JMR

http://jmr.tums.ac.ir

Research Article

Play Therapy in Augmented Reality Children with Autism

Entesar Hosseini[*1], Faranak Foutohi-Ghazvini[2]

1- PhD Student, Department of Information Technology, School of Software Engineering and Information Technology, University of Qom, Qom, Iran
2- Assistant Professor, Department of Technical and Engineering, School of Software Engineering and Information Technology, University of Qom, Qom, Iran

ARTICLE INFORMATION

Article Chronology:
Received: 25.05.2016
Revised: 12.06.2016
Accepted: 27.07.2016

Corresponding Author:

Entesar Hosseini
Emial:
entesar.hossini@yahoo.com
Tel: +98 9357397254
Fax: +98 9357397254

ABSTRACT

Introduction: development. It is a lifelong condition, with symptom that appears in early childhood. These people have problem in social skills, communicating with others and expressing their feelings. These people specially have difficulties with the surrounding world and recognizing objects. One of the most effective methods in educating the autistic children is "Picture Exchange Communication System (PECS)" thus helping to enhance the child's communication abilities and understanding of the function of communication. Autism therapies implementation in a digital environment like computer and mobile games is very influential, and it acts as a bridge between children and the world around them. Then, the "PECS " method is implemented using an augmented reality mobile game. Augmented reality has added virtual objects into the real environment.

Material and Methods: A quasi-experimental study was conducted on children between the ages of 6 and 11 years at three different intensities of developing autism spectrum disorder poor, medium and strong, respectively. Three different tests were considered and how to answer these questions based on Likert scale were collected, and data analysis was performed using Wilcoxon test.

Results: Tests' results show (significant = 0.007) that is < 0.05 and represent that there is difference between the performance of children before and after applying the method for learning to play.

Conclusion: One of the best platforms for mobile phone implements training methods and treatment. Using augmented reality is very effective technology on an understanding of educational and treatment methods.

Keywords: Autism; Treatment and education system; Picture exchange communication system; Augmented reality

Citation: Hosseini E, Foutohi-Ghazvini F. **Play Therapy in Augmented Reality Children with Autism.** J Mod Rehab 2016; 10(3): 110-5.

Introduction

In the medical world, there are personality and psychological disorders. A collection of disorders is including decentralization childhood disorder, autism, Asperger's disorder, pervasive developmental disorder, and Rett's disorder which are part of pervasive developmental disorders (1). A disorder of the nervous system causes a non-functioning brain is effective in causing autism. The autistic disorder causes the brain fails to function in social behavior, verbal and nonverbal communication, and communication skills properly; that affects cognition, behavior, and multiple body systems (2, 3). Different methods have been developed to improve the problems. These methods considered by repetition and practice steps can help your child to improve autism spectrum disorder. Some of these methods include applied behavior analysis, Training and Education of Autistic and Related Communication Handicapped Children, Picture Exchange Communication System (PECS), flora time, social stories, and sensory integration. Today in education, game known training as one of the most effective means because with game can help the children through education and game to treatment mental illness and behavioral problems in children (4). These people have a keen interest in video games and adventure games (5). In a project called ASK-Inclusion-VE seven commissioned teach requirements

and how to use virtual environments to autistic children. The group feedback helped design computer for this collection (6).

