World Journal of Advanced Engineering Technology and Sciences
eISSN: 2582-8266
Cross Ref DOI: 10.30574/wjaets
Journal homepage: https://wjaets.com/

(REVIEW ARTICLE)

Check for updates

Digital Technologies and Empathy for Students with Special Education Needs

Chara Papoutsi *

Department of Information and Communication Systems Engineering (ICSD), University of Aegean, Greece.

World Journal of Advanced Engineering Technology and Sciences, 2023, 09(02), 058–069

Publication history: Received on 02 June 2023; revised on 11 July 2023; accepted on 13 July 2023

Article DOI: https://doi.org/10.30574/wjaets.2023.9.2.0197

Abstract

Information and communication technologies (ICTs) have significantly advanced a number of industries during the past few decades. ICTs are now a vital part of the teaching and learning process in many contexts. All social groups, including those with unique educational requirements for children and adults, have received assistance. In this essay, we give a succinct summary of the most pertinent articles for apps used for assessment, intervention, and development of empathy, a critical skill that studies show persons with special educational needs lack. Empathy is a sophisticated sort of psychological inference that draws conclusions about the thoughts and feelings of others by combining observation, memory, information, and reasoning.

Keywords: ICTs; Empathy; Special Education; Emotion Recognition

1. Introduction

The majority of individuals utilize information and communication technologies (ICTs) on a regular basis in today's society. Information and communication technologies are a broad category of technologies that allow people to access and manipulate information [1]. ICTs have been extensively investigated in a variety of sectors as well as being a topic of study in and of itself. More and more tools utilizing new technologies are being launched in the realm of education to enhance teaching. Additionally, a growing body of research is supporting the idea that ICTs and assistive technologies in general help children and persons with special needs live more fulfilling lives. Computer applications can be helpful in reaching this objective.

Because the computerized environment is predictable, consistent, and free of social demands, which people with SEN may find stressful, the use of information and communication technologies (ICTs) with people who have special educational needs (SEN) has grown over the past ten years. Users can progress at their own rate and knowledge level, and lessons can be repeated endlessly until mastery is attained. Additionally, various, personally chosen automated rewards can be used to keep motivation and interest high. Numerous ICT programs were developed to teach different skills to this demographic as a result of these factors and the affinity people with SEN display for the computerized environment Web apps have been used more and more for social interaction over the past decade as online communities and social networks have grown rapidly thanks to internet-based communication [2].

A wide range of issues that can hinder learning are referred to as "special educational needs." The phrase "special educational needs" might signify different things to different countries, despite the fact that there have been numerous classifications over the years [3]. The classification presented below, which advocates a graded approach to educating learners who require special accommodations, is one of the more prevalent ones. The 2001 SEN Code of Practice lists the following as "the areas of needs": communication and interaction, sensory and/or physical, cognition and learning, behavior, emotional stability, and social development [4]. It has been hotly debated how to define the term "Special Needs." A subset of the population that experiences difficulties in their academic performance and possibly later in life

* Corresponding author: Chara Papoutsi

is referred to as having learning disabilities or having learning disorders. The lack of empathy, which has frequently been listed as a key trait of people with special educational needs, will be the topic of this essay.

Understanding other people's emotions and behaviors through empathy enables us to anticipate their actions and feel the emotions that are sparked by those actions. Empathy is exhibited in sentiments and perceptions that are brought on by a person's attraction to the feelings of others. Empathy, according to Baron-Cohen and Weelwright (2004), has two parts: the capacity to identify other people's mental states, including their goals, beliefs, desires, and emotions, and the capacity to reacted to these states appropriately. The traditional argument over whether empathy is purely an emotional response (the emotion elicited by another person's emotions) or purely a cognitive operation (the capacity to step into another person's shoes and see the world from their perspective) is sidestepped by this two-factor definition of empathy. The current agreement among academics is to recognize that both elements are required to define empathy [5], [6]. This is in accordance with traditional conceptions of empathy, such as Feshbach's model, which conceptualizes empathy as entailing cognitive and emotional processes.

ICTs have numerous opportunities for creatively teaching empathy and emotion awareness to youngsters and students with specific educational needs. According to research, computer programs can be used to perform false belief tasks, identify simple emotions from static images and cartoons, recognize complex emotions from speech and facial expressions, assess, intervene, and cultivate empathy through virtual environments, among other tasks. Assistive technology offers socially impaired individuals an environment in which they can learn the meaning of emotions and understand more about the way they communicate with their peers.

The current paper's goal is to provide an overview of the most pertinent studies that deal with computer-interactive intervention programs for evaluating and fostering empathy in both children and adults with special educational needs. This study shows that doing simulated tasks on a computer improves facial and emotional recognition skills. The findings provide evidence in support of the efficacy of adopting a computer-based interactive simulation program as a means of improving empathy and emotion recognition abilities. There are enough studies that use instruments like well-established questionnaires, scales, and photographs to export results, measure, and evaluate empathy, despite the ongoing development of technologies and sensors that can sense emotions or express emotions, and thereby influence users' emotions.

2. Empathy and Special Education

2.1. Students with General learning disabilities

The impact of the PATHS curriculum (Promoting Alternative THinking Strategies) on the adjustment of school-age children with special needs was investigated by Kam et al. in 2004. Based on the ABCD (affective-behavioral-cognitive-dynamic) model of development, PATHS is a preventive intervention program. PATHS aims to integrate self-control and social problem-solving abilities with emotional awareness and emotional regulation skills development in the early school years. The curriculum for PATHS is integrated with the existing curriculum in the school and uses a classroom-wide approach. Additionally, it encourages a change in the climate of the classroom to foster greater empathetic and open communication about emotional needs. PATHS consists of numerous activities to accomplish the aforementioned goals. The PATHS curriculum was evaluated on 133 pupils in elementary schools, and the results showed that it had favorable impacts over the long term [32]. However, more research on larger samples is required.

