Research Paper Medical Science

Elaboration and Practical Application of Information Technology in Romania in the Therapy of the Persons With Special Needs

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ABSTRACT

The educational system uses intensively ICT devices and programmes, as the use of these technological devices can change the perspective on the educational policy. Appropriate interfaces for kids-computer interaction are interactive surfaces with major enhancements that combine visual and audio modalities, all under the specific goal of achieving skills, intelligence and knowledge building. The new technology will shed a new light upon the teaching methodologies and psychologists, pedagogical experts and computer experts will have to closely collaborate in order to produce a readymade tool to be used in the future teaching practice. In Romania, the psycho-pedagogical researches and experiments contributed to the improvement of the therapeutic progress of the persons with special educational needs.

KEYWORDS computer, software, therapy, education, child.

1 Introduction

At present, we are facing major changes in education, by shifting the objectives and the educational actions from the classic methods to formulae supported by the new media and informatics technologies. The educators are concerned with introducing and using these informatics technologies in optimum conditions, since the computer functions as a mediator between teacher and student, somehow dethroning the role of the teacher in the triad sender – channel – receiver. The use of various technologies in the learning process depends on the learning style of the student, on the teacher's knowledge, creativity and imagination, and on the understanding of the factors that can influence the process of learning, not to mention a very good understanding of the curriculum, of the methodology and of the final educational objective.

Practical application of information technology in the therapy of the persons with special needs

The results of the therapeutic activity depend on the way in which the therapist manages to integrate these programs in the corrective recovery demarche, on the way in which (s)he uses them in order to obtain special didactic materials in order to realise attractive and efficient activities. We will focus on some researches detailing the practical methods for using some informatics programmes, therapeutic software that proved their efficiency by the results obtained in the recovery and corrective process of the persons suffering from various disabilities (speech disorders, neuromotor dysfunctions).

2 SYSTEM FOR THE PERSONALISED THERAPY IN LINGUISTIC EXPRESSION DISORDERS – "TERAPERS"

The objective of the research was the elaboration and implementation of an intelligent system of therapy for the linguistic expression disorders, specific to the Romanian language (CBTS system – computer-based speech therapy), as additional speech therapy method, personalised and client oriented. At first, the team of psychologists and speech therapists carried out an ample study on the evaluation methods in speech disorders (especially dyslalia), elaborating a complex methodology for the objective diagnosis of various forms of dyslalia, for the Romanian language. (Tobolcea, I. 2013).

A second research direction focused on the deep analysis of the various therapeutic orientations, realising thus a comparative study on the efficiency of the classic speech therapy methods (general and specific), used in the treatment of speech disorders for the Romanian language. At the same time, the perspective of the modern speech therapies was also analysed, introducing the audio-visual means as an additional method in the treatment of speech disorders, both on international and internal level (the analysis of the CBTS systems used in the speech therapy research and practice of speech disorders, specific to the English language and the analysis of the Romanian experience in using the audio-visual means in the speech disorder treatment of other speech disorders besides dyslalia, on the basis of which recommendations have been made for the design of the CBTS systems); then, an experimental design was carried out in order to validate the efficiency of integrating computers in the consolidation stage of the correct pronunciation pattern.

In the next stage of the project, two major objectives were pursued: (1) the creation of a therapeutic guide, in which were specified the therapeutic techniques characteristic to each specific type of dyslalia (both to the general methods and procedures: gymnastics and myogymnastics of the body and of the organs participating in pronunciation, the education of breadth and of the balance between inspiration and expiration, phonematic hearing education, personality education, as well as the specific methods: impostation, consolidation, and automation): (2) the elaboration of a set of exercises specific to each stage of the therapeutic process described in the speech therapy guide.

In order to reach the first objective, the team of psychologists and speech therapists carried out detailed speech therapy programmes for each sound. The complex speech therapy programmes were analysed by the mixed team of psychologists, speech therapists and IT specialists aiming to transpose the speech therapy procedures in an IT environment and to carry out a pseudo-coded therapeutic programme useful in the realisation of the expert system programme. This expert system consists of two parts: a working programme for the child with the speech therapist and a working schedule to be used at home, in view of practising and consolidating the achievements obtained with the speech therapist. This pseudo-coded therapeutic programme includes the development of the theoretical programme stages from a speech therapy perspective and from what the expert system can realise.

Starting from the model of speech therapy programmes (theoretical and pseudo-coded) specific speech therapy programmes have been created for each sound (each type of exercise from general and specific therapy was exemplified). The pseudo-coded therapeutic programmes used in the creation of the expert system establish decision trees on the basis of a system of decision rules which has in view the following variables: the category of defect, previous experience in pronun-

ciation therapy and previous development of the child. In order to realise the set of specific exercises for each stage of the process described in the speech therapy guide, the team of professionals elaborated a complete set of exercises for each particular stage, which could allow the best adaptation of the speech therapy treatment to the bio-psychological characteristics of the persons with speech disorders.

