Importance of Computer-Aided Education for Children with Autism Spectrum Disorder (ASD)

Ülkü Pişkin Abidoğlu
Cyprus International University, NORTHERN CYPRUS

Oya Ertuğruloğlu
American University of Cyprus, NORTHERN CYPRUS

Niyal Büyükeğilmez
Cyprus International University, NORTHERN CYPRUS

ABSTRACT

Education materials such as computers, tablets etc. used in the education of normally developing children starting from pre-school, are also used in the education of the children with special needs, albeit inadequately. Computer-aided education has a significant potential in terms of increasing the educational experiences and facilitating the education of the children with special needs. Despite its limited use in our country, the said technology, which has been used in the western world for a long time, has become a tool that supports the academic skills of the individuals with special needs as well as facilitating their daily lives. In this study, literature related to the children/youth diagnosed with ASD were scanned and information has been compiled in such subjects; "the targets set to develop the skills of children/youth diagnosed with ASD through the usage of technology-aided education and the results, thereof, achieved; the content of the programmes that were applied and the differences between desk-based and computer-based education. Even though all the studies were case studies, the outcome shows that technology supported education brings out a more positive development. While obtaining information through the scanning of the said literature, face-to-face interviews were held and relevant questions were asked to the professional staff who work in the field of special education and deal with the children diagnosed with ASD in the TRNC, with the aim of finding out their perspective vis-a-vis the technology aided education of the children/youth diagnosed with ASD. This study aims to provide information, to parents and to experts who work in the domain of special education and to shed a light to researchers who will engage in future, more detailed studies.

Keywords: computer aided education, special education, autism spectrum disorder

INTRODUCTION

As in all areas of education; besides educational environment, staff and selected education methods, the materials used are of great importance in the education of children with special needs (Hızal, 1982). Computers ensure and even force the children to actively participate in the entire educational process. In other words; children have to

Correspondence: Ülkü Pişkin Abidoğlu, *Cyprus International University, Department of Special Education Teaching, Northern Cyprus.*
✉ uabidoglu@ciu.edu.tr

State of the literature

- Computers affect the attitude of the children towards the class activities in a positive way and it provides the children with more opportunity to practise their basic skills.
- Autism Spectrum Disorder (ASD) is described as a neuro-developmental disorder that appears in social environments characterized by inabilities to communicate and interact and restricted repetitive behaviours.
- Teachers who work in special education utilise computers as a tool of education to motivate children and to develop their academic skills and as a means of reward.

Contribution of this paper to the literature

- Computers provide consistency, regularity, usefulness and stimulates willingness without exertion of pressure and allows the children to control their learning process.
- Structured computer programs help autistic children to overcome their over stimulation selectiveness through practice or sufficient experience.
- Children, diagnosed with ASD, can learn academic, social and emotional skills more easily through computer-aided education.

actively participate in the study/work if they are to complete the learning process. In fact, computers force/encourage children in such a way that they actually enjoy this enforcement (Seniş, 1992).

Considering the general benefits of computer usage in education and training, it is possible to enlist the following: It motivates the child and is interesting; it contributes to permanent experiences; develops skills and behaviour, has wide-range applicability, enabling education based on needs (Doğan, 2003).

Computers enable each and every child to actively participate in the learning process, because computer-aided education provides individualized education. Researches and observations show that although they may be at the same developmental stage, there may be differences amongst individuals. These differences, referred to as individual differences, stem from the genetic differences of individuals. Some of these do not change for a life time, whereas some change due to different socio-economic and cultural environments individuals find themselves in. In addition, inadequacies in the systems of stimulant perception and response of some individuals, their disabilities or capabilities cause them to be different from the individuals in their age group. As a result, even if the individuals are at the same level of education, they have to be educated with the appropriate tools and methods which have to take into account the qualities and abilities of the individuals. Individuality plays an even bigger role in special education, as the level of differences between the children who receive special education is much greater (Çilenti & Kamuran, 1991).