Spackman et al. (2005) used facial expressions in photographs and music to test how well language-impaired kids could identify the emotions being exhibited by the people in the pictures and music. 43 children with learning disabilities and 43 generally developing, age-matched peers, who were selected from the age groups of 5 to 8 and 9 to 12 years, respectively, participated in the study. The findings revealed no differences between children with and without learning disabilities in their ability to recognize happy, anger, sadness, fear, and disgust. Results also showed that children who were trained to identify emotions in music snippets performed differently from regular children [33].

In their 2009 study, Bloom et al. looked at teenagers' capacity to identify, communicate, and comprehend emotional facial expressions. The 69 participants were divided into three groups for the study: a group of 23 adolescents with nonverbal learning difficulties (NVLD), a group of 23 similar adolescents without learning disabilities, and a group of 23 similar adolescents with general learning difficulties. Wechsler Intelligence Scale for Children, Third Edition, the Pictures of Facial Affect (PFA) Recognition Measure, the Expression Measure, and the Understanding Measure were all employed as relative scales. It was found that adolescents with GLD performed considerably worse than adolescents with NVLD and without LD in identifying emotional facial expressions, with no difference between the NVLD and NLD groups [34].

Proyecto Aprender is an accessible educational online resource for kids with special educational needs, which was created by González et al. in 2006. The overall goal is to increase and develop the learners with special educational needs' physical, emotional, cognitive, and communicational skills while using new information and communications technologies to the greatest extent possible to promote their social and personal autonomy. For this reason, the project contains a number of multimedia learning activities, some of which deal with emotions and the growth of empathy [35, 36].

2.2. Students with Autistic Spectrum Disorders

In order to teach people with ASD to perceive and anticipate emotions in others, Silver and Oakes (2001) looked into the usage of a multimedia software application called the Emotion Trainer. The Emotion Trainer was a teaching tool for emotions that featured animated emotional reactions and five sections with images of real people. The degree of success or difficulty that individual encountered as they advanced through the program determined the frequency of feedback, prodding, and reinforcement that was provided. Based on age, gender, and academic level, 22 ASD sufferers, ranging in age from 10 to 18, were paired. While the second member of the pair was placed in the no-intervention control condition, one member of the pair was randomly allocated to the intervention condition, which consisted of 10 computerized sessions spread over 2-3 weeks. From pre- to post-intervention, both groups demonstrated a considerable improvement in their capacity to deduce emotion or mental state from photographs of facial expression [10].

To assist children with autism between the ages of three and eight, Golan et al. (2010) developed the animated series "The Transporters" to enable them gaze at human faces and comprehend and recognize emotions that support the growth of empathy. The 15 five-minute episodes of the cartoon series follow the exploits of 8 mechanical vehicles with human faces and each episode focuses on a different human emotion. Both preschoolers with autism and those so-called "low-functioning" youngsters with autism who have major learning challenges would be attracted to such vehicles. Each figure was portrayed as a toy that comes to life and engages in social interactions in a child's bedroom. Children with ASC (ages 4-7) assessed before and after watching "The Transporters" every day for four weeks. The use of "The Transporters" dramatically increases levels of emotion comprehension and recognition, according to the results [11].

The "The Affective Social Quotient project" was created by Blocher et al. (2002) and is one of the earliest experiments at the MIT Media Lab to create assistive technology for autism utilizing physical input devices, namely four dolls (stuffed dwarfs) that displayed different emotional states, such as happiness, rage, sadness, and surprise. The device would show brief digital movies that represented each of the four emotions before encouraging the youngster to select the appropriate dwarf. The device recognized the stuffed animal's infrared signal when the youngster picked it up and responded. Because a second person is usually present throughout the session, using the dolls as physical input devices also supported the development of cooperative attention and turn-taking abilities [12].

The game platform ASC Inclusion was unveiled by Schuller et al. (2014) with a focus on autistic spectrum disorder (ASD) kids between the ages of 5 and 10. The ongoing ASC-Inclusion project intends to assist kids with ASC by letting them use gaming in a virtual environment to understand how emotions can be expressed and acknowledged. The site offers training through games, text chat with peers, animation, video, and audio clips, as well as analysis of users' motions, facial, and voice expressions utilizing a regular microphone and webcam or a depth sensor [13].

To enhance social cognition and empathy in people with ASD, Serret (2012) created the serious game "Jestimule". The game was also made easier to operate for young children or kids with developmental disabilities thanks to ICT (such as a haptic joystick for feedback). One of the main goals of the game was to teach people with ASD how to understand emotional situations, emotional gestures, and facial expressions. At the hospital, the game was tested on a group of 40 people ranging in age from 6 to 18. In several tasks, the participants' ability to recognize facial expressions of emotion, emotional gestures, and emotional circumstances improved, according to the results. Future training should take these findings into consideration as they have strong educational and therapeutic implications for ASD [14].

A computerized intervention designed to teach people with ASD the fundamentals of facial affect recognition was created and evaluated by Bölte et al. in 2002. This program's goal is to identify and encourage the growth of social-communicative abilities through evaluation and instruction in the observation and interpretation of simple emotions. Individuals were trained to distinguish emotions using 500 images, each with the ability for visual and aural feedback. As reinforcement, an animation of the associated emotion was displayed on the screen after receiving input for a given photo. The program's ability to recognize emotions was tested on people with high-functioning autism or Asperger syndrome by either showing them the person's entire face or just their eyes. The program's effectiveness in teaching

the identification of facial affect is supported by the results. The enhancement discovered is nonetheless restricted to a specific social-communicative function, making generalization uncertain [15].

An Affective Computer-Aided Learning Platform for Children with Autism (ACALPA) was developed by Konstantinidis et al. (2009) to improve or mediate the educational process between teachers and students. It is based on several interaction techniques depending on the degree of the autistic person's handicap. The platform is made up of a number of modules. They all stand for different learning domains. Finding emotional states through facial expressions is covered in one module. The directions are either supplied by an emotive avatar, synthetic speech in the native tongue of an autistic person, written on the screen, or a combination of these. ACALPA was deployed at a specialized school for individuals with autism, and the results showed that the platform was crucial in emotion recognition and that an interactive learning environment might make the educational process easier for persons with autism [16].

