line with Article 4 of the Salamanca Statement, UNESCO organized an informal consultation in March 1995 with Denmark, Finland, the Netherlands, Norway, Portugal, Spain, and Sweden, to discuss the project proposal “Inclusive Schools and Community Support Programmes” with the aim of mobilizing support from donor countries.

The "Inclusive Schools and Community Support Programmes" project departed from the principle endorsed at Salamanca, namely, that it is better and socially and economically more efficient to integrate — to include — children with disabilities and learning difficulties in mainstream school and regular education programmes than to segregate them in specialized institutions or, worse, not educate them at all. The project's aim thus has been to foster wider access and quality education for children and youth with special educational needs, seeking to promote their inclusion in regular education provision.

The Project aspires to identify, support, and disseminate information on small-scale innovations at the national level, and is intended to serve as a catalyst for all countries that wish to carry out initiatives in line with the Salamanca Framework for Action. The Project target areas are policy and school development, teacher education, education of the deaf, adult education, transition to active life, development of educational support services in schools and communities, parent education, early childhood education.

The basic parameters of the "Inclusive Schools and Community Support Programmes" project place emphasis on:

- small scale pilot/demonstration projects with built-in dissemination strategies, i.e. to ensure sustainability and replicability;
- capacity building in the form of trained teams of professionals at national, provincial and local levels;
- upstream work to incorporate new initiatives into national planning;
- genuine parental and community involvement in new initiatives;
- benefits to a wider number of countries than those directly participating through networking and exchange opportunities, particularly at the sub-regional level.

The establishment of the UNESCO Institute for Information Technologies in Education (IITE) in Moscow, based on resolution 6 adopted by the General Conference at its 29th session is part of an overall plan to reinforce the Organization's activities concerning the introduction and application of information and communication technologies in education.

The Institute, which benefits from the active and generous support of the Russian Federation Government, is specifically mandated: to assist Member States in developing their national infrastructure in this field; to train educational personnel; to facilitate dissemination and exchange of information on the subject; to mobilize partnerships within and outside UNESCO in all fields of the Institute's competence.

The 30th Session of the General conference of UNESCO indicated the following priorities of IITE:

- an international network of national focal points established as an interactive system fostering the exchange of information and experience;
- an international project "ICTs in Education: State of the Art, Needs and Perspectives" focused on national action plans and policy documents launched;
- a set of training and self-training modules for different categories of educational personnel prepared and tested;
- partnerships and co-operative agreements with existing institutions, programmes and organizations established;
- national pilot projects launched.

Following its mandate IITE launch several projects adopted by the international IITE Governing Board, and among them the project "ICTs in Education for People with Special Needs" aimed at providing an access to electronic educational materials for this category of learners and other activities in this direction.

Starting the investigation ITE met such difficulties as a lack or fragmentary character of information on the use of ICTs in SNE. Collecting and systematization of information on application of ICTs in SNE seems to be the most important and complex task at the first stage. Stoking and analysis of this information should become a basis for true recommendations for policy-makers, educators, learners and designers of soft and hardware and teaching/learning methodology. That is the reason of drafting the first Analytical survey on this issue.

Process

This Analytical Survey originated in an Expert Meeting convened by ITE in Moscow, 18-19 February 2000. The participants were:

- Prof. Kiyoshi Amano, CHUO University, Japan;
- Dr Joost M van den Broek, Kompagne, Netherlands;
- Dr Alistair Edwards, University of York, United Kingdom;
- Dr Grigori Evreinov, Specvuzavtomatika DB, Russian Federation;
- Dr Boris Koprivnikar, Centre for the Blind and Visually Impaired, Slovenia;
- Dr Giuseppe Nicotra, ARCA Progetti SRL, Italy;
- Dr Yuri Sereda, Apple Distinguished School # 1126, Russian Federation;
- Dr Dmitry Shilov, Ministry of Education of the Russian Federation, Russian Federation.

The survey has been compiled by the following group:

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ANALYTICAL SURVEY OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SPECIAL EDUCATION

1. Foundations

Promotion of education is a fundamental objective of UNESCO. By definition (UN 1981), 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 their receiving good education.

The most important educational resource is people — teachers. However, it has to be recognized that in the present and the foreseeable future, economic and political restrictions are unlikely to be such that adequate supplies of suitably trained teachers will be available to completely fill the need for them. Apart from other restrictions, education is a self-sustaining process; to have a good supply of teachers tomorrow we must be educating numbers of children today. The availability of teachers trained in the speciality of teaching children with disabilities is even lower.

When human resources are inadequate, it is often easier to procure and provide technological solutions and it is most fortunate that in special education, technology can play a highly beneficial role. Although economic restrictions can affect access to technology, it can represent a good investment.

2. Objectives

This document outlines the role that information and communication technology¹ (ICT) can achieve in special education, with the objective of getting it more widely adopted and used in UNESCO Member States.

3. Fundamental assumptions

Technology is no substitute for human teachers — but can be a most valuable tool to supplement their contribution.

¹ Some writers refer to information and communication technologies in the plural (i.e. ICTs). However, since the trend is towards the convergence of the technologies, it seems appropriate to refer to them in the singular; in time it will be too difficult to separate the communications components from other aspects of the technology, so they might as well be treated as one.