Computers allow adjustment of learning periods for different skills; practising of already learnt skills and developing towards the next stage. Teachers who work in special education utilise computers as a tool of education in addition to motivating the children to learn, to develop their academic skills and as a means of reward (Bahr, 1991). The importance of using of computers becomes more evident when the different features of children with special needs; i.e., their inadequacy in academic skills, their short attention span, and their need to be motivated more when compared to their peers, are considered. Moreover, special education teachers and experts emphasize strongly that the computers affect the attitude of the children towards the class activities in a positive way and it provides the children with more opportunity to practise their basic skills (Cosden & Semmel, 1987).

Results of many studies show that computer-aided education is more effective than the conventional education (Bayhan, 1993). However, the studies regarding different special needs groups have to be planned differently and accordingly with their levels and programmes have to be developed taking these into account. No matter for which disabled group and for which skill they are developed for, computer software have to have certain features. These are;

- In order to intensify the attention, important information in the software has to be emphasized both visually (colours, framing, underlining, etc.) and aurally (verbal cautioning, music, etc.)
- Those required in the content of the programme has to be indicated in a short and clear manner and has to be the appropriate for the level of the child's development.
- Programmes have to include clues and assistance (both verbal and sign) to facilitate learning.
- Feedback (reward for correct answer, new try as well as help for wrong answer) should be given for each response.
- Regardless of the skill the programme contains, it must follow a sequence from simple to complex (Kuloğlu & Pişkin, 1994).

In the light of this information, the contribution of computer-aided education to various basic principles such as motivation, individuality, frequent repetition, applying one situation to another (to transfer), feedback, education based on senses, is indisputable.

Computer-Assisted Education for Children with ASD

Autism Spectrum Disorder (ASD) is described as a neuro-developmental disorder that appears in social environments characterized by inabilities to communicate and interact and restricted repetitive behaviours and interests (APA, 213). There are different types of disorders under the main category of ASD; such as, Autism, Asperger Syndrome, Childhood Disintegrative Syndrome and Atypical Autism (Kırcaali-İftar, 2007).

Autism is also characterized by cognitive impairment as well as inabilities in communication and creative activities.

Insistence of the child on sameness is a core feature of autism. In comparison to people, computers are tools that tend to provide for such kind of sameness. This is the main reason why children with ASD prefer mechanical objects in communication instead of people. Hence, the interest of the autistic children in mechanical objects allow the usage of computers.

Colby and Smith (1970) emphasize the significance of usage of computers for autistic children. Computers never get tired, they are predictable, always saying the same thing in the same manner, never becoming angry or bored. Colby has used computers to trigger the development of speech of autistic children with speech difficulties. He developed a game that utilises symbols, combined with human voice, which appear on the screen when the buttons are pressed on the keyboard. He worked with 17 autistic children with speaking difficulties, setting, after 50 and 100 half-hour education sessions, significant targets to be used for educational purposes in the field of language development. In this training, prior importance was given to using clear expressions and sentences used in daily communication (Weir, 1987).

Pleinis and Romanczyk observed that computers have a positive effect on the comparative performances of the autistic children in the domains of attention and other education methods (Chen et al., 1993). Computer-aided education increases the verbal communication among autistic children and provide for peer communication. This is also effective in the application of social skills to other situations (Randoss et al., 2011). Bölte, Golan, Goodwin and Zwaingenbaum, through their studies, have observed that computers and internet minimized the problems experienced by autistic individuals in verbal communication and interaction and made their lives easier (Bölte et al., 2010).