O Open Autism is open source software applications were presented at the University of Iowa by Hourcade et al. (7). This code is free software and easy to use, so by parents and educators interested is easily customizable. Noor et al. offered on the design process interactive toys to explain the behavior of autistic children and can also be used for behavioral training autistic children. Researcher behaviors and interests of children were used in a regular pattern to stimulate motivational skills and explore social categories. Finally, he offered a toy of some undefined cube the expression of behavioral effects by their relationship and change color as though each player how use them (8). Noor et al. offered a personal computer that autistic children aged 9-14 years, helped, learn the proper use of money and good behavior while shopping. This game was made by Build Your Own Block (8). CMotion was presented by Finkelstein et al. (9) actually use virtual humans to teach emotion recognition and simple programming concepts to children. CMotion has an interface that child interact with the drag-and-drop and teaches different faces and emotions. Finkelstein et al. offered an interactive computer game to improve speaking fluency in children with autistic that user should spelling name appear on screen objects at short space of time (9). Autism Touch is a list of software applications and games is usable by individuals with autism, Down syndrome and children with specific problems. This program was written by Jenny Vynyngham a Certified Behavior Analyst and Thomas Kernose a software engineer It contains links to information about each program is available in this list. This list includes 30 examples of software that is easily searchable list and if needed and it can be downloaded and used. It was written by the duo Autism Touch (10). Game software offered by Noor et al., is touch story that aims to improve understanding of the stories and concepts in children with autism. The game uses simple image-based activities that comprise the main components of a story improve children's understanding (8). A Hoque et al. (11) introduced a story about customization speech, presented a game so are able to produce intelligible speech and words in children. In this way, they were identified fields physical and computational problems by the participants. They created an interactive relationship and customized for your users to be able to manipulate aspects of his speech. They launched a pilot project within 12 months and to analyze games and audio processing algorithms. Initial results show of the appeal and effectiveness of the games on participants. Whiz Kid portal is a collection of online games (12) which have emerged aims to help people with autism and develop their life skills focusing on areas such as coping with change, recognizing emotions, and nonverbal communication. It is created by a group of senior students multimedia Svyn University of Bern, Autism school Partnership and the Center for Treatment National Electronic Boleyn that is E Therapy refers to delivery of structured early intervention/treatment programs for clinical disorders/symptoms via the internet with or without human support. They believe that children with autism are weary of traditional education and treatment, and in front, they enjoy of computers and mobile technologies. Whiz Kid collection consists of 16 games for the treatment of autism-themed children's everyday activities such as getting dressed, going to school (13). Ferdous et al. (14) presented an interactive computer game that was increasing speech intelligibility in autistic children and used as one the foundations of treatment in addition to conventional therapy. Their research results showed the effectiveness of this method. Interactive Therapy System (ITS) design was presented by Choi and Limb (12); the study was on the potential use of assistive technology designed as interactive. Key methods in collaborative design are interactive modeling, heuristic evaluation, user-driven process, Virtual reality technology, tangible interfaces, and text-based scenarios. They applied these methods in the ITS and offered an efficient design of interactive technology as an aid in the clinical trials. Five types of social skills training scenarios developed and one various scenarios was the ability to evaluate. Noor et al. presented a design and initial evaluation of collaboration puzzle games and design of interactive games to aimed increasing activities and cooperation in children with autism spectrum. The results showed that the interaction with a set of rules systems to implement collaborative even though it is more complex interaction but it has a positive impact on cooperation between children (8). The game uses a virtual reality used to improve social skills in children aged 7-16 that resulted in improvements in emotion recognition and social performance during several sessions in 5 weeks (15).

Most autism treatments methods are based on repeated and training. Mobile is one of the best ways to implement platforms for education. The use of new technologies such as virtual reality and augmented reality are very effective on understanding of educational and therapeutic methods. We are going apply augmented reality techniques to facilities understand and more attractive educational and health. The techniques used for implementation one of the most common methods in the treatment of autism in a fun environment. Augmented reality is a live direct or indirect view of a physical world and often interacts with user that adds objects around real world (16, 17). These objects created by receiving and processing sensors input data such as audio, video, graphics, or GPS. PECS

method was chosen for implementation in mobile phones with the Android operating system in the initial phase that helps autistic children to improve treatments and education (18, 19). Research has shown these technologies very helpful in education and special education for children with disabilities and disorder (20). We use augmented reality for digital implementation early stages of PECS that are recognition and diagnosis. If child selected each image, he sees a three-dimensional (3D) image similar to reality (21).

Materials and methods

We choose animals from the entities and objects in the world around. The selection has been done according to coach and school administrator speech Autism Tehran Pasargad. Because the basic requirements objects are taught at the home and school but to other objects, such as animals and fruits are less taught. In the first phase of our application, the animals are divided into two groups, livestock, and wild animals. There are wild animal's icons in the list. With click each icon, program run the augmented reality environment and its 3D shape of the icon to be displayed. 3D icons replace the real image of item that selected by the child in the physical world. There are not question about which animal is selected from the list because the diagnosed animal is not necessary at this stage and target is only recognition objects. By repeating this step and click on various icons will recognize the names and even sounds of various animals and due to this experience can serve diagnostic phase. Click on the icon to display a 3D shape of the selected icon first will be with an assistant coach. Repeat several times a child can do this stage alone. For pets animal game environment implemented with and engine and children by click on the name of each animated sees it as a two-dimensional shape. This stage is impressive for child is familiar with the appearance of each animal.

