

# Empathy, Special Education and ICTs

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**Abstract** – During the past decades there have been considerable innovations with the use of Information Communication Technologies (ICTs) in many fields and sectors. In many settings ICTs have become an important element of the learning and teaching process. All social groups have been helped including children and adults with special educational needs. In this paper we provide a brief overview of the most representative articles for applications used for assessment, intervention and development of empathy which is an important skill that researches indicate that people with special educational needs lack of it. Empathy is a complex form of psychological inference in which observation, memory, knowledge, and reasoning are combined to yield insights into the thoughts and feelings of others.

**Index Terms** – ICTs, Empathy, Special Education, Emotion Recognition

## I. INTRODUCTION

In today's society, the use of information and communication technologies (ICTs) is a regular part of most people's lives. The term Information and Communication Technologies is a general term which refers to all kinds of technologies that enable users to access and manipulate information [1]. ICTs have been widely studied in a large number of fields as well as being a subject of study of its own right. In the field of education, more and more tools making use of new technologies are being released to support teaching. Furthermore, there has been a growing number of researches that supports the fact that, ICTs and assistive technologies more generally, enable children and people with special educational needs to lead more fulfilled lives. Computer applications can be helpful in reaching this objective.

The use of Information and Communication Technologies (ICTs) with individuals with special educational needs (SEN) has flourished in the last decade for several reasons: the computerized environment is predictable, consistent, and free from social demands, which individuals with SEN may find stressful. Users can work at their own pace and level of understanding, and lessons can be repeated over and over again, until mastery is achieved. In addition, interest and motivation can be maintained through different and individually selected computerized rewards. For these reasons, and following the affinity individuals with SEN show for the computerized environment, dozens of ICT programs, teaching various skills to this population were created. In the last decade, with the rapid development of internet based communication, web applications have been increasingly used for social interaction, forming online communities and social networks [2].

The term 'special educational needs' covers a range of problems which can cause difficulties in learning. Even though there have been many definitions over the years,

comparative studies show that the term 'special educational needs' can mean different things to different countries [3]. One of the most dominant categorizations that recommends a graduated approach to educating learners in need of special provision is the one introduced below. 'The areas of needs' as defined in the 2001 SEN Code of Practice are: Communication and Interaction, Sensory and/or Physical, Cognition and Learning, Behavior, Emotional and Social Development [4]. Defining the area of 'Special Needs' has been a widely discussed issue. Titles as Learning Disabilities or Learning Disorders are also used to describe a group of the population that have problems in their school performance and maybe later in their lifetimes. In this paper we will focus on empathy and its deficit which has consistently been cited as a central characteristic of people with special educational needs.

Empathy allows us to understand the feelings of others, predict their behaviors, and experience emotions triggered by their emotions. Empathy is manifested in emotions and perceptions triggered by an individual's attraction to external feelings. Baron-Cohen and Weelwright (2004) define empathy as having two components: the ability to recognize other people's mental states (such as intentions, beliefs, desires and emotions), and the ability to respond to these with an appropriate emotion. This two-factor definition of empathy sidesteps the traditional debate about whether empathy is a wholly emotional response (the emotion triggered by another person's emotions) or an entirely cognitive operation (the ability to put oneself into another person's shoes and perceive the world from their point of view). In line with classic models of empathy such as Feshbach's model, in which empathy is conceptualized as entailing cognitive and affective processes, the current consensus among scholars leans towards recognizing both components as necessary to define empathy [5], [6].

ICTs offers many chances to find innovative ways of teaching empathy and emotion recognition to children and people with special educational needs. Research has shown that computerized programs can be used to pass false belief tasks, recognize simple emotions from static photographs and cartoons, identify complex emotions from facial expressions and prosody of speech and assess, intervene and cultivate empathy through virtual environments and other software. 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 purpose of the current paper is to present an overview with the most representative studies that deal with computer interactive intervention programs in order to assess and develop empathy in children and adults who have special educational needs. This paper indicates that practicing simulated activities on the computer enhances

facial and emotion recognition abilities. The results provide support for the effectiveness of using a computer-based interactive simulation program as a vehicle for enhancing empathy and emotion recognition skills. Technologies and sensors that can sense emotions or express and thereby influence users' emotions have been continuously developed but there are enough studies that use instruments such as well-established questionnaires, scales and photographs in order to export results, measure and evaluate empathy.

## II. EMPATHY AND SPECIAL EDUCATION

### A. Learners with sensory impairments

Griffin-Shirley et al. (2005) conducted a study in order to compare the self-esteem and empathy of preadolescent children with visual impairments with those of sighted children. Several family variables were explored. Of particular interest to this study was the variable of pet ownership. Instruments included the CSEI-Short Form, the Bryant Index of Empathy for Children and Adolescents (IECA), and the Companion Animal Bonding Scale (CABS) were used to extract results. The study has been tested on 159 participants (81 boys and 78 girls) included two groups of preadolescents--71 who were visually impaired and 88 who were sighted--who ranged in age from 8 to 14. 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].