Circumstances/objects contained in a material that is not intended for its use of purpose (for example the shape of card instead of the object on the card) can prevent autistic children from learning. Autistic children can pay more attention to the worn out edge of the card instead of the educational content contained in the card. Computers are suitable for both adults and children, as they do not have these types of idiosyncratic and random behaviours. However, computers can provide warnings that are limited in numbers and merely those that can be observed on a screen. Thus, if an autistic child directs his/her attention to a situation other than what is displayed on the screen, this situation will be eliminated at the beginning of the training (Panyan & Marion, 1984). This over selective response is being discussed as a problem affecting learning and generalization in autistic children. This

situation occurs when the child focuses on an irrelevant point in a complex stimulus and affects the child giving the right reaction.

With the introduction of technology into educational life, computer and internet usage have been considered as beneficial in supporting the cohering of autistic children. Considering that technology will assist individuals with autism in their functional inadequacies, increase their learning abilities, allow them to be independent and facilitate their communication, Lozano, Ballesta and Murcia (2011) have developed an educational computer programme for children attending primary and secondary school that will enable learning of social and emotional skills.

9 children, aged 8-18, who had difficulty in expressing their emotions participated in the research. The research lasted 20 weeks in total, conducted twice a week as 45-minute courses. It was observed that the programme was effective on autistic children, and the families and teachers noticed these positive developments (Lozano et al, 2011).

Moreover, in support of the development of social skills, Escobedo, Nguyen, Boyd, Hirano, Rangel, Gorcia-Rosas, Tentori and Hayes (2012) have developed an auxiliary tool named MOSOCO (Mobil Social Compass). The study was carried out on 12 children with the diagnosis of ASD. In the study, emphasis was put on such social skills as whether the student made eye contact, cohered with his/her peers and conversed about himself/herself. Results of the research show that MOSOCO facilitates learning and implementation of social skills and also strengthens the qualitative and quantitative social interaction (Escobedo et al, 2012).

Hetzroni and Tannous evaluated the effectiveness of computer-aided programs on the communication skills of the children with ASD. The main target is to decrease the echolalia of children. Five children aged between 7 and 12 participated in the study. The programme consisted of three main sets; game, food and cleaning. Findings showed that the computer-aided program had positive effects on improving communication skills of all the participating children (Hetzroni & Tannous, 2004).

In another study, Hourcade, Bullock Rest and Hansen (2012) assessed the effectiveness of touch-screen tablet applications in the development of social skills of children with ASD. This study which was carried out with three children aged 9-13, programs were designed with the aim of improving children's creativity, fine motor, sequencing, sharing, and cooperation skills. The findings of this study, which was developed as a case study, show that tablet applications are effective in the improvement of social skills of the subjects (Hourcade et al., 2012).

Moore, Cheng, McGrath and Powell (2005) have developed collusive virtual environment technology for children who had ASD diagnosis. In their study, they used a three-dimensional simulation program similar to real life environment. 34 children, aged 7-16, with ASD diagnosis participated in the study. The aim of the work is to provide the children with skills to recognize feelings. In the study, a program was designed which included different phases with happy, sad, angry and scared facial expressions. The study has shown that 90% of the children were successful in identifying feelings (More et al., 2005).

Moore and Calvert (2000), in teaching vocabulary to children with ASD diagnosis, compared the computer-aided teaching methods with the teacher assisted teaching methods. 14 children between the ages 3-6 participated in the study. The behavioural programme and the educational software used in the study assessed the attention, motivation and learning characteristics of children in learning words. Study results show that the children are more successful in learning words through computers (More & Calvert, 2000).

Tang, Jheng, Chien, Lin and Chenn (2013) have designed system called "iCAN". iCAN includes arrangement of PECS (Picture Exchange based on Communication System) on tablet computers which is also used in the communication of children within the range of autism (Tang et al, 2013). 11 children, aged 5-16 with ASD diagnosis participated in the study. The study showed that the application of iCAN is useful for the children.