In the following stage, the team of psychologists and speech therapists studied the important aspects related to the psycho-social impact of the use of the multimedia means in the treatment of dyslalia. The answers of the subjects were analysed by quantitative and qualitative methods, contributing to reaching the final objective of this stage, that is the completion and the integration of all the components of the personalised therapy system, in a form as adapted and as efficient as possible for dyslalic children. Besides empirical research, the psychologists have also realised an important synthesis of the results obtained in other studies concerning the efficiency of introducing the multimedia methods in the field of speech language therapy. We should mention that there are very few studies concerning computer use in Romanian speech therapy (which used mainly the magnetophone, the tape recorder and other similar devices), but a series of practical suggestions could be adapted from other researches carried out in the field of other languages (especially English).

The content validation of the computer system realised within the project TERAPERS was required. In the first part, the concept of validation was defined from a psychological point of view. The results obtained were processed and analysed, realising thus a content validation for the software Logomon and 3D System. A comparative study was realised between the classical speech therapy intervention method and the treatment methods suggested by the software Logomon and 3D System.

The LOGOMON programme (Danubianu, M., Socaciu, 2009) proves to be an extremely useful tool in speech and language therapy, helping the therapists to diversify the exercises realised together with the children, as well as to give them homework. The programme is also very useful from the point of view of organising the therapy, helping the speech therapist in the process of selecting and organising the persons suffering from speech disorders by groups, programming the therapy and maintaining a record of the children during the speech therapy sessions. Another advantage of the LOGOMON programme is its easiness in the extraction and printing of the various reports the specialist needs (list of children diagnosed with speech disorders, speech therapy catalogue, attendance list, statistical data centralizers, individual activity reports, speech therapy record). Equally useful are the possibility to archive the current data, recording and highlighting some data which are particularly important, the initialisation of some new databases, etc. The 3D virtual graphic model enables visual interaction with the correct pronunciation model, which facilitates a quicker impostation of the sound initially pronounced incorrectly. The virtual 3D model provides the children with attractive impostation methods of the sound pronounced incorrectly, that is, it provides the child with the optimum practicing exercises and enables him/her to better understand the speech mistakes produced, compared to the classical methods.

By applying the system Terapers in dyslalia correction we have noticed special advantages in correcting dyslalic forms in preschool and school age children, system that calls for a wide use in Romanian speech therapy, being one of the few programmes elaborated and usable for the Romanian language.

3 THE COMMUNICATION SYSTEM FOR PERSONS WITH MAJOR NEURO-LOCOMOTOR HANDICAP – "TELPROT", research continued with ASSISTING INTEGRANT SYSTEM FOR PATIENTS WITH SEVERE NEUROMOTOR DISORDERS – "ASISTSYS"

Communication with persons with locomotor disorders can call for the use of functional recovery techniques and methods able to help the patient train and improve his/her motion capacities. Recovery asks for an interdisciplinary team consisting of a neurologist, a physical therapist, a speech therapist and a psychologist which will contribute to the patient treatment and recovery. In addition, the contribution and the involvement of the family are important in the medical and psycho-social recovery of the patient. Many patients present language disorders because of the neuro-motor disorders both at the central level and at the level of the phono-articulator apparatus (lips, tongue, etc.). In cases where the patients cannot speak, cannot utter and pronounce sounds, it is recommended to use special speech therapy techniques associated to images in order to communicate. The system Telprot gives the advantage of using alternative means of communication, with the help of which the disintegration of the communication cycle can be prevented. This system allows the patient to convey a message, which will increase his/her motivation to communicate, to express his/her needs, and to have a certain control over his/her environment, diminishes the pressure to which (s)he is submitted to while speaking (the relaxation resulting from here has often as a result even a spontaneous improvement of his/her speech), the physical effort of the patient is reduced since the motor control on gestures and on the use of images is weaker compared to the effort necessary to speak. (Eriksson, E. , 2004).

In order to reach these objectives, the TELPROT Images Dictionary was created, a dictionary by means of which the patients manage to communicate both with the medical team that provides assistance and with the family members. The patients have to be familiarised with the use of pictograms. There have been selected the most appropriate pictograms, the ones that would express objects, actions, feelings, etc. The pictograms have been chosen according to the hospital environment of the patient, in order to be representative for each moment of the recovery period of these persons. The display of the pictograms on the monitor was analysed, and also the mobility of the persons with neuro-motor disabilities, in order to fix the images in the most accessible position for the patient; also, the most appropriate size for pictograms was established. The "start up" screen has two options, which are displayed successively. Each start up "screen" is marked by a colour – red or green, by a graphic representation and by a word / expression which refers to a category of concepts. The "screens" are continuously shown, in a slow run, until the patient picks one of them. The graphical representation has the role of facilitating the task of the patients with reading disorders. When a "screen" is chosen, the patient hears the voice that calls the chosen option: EMERGENCIES or WISHES / RELATIONSHIPS. If the patient makes a wrong choice, (s)he hears the voice and can make another one, transmitting again the choice signal.