Alves et al. (2013) introduced the LIFEisGAME prototype-iPad version, a game that uses real-time automatic facial expression analysis and virtual character synthesis to encourage facial recognition and assist people with ASD in understanding emotions in order to foster empathy. There are five different game modes. The LIFEisGAME prototype was tested on 11 ASD kids, ranging in age from 5 to 15, and was played over the course of a 15-minute game session. The outcomes were encouraging and showed the game's value in fostering emotional understanding, which improved the quality of life for autistic kids [17].

A portable assistive computer gadget called "The emotional hearing aid" was introduced by Kaliouby et al. (2005) to help children with Asperger Syndrome read, comprehend, and respond to facial emotions in a socially appropriate manner, hence promoting empathy. It is made up of a wearable camcorder, an earpiece speaker, and a personal digital assistant (PDA). An automatic mind-reading system that deduces complicated mental states from facial expressions in real-time video and a reaction advisor that offers the user's best course of action in real-time have both been implemented in the development of the emotional hearing aid [18].

The "Let's Face It! Skills Battery (LFI! Battery)," a computer-based assessment, was created by Tanaka et al. (2008). It is organized into a theoretical hierarchy of face processing domains that support the child's capacity to pay attention to faces, identify facial identity and emotional expressions, and interpret facial cues in a social context. subjects with ASD and normally developing control (TDC) subjects, who were matched for age and IQ, underwent the LFI! Battery test. The results demonstrate that people with ASD were equally as capable of correctly labeling the fundamental facial emotions as typically developing participants, with the exception of the angry face. However, participants with ASD tended to perceive the mouth feature holistically and the eyes as independent pieces, and they were less able to generalize facial emotions across multiple identities. The findings also suggest that autistic children's facial recognition abilities can be significantly improved by very brief intervention programs [19], [20].

An interactive multimedia application called "Mind Reading" was developed by Golan et al. (2006) to educate adults with Asperger syndrome and high-functioning autism about emotions and mental states. Based on a taxonomy system with 412 emotions and mental states grouped into 24 emotion groups and six developmental stages from four years old to adulthood, it can be used to understand human behavior. Basic and complicated emotions are systematically introduced and taught via written text, audio, and video in Mind Reading. Users had access to a library of emotions to study, lessons and tests in the learning area, and games on emotions in the gaming zone. When compared to their performance prior to the intervention and when compared with a control group, results showed that users significantly improved their ability to recognize complex emotions and mental states from both faces and voices after 10–20 hours of using the software over a period of 10-15 weeks [21].

Golan and Baron Cohen's (2006) research was expanded upon by LaCava et al. (2007) who tested the effectiveness of Mind Reading on a group of eight American children with ASD ranging in age from eight to eleven. This study used a pre-test/post-test approach and discovered that following exposure to the multimedia training program, children's ability to recognize emotion from faces improved. Furthermore, individuals could generalize their abilities to recognize emotions in voices but not in faces that were not directly related to the training program. The program's presentation and content were praised by kids, parents, and teachers, who also deemed it to be a highly effective educational tool. Nonetheless, there was not strong support for the transfer of these skills to emotion recognition to more realistic and meaningful contexts [22].

In order to teach social skills and emotional intelligence to kids with Asperger syndrome, Beumont and Sofronoff (2008) created "The Junior Detective Training Program," an intervention program that featured a computer game, small group sessions, parent training sessions, and teacher handouts. The user of the computer game is a detective with expertise in deciphering the mental and emotional states of others. The study used computer-animated and real characters to teach

social problem solving and emotion recognition. Depending on how a user completed a task, support and mission objectives were customized and different. 49 Asperger syndrome-afflicted kids aged 7.5 to 11 were used in the study. The Junior Detective Training Program may be a useful tool for teaching social functioning and emotion awareness to kids with Asperger syndrome, according to the study's overall findings. Despite the fact that the intervention's components were created expressly to improve skill generalization, this study did not assess the transfer of the study's targeted abilities to actual social contexts [23].

A "Collaborative Virtual Learning Environment (CVLE) - Empathy System" was introduced by Cheng et al. (2010) to foster empathy for kids with ASCs. On a laptop, participants are shown a virtual restaurant environment. The CVLE-empathy system enables kids with ASCs to exercise empathy in a social setting and express their emotional states to other users while also allowing them to select expressive avatars that represent themselves. The CVLE-empathy system had positive impacts on the formation of empathy and generalized this concept of empathy to the participants' daily lives, according to the five-month study, which involved three people [24].

The 'Reading the Mind in the Eyes' Test was created in 1997 by Baron- Cohen et al. (2001), but an updated version was released in 2001. The participant must determine the subject's emotional state solely based on details surrounding the face's eyes. This test evaluates mental state as well as cognitive empathy and emotion recognition. Each question that is correctly answered earns one point, whereas questions that are left unanswered or wrongly answered receive zero points. The total score is the sum of all points earned. The Empathy Quotient (EQ), a self-report scale used in the general population, and the Eyes test, a sensitive diagnostic of modest cognitive deficiencies in people with autism spectrum disorders (ASC), are correlated. Findings indicated that individuals with AS or HFA, despite having at least normal intelligence, have specific difficulties in identifying subtle mental states and cognitive empathy [25].

The Cambridge Mind-Reading Face-Voice Battery, developed by Golan et al. (2006), tested adult participants' ability to identify 20 emotional themes from speech segments and video clips of facial expressions. Participants were then asked to select which of four emotion adjectives best captured the feelings of the characters in each clip. The CAM-C has two subtests that each have 45 questions, for a total of 90 items: Face ER (Emotion Recognition) and Voice ER. Males and females with AS as well as matched controls were given the battery. Results revealed that those with Asperger Syndrome (AS) had greater difficulty identifying mental states and emotions in both faces and voices when compared to the control group [26].