As referred to in another study, kinaesthetic cues in autistic response are better than visual cues. This situation is related to the ability of the child to define his/her body movement very well. According to Ornitz, like objects which rotate and swing and stroke on their own, autistic children clap their hands and shake their legs; and

use these movements to warn their surroundings. They use their own bodies and body parts for kinaesthetic feedback. In a study, "a mechanical turtle" of a logo program was introduced to the child. As a result of the use of "a mechanical turtle" in this program on a study with numbers, the child's success and interest increased and, he/she was able to make a move without guidance (Weir, 1987).

Moreover, the program of "Basic Skills Keyboards", prepared for autistic and atypical children, increases children's attention, speeds, response rate/speed, willingness, problem solving skills, and it can be an effective stimulus for social interaction, mutual communication and behavioural change. This programme, is an experimental discovery programme which aims to provide a learning environment that meets the needs of children. As is clearly stated by the two main ideas put forward by the related individuals, autistic individuals seem to be inelastic in information process. These researchers define this as the "Gestalt" process. It means: autistic individuals should be trained to learn the information as a whole (Levine, Jude & Curtis, 1986).

Individuals with ASD are seen inadequate in distinguishing the components of knowledge. As a result, they are inadequate to see how the environmental factors influence the parts forming a whole. Thus, autistic individuals are less functional when they are expected to adapt themselves to short term stimulus, which are related and move very fast.

METHOD

Research Design and Methodology

A qualitative research method was used in the study. Analysing the events and facts in social sciences in their own environments and conducting a field study, enable the perception of wide variety of events to become more understandable. This kind of approach in social sciences makes it more conceivable. In social sciences, this kind of approach helps to produce more realistic results. In the field of social sciences, there is no single fact and no single truth, reality and perceptions are multiple, rigid rules are not applicable; however, descriptions can be made in accordance with the environment. For this reason, the qualitative research method in social sciences, in recent years, has been considered as an important method (Yıldırım & Şimşek, 2005). In qualitative research, the concept of "transferability" is adopted instead of "generalization". Descriptions revealed at the end of research, merely show the value of being transferable to similar environments (Erlandson et al., 1993). In this context, interviews with the special education teachers used in the study, have been transferred to the reader by creating themes and interpreting their analysed opinions and experiences.

This research has been carried out with descriptive analysis and supported by qualitative data. Qualitative data were generated by using the method of face-to-face interviews with the teachers working in the field of special education at the State and private special education centres operating within framework of the TRNC Ministry of National Education (MoNE) For interviews, 15 interviewees were targeted, however, since 3 interviewees could not be reached, and 1 refused the interview, 11 interviewees were done. The preliminary permit which was received from the TRNC Ministry of National Education (MoNE), required for the realization of this study, is presented in the annex (Annex 1). The aim of this study is; to emphasize the suitability of the use of computer-aided teaching and technology in facilitating the academic, speech-communication and social lives of children and individuals with ASD diagnosis, as well as shedding light to the field through reflecting the experiences, observations and contributions regarding computer-aided teaching of special education teachers with different occupational experiences.

Findings and Remarks

A total number of 11 special education teachers were interviewed for the purposes of this study. Thematic approach was used for data analysis and names of institutions and interviewees were kept confidential. In an attempt to obtain wide and comprehensive information, the semi-structured interview technique was used and interviews were carried out face-to-face. In order to carry out the interviews, available dates and times of the interviewees were noted, appointments were made and interviewees were visited in their respective institutions.

Interviews were completed in 30 to 50 minutes and were audio-recorded with the consents of the interviewees. The data was later evaluated by listening to the audio-recorded interviews.

During the interviews, questions were asked regarding the field experience of the special education teachers, whether they used computer-assisted education, for what purpose and for which skills; and whether there was a difference between desk-based and computer-aided education with respect to the learning of the children. Finally, they were asked to share their knowledge and experience with regards to the teaching practices that they use in their current institutions.