For evaluate this study is considered three types of tests that are the use of mobile phone and interact with it, work with PECS method and compare the rate of feedback in virtual education to physical education. For each test were introduced three figures of three categories about the subject of study and number of items in each category. How to answer these questions collection and calculation based on Likert scale data. Replies marked in five categories very good, good, medium, poor and very poorly and given points each of the answers. Replies rating are investment in the order of 5 to 1. We used Wilcoxon test for data collection. Wilcoxon test is a nonparametric statistical used test to assess the similarity of two related samples with a rating scale. With this test can be studied differences between the quality data of two dependent groups. Research data were collected before applying the implemented method in the school's records. After applying method, the data to be recorded in the report was prepared for children. Our study population is autistic children which among these are selected, children between the ages of 6 and 11 years that are in three groups of varying intensity autism spectrum disorder weak, medium and strong, respectively. From now referred on children with autism spectrum weak, medium and strong to three groups mentioned first, second, and third. The children were all educable. There was a weak disorder with hyperactivity problems and a strong disturbance with Down syndrome problem and children with autism strong intensity did not want to communicate and dialogue. For each child were set three report cards in accordance with the statements of the test. Before starting the course trained, how to interact and communicate with software, fully. The application was installed on three mobiles. Two of them were given to a group of children who were at school, and one number was given to the other two children were in their home. Tests were divided into eight sessions of 1-hour that split 10-15-minute. Researchers were at all test stages and controlled performance of the child and his behavior during the course of working with software and answers to questions on the report card of each child. Answer these questions were different for each child according to the severity of their autism. For all three groups of children were considered a separate report. In each category calculated of each item separately and then has been shown in graph for three groups. The third level was reviewed physical education and clinical records of every child in school and his report card was compared with report card that was developed in the early part of the test. The purpose of this phase is comparison test learning physical time with mobile learning time. We propose two hypotheses on evaluation the educational performance of children and the first feedback before and after applying the virtual learning method:

H_1: There is difference between the performance of children before and after the use virtual learning.

H_2: There is not difference between the performance of children before and after the use virtual learning.

Results

In this section has been shown, the results of tests and comparisons made in the three-phase program's success in performance, the success program in the field of education and treatment play of early stages of PECS and the success and excellence in education and treatment programs for training and physical therapy. The results of the test No. 1 in figure 1 represent the ease of use mobile phones by children due to the severity of their autism. Children with weak spectrum disorders were much better than children with strong autism spectrum disorders in clicking, interacting with the user interface. As well as children with medium autism spectrum disorders were required to repeat and practice more than the first group but they were much better than children with strong disorder.