Hopkins et al. (2011) examined the efficacy of employing an interactive computer-based simulation software to improve the social skills of children with autism spectrum disorders (ASD). FaceSay develops a more realistic software tool to teach face and emotion recognition skills by utilizing an interactive method with computer animated avatars of both humans and animals. Children filled out post-test questionnaires after seeing the computer intervention sessions. The LFA (low-functioning autism) children showed gains in the intervention's two focus areas of emotion detection and social interactions. Improvements were seen in each of the three domains—facial recognition, emotion recognition, and social interactions—in children with HFA (high functioning autism) [27].

In a task that required explicit empathy, Schulte-Rüther et al. (2011) looked at participants with ASD. By "feeling into" the person shown, participants were asked to empathize with emotional facial expressions displayed on a computer screen. They were then given the choice of either judging the emotional state of each face (another task) or reporting the emotions the emotional faces had caused them to experience (a self-task). Additionally, the Empathy Questionnaire (EQ) and the Autism Spectrum Questionnaire (AQ) were completed by each participant. During the other task, ASD patients performed nearly as well as the control group, but they displayed less emotionally congruent reactions during the self task [28].

2.3. Students with attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD)

Braaten and Rosen (2000) told several tales to ADHD patients aged 6 to 12 as well as to typically developing peers. Participants were given instructions to respond to questions concerning their own sentiments, the feelings of the protagonist, and the causes of those feelings. ADHD patients produced fewer protagonist-centered interpretations and did so less frequently when comparing the protagonist's feeling to their own [29].

Children with ADHD were put in emotional and non-emotional situations by Yuill and Lyons in 2007. They were given instructions on how to match images with the protagonist's non-emotional facial expressions and emotional facial expressions. In the emotional task, children with ADHD underperformed compared to the control group. They also demonstrate impairments when asked to make decisions regarding non-emotional features of faces, indicating that deficits do not necessarily reflect unique social cognition problems [30].

Empathy and social perspective-taking in 8 to 12 year old children with and without Attention-Deficit/Hyperactivity Disorder (ADHD) were studied by Marton et al. in 2009. In order to export results from this study, well-respected scales and questionnaires were employed to gauge empathy and social viewpoint. Measures are used to evaluate empathy and its relationship to social development, such the "Interpersonal Negotiation Strategies" and the "Index of Empathy for Children and Adolescents". 50 youngsters with an ADHD diagnosis and 42 usually developing comparison children made up the study's sample of 92 kids. In terms of empathy, the results showed that children with ADHD were less sympathetic than comparison children, although there was no statistically significant difference. In addition, more severe deficiencies in empathy are linked to conduct and oppositional difficulties rather than ADHD [31].

2.4. Students with sensory impairments

The self-esteem and empathy of preadolescent children with visual impairments and those of sighted children were compared in a study by Griffin-Shirley et al. (2005). We investigated several family-related factors. The variable of pet ownership was of particular relevance to this investigation. The Companion Animal Bonding Scale (CABS), the Bryant Index of Empathy for Children and Adolescents (IECA), and the CSEI-Short Form were used to gather data. The study involved 159 individuals, 81 boys and 78 girls, ranging in age from 8 to 14, and two groups of preadolescents: 88 sighted and 71 visually impaired. Sighted and visually impaired participants were recruited from two southwestern states, two midwestern states and one western state form the United States. No significant differences were found between the sighted and visually impaired children for levels of self-esteem, empathy toward others, or taking care of pets [7].

The ability of hearing and deaf children to understand and assess emotionally charged situations was explored by Odom et al. in 1973. Two tasks were given: (a) sorting faces depicting nine emotions, and (b) matching those faces with pictures of suitable emotion-arousing scenarios. pictures were displayed by an opaque projector. On the first exercise, the deaf children performed equally well to the hearing children, however they were less adept at matching the faces to the circumstances. We came to the conclusion that deaf people have trouble understanding and comprehending emotionally charged situations. A prime example of the connection between language learning and a significant personality trait is the deaf person's lack of emotional empathy [8].

2.5. Students with motor impairments

According to Cummins et al. (2005), children with weak motor coordination may have empathetic skills, and these skills may be linked to issues with moral judgment, pro-social behavior, and social competence. The study used emotion recognition scales to assess participants' abilities to identify facial expressions of emotion (The Fluid Emotions test), comprehend vocal intonations that are specific to various emotions (The Vocal Cues test), define emotion words (The Emotion Vocabulary test), comprehend the emotional effects of being exposed to an emotion that causes context (The Comprehension Test), and apply logic skills and knowledge of the causes of emotions. Children with motor coordination issues do indeed show distinct empathy deficits, according to one study, which examined 234 children aged 6 to 12 years who were matched for age and gender [9].

2.6. The role of Digital Technologies

Finally, it is important to highlight the productive and effective role that digital technologies play in the education sector. These technologies, such as mobile devices (36-39), a variety of ICT applications (40-59), AI & STEM ROBOTICS (60-64), and games (65-67), facilitate and enhance educational procedures such as assessment, intervention, and learning. Additionally, the use of ICTs in conjunction with theories and models of metacognition, mindfulness, meditation, and the cultivation of emotional intelligence [68-94], accelerates and improves educational practices and outcomes, particularly for empathy in students with special educational needs.

3. Conclusions

There is no doubt that empathy is a valuable skill. We are all capable of tuning into another person's emotions or possible thoughts. Understanding others' intentions, predicting their conduct, and feeling an emotion sparked by their emotion are all made possible by empathy. Simply said, empathy enables us to communicate effectively with others. The above-mentioned papers covered the use of cutting-edge computer technology for evaluation, intervention, and empathy development. Interactive multimedia was used in programs to teach people with SEN about social communication principles like empathy, emotion identification, and social skills. ICT software programs have made significant advancements in their design and development, giving children with unique educational needs the chance and capacity to succeed.

Future interactive multimedia programs should concentrate on strategies to evaluate and improve this capability. Additionally to evaluating and examining affective and cognitive empathy in children and adults with special educational needs, more research is required to identify intervention strategies that will help these kids improve both their cognitive ability and their understanding of different emotional expressions. This essay demonstrates how computers might also be used as instruments to enhance emotional communication for everyone.

Compliance with ethical standards

Acknowledgments

The Authors would like to thank University of Aegean Team for their support.

Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

References

[1] Dillon, P.: Trajectories and tensions in the theory of information and communication technology in education. British Journal of Educational Studies, 52 (2), pp. 138-150, (2004). http://dx.doi.org/10.1111/j.1467-8527.2004.00259.x

[2] Schuller, B., Marchi, E., Baron-Cohen, S., O'Reilly, H., Pigat, D., Robinson, P., & Daves, I. (2014). The state of play of ASC- Inclusion: an integrated Internet-based environment for social inclusion of children with autism spectrum conditions. arXiv pre- print arXiv:1403.5912.

[3] Meijer, C., Soriano, V., Watkins, A.: Inclusive Education across Europe: Reflections upon 10 Years of Work from the European Agency for Development in Special Needs Education. Childhood Education 83(6), 361 (2007). http://dx.doi.org/10.1080/00094056.2007.10522951 Department for Education and Skills, Special Educational Needs Code of Practice. DfES, London (2001).

[4] Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. Journal of autism and developmental disorders, 34(2), 163-175.http://dx.doi.org/10.1023/B:JADD.0000022607.19833.00

[5] Rueda, P., Fernández-Berrocal, P., & Baron-Cohen, S. (2015). Dissociation between cognitive and affective empathy in youth with Asperger Syndrome. European Journal of Developmental Psychology, 12(1), 85-98. http://dx.doi.org/10.1080/17405629.2014.950221

[6] Griffin-Shirley, N., & Nes, S. (2005). Self-esteem and empathy in sighted and visually impaired preadolescents. Journal of Visual Impairment & Blindness (JVIB), 99(05).

[7] Odom, P. B., Blanton, R. L., & Laukhuf, C. (1973). Facial expressions and interpretation of emotion-arousing situations in deaf and hearing children. Journal of Abnormal Child Psychology, 1(2), 139-151. http://dx.doi.org/10.1007/BF00916109

[8] Cummins, A., Piek, J. P., & Dyck, M. J. (2005). Motor coordination, empathy, and social behavior in school aged children. Developmental Medicine & Child Neurology, 47(7), 437-442.http://dx.doi.org/10.1017/S001216220500085X

[9] Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. Autism, 5(3), 299-316. http://dx.doi.org/10.1177/1362361301005003007

[10] Golan, O., Ashwin, E., Granader, Y., McClintock, S., Day, K., Leggett, V., & Baron-Cohen, S. (2010). Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotional faces. Journal of autism and developmental disorders, 40(3), 269-279. http://dx.doi.org/10.1007/s10803-009-0862-9

[11] Blocher, K., & Picard, R. W. (2002). Affective social quest. In Socially intelligent agents (pp. 133-140). Springer US. http://dx.doi.org/10.1007/0-306-47373-9_16

[12] Schuller, B., Marchi, E., Baron-Cohen, S., O'Reilly, H., Pigat, D., Robinson, P., & Daves, I. (2014). The state of play of ASC- Inclusion: an integrated Internet-based environment for social in- clusion of children with autism spectrum conditions. arXiv pre- print arXiv:1403.5912.

[13] Boucenna, S., Narzisi, A., Tilmont, E., Muratori, F., Pioggia, G., Cohen, D., & Chetouani, M. (2014). Interactive technologies for autistic children: a review. Cognitive Computation, 6(4), 722-740. http://dx.doi.org/10.1007/s12559-014-9276-x

[14] Bölte, S., Feineis-Matthews, S., Leber, S., Dierks, T., Hubl, D., & Poustka, F. (2002). The development and evaluation of a computer-based program to test and to teach the recognition of facial affect. International Journal of Circumpolar Health, 61. http://dx.doi.org/10.3402/ijch.v61i0.17503

[15] Konstantinidis, E. I., Hitoglou-Antoniadou, M., Luneski, A., Bamidis, P. D., & Nikolaidou, M. M. (2009, June). Using affective avatars and rich multimedia content for education of children with autism. In Proceedings of the 2nd International Conference on Pervasive Technologies Related to Assistive Environments (p. 58). ACM.

[16] Alves, S., Marques, A., Queirós, C., & Orvalho, V. (2013). LIFEisGAME Prototype: A Serious Game about Emotions for Children with Autism Spectrum Disorders. Psychology Journal, 11(3), 191-211.

[17] El Kaliouby, R., & Robinson, P. (2005). The emotional hearing aid: an assistive tool for children with Asperger syndrome. Uni- versal Access in the Information Society, 4(2), 121-134. http://dx.doi.org/10.1007/s10209-005-0119-0

[18] Wolf, J. M., Tanaka, J. W., Klaiman, C., Cockburn, J., Herlihy, L., Brown, C., ... & Schultz, R. T. (2008). Specific impairment of face processing abilities in children with autism spectrum disorder using the Let's Face It! skills battery. Autism Research, 1(6), 329-340. http://dx.doi.org/10.1002/aur.56

[19] Tanaka, J. W., Wolf, J. M., Klaiman, C., Koenig, K., Cockburn, J., Herlihy, L., ... & Schultz, R. T. (2012). The perception and identification of facial emotions in individuals with autism spectrum disorders using the Let's Face It! Emotion Skills Battery. Journal of Child Psychology and Psychiatry, 53(12), 1259-1267. http://dx.doi.org/10.1111/j.1469-7610.2012.02571.x

[20] Golan, O., & Baron-Cohen, S. (2006). Systemizing empathy: Teaching adults with Asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. Development and psychopathology, 18(02), 591-617. http://dx.doi.org/10.1017/S0954579406060305

[21] Lacava, P. G., Golan, O., Baron-Cohen, S., & Myles, B. S. (2007). Using assistive technology to teach emotion recognition to students with Asperger syndrome a pilot study. Remedial and Special Education, 28(3), 174-181. http://dx.doi.org/10.1177/07419325070280030601

[22] Beaumont, R., & Sofronoff, K. (2008). A multicomponent social skills intervention for children with Asperger syndrome: The Junior Detective Training Program. Journal of Child Psychology and Psychiatry, 49(7), 743-753.