The information provided by the special education teachers is as follows; when the field experience of the special education teachers were considered, it was determined that 3 of the teachers have 1 year of teaching experience, 1 has 2 years of experience, 2 have 3 years of experience, 2 have 4 years of experience, 1 has 5 years of experience, 1 has 7 years of experience and 1 has 25 years of experience in teaching children with ASD. The participating teachers' field experience is between 1-25 years, which indicates that they are highly experienced. Their positive-negative and appropriate-inappropriate predictions regarding their practices with the children suggest that they have the necessary experience.

All of the participating special education teachers stated that they use computers for educational purposes. They have also stated that they mostly use computer-aided education while working on self-care skills (washing/drying hands, brushing their teeth, etc.), daily life skills (house work/ kitchen skills, etc.) and academic skills (colour, opposites, etc.). The participants also stated that, apart from computers, that they make use of interactive whiteboards and tablets.

When the special education teachers were asked whether "the desk-based or computer-aided education makes learning for the children with ASD easier'', a great majority stated that computer-aided education is more beneficial. According to the participants, the use of computers in distractible children and those with a limited eye contact revealed greater benefits. They have also stated that they use computer-aided education for revising and generalisations.

The problems encountered by the teachers in computer-aided education is related to the programs used. The participants stated that there are deficiencies in the software designed for the target age group as well as those that take into account the individual differences of the children. There are also deficiencies regarding the stages set within the programmes, and that the majority of the software that is available tend to focus mainly on academic skills.

RESULTS AND SUGGESTIONS

National Autism Centre (NAC) has carried out a number of studies and prepared reports in order to identify methods of intervention as regards children with ASD. In the aforementioned report, the methods of involvement are categorised into three types; scientific-based, up-and-coming and those that lack scientific basis (NAC, 2009). It is observed that, the report published by Wang et al. includes technology-assisted education (Kiriz & Yıkmış, 2016).

In order to make use of computer-assisted education for children and individuals with ASD, there is need for software that is designed for different educational development fields and have appropriate stages. The software must support the academic, as well as social-emotional skills and address inadequacies intensively while also supporting language and communication skills of the users. The software must also be designed taking into account the age, interests and level of skills of the children.

When the benefits of Computer Aided Education for children referred to in this study are taken into account;

- Computers provide consistency, regularity, usefulness and stimulates willingness without exertion of undue pressure and allows the children to control their learning process.

- Structured computer programs help autistic children to overcome their over stimulation selectiveness through practice or sufficient experience.
- The use of voice separator in speech provides a similar strategy in acquiring verbal language.
- Multiple internal-external tools can be adapted according to the development of the child (touch screen, joystick, etc.)
- Computer voice separator provides children that are unable to develop their speech skills with mutual communication through a visual interpretation of the language or symbol systems (12).

The results of the studies on the use of computer-aided education with children diagnosed with ASD reveal that the children learn such skills as academic skills, mood state skills, social and emotional skills more easily through computer-aided education. The results also suggest that, with computer-aided education, children with ASD can more easily tolerate and regulate their inadequacies stated in their medical diagnosis. Nevertheless, the majority of the area studies are case studies. In order to increase the reliability of the studies, there is need for further case studies; for the families to be involved in the studies; for the technology-assisted tools not to be limited to the school environment but also be present at the home environment. These are also important for children to generalise their skills There is also need for further studies with people who work in this occupational area who are the ones implementing these studies. Studies that look into the views of the members of the profession with regards to the use of technology in education and learning, as well as those that measure the knowledge and level of experience are particularly important. Briefing the members of the profession about the use of technological devices by means of in-service training is significant, as this will directly have a positive impact on the learning of children with ASD. Furthermore, technology-assisted education for children/youth in question must not only be limited to the teaching of academic skills, but instead, it must also become a tool that will help make the lives of children/youth diagnosed with ASD easier. Consequently, authentic programs intended for all skills and for children with various levels of development must be designed and in order to allow programmers and members of the profession to work in cooperation for the development of the software, necessary arrangements need to be made and be supported with projects and incentives.

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