Software is the key to success with Assistive Technology for the Special Needs People.

By: Pantelis Makris
Assistive Technology Specialist
United Nations' Expert
Evaluator of European Projects
makrisp@cytanet.com.cy
www.icteach.org
www.sesarab.com

The use of technology is getting more and more spread in all aspects of life. Most of the modern business applications, office tasks and industry processes are taking full advantage of the advance features of micro, nano or other technology. Education follows and is now utilizing, at a great deal, Information and Communication Technology (ICT). ICT brought about upgrading of provided services and resulted to enormous changes to the educational environment, the curriculum content, the methodologies used and the procedures followed.

In reality technology has invaded into all Education areas from administration, to diagnosis and assessment, to tests' preparation, to instructional material development to teaching and researching and has proved to be a very useful supplementary tool.

Special Education is also in line with the new trends of technology and a big number of specially designed hardware, software and methodologies have been developed. The existing specially designed technological advances have changed the life style and life quality of many disadvantaged people all over the world. There is a huge number of case studies which attest and justify the use of special educational technology otherwise called **Assistive Technology** (AT). The case of **Ben Way**, a dyslexic and hyperactive child, who became a millionaire at his seventies, is worthy to keep in mind when studying the contribution of technology to the special needs people.

"…….Letters and numbers were a battleground for me. I'd sit there with a pencil and paper and find it impossible to write anything down. This would make me frustrated and I'd become disruptive.

Then I have discovered the ultimate weapon: a laptop computer. It went everywhere with me, including school. It was like I'd had blurry vision and now I had glasses. I could see, I could apply myself, I could do anything with it! Once I realized that, there was no stopping me. The world was at my feet — I even thought I could tap into the Pentagon. By 11 I'd written my first software program and by 15 I'd established my own company. By 17 I'd made my first million…..".

Ben Way could survive and be educated, with the help of a computer, although he has failed within the traditional school environment. The failure of the traditional educational systems, the new psychology and sociology theories and approaches, the findings from applications and researches, the worries of the parents of the special needs people, the expectations of the handicapped people themselves in combination with the enhancements on electronic devices and computers fostered the development of new tools which contribute to the welfare of the less fortunate people and are providing better, easier and faster access to information and knowledge.

Many new technology features like, new ways of access and input methods (dwelling, switch access, voice input, touch facilities,...), more advanced features of computers like interactivity, multimedia (sound, pictures, video, animation, text), networking options, internet and communication facilities, availability of virtual spaces, e-learning possibilities, high speeds of data transferring, mobile devices (Ipad, Iphone,...) and affordable prices made **Assistive Technology** even more productive, attractive and challenging.

In the meantime, during the last three decades, programming software and authoring tools have improved a lot. New programming languages made programming of special applications and software an easy and quick job. In this way special education is taking advantage of the new technology features and there is a big number of special software which support the less fortunate in many areas of life like:

- **Education (assessment, diagnosis, intervention, skills building)**
- **Communication (basic or advance communication)**
- **Mobility and accessibility (access to knowledge and to the environment)**
- **Vocational training (prevocational, follow up at work place)**
- **Rehabilitation (skills and therapies, intervention)**
- **Social integration (support to participate in the society)**
- **Personal development (entertainment, independence, self-learning).**

The effort made towards the development of special software has focused on meeting the actual needs of the different disabilities. The existence of multiple needs, among the handicapped, urges for software that is flexible and versatile, able to satisfy many and varied needs at different levels of knowledge and which is appropriate for different ages. In addition software needs to have different and variable content. Content wise the existing special software fall into three categories:

1. **Close software:** Both the content and the interface are not changeable. The user just follows the structure of the software and works with already prepared activities. Nothing can be added or modified on the software. A good example is the **CoPs** (by the Kuwait Dyslexia Association) software which has a certain and given number of activities which cannot change at all, as this is an assessment tool.