1. The category EMERGENCIES is presented on a red background

2. The category WISHES / RELATIONSHIPS is presented on a green background.

In case the EMERGENCIES category was chosen, the screen is divided into four quarters, containing the categories: NECESSITIES, ASSISTANCE, PAIN, SOCIAL.

Description of the TELPROT system software

The system is created with a client – server application. The client module is represented by the graphic interface of the patient by means of which (s)he receives audio / video information, and a selection button. The server is represented by an application that receives data from the client module, with the help of the TCP/IP protocol. The graphic user interface of the patient, running on a compatible PC, (Fig. 1) was developed with the help of the LABWindows CVI environment [1]. It contains the editing list where the keywords and the associated images sent to the display system are listed. The programme functions as follows: initially, the programme is in an initial state (STANDBY). Pressing the right button of the mouse

(that stimulates the communicative desire of the patient) starts the display within the formatting list of the keywords and associated images. These are shown in a succession with a selectable rolling speed (in seconds). When the mouse right button is pressed again, specifying the patient's answer, the programme functions in one of the conditions:

- if that word represents the name of a (sub)category of keywords, the corresponding word (sub)category is selected, and the display of the words on the screen goes on with words from that particular (sub)category:

- if the word is a keyword from a words (sub)category, the word "SEND" appears on the screen, case in which the patient can confirm the sending by pressing the same mouse button (right click), or if the (previously established) brake between the words is exceeded and the patient did not press the button again when the display of the keywords (sub)categories is resumed.

Following the applications we observed that:
- the use of a graphic interface/calculation programme in order to facilitate communication between the caretakers and patients improves considerably the treatment of patients during their hospitalisation;

- the patients have been extremely responsive to such a system, some of them even being interested in the moment when such a program will become an integrant part of hospital equipment;

- such programmes are necessary both for the patients and for the caretakers.

4 PERSPECTIVES

At the core of our preoccupation there is the development of a new concept, of some new means and technologies for the creation of computers interfaces designed for children, based on the concept of tabletop, interactive objects and interfaces and will combine visual, audio and haptic types of feedback in order to carry out the process of education, and to develop capacities and skills. Such an approach demands collaborations with experts in computer vision, sensorial technologies, tangible interfaces, determining thus some challenges on various plans:

1. The technological challenge: combining and introducing the intelligent sensorial technologies (touching, mimic, video, audio plate, haptics) in the same interface in order to perceive and follow children's intentions and behaviour. Our objective is that of elaborating a new concept and a new technology for the development of a new specific interface, having as established target: interface based education.

2. The psychological challenge: understanding the way in which children interact with computer interfaces and with the present day educational software, the main feedback sources to which they respond the best, the way in which a completely new multimodal interactive interface (created on a visual, audio, haptic and sensorial basis) helps us to understand their intentions, their needs and behaviours, in order to help them develop certain skills and competences. The specialists in the field of psychology, as well as educators and practitioners will answer to these challenges and will report the results of their researches, which will serve as feedback to technological problems.

3. Educational challenge: the discovery and the development of the implementation and application scope in education, which will fully benefit from the sensorial interface, understanding the importance that such a technology can have in the process of learning, the knowledge we can obtain following these researches being subsequently transmitted to the educational sector. The success of this challenge will be evaluated, together with the experts in education, by direct feedback assessment in classrooms.

The haptic feedback will be assessed in accordance with the active surfaces, since the interaction will seem much more realistic when the children will work with objects they can touch and action virtually. We believe that some exercises and applications will truly benefit from their use, considering the haptic benefit they present. We intend to study the effect of the haptic information on the development, skills and learning. These new technological challenges will focus on development by: the use of 3D images and specially projected surfaces, the mixture of real and virtual objects that can intercept, react and communicate, obtaining thus a haptic feedback.

5 CONCLUSIONS

1. The importance and the role of the haptic systems having the software necessary to determine and estimate (haptic rendition / transformation) the forces resulting from the interaction between the virtual interaction of a subject with different objects. Tangible results will mainly consist of carrying out an open source type of source in order to realise the input, for the intentions perception and detection, and for giving the appropriate feedback to educational software.

2. The professionals in education and in the field of computers emphasize the necessity to answer the challenge "interface based education": the way in which intelligent interfaces influence the process of learning, the working method, collaboration and communication ability; interfaces with a high level of multisensorial intelligence become "playing" interfaces.

3. Elaboration and practical use of the information technology in the treatment of the persons with special needs provides the advantages of the use of alternative means of communication which can prevent the disintegration of the communication cycle, and help the correction and the development of communication skills.

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