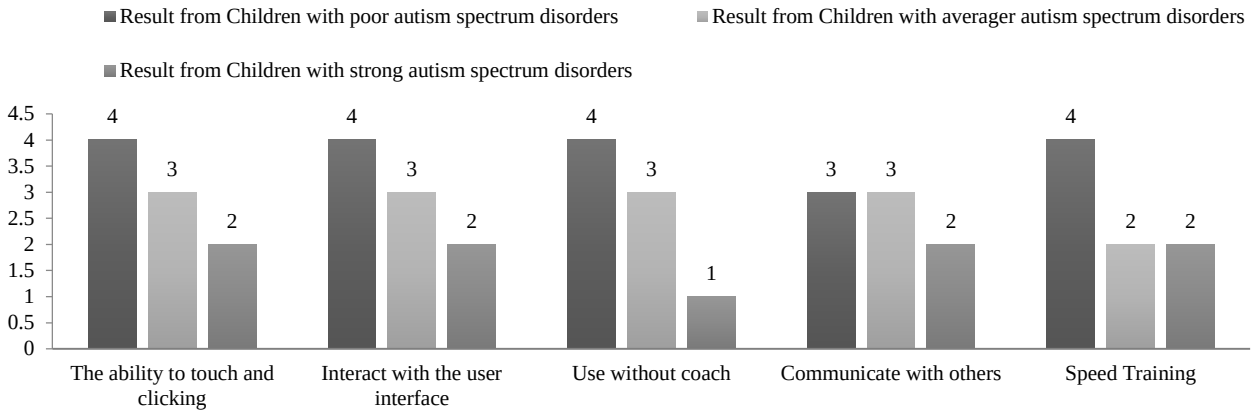

Figure 1. Test results 1: Using a mobile phone and interact with it

PECS methods and work with it for three groups of children in the second test shown the speed training to identify and recognize names of animals and need to repeat the process for each group of children with the results in figure 2.

Figure 3 has shown comparison of speed training of virtual and physical treatment method in all groups. Data obtained results using Wilcoxon test shown amount 0.007, that is < 0.050 and indicates there are a significant. Thus H_1 proven and H_2 to be rejected.

Discussion

The aim of this study was to increase the motivation and speed feedback on education and treatment of autistic children. The use of virtual world technology and tools is an effective way in achieving this goal. One of the main reasons for the success of the program was implemented using augmented reality techniques because displaying 3D model of object in the scene a real was attractive to children. The child was trying to see every object in all aspects of the environment this would be repeated to see any object that one of the main reasons to conclude PECS, and most of treating autism method is repetition and practice. Some children with severe autism spectrum disorder were in sever trouble communicating with the people, is absorbed on seeing the graphical appearance and 3D models of objects and were interested to see next program option. According to Figure 1 children with weak disorder using a mobile phone and work with very easy. Children only with a guide, continued to work with the program easily repeat the name of the animal and its sound. Children with middle autism do not have trouble in using a mobile phone, and they were interested in using the app but need guides more than children with weak disorder. Ability to communicate with autism strong children was difficult and long time. These children are not allowed guide for proper their use phone. After the passage of time and convince children to see one of the models loaded graphically, children are recruited and though worked with the program for a short time. Learn needs more time in these children than in children with weak and moderate autism spectrum disorder.

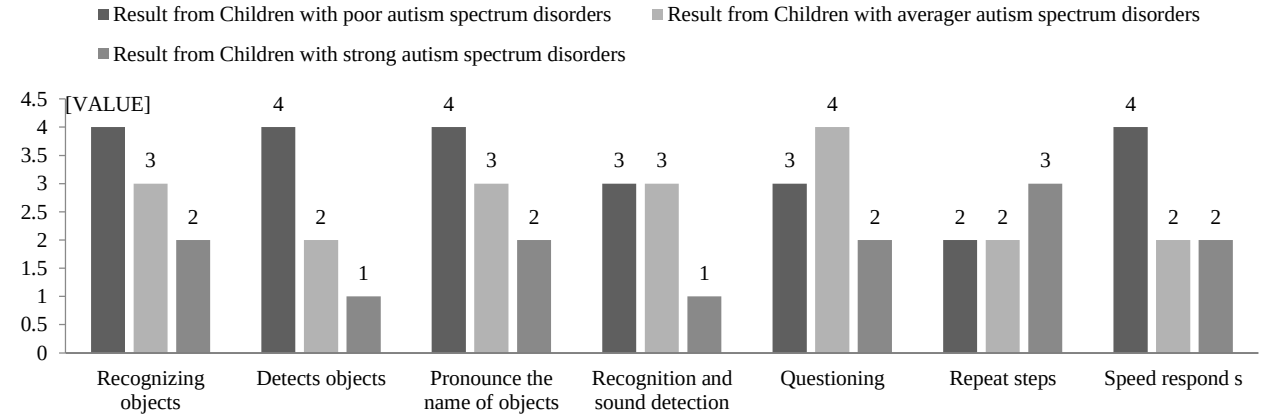

Figure 2. Results of Test 2: Check the Picture Exchange Communication System approach and work with it for three groups of children