2. **Open Ended software**: There is no content but there is the possibility for the user to develop his own material and activities. An example is the **Story Book Weaver** a software with tools and objects for children to use to write, present and print essays.

3. **Mixed type of software**: This type of software includes already content but there is also the possibility for the teacher, the parent even the user to modify or delete the existing activities as well as to create and add new activities. Two good examples are the **PESKids** and **Clicker** both working with Arabic language.

The great importance and the potentials of software is not questioned and there are lots of researches (Lovaas, O.I. 2003) which encourage the use of computers and suitable software to support the handicapped. Software is the focus of the present paper and their contribution is emphasized through examples of use by

children and adults with developmental, learning or physical disabilities, like deaf, blind, dyslexics, autistics, cerebral palsy (CP), slow learners, ADD, ADHD, Down Syndrome etc.

The existing special software is designed to speed up their learning, to facilitate their access to knowledge but also to assist them in their effort for a better quality of life. It is a tool for assessment and diagnosis, a tool for intervention (teaching, drill and practice, learning and testing), a tool for skills' development, a means to brain empowerment and can be used for creative engagement of the users. Further more the software in combination with special hardware can contribute to the vocational training, the rehabilitation and social integration of the special needs people and can assist to their personal development.

It has been clearly defined (ATIA Minority Report for the TEITAC Committee) that special software should be as versatile as possible, flexible, user friendly (easy to learn, easy to use, interactive with feedback), to be easily adjustable to the different needs, different levels and interests of the users and to combine the features of multimedia with graphics (pictures, animation, video), sounds and text.

For this reason a great effort was also put to provide software with certain criteria so as to make them more easily identified and chosen as well for the software to become more helpful and applicable to each individual case. In summary special software should meet most of the following criteria and should:

- **Be very user friendly**
- **Provide help and prompts**
- **Be easy to install, learn and use**
- **Maintain the interest of the user**
- **Provide positive feedback**
- **Be preferably of mixed type**
- **Be versatile, flexible and easily customized**
- **Use simple language (content, syntax, lexicon)**
- **Provide a multi-sensory environnent**
- **Aim at user's individual needs**
- **Record data and output report of achievements**
- **Have various ways and methods of access.**

Based on the above criteria it is clearly stated that, for the special needs people, software should compensate for their loss and should provide different methods

of access which will make them more user friendly for a wider number of users. Such methods are: Switch Access, Touch access, Eye Gaze access, Head motion access, Dwell access (auto click) which can be combined with other ways of presentation or input methods like Magnification, Scanning, Highlighting, Speech synthesis, Speech recognition, Word prediction, Brain Computer Interaction (BCI) and many more.

Methods of access:

- ***Switch Access*** is a method used to help communicatively impaired people and people who have motor control problems (Motor Neuron disease-MND, ALS, Muscular Dystrophy, CP, Stroke, Spine Cord Injury-SCI,..) to get access to a computer or other devices through the use of a binary switch. There is a number of switch access software like **Clicker** which makes it possible for the users to select and activate cells, icons and buttons. Switch access is a very popular and price affordable way to provide quick access to a computer. A person with severe motor control problem can use, for example, an on screen keyboard which can be scanned and with a simple press on a switch attached to the computer (Clicker makes this possible), to write and communicate with others.
- ***Touch access*** is a method that is very popular nowadays on mobile phones, tablets, interactive whiteboards and touch screens and is very good for quick access. Users can use their fingers to select, click double click or drag, open windows and type text. This is a great method for autistics, CP, Down Syndrome, blind and other children.

- ***Eye Gaze*** access includes special software with special camera which makes it possible for the user, by his eye gaze (eye-looking), to move the mouse pointer, select, click, double click, drag and use the computer with his eyes. Auto-clicking method (Dwelling) of access is used with such a system.

- ***Dwell access*** (auto click) is a method which helps those with difficulty with fine motor control. Users can possibly use a big ball mouse (trackball) to move the mouse pointer over objects and icons on the screen. They do not have to push any buttons to achieve clicking. By the time the pointer is over an icon there is an auto click (Dwelling) happening. The time needed for dwelling to happen is always adjustable.

