ADDITIONAL DIGITAL RESOURCES AND TECHNOLOGIES TO SUPPORT THE EDUCATION OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS

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Abstract. The article comments on the role of information and communication technologies (ICT) in the education of children with special educational needs (SEN). Here is an overview of aids and technologies supporting the activities in this direction. Two computer-based approaches are presented that support their training – multisensory and game approach. The possibilities of several types of specialized educational computer games, applications and assistive technologies in helping children with autism spectrum disorders (ASD) have been studied.

Key Words: *information and communication technologies, autism spectrum disorders, education, special educational needs.*

Introduction

The continuous and rapid improvement of hardware and software technologies allows for more and more adequate and intelligent cooperation with education. The "ICT in Education" factor is becoming essential. The development of these types of technologies accelerates the integration process and allows the application of new innovative approaches in the modern learning environment. The fact was reported by the Ministry of Education in 2014 with the adoption of a Strategy for effective implementation of information and communication technologies in education, whose mission is related to the overall modernization and transformation of education and science through ICT. Integrating ICT into the learning process as a tool helps the lesson to acquire a more perfect form of teaching [1, 6, 7, 8, 9]. Teachers enrich their experience and cause a motivating factor for the implementation of didactic goals on students.

Further acceleration in this direction was caused by the pandemic situation, which necessitated the use of distance learning in the electronic environment (DLEE – Distance Learning in an Electronic Environment).

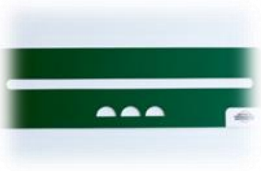
Here the following questions arise: What is happening with the inclusive education of children with ASD who are enrolled in general education schools?; Is it possible for their training to take place in DLEE?; How successful can it be and for which groups of them?.

When looking for answers to these questions, one must first examine the current state of the means and technologies intended for children and students with SEN. This article aims to do just that – to give information about existing solutions in this direction.

Assistive devices and technologies in the education of children and students with SEN

Assistive devices and technologies support the integration and implementation of assigned tasks for children with special needs in school. They can be classified according to how they are used in the learning process. An exemplary division is into: low-tech, mechanical (low tech); high-tech, electronic (hi-tech). Table 1 presents a similar classification [15].

Table 1. Classification

Low-tech devices	
Graphic writing skills    	• Seals/grips for writing tools • Simulators for writing with a pencil or pen • Adaptive writing tools • Adaptive writing tools with weight • Writing tools with indicator light • Slant boards and book holders • Writing guides • Alternative paper • Embossed/tactile writing pad • Tactile cards and templates with numbers and letters
Reading skills  	• Contrast markers/strips • A reading window • Tracker – a tracking ruler for reading • A coloured reading window • Reading windows with colour filters • A slant board/book holder • Magnifying glasses • Static magnifying glasses
Math skills  	• An adapted drawing compass • Geoboard (Geometric panel/board) • A set of protractors and rulers for the blind • An adapted ruler • Maths cubes • Tactile numbers • Embossed dice

	• Volumetric (3D) geometric shapes • A sandglass
Graphic skills 	• An adapted paintbrush • Finger brushes • A reinforced paintbruh holder/seal
Cutting with scissors skills (skills for hand technical activities and fine motor skills**)** 	• Adapted scissors for children • Long handled adaptive scissors • Training scissors with double control • Sliding scissors • Adaptive scissors "Push down table" • Paper holder for cutting activities
Communication skills	• Communication panels/boards • Daily Schedule Pocket Chart
Computer skills 	• Keyboard and mouse support bracelet
High-tech devices	
Writing skills and reading techniques  	• Dictaphone • Braille typewriter • Electronic spelling dictionary • Scanners • Pocket-size electronic video magnifier • Desktop electronic magnifier (closed TV)
Math skills 	• Calculator with a large display • Talking calculator with a large display • Adapted electric clock
Cutting with scissors skills (hand technical activities**)**	• Electric scissors
Communication skills – devices for alternative and complementary communication with the ability of recording speech	• Talking circle – a device for alternative and complementary communication with the ability to record speech;

 	• Talking button – a device for alternative and complementary communication with the ability to record speech • Talking peg – a communicator with the ability to record speech • 10 button communicator with the ability to record speech • Panel with talking buttons – a device for alternative and complementary communication with the ability to record speech • I Talk 2 option buttons – a device for alternative and complementary communication with the ability to record speech • Pocket communicator • Portable Go Talk 9+/32+ communicator
Computer skills (peripherals and software**)** – alternative computer peripherals.	• Braille keyboard • Braille display for keyboard • Braille printer • Alternative keyboards • Alternatives to the regular computer mouse • Electronic devices for alternative cursor control • Touchscreen
Adapted applications for computer operating systems	• Applications for access in the Windows/Pc operating system • IOS/Mac access applications • Applications for access in the Linux operating system
Adapted software products	• Reader in Bulgarian – Irina • Camera Mouse – mouse control software through head movements • Look To Learn – software with a package of fun educational games for eye control devices • Light box etc.