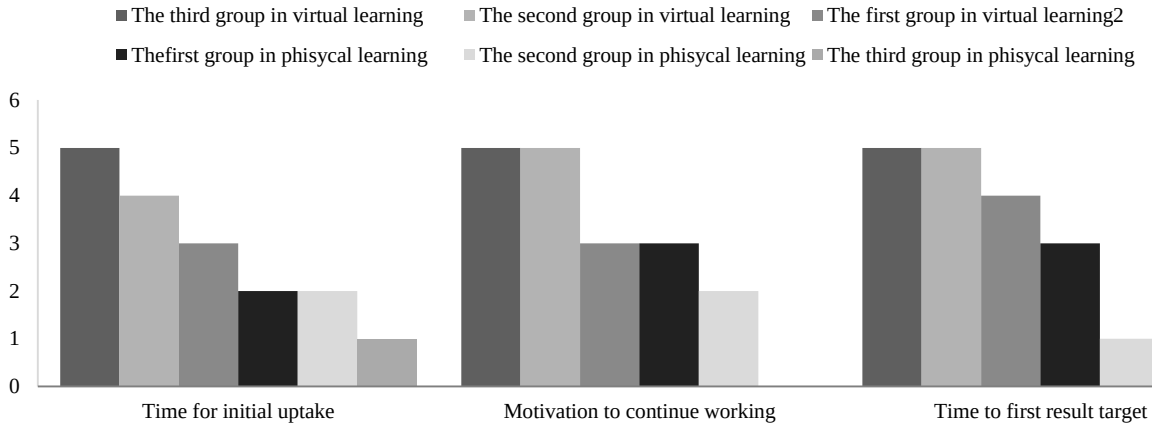

Figure 3. Results test 3: Compare the speed training and treatment between virtual and physical method in all groups of the population

In general, however in the stages of diagnosis, in the case, child was selected incorrect option in response to questions but was resolved problem with back to recognize stage and repeat several times and the child was able to give the correct answers. Children in low and medium autism spectrum disorder groups were done well to identify the objects and voice recognition animals and with a little practice and basic guidance during rest of the game to easy. Speed respond to questions in the first group was higher than the other two groups. The third group of children in the diagnosis step were poor and need to repeat the steps more and were able pronounce and recognize during several meetings.

By comparing physical education records card of children in school with records card virtual learning during test sessions, attract children in physical and clinical education is much less than if the mobile phone is used in education. Motivation and attention in children for education via mobile phone much more than when physical education. After training in three groups of children, getting feedback is much faster than getting feedback on practice time coach or parent. For example, for child with severe disorder it takes a year to train the word "Hello" but the child learn "Tiger" and repeating its during meeting and working with the program in some 15-minute time with the help a coach. Time required to repeat and practice, especially in the early stages of PECS method in the area of recognition, is much less than the time it takes to train at school and clinic. Autistic children are interacting in learning use mobile more powerful than learning by communicating with their coach. In general, the implementation of autism treatment through mobile games has the positives and negative points. Positives points are speed attract attention and education, create incentives for repetition and practice and reduce the time required to identify and recognize education via mobile phone and negative point is long-term use of mobile phones leads to further isolate the child.

Conclusion

In this paper, one treating method of autism implemented with augmented reality techniques in android smartphone. The program was tested on the autistic children with severity of the autism spectrum weak, medium, and strong. Implement any of the methods such applied behavior analysis, social stories, set the senses, and other methods listed and combine them together to help to the treatment and education of autistic people, especially children's. In this study, three-phase of PECS method implemented and program was for training and orientation of objects of the real world. Select another set of objects and continued implementation of the last phase of the PECS method is widely used to help improve autistic children. Implement all methods of treatment and training use of emerging technologies increases the efficiency and attractiveness of product offerings. To implement any therapies for pervasive developmental disorders, particularly autism via cell phones and computers to create instructions which by that children benefit the positive points of the education and health through digital games and that the long-term use of these devices for education, not isolated and loners. In addition, the program has been implemented have encourage cooperation spirit and questions from around and eventually, improve connection with both teachers and children around.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgement

This article was extracted from the Information Technology thesis prepared with title Play Therapy with Augmented Reality Children with Autism. The authors would like to acknowledge the Faculty of Rehabilitation, Tehran University of Medical Sciences

and Health Services, for their support and contribution to this study.