There are other people who have no difficulty with the physical process of writing, but do have problems with composition. The largest such group are those with forms of dyslexia which affect writing, but there are also others who have different degrees of language impairment, perhaps due to brain damage (possibly caused by trauma or stroke). A variety of tools exist to assist such people. Modern word processors often have tools such as spelling checkers, grammar checkers and outliners built in but there are also specialist tools that will help with composition.

5.1.4. Speaking and face-to-face communication

Some people cannot communicate in speech. This may be due to an inability to physically generate the sounds of speech or it may be due to some language processing deficit. Clearly this is a handicap in most daily activities, but will clearly have a particular effect on education.

A wide range of alternative and augmentative communication (AAC) devices exist. They employ a range of input strategies, aimed to suit the abilities of different users. Output may be in a written form, but most often they produce synthetic speech, which is perhaps natural as it is speech that they are intended to replace. The quality of the speech generated is most important and is constantly improving. In spite of the fact that English (and particularly American English) has received the most attention, synthesizers for other languages are available and are constantly improving. Sign languages are languages in their own right, but they tend to be used only by people who need to use them. In other words, many deaf people learn sign, but not many hearing people do. Also, there are a variety of sign languages, and they are distinct from the spoken languages used in the same countries, so that, for example, American Sign Language is quite different to British Sign Language even though the spoken language is the same in those countries. All these factors can contribute to the isolation of deaf people from the rest of the community. For those who would prefer not to be so isolated, technology may have a role to play. As yet, sign language interpretation and translation is somewhat limited, but again it is probably only a matter of time before adequate translation (such as sign to speech) is available.

There are a number of other possible uses of ICT in relation to sign language. It has to be remembered that to many deaf people, sign is their first language, and they can have difficulties with spoken and written language. Sign may be presented through technology, so that an animated figure on a screen might sign a message in place of text or speech. Also, sign is by nature dynamic, so that dictionaries of sign with animation on a computer screen are much richer than books with static pictures.

5.1.5. Other therapeutic applications

The flexibility of ICT and the variety of input and output forms that can be handled, creates possibilities for therapeutic uses. For instance, speech inputs can be processed and displayed visually to help deaf students improve the quality of their speech. Another example is that gesture-based input has been used as the basis of physical therapy (Wong 1991; Pausch and Williams 1995).

5.2. Educational uses

Computer programs can be used to teach directly to students⁴. They have a number of benefits. They offer a form of individual attention to the learner. A program is infinitely

⁴ A number of different terms are used to describe this field, including Computer-Assisted Learning, Computer-Aided Learning (both abbreviated to CAL) and Computer-Based Learning (CBL)

"patient" and can present a lesson or idea repeatedly and consistently without variation or fatigue. That is particularly useful in drill-and-practice lessons, where repetition is necessary in order for a concept or skill to be learned. This can be most useful for children with learning disabilities.

It is important in computer-aided learning that a machine cannot be judgmental. Children with learning disabilities are accustomed to *failing* and will often adopt strategies such that they can avoid situations in which there is a danger they may fail again. They avoid the risk of failure. However, when interacting with a machine there is not the danger of annoying or upsetting another person, no matter how many mistakes one makes.

Much of the educational software currently available is based on a playful, games-style approach. There is relatively little that is designed specifically for children with learning or other disabilities, but it is often possible to use software targeted at one group with others. The increasing availability of multimedia forms of interaction is important, too. For example, pre-literate students may be taught to read with the aid of programs that will produce speech.

Almost all the other features of ICT mentioned in this report can have a relevance to direct educational use of the computer. For instance networks and communications can mean that educational programs can be delivered at a distance. Similarly, the flexibility of input and output channels that are available can be important. An example would be a child using a simplified form of input such as a touch-sensitive pad, rather than a keyboard. Thus lessons on handling money might be taught through pressing real coins on a touchpad, to someone who would not be able to type arithmetic sums on a keyboard.

There are reasons to believe that one particular group of students with special needs can benefit from computer-based learning, and that is those who are autistic. Autism is mainly a social handicap, characterized by difficulties in relationships with other people and one suggestion is that such people have less difficulty forming a "relationship" with a machine. Furthermore, regularity and predictability are important to autistic people and computers are, by nature, consistent and logical.

An important example is the use of everyday computer tools, especially word processors. As discussed elsewhere, the word processor may be used prosthetically as a writing aid for someone who cannot write manually. It can also be used, though, by someone who can write — but not very well. The motivational effect of being able to produce a piece of written work which is neat and correct and printed with high quality, can be significant, and with the facilities of editing, correcting and printing this is possible for anyone.

Motivation is also apparent in that children often greatly enjoy interacting with computers. Some programs — notably games — are specifically designed to enhance motivation (Malone 1982), but even with more mundane programs seem to capture children's attention and make them concentrate for longer than they find possible for other activities.

As has been stressed elsewhere, technology can never be a substitute for the human teacher. It is in the area of educational software that it is most tempting to try to make that substitution, but in general it is best to see software as a tool that the teacher can choose to use. The best software should be intelligent. That is to say that it should incorporate a student model, a representation of the individual student.