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- *Head motion access* is very similar to Eye Gaze method but in this case the user moves the head rather than moving the eyes. Auto-clicking method (Dwelling) of access is also used with this system.

- *Magnification* is a simple method integrated in many software and used by the visually impaired to enlarge text and objects on the screen. It is a very common method used by the blind or visually impaired and it is usually coming with a screen reader as well. Screen reader is a speech synthesis software which reads all text captions, menus and messages on the screen.

- *Scanning* is the most popular method used for the communicatively impaired who have also motor control problems. Scanning means that the control on screen is automatically sent from icon to icon, from object to object from area to area and it is usually visually seen as a colour moving from one object to another object. In this way the selection process is done automatically by the system, (the speed of scanning is adjustable), and the activation (clicking) is done by a switch (touch switch, pressure switch, blow switch, foot switch, sip and puff switch etc), depending on the residual motor control abilities of the user.

- *Highlighting* is a method of changing the background colour of text, whilst the text is read, mostly to improve or to raise the attention of the reader. It is a very common approach for dyslexics, ADD, ADHD students, slow learners, Down Syndrome people, mentally retarded readers, poor readers in general.

- *Speech recognition* is another useful input method and practically the user can control the computer by talking to it. The software needs to be customized to the user's voice and there are today very accurate systems with more than 95% accuracy in transforming speech into text or visual effect. It is a very good input method for those with motor control problems, who still have no speech problem, for dyslexics, for deaf, for visually impaired, for those who are not fast with writing or who have poor writing skills, for those who want to avoid spelling mistakes, and for many others.

- *Speech synthesis* is a widely used method of giving speech to text. The speech is generated by computer speech engines and provides voice auditory output during reading mostly. The reading is usually

- accompanied by highlighting as well. It is a very good method for the blind and visually impaired, for the dyslexics, for children with poor phonological awareness and for children who struggle with reading.

- *Word prediction* is a widely used method to help users save typing hits. By the time the user types the first letter of a word, he wants to type, the software will popup a list of words starting with the typed letter. Adding the next letter of the word will limit the number of words in the list. The selection is usually done by pressing one of the function keys or one of the numbers on the keyboard. The prediction in most cases considers also the most frequently used words and brings them on top of the list. This is a very common method used by deaf, dyslexics, CP and others. It is also found on mobile phones.

- *Human Computer Interaction* (HCI) is an on going focus of research and there are already some promising results on the Brain Computer Interaction (BCI), when the user will be able to write with thinking.

There is today a series of software which incorporate one or more of the above methodologies, they are versatile and flexible enough to meet one or more needs of the less fortunate and can address one or more functions or tasks. The decision on which software to use is not an easy job and should not be taken lightly. It is a job of an Assistive Technology expert who needs to assess the user and specify his personal needs first before making any selection of software. The expert should collaborate with other professionals like the teacher the psychologists the speech therapist or other professionals who see the child regularly even before making the assessment.

Areas like assessment, memory and attention boosting, reading and writing development, speech, visual discrimination, communication and access to knowledge and many more can be successfully supported with the right software. The following examples provide some information on a small number of software and on their contribution to special needs people:

A. <u>Assessment tools :</u>

- CoPs software in Arabic (closed type), localized and standardized by the Kuwait Dyslexia Association. Has a series of activities to record and provide valid information and a Profile of the Mental Attributes of children.
- LiFlexia, a mixed type tool that turns to become multilingual. It is both assessment and intervention tool. Keeps records of students' results.

Extremely good for dyslexic children and children with learning difficulties. Supports visual and auditory memory, trains reading, spelling and attention.