Odom et al. (1973) examined empathy in deaf and hearing children and their ability to interpret and evaluate emotion-arousing situations. Drawings were shown by an opaque projector and two tasks were given: (a) sorting faces portraying nine emotions and (b) matching those faces with drawings of appropriate emotion-arousing situations. The deaf children performed as the hearing children did on the first task but did not match the faces to the situations as well as the hearing children. It was concluded that the deaf have difficulty analyzing and interpreting emotion-producing situations. The lack of emotional empathy in the deaf may well be a model instance of a relationship between language training and an important dimension of personality [8].

### B. Learners with motor impairments

Cummins et al. (2005) investigated whether children with poor motor coordination have empathic abilities, and whether these could be connected to problems in moral judgement, pro-social behaviors and social competence. The research included emotion recognition scales that measured the ability to recognize facial expressions of emotions (The Fluid Emotions test), to understand vocal intonations specifically for different emotions (The Vocal Cues test), to define emotion words (The Emotion Vocabulary test), to understand the emotional consequences of exposure to an emotion that causes context (The Comprehension Test) and to implement logic skills and knowledge of the causes of emotions to explain apparent discrepancies between one emotion that is the context and the emotion caused by the frame (The Unexpected Outcomes test). This study has been tested on 234 children aged 6-12 years matched for age and gender and the results indicated

that children with motor coordination problems do have specific deficits in empathy [9].

### C. Learners with Autistic Spectrum Disorders

Silver and Oakes (2001) investigated the use of a multimedia software program, the Emotion Trainer, to teach individuals with ASD to recognize and anticipate emotions in others. The Emotion Trainer had five sections and utilized photographs of real people, as well as animated emotional expressions, to teach about emotions. Consistent feedback, prompting and reinforcement were provided and were contingent upon the level of success or difficulty an individual experienced while progressing through the program. Twenty-two individuals with ASD, ranging from ages 10 to 18, were matched based on age, gender, and school class. One member of the pair was randomly assigned to the intervention condition of 10 computerized sessions over 2-3 weeks, while the second member was placed in the no-intervention control condition. Both groups showed significant improvements in the ability to identify emotion or mental state from photographs of facial expression from pre- to post-intervention [10].

Golan et al. (2010) created an animated series called "The Transporters" to help children with autism between the ages of three and eight to look at the human face and to understand and recognize emotions that contribute to the development of empathy. The series of 15 five-minute episodes features the adventures of 8 animated mechanical vehicles with human faces, each focusing on a different human emotion. Such vehicles would grab the attention of both preschoolers with autism and those so-called "low-functioning" children with autism with significant learning difficulties. All of the characters were depicted as toys in a child's bedroom which come alive and take part in social interactions. Children with ASC (aged 4-7) watched "The Transporters" every day for 4 weeks and tested before and after the intervention. Results indicated that using "The Transporters" significantly improves levels of emotion comprehension and recognition [11].

Blocher et al. (2002) designed "The Affective Social Quotient project" which is one of the early projects at MIT Media Lab to develop assistive technologies for autism using physical input devices, namely four dolls (stuffed dwarfs), which appeared to be happy, angry, sad, or surprised. The system would play short digital videos that embody one of the four emotions, and then encourage the child to choose the dwarf that went with the appropriate emotion. When the child picked up the stuffed toy, the system identified its infrared signal and responded. Use of the dolls as physical input devices also encouraged development of joint attention and turn-taking skills, because typically another person was present during the session [12].

Schuller et al. (2014) introduced the gaming platform ASC Inclusion targeted to children aged 5 to 10 years with Autistic Spectrum Disorders. The running ASC-Inclusion project aims to help children with ASC by allowing them to learn how emotions can be expressed and recognized via playing games in a virtual world. The platform includes analysis of users' gestures, facial, and vocal expressions using standard microphone and web-cam or a depth sensor, training through games, text communication with peers, animation, video and audio clips [13].

Serret (2012) developed a serious game, “Jestimule”, to improve social cognition and empathy in ASD. ICT was also used to facilitate the use of the game by young children or by children with developmental delays (e.g., haptic joystick for feed-back). One of the main aims of the game was to teach ASD individuals to recognize facial emotions, emotional gestures and emotional situations. The game was tested on a group of 40 individuals (aged from 6 to 18) at the hospital. Results showed that participants improved their recognition of facial emotions, emotional gestures and emotional situations in different tasks. These results have clear education and therapeutic implications in ASD and should be taken into account in future training [14].

Bölte et al. (2002) developed and assessed a computerized intervention aimed at teaching basic facial affect recognition skills to individuals with ASD. The objective of this program is to diagnose and support the development of social-communicative skills through the assessment and training of elementary emotion perception and interpretation. Five hundred photographs, each with visual and audio feedback capabilities, were used to train individuals to recognize emotions. After providing feedback