Pedagogical strategies, methods and technologies require constant changes in the creation of assistive technologies to support the inclusive education and daily life of children and students with SEN. This is one of the reasons why different methods of teaching through ICT are being developed. Technology is a tool that can patiently partner a child with SEN without blaming him for mistakes,

without making fun of, without humiliating him [4, 13]. Modern specialized educational software designed for children with SEN include Intelligent Tutoring Systems, who are in contact with children and works at their pace, presents them with educational material through illustrations for easier learning. It can correct, encourage or arouse curiosity and the desire to complete the work.

Approaches to variety in the methods and tools for teaching children with SEN through the application of ICT

Children live in an environment of easy access to information. They actively use ICT from an early age, which helps their integration into the learning process. Two main approaches can be mentioned, often used in the classroom for a change in teaching methods and tools [11]:

- Computer based multisensory approach

Multisensory learning stimulates several sensory channels simultaneously to help develop memory and the learning process. The combination of visual, auditory, kinetic and tactile channels enhances concentration, brings interactivity to learning, attracts the attention of especially younger students and helps to memorize learning material faster and easier. The multisensory environment provides thinking on the same things, but in different contexts, in different ways and with different methods and means [10].

- Computer based game approach

The game approach stimulates observation and develops research skills. Its qualities as entertainment, "unnoticed" training of skills or stimulating curiosity in children support the acquisition of knowledge and skills. There are different types of computer games, which are applied in the classroom depending on the didactic purposes. They can be: tests and exercises presented like a game; adventurous; simulator type; emergency simulators; social games; strategy games; role games; serious games;

To achieve the goals of learning through the use of computer didactic games successfully, their design is important. It is necessary to comply with certain criteria in order they to be pedagogically effective [14]. Some of them are:

- the game must be designed with clearly specified educational goals;
- scope of the game – for the formation and acquisition of new knowledge and skills, for the consolidation of knowledge and skills, for testing (self-examination) and assessment of knowledge and skills or combines more purposes;
- to use an appropriate platform that meets the criteria of students' needs, the content of the study;

- to provide an interactive environment;
- the game must include an evaluation module that allows data to be collected during each session.

Types of educational computer games, applications and assistive technologies to support children with SEN

With the help of educational games, applications and assistive technologies in the learning process, children with SEN develop their knowledge, skills and competencies, increase their participation and integrate into the world around them. Software is available that seeks to solve various educational tasks related to the education of children with SEN. There is a wide variety of such types of applications in English, which can be classified according to their purpose:

- for communication: Go talk, Talk Board;
- for the perception of digital content (video, music): Kids videos, Niki music, Do2Learn;
- for learning through games: Match Square;
- applications supporting the organization of daily activities: Tiimo and others.

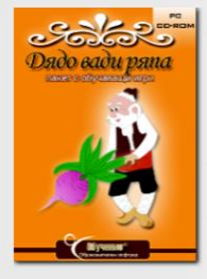
It is the language that makes their use impossible or difficult for us. This does not mean that we do not have our own solutions to support the education of children with SEN. The following is a description of several applications, which support the learning of children with autism spectrum disorders and children with SEN in different areas.

The House of Games

The software package with educational games has been developed especially for computer training of children with cerebral palsy, but it is also applicable in the training of children with other types of disabilities. The package aims at introducing children to the computer system, mastering the mouse and keyboard, and acquiring certain school knowledge. Due to the specific physical and age characteristics of the main group of users for whom the product is intended, it is developed entirely in the form of a game. (http://it-obuchenie.info/gamehouse.html).

Horn Honker

The software package contains 8 educational games for children from 4 to 7 years old, related to traffic safety. They are made in such a way to be fun for children and educational at the same time. The games can be used both for group and individual work on the topic (http://it-obuchenie.info/bibtko.html).



The Enormous Turnip

The software package contains animation of the classic fairy tale and 8 educational games. In them the children solve different tasks in which the characters from the fairy tale participate. The main part of the tasks are related to the teaching of Bulgarian language and literature in 1st grade (http://it-obuchenie.info/djado_rjapa.html).

The Wheat Bread

The software package contains animation of "The Wheat Bread" folk tale and 11 educational games. Some of the tasks in the games are related to the teaching of Bulgarian language and literature in the 1st, 2nd and 3rd grade, and others such as "Find the pairs", "Set the Character" and "Arrange the Puzzle" are logical. In the game "Create a Fairy Tale" the child can retell the story or assemble his own, using the available characters and pictures. One of the games in the package is a karaoke to perform the song of the wheat bread (http://it-obuchenie.info/pitka.html).