5.3. Communication at a distance

ICT can be used as part of distance teaching. This can be important when (specialized) teachers are in short supply and have to be shared between geographically dispersed students and teachers. Communication can take place in different modes and requires different rates of information flow (bandwidth). These are all summarized in Table 1.

Educational software currently takes the form of games and programs designed to teach skills and concepts. Computer-aided learning is still of a fairly general, simple drill-and-practice style. This can be most valuable to children with learning disabilities. Deeper learning will become possible as more intelligent software is developed — which incorporates a model of the learner. Such models are difficult to build for the average student and are even more challenging for learners who are so unusual that they are classed as having special educational needs. Such software will emerge — but not for some time yet. It will depend as much on better understanding of the psychology of learning as on better technology.

7. Conclusions

Children with disabilities generally have special needs with regard to their education. Some of those needs can be met by information and communication technologies. As the technologies become more advanced and more available there is a significant opportunity to improve the quality of life of this disadvantaged group significantly.

Recommendations of the Meeting of Experts (Moscow, February 2000):

- UNESCO and Member States should turn their attention to the fact that the real breakthroughs in special needs education could be provided by introduction of ICTs in their learning, training and self-training;
- IITE should become an international clearing house for the application of ICTs in education, in particular special needs education, and promote exchange of information and experience in this field. The examples of good practice of application of ICTs in exclusive and especially inclusive education of people with special needs in countries with different economic, social and cultural environments should be found and disseminated;
- There is a need for stocking existing data and knowledge bases on the use of ICTs in special needs education and making it available for learners with special needs, their teachers, teacher trainers, other educators, and decision-makers, in particular through the IITE information facilities. Thus, for this purpose an information sub-system "ICTs in Education for People with Special Needs" within the framework of the IITE international project "ICTs in Education: State-of-the-Art, Needs and Perspectives" should be created. Specialized questionnaires are necessary for its continual up-dating and replenishing;
- Education modules on application of ICTs in special needs education, first of all such modules for teacher training and re-training, should be developed within the framework of the intersectorial UNESCO project "The Status of Teachers and Teacher Education in the Information Society" and included in the IITE educational programme.

8. Glossary

AAC

Alternative and augmentative communication. Use of technology as a replacement for speech. The user specifies utterances and these are (usually) translated into synthetic speech.

ASCII

American Standard Code for Information Interchange. Pronounced "Askey". A standard data transmission code, which is capable of representing 127 distinct codes, including all the Latin letters (upper- and lower-case), the digits, 0 to 9 and punctuation characters, such as brackets and full-stops. It also includes some unprintable control codes for formatting and printer control (e.g. formfeeds to end a printed page).

Asynchronous communication

See "*synchronous/asynchronous communication*".

Bandwidth

Broadly, the rate at which information can be communicated along a channel. A high bandwidth interface can communicate a lot of information quickly and is required for rich forms of information, such as video. However, it will also be expensive. Simple information, such as text requires lower bandwidth and is less expensive.

GUI

Graphical user interface. A computer that is controlled mainly through a visual form of interaction, based on a screen, keyboard and mouse pointing device. Also sometimes referred to as a WIMP interface (windows, icon, menu and pointer).

ICT

Information and communication technology. The term that has been coined to describe the convergence of technologies that process information (mainly computers) and those which communicate it (networks).

Keyboard emulation

This software generates output which is indistinguishable from keys pressed on a keyboard to other software (such as a word processor). In this way, someone who cannot physically press keys can nevertheless use standard, keyboard-based software through some other style of interaction (such as selecting letters from menus on screen, using a single switch).

Prosthetic technology

Use of technology to reduce the handicapping effect of a disability. That is to say, using technology to perform actions that the non-disabled person might achieve without technology. An example is communication through an AAC device, in place of natural speech.

Screen reader

A piece of software which effectively interrogates the contents of a computer screen and converts it into a non-visual form. That form may be presented to the user in the form of synthetic speech or braille.

Sip and puff switch

A switch that is activate by a tube placed in the mouth. The switch has three states: neutral (off), one activated by blowing into it and the other by sucking on it.

Synchronous/asynchronous communication

Loosely, synchronous communication involves both participants simultaneously. For instance, a telephone conversation requires both people to be on the line at the same time, to respond to each other in turn. Asynchronous communication does not require immediate responses. For example, an email message will be normally read and responded to the next time the recipient logs on to the system and not necessarily as soon as it arrives.

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10. Web sites

ABLEDATA

[http:// www.abledata.com/index.htm](http://www.abledata.com/index.htm)

EagleEyes drawing software for physically disabled people

<http://www.cs.bc.edu/~eagleeye>

IBM Special Needs Home Page

<http://www.austin.ibm.com/sns>

Microsoft Accessibility Support

<http://www.microsoft.com/enable/>

Morse Code

<http://www.uwec.edu/academic/hss-or/Morse2000>

Trace Research and Development Center

<http://trace.wisc.edu/>

The Web Accessibility Initiative (WAI)

<http://www.w3c.org/wai>

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