B. Phonology:

- Phonics, a software that was developed completely in Arabic with a purpose to help with the speech production. All Arabic phonemes and combinations of phonemes are presented and demonstrated with a video. The tool is a valuable software for speech therapists, speech pathologists who want to train their clients on speech production, speech correction.
- Speech Viewer by IBM visualizes speech. Deals with the prosodic features of language. Students can learn how to deal with pitch, volume, intonation, phonemes and other prosodic features of the language with the help of this software. The menu is in English but works very well with phonology in Arabic. A tool that is very helpful to deaf children and children with speech problems.
- Clicker, by Crick Computing, is a tool that can also help with phonological awareness in different languages. There are already existing phonics activities but the user can also very easily modify the existing or develop new ones.

C. Early concepts:

- PESkids in Arabic and English, mixed type of software, helps children with Cerebral Palsy (CP), young children and also children who are shy or communicatively impaired. Great tool for oral communication. Works also with scanning and a switch.
- Clicker 5 is a writing support and multimedia tool for children of all abilities and people with special needs. You can use Clicker to support teaching and learning in any subject area – and it's so easy to use! It has a talking word processor, called Clicker Writer, and you can write in this without using the keyboard – simply click on words in the on-screen Clicker Grid. You can even hear the words before you write! Clicker 5 makes it easy to create an engaging variety of learning activities. But it's not just for writing – you don't have to use Clicker Writer. You can use full-screen Clicker Grids for a variety of uses, such as talking books, multimedia presentations, communication and labelling activities. Clicker 5 comes with high-quality picture support so you can rapidly make useful and attractive teaching materials. Its realistic speech support reinforces learning and enables effective literacy and language teaching. It's such a versatile tool; the only limit is your imagination!
- Albert's house. Simple software but very rich in early concepts about the house. Keeps students interests and provides lots of learning experiences and talking opportunities with cause and effect events.

D. Reading-Writing

- Clicker can help a lot with this task and there is already a big number of Arabic resources that teachers and parents can use.
- For essay writing users can use Story book Weaver. The software is an open ended program with lots of tools for the users to write their essays.
- Kidspiration is another great tool both for essays writing but also for mind mapping and organizing students' thoughts.
- ALFA, is a software which helps children to speed up reading. Combines reading with writing and also has visual and auditory input. Students are given a group of letters, syllables, words to read. They hear or see one word and they have to match with one in the group. Speed of reaction is measured and the software records the results. This is a mixed type of software and works fully in Arabic.
- WORDQ, a word-prediction software that works with almost all word processors.

E. Dyslexia

- CoPs for assessment.
- Intervention, an Arabic software which helps with the first phonological awareness and phoneme grapheme association
- Clicker has a big number of ready activities for dyslexia intervention.

F. Memory

- Cinbad, an Arabic memory booster.
- Memory for juniors
- Memory for seniors. Both software are in English but if you spend an hour to record the sounds in Arabic you can make them work fully in Arabic. They include a step by step memory training module. Both work with switches as well and record data of user's progress.
- Arabic memory. A simple flash card type software where the child has to match two identical cards. This program works only with text and it is a software of mixed type.

G. Attention-Visual Discrimination-Spatial perception

- Complete the picture, software for understanding the space and focusing on picture details
- Puzzles and Puzzles Plus, provide creative activities for the students to reorganize pictures and rebuild them.
- Matching pictures
- Matching machines

- Matching people, are three different software which encourage the user to match. These software help users improve their focusing and visual perception. Most of the attention software work also with one or two switches
- Beebot, a robot simulator which the students can program and give instructions and directions to move on the screen. A perfect tool for helping lateralization, sequencing, orientation but also for language development.

H. Access
- ASSS
- Cross scanning
- Switch cursor

The above three software are used to scan the screen and make simple click, double click and dragging with a switch.

I. Visual impairement
- Zoom Text for the blind (Reader and Magnification). Reads and magnifies the screen, a perfect tool fro the blind.

J. Imagination-Creativity Other subjects
- Music Maker Pitch simple in understanding and step by step teaching music and early music experiences. A software that provides tools for children to create their own music.
- Little Artists in action and other painting tools. This particular software is a multimedia tool and students can create their own pieces of art.
- On the road with Safety, a tool for children to learn how to behave in the streets and how to avoid car accidents.