REFERENCES

1. Llaneza DC, DeLuke SV, Batista M, Crawley JN, Christodulu KV, Frye CA. Communication, interventions, and scientific advances in autism: a commentary. Physiol Behav 2010; 100(3): 268-76.
2. Sula A, Spaho E, Matsuo K, Barolli L, Xhafa F, Miho R. An IoT-Based framework for supporting children with autism spectrum disorder. In: Park JJ, Barolli L, Xhafa F, Jeong HY, editors. Information technology convergence. New York, NY: Springer; 2013. p. 194-7.
3. Zablotsky B, Black LI, Maenner MJ, Schieve LA, Blumberg SJ. Estimated prevalence of autism and other developmental disabilities following questionnaire changes in the 2014 National Health Interview Survey. Natl Health Stat Report 2015; (87): 1-20.
4. Liarokapis F, Anderson EF. Using augmented reality as a medium to assist teaching in higher education. Proceedings of the Eurographics 2010; 2010 May 3-7; Norrkoping, Sweden.
5. Mazurek MO, Engelhardt CR, Clark KE. Video games from the perspective of adults with autism spectrum disorder. Comput Human Behav 2015; 51(PA): 122-30.
6. Schuller B, Marchi E, Baron-Cohen S, O'Reilly H, Robinson P, Davis I, et al. ASC-inclusion: interactive emotion games for social inclusion of children with autism spectrum conditions. Proceedings of 1st International Workshop on Intelligent Digital Games for Empowerment and Inclusion (IDGEI 2013); 2013 May 14-17; Chania, Greece.
7. Hourcade JP, Bullock-Rest NE, Hansen TE. Multitouch tablet applications and activities to enhance the social skills of children with autism spectrum disorders. Personal Ubiquitous Comput 2000; 16(2): 157-68.
8. Noor HAM, Shahbodin F, Pee NC. Serious game for autism children: review of literature. World Acad Sci Eng Techno 2012; (64): 647.
9. Finkelstein SL, Nickel A, Harrison L, Suma EA, Barnes T. cMotion: a new game design to teach emotion recognition and programming logic to children using virtual humans. Proceedings of 2009 IEEE Virtual Reality Conference; 2009 Mar 14-18; Lafayette, LA, USA.
10. Touchautism. Touchautism website [Online]. [cited 2015 Oct 5]; Available from: URL: http://touchautism.com
11. Hoque ME, Lane JK, el Kaliouby R, Goodwin M, Picard RW. Exploring speech therapy games with children on the autism spectrum. Proceedings of the 10th Annual Conference of the International Speech Communication Association 2009 (INTERSPEECH 2009); 2009 Sep 6-10; Brighton, UK.
12. Choi MY, Limb CY. Interactive therapy system design for children with autistic spectrum disorders. Proceedings of KEER2010-International Conference on Kansei Engineering and Emotion Research; 2010 Mar 2-4; Paris, France.
13. Dexigner. WhizKid games: online portal helps children with autism [Online]. [cited 2015 Aug 10]; Available from: URL: http://www.dexigner.com/news/19590
14. Ferdous SM, Ahmed SI, Rahman M, Anwar A, Anik SA. A computer game based approach for increasing fluency in the speech of the autistic children. Proceedings of the 11th IEEE International Conference on Advanced Learning Technologies (ICALT); 2011 Jul 6-8; Athens, GA, USA.
15. Didehbani N, Allen T, Kandalaft M, Krawczyk D, Chapman S. Virtual reality social cognition training for children with high functioning autism. Comput Human Behav 2016; 62: 703-11.
16. Gay V, Leijdekkers P. Design of emotion-aware mobile apps for autistic children. Health Technol 2014; 4(1): 21-6.
17. Raghavsood R. Pro android augmented reality. 1st ed. New York, NY: Apress; 2012. p. 1-11.
18. Azuma RT. A survey of augmented reality. Presence: Teleoper Virtual Environ 1997; 6(4):355-85.
19. Domhan T. Augmented reality on android smartphones. Stuttgart, Germany; Dualen Hochschule Baden-Württemberg (DHBW); 2010.
20. Lin CY, Chai HC, Wang Jy, Chen CJ, Liu YH, Chen CW, et al. Augmented reality in educational activities for children with disabilities. Displays 2016; 42: 51-4.
21. Rogers RA. Learning Android Game Programming. Upper Saddle River, N: Addison-Wesley; 2011.