The Street of Games – 1st grade

The software package is for children from 5 to 8 years of age. With it, in the form of a game, children learn to count, read, count and colour. The educational content is based on the subjects studied in the 1st grade of Bulgarian schools. The software package contains 16 separate games. Each game is related to the implementation of some educational task in the subject areas: Bulgarian language and literature, mathematics, home economics, art, music, native studies. Access to each game is given by selecting a house, a building or an object located on a street (http://it-obuchenie.info/gamestreet1.html).

ToolKID

Another interesting software aimed at educating students with SEN is ToolKID – a software package for educating children in the age group 1st – 4th grade in information and communication technologies and is the first step in the overall process of ICT education in school. Its main purpose is to give an initial idea of the capabilities of modern computer systems. This is done as children work with different types of information – graphic, textual, audio, animation and video – and combine it into one (http://it-obuchenie.info/toolkid-2.html). The software programs included in the

packages for children can be divided into two main groups: tools for creation (editors) and educational games [3].

Look To Learn

Software (developed by Sensory Software – SmartBox), offering a package of fun educational games that can be used with the help of an eye control device. The games are designed specifically to provide a fun way to develop control and choice skills with the help of eyesight. Each game develops different skills – from the initial acquaintance with cause and effect to a precise eye control (http://interacta.bg/look-to-learn/).

Tools with similar functionality are:

- **Inclusive Eye Gaze Learning Curve** – it allows to customize and automatically record any interaction with the software.
- **Sensory EyeFX** – a set of 30 games that are designed to get initially acquainted how to interact with a computer by using the eyes.
- **Tobii Gaze Viewer** – an assessment tool that helps to understand individual physical abilities, cognitive abilities and the ability to use eye control.

Kinect

Kinect is a Microsoft product and is based on the concept of a natural user interface or physical interface – a system of interaction between man and computer as the user performs intuitive actions related to his natural behaviour and thus controlling the computer. Specialized educational software for children with SEN has been developed to be used together with Kinect technology in the learning process. In students with SEN there is an improvement in coordination, balance and physical fitness level, as well as an increase in motivation to learn. Kinect technology is also used to recognize the sign language of people with hearing or speech disorders. An application for the Bulgarian language has been developed, which uses Kinect to create a database with gestures, which can then be used in an online video communication system for people with hearing or speech disorders on the Internet [4].

Somantics

This program has ten different applications that correspond to the movement of the body, you can paint with the body, special effects can appear around the body, it allows you to experiment with learning about different graphic reactions when moving. The program encourages students to move, it creates an opportunity for them to explore their physical movements. It

is good for students with SEN. The Visikord system provides similar functionality. It is used for students with Down syndrome. The software can be used by two students at the same time.

Proloquo2Go

The application is for iOS and is used for augmentative and alternative communication (AAC). Fully adaptable and designed for a number of fine motor and visual skills, the flexibility of the application makes it useful for nonverbal people with autism, Down syndrome, cerebral palsy and a number of other diagnoses or speech difficulties such as apraxia and dysarthria. The JABtalk and iComm applications have similar functionality.

Letters Numbers Colours Free

The application is a good tool for learning numbers, letters and colours by children with SEN. It is designed to be installed on an Android phone or a tablet.

Access to Math

Assistive software for special education covering aspects of elementary mathematics through a system of virtual, speaking worksheets. It provides fun rewards for perseverance and training on demand. Fun presentation of mathematics is also provided by JUMP Math, Jumpido.

Grid 3

This software allows communication through symbols and text, interactive activities, computer management, accessibility applications, environmental control, and the preparation of teaching materials. The Boardmaker 7 application provides similar functionality.

Playing and Knowing

The inclusive "Play and Know" classroom is a project aimed at developing an innovative software solution for game-based learning, artificial intelligence methods and specific pedagogical practices [12]. The software platform is designed for students with SEN, their teachers and parents. Interactive games with different levels of complexity are planned for the students, providing knowledge in the fields of "Natural Sciences" and "Ecological Education and Healthy Lifestyle". For teachers and parents, the system will provide management and control functions. The integration of a smart personal assistant in the platform will facilitate the learning process for all participants. The implementation is intended for tablets and mobile devices with distributions for Android and iOS.

All information technologies, resources with stimulating materials give the opportunity to work at different levels of complexity, which simultaneously develop the child's speech, perception, attention, memory and thinking ability.

They allow the creation of individual didactic material, taking into account the level of education of the child and the structure of the disorder.

For example, Boutsika observed that the processes of learning and socialization of autistic students through education games are very important. On the occasion of these findings, she uses the platform Kinect to teach children with moderate degree of autism in her project [1]. Kinect-based physical training system for special education, created in Japan, is commented by Matsuda [5]. Possible combinations of Kinect technology with other software allow their application in traditional and special education (Somantics, Jumpido, VirtualRehab, Visikord and so on).

Conclusion

Nowadays ICT appear as the most advanced tool for information processing, a supporting learning tool, an assistant for education and mental development of children and students. ICT provides equal access to education for children with SEN, which is why it is important for the modern information society to promote and discuss existing modern ICT solutions that can be useful to them in the educational process.

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