There is also a big list of software that is in English but can be used, as it is, to support Arabic speaking students with disabilities. It is advisable though that the decision on what software to use to be taken by a specialist on Assistive Technology in collaboration with the special needs professionals. All software need to be taught by specialists so as the user can make the best use of them.

There is always a question on why we need software to support our teaching and to supplement our methodologies. The application and experience of teachers revealed the reasons and the benefits of supplementing our instructional materials and methodologies with software:

- Students love computers and they enjoy working on them as they use multimedia (colours, graphics, animations, videos, text).

- Computers provide a multi-sensory environment
- The presentation of the lesson is more attractive (use of presentations, simulations, tests, experiments)
- The content can be modified, adapted and organized step by step
- For some students the content can be visualized so it gets easier to understand (use of graphics, symbols, videos, pictures, animations).
- Most software keep record of the results and provide valuable information

on the child's progress.

CoPs by Kuwait Dyslexia Association.

The importance and contribution of software would not be underestimated but at the same time the selection of software needs to be very careful. Equally important is the training on the use of software so as to make the most of them. Software has positive role to play in Special Education but there is still al long way to go and lots of things that need to be considered and thought about in the Arab world as:

- There are not many software specially designed to work in Arabic language
- There are not many experts on the subject
- The selection procedure is difficult
- People tend to judge software by price
- Updating and new versions of software need to be obtained continuously
- There are compatibility issues with new hardware new platforms
- Training is always needed (installation and use)
- Software is sometimes very demanding by the teacher
- The needs of the students are changing continuously
- Teachers should be able to work on the software at home and prepare work for their students
- are not allowed to have the software at home
- Students and teachers become over dependent on the software

Always remember that software is the key to success with assistive technology only if the teachers are ready to go it and only if the educational system has adopted Assistive Technology as a tool for the education, rehabilitation and welfare of the special needs people.

CLICKER is probably the most versatile software, for all abilities all disabilities. Works with switches also.

Bibliography:

- Cyprus 'Education and Training of Children with Special Needs' law 113(1) (1999), Ministry of Education and Culture.
- Elena Aristodemou E., Taraszow T., Laouris Y., Papadopoulos T., Makris P (2008) "Prediction of Reading Performance Using the MAPS (Mental Attributes Profiling System) Multimodal Interactive ICT Application", Napa.
- Lovaas, O.I. (2003). Teaching individuals with developmental delays. Austin, TX.: PRO-ED.
- Makris, P. (1994). Multimedia for the Hearing Impaired Children and Total Communication. BATOD Sept, 1994. London, UK.
- Makris P. (2003). Technology for the Welfare of People with Special Needs, National Committee for the Special Needs YEAR 2003, November 13, Nicosia, Cyprus
- Makris P. (2003). The Use of Films for Language Development, International Conference on Assistive Technology (ICAT), British Computer Society, Disability Group, December 2-3, 2003 – London, UK.
- Makris P. (2007) « COST Action 2102: Cross-Modal Analysis of Verbal and Non-verbal Communication», Springer-Verlag, Computer Science Editorial, Germany

- Porpodas, K. (2002). *The Reading process*. Greece-Patra: Porpodas.
- Raskind, MH. and Higgins, EL. (1999). *Assistive Technology for kids with Learning Disabilities.* www.schwablearning.org/articles.asp.r=286-39k 23-08-06, 20:00.
- Singleton, C. (1994). *Computers and Dyslexia. Educational applications of new technology.* University of Hull: Dyslexia Computer Resource Centre.
- Stasinos, D. (2003). The Learning Difficulties of Children and Teenagers. The experience of Modern Europe. Athens: Gutenberg.
- Tijms, J. (2004). A process-Oriented Evaluation of a Computerised Treatment for Dyslexia, *Educational Psychology.* Vol: 24, No: 6, pp 767-786.