[23] Cheng, Y., Chiang, H. C., Ye, J., & Cheng, L. H. (2010). Enhanc- ing empathy instruction using a collaborative virtual learning environment for children with autistic spectrum conditions. Computers & Education, 55(4), 1449-1458. http://dx.doi.org/10.1016/j.comp edu.2010.06.008

[24] Baron Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the Mind in the Eyes" test revised version: A study with normal adults, and adults with Asperger syndrome or high functioning autism. Journal of child psychology and psychiatry, 42(2), 241-251. http://dx.doi.org/10.1111/1469-7610.00715

[25] Golan, O., Baron-Cohen, S., & Hill, J. (2006). The Cambridge mindreading (CAM) face-voice battery: Testing complex emotion recognition in adults with and without Asperger syndrome. Journal of autism and developmental disorders, 36(2), 169-183. http://dx.doi.org/10.1007/s10803-005-0057-y

[26] Hopkins, I. M., Gower, M. W., Perez, T. A., Smith, D. S., Amthor,R., Wimsatt, F. C., & Biasini, F. J. (2011). Avatar assistant: improving social skills in students with an ASD through a computer- based intervention. Journal of autism and developmental disorders, 41(11), 1543-1555. http://dx.doi.org/10.1007/s10803-011-1179-z

[27] Schulte-Rüther, M., Greimel, E., Markowitsch, H. J., Kamp- Becker, I., Remschmidt, H., Fink, G. R., & Piefke, M. (2011). Dysfunctions in brain networks supporting empathy: an fMRI study in adults with autism spectrum disorders. Social Neuroscience, 6(1), 1-21. http://dx.doi.org/10.1080/17470911003708032

[28] Braaten, E. B., & Rosen, L. A. (2000). Self-regulation of affect in attention deficit-hyperactivity disorder (ADHD) and non-ADHD boys: differences in empathic responding. Journal of consulting and clinical psychology, 68(2), 313.http://dx.doi.org/10.1037/0022-006X.68.2.313

[29] Yuill, N., & Lyon, J. (2007). Selective difficulty in recognizing facial expressions of emotion in boys with ADHD. European child & adolescent psychiatry, 16(6), 398-404. http://dx.doi.org/10.1007/s00787-007-0612-5

[30] Marton, I., Wiener, J., Rogers, M., Moore, C., & Tannock, R. (2009). Empathy and social perspective taking in children with attention-deficit/hyperactivity disorder. Journal of abnormal child psychology, 37(1), 107-118. http://dx.doi.org/10.1007/s10802-008-9262-4

[31] Kam, C. M., Greenberg, M. T., & Kusche, C. A. (2004). Sustained effects of the PATHS curriculum on the social and psychological adjustment of children in special education. Journal of emotional and behavioral disorders, 12(2), 66-78. http://dx.doi.org/10.1177/10634266040120020101

[32] Spackman, M. P., Fujiki, M., Brinton, B., Nelson, D., & Allen, J. (2005). The ability of children with language impairment to recognize emotion conveyed by facial expression and music. Communication Disorders Quarterly, 26(3), 131-143.http://dx.doi.org/10.1177/15257401050260030201

[33] Bloom, E., & Heath, N. (2009). Recognition, expression, and understanding facial expressions of emotion in adolescents with nonverbal and general learning disabilities. Journal of Learning Disabilities.

[34] Cantón, P., González, Á. L., Mariscal, G., & Ruiz, C. (2006). Developing pedagogical multimedia resources targeting children with special educational needs. In Computers Helping People with Special Needs (pp. 536-543). Springer Berlin Heidelberg. http://dx.doi.org/10.1007/11788713_80

[35] Fuertes, J. L., González, Á. L., Mariscal, G., & Ruiz, C. (2008). Applying a Methodology for Educating Students with Special Needs: A Case Study. In Innovative Techniques in Instruction Technology, E-learning, E-assessment, and Education (pp. 229- 234). Springer Netherlands. http://dx.doi.org/10.1007/978-1-4020- 8739-4_41

[36] Stathopoulou, et all 2018, Mobile assessment procedures for mental health and literacy skills in education. International Journal of Interactive Mobile Technologies, 12(3), 21-37, https://doi.org/10.3991/ijim.v12i3.8038

[37] Kokkalia G, AS Drigas, A Economou 2016 Mobile learning for preschool education. International Journal of Interactive Mobile Technologies 10 (4), 57-64 https://doi. org/10.3991/ijim.v10i4.6021

[38] Stathopoulou A, Karabatzaki Z, Tsiros D, Katsantoni S, Drigas A, 2019 Mobile apps the educational solution for autistic students in secondary education Journal of Interactive Mobile Technologies 13 (2), 89-101https://doi.org/10.3991/ijim.v13i02.9896

[39] Drigas A, DE Dede, S Dedes 2020 Mobile and other applications for mental imagery to improve learning disabilities and mental health International Journal of Computer Science Issues (IJCSI) 17 (4), 18-23, DOI:10.5281/zenodo.3987533

[40] Drigas, A. S., J.Vrettaros, L.Stavrou, D.Kouremenos, 2004. E-learning Environment for Deaf people in the E-Commerce and New Technologies Sector, WSEAS Transactions on Information Science and Applications, Issue 5, Volume 1, November

[41] Drigas, A., Koukianakis, L., Papagerasimou, Y., 2011, Towards an ICT-based psychology: Epsychology, Computers in Human Behavior, 27:1416–1423. https://doi.org/10.1016/j.chb.2010.07.045

[42] Papanastasiou, G., Drigas, A., Skianis, C., and Lytras, M. (2020). Brain computer interface based applications for training and rehabilitation of students with neurodevelopmental disorders. A literature review. Heliyon 6:e04250. doi: 10.1016/j.heliyon.2020.e04250

[43] Drigas, A., & Papanastasiou, G. (2014). Interactive White Boards in Preschool and Primary Education. International Journal of Online and Biomedical Engineering (iJOE), 10(4), 46–51. https://doi.org/10.3991/ijoe.v10i4.3754

[44] Drigas, A. S. and Politi-Georgousi, S. (2019). ICTs as a distinct detection approach for dyslexia screening: A contemporary view. International Journal of Online and Biomedical Engineering (iJOE), 15(13):46–60. https://doi.org/10.3991/ijoe.v15i13.11011

[45] Drigas A, Petrova A 2014 ICTs in speech and language therapy International Journal of Engineering Pedagogy (iJEP) 4 (1), 49-54 https://doi.org/10.3991/ijep.v4i1.3280

[46] Bravou V, Oikonomidou D, Drigas A, 2022 Applications of Virtual Reality for Autism Inclusion. A review Retos 45, 779-785https://doi.org/10.47197/retos.v45i0.92078

[47] Chaidi I, Drigas A, 2022 "Parents' views Questionnaire for the education of emotions in Autism Spectrum Disorder" in a Greek context and the role of ICTs Technium Social Sciences Journal 33, 73-9, DOI:10.47577/tssj.v33i1.6878

[48] Bravou V, Drigas A, 2019 A contemporary view on online and web tools for students with sensory & learning disabilities iJOE 15(12) 97 https://doi.org/10.3991/ijoe.v15i12.10833

[49] Chaidi I, Drigas A, C Karagiannidis 2021 ICT in special education Technium Soc. Sci. J. 23, 187, https://doi.org/10.47577/tssj.v23i1.4277

[50] Xanthopoulou M, Kokalia G, Drigas A, 2019, Applications for Children with Autism in Preschool and Primary Education. Int. J. Recent Contributions Eng. Sci. IT 7 (2), 4-16, https://doi.org/10.3991/ijes.v7i2.10335

[51] Drigas AS, Koukianakis LG, Papagerasimou YV, 2005 A system for e-inclusion for individuals with sight disabilities Wseas transactions on circuits and systems 4 (11), 1776-1780

[52] Stathopoulou A, Spinou D, Driga AM, 2023, Burnout Prevalence in Special Education Teachers, and the Positive Role of ICTs, iJOE 19 (08), 19-37

[53] Stathopoulou A, Spinou D, Driga AM, 2023, Working with Students with Special Educational Needs and Predictors of Burnout. The Role of ICTs. iJOE 19 (7), 39-51

[54] Loukeri PI, Stathopoulou A, Driga AM, 2023 Special Education Teachers' Gifted Guidance and the role of Digital Technologies, TECH HUB 6 (1), 16-27

[55] Stathopoulou A, Temekinidou M, Driga AM, Dimitriou 2022 Linguistic performance of Students with Autism Spectrum Disorders, and the role of Digital Technologies Eximia 5 (1), 688-701

[56] Vouglanis T, Driga AM 2023 Factors affecting the education of gifted children and the role of digital technologies. TechHub Journal 6, 28-39

[57] Vouglanis T, Driga AM 2023 The use of ICT for the early detection of dyslexia in education, TechHub Journal 5, 54-67

[58] Drakatos N, Tsompou E, Karabatzaki Z, Driga AM 2023 Virtual reality environments as a tool for teaching Engineering. Educational and Psychological issues, TechHub Journal 4, 59-76

[59] Drakatos N, Tsompou E, Karabatzaki Z, Driga AM 2023 The contribution of online gaming in Engineering education, Eximia 8, 14-30

[60] Chaidi E, Kefalis C, Papagerasimou Y, Drigas, 2021, Educational robotics in Primary Education. A case in Greece, Research, Society and Development 10 (9), e17110916371-e17110916371, https://doi.org/10.33448/rsd-v10i9.16371

[61] Drigas, A.S., Vrettaros, J., Koukianakis, L.G. and Glentzes, J.G. (2005). A Virtual Lab and e-learning system for renewable energy sources. Int. Conf. on Educational Tech.

[62] Lytra N, Drigas A 2021 STEAM education-metacognition–Specific Learning Disabilities Scientific Electronic Archives 14 (10) https://doi.org/10.36560/141020211442

[63] Ntaountaki P, et all 2019 Robotics in Autism Intervention. Int. J. Recent Contributions Eng. Sci. IT 7 (4), 4-17, https://doi.org/10.3991/ijes.v7i4.11448

[64] Demertzi E, Voukelatos N, Papagerasimou Y, Drigas A, 2018 Online learning facilities to support coding and robotics courses for youth International Journal of Engineering Pedagogy (iJEP) 8 (3), 69-80, https://doi.org/10.3991/ijep.v8i3.8044

[65] Chaidi I, Drigas A 2022 Digital games & special education Technium Social Sciences Journal 34, 214-236 https://doi.org/10.47577/tssj.v34i1.7054

[66] Doulou A, Drigas A 2022 Electronic, VR & Augmented Reality Games for Intervention in ADHD Technium Social Sciences Journal, 28, 159. https://doi.org/10.47577/ tssj.v28i1.5728

[67] Kefalis C, Kontostavlou EZ, Drigas A, 2020 The Effects of Video Games in Memory and Attention. Int. J. Eng. Pedagog. 10 (1), 51-61, https://doi.org/10.3991/ijep.v10i1.11290

[68] Drigas A, Karyotaki M (2017) Attentional control and other executive functions. Int J Emerg Technol Learn iJET 12(03):219–233 https://doi.org/10.3991/ijet.v12i03.6587

[69] Drigas A, Karyotaki M 2014. Learning Tools and Application for Cognitive Improvement. International Journal of Engineering Pedagogy, 4(3): 71-77. https://doi.org/10.3991/ijep.v4i3.3665

[70] Drigas A., Papoutsi C. (2020). The Need for Emotional Intelligence Training Education in Critical and Stressful Situations: The Case of COVID-19. Int. J. Recent Contrib. Eng. Sci. IT 8(3), 20–35. https://doi.org/10.3991/ijes.v8i3.17235

[71] Kokkalia, G., Drigas, A. Economou, A., & Roussos, P. (2019). School readiness from kindergarten to primary school. International Journal of Emerging Technologies in Learning, 14(11), 4-18. https://doi.org/10.3991/ijet.v14i11.10090

[72] Papoutsi, C. and Drigas, A. (2017) Empathy and Mobile Applications. International Journal of Interactive Mobile Technologies 11(3). 57. https://doi.org/10.3991/ijim.v11i3.6385

[73] Angelopoulou, E. Drigas, A. (2021). Working Memory, Attention and their Relationship: A theoretical Overview. Research. Society and Development, 10(5), 1-8. https://doi.org/10.33448/rsd-v10i5.15288

[74] Drigas A, Mitsea E, Skianis C 2021 The Role of Clinical Hypnosis & VR in Special Education International Journal of Recent Contributions from Engineering Science & IT (iJES) 9(4), 4-18. https://doi.org/10.3991/ijes.v9i4.26147

[75] V Galitskaya, A Drigas 2021 The importance of working memory in children with Dyscalculia and Ageometria Scientific Electronic Archives 14 (10) https://doi. org/10.36560/141020211449

[76] Chaidi I, Drigas A 2020 Parents' Involvement in the Education of their Children with Autism: Related Research and its Results International Journal Of Emerging Technologies In Learning (Ijet) 15 (14), 194-203. https://doi.org/10.3991/ijet.v15i14.12509

[77] Drigas A, Mitsea E, C Skianis 2022 Clinical Hypnosis & VR, Subconscious Restructuring-Brain Rewiring & the Entanglement with the 8 Pillars of Metacognition X 8 Layers of Consciousness X 8 Intelligences. International Journal of Online & Biomedical Engineering (IJOE) 18 (1), 78-95. https://doi.org/10.3991/ijoe.v18i01.26859

[78] Drigas A, Karyotaki M 2019 Attention and its Role: Theories and Models. International Journal of Emerging Technologies in Learning 14 (12), 169-182, https://doi.org/10.3991/ijet.v14i12.10185

[79] Drigas A, Karyotaki M 2019 Executive Functioning and Problem Solving: A Bidirectional Relation. International Journal of Engineering Pedagogy (iJEP) 9 (3) https://doi.org/10.3991/ijep.v9i3.10186

[80] Bamicha V, Drigas A 2022 ToM & ASD: The interconnection of Theory of Mind with the social-emotional, cognitive development of children with Autism Spectrum Disorder. The use of ICTs as an alternative form of intervention in ASD Technium Social Sciences Journal 33, 42-72, https://doi.org/10.47577/tssj.v33i1.6845

[81] Drigas A, Mitsea E, Skianis C. 2022 Virtual Reality and Metacognition Training Techniques for Learning Disabilities SUSTAINABILITY 14(16), 10170, https://doi.org/10.3390/su141610170

[82] Drigas A,. Sideraki A. 2021 Emotional Intelligence in Autism Technium Soc. Sci. J. 26, 80, https://doi.org/10.47577/tssj.v26i1.5178

[83] Drigas A, Mitsea E, Skianis C.. 2022 Subliminal Training Techniques for Cognitive, Emotional and Behavioural Balance. The role of Emerging Technologies Technium Social Sciences Journal 33, 164-186, https://doi.org/10.47577/tssj.v33i1.6881

[84] Bakola L, Drigas A, 2020 Technological development process of emotional Intelligence as a therapeutic recovery implement in children with ADHD and ASD comorbidity. . International Journal of Online & Biomedical Engineering, 16(3), 75-85, https://doi.org/10.3991/ijoe.v16i03.12877

[85] Bamicha V, Drigas A, 2022 The Evolutionary Course of Theory of Mind - Factors that facilitate or inhibit its operation & the role of ICTs Technium Social Sciences Journal 30, 138-158, DOI:10.47577/tssj.v30i1.6220

[86] Karyotaki M, Bakola L, Drigas A, Skianis C, 2022 Women's Leadership via Digital Technology and Entrepreneurship in business and society Technium Social Sciences Journal. 28(1), 246–252. https://doi.org/10.47577/tssj.v28i1.5907

[87] Drigas A, Bakola L, 2021The 8x8 Layer Model Consciousness-Intelligence-Knowledge Pyramid, and the Platonic Perspectives International Journal of Recent Contributions from Engineering, Science & IT (iJES) 9(2) 57-72, https://doi.org/10.3991/ijes.v9i2.22497

[88] Drigas A, Karyotaki M, 2016 Online and Other ICT-based Training Tools for Problem-solving Skills. International Journal of Emerging Technologies in Learning 11 (6) https://doi.org/10.3991/ijet.v11i06.5340

[89] Mitsea E, Drigas A,, Skianis C, 2022 Breathing, Attention & Consciousness in Sync: The role of Breathing Training, Metacognition & Virtual Reality Technium Social Sciences Journal 29, 79-97, https://doi.org/10.47577/tssj.v29i1.6145

[90] Mitsea E, Drigas A, Skianis C, 2022 ICTs and Speed Learning in Special Education: High-Consciousness Training Strategies for High-Capacity Learners through Metacognition Lens Technium Soc. Sci. J. 27, 230, https://doi.org/10.47577/tssj.v27i1.5599

[91] Drigas A, Karyotaki M, Skianis C, 2017 Success: A 9 layered-based model of giftedness International Journal of Recent Contributions from Engineering, Science & IT 5(4) 4-18, https://doi.org/10.3991/ijes.v5i4.7725

[92] Drigas A, Papoutsi C, 2021,Nine Layer Pyramid Model Questionnaire for Emotional Intelligence, International Journal of Online & Biomedical Engineering 17 (7), https://doi.org/10.3991/ijoe.v17i07.22765

[93] Drigas A, Papoutsi C, Skianis, 2021, Metacognitive and Metaemotional Training Strategies through the Nine-layer Pyramid Model of Emotional Intelligence, International Journal of Recent Contributions from Engineering, Science & IT (iJES) 9.4 58-76, https://doi.org/10.3991/ijes.v9i4.26189

[94] Drigas A, Mitsea E, Skianis C, 2022 Intermittent Oxygen Fasting and Digital Technologies: from Antistress and Hormones Regulation to Wellbeing, Bliss and Higher Mental States BioChemMed 3 (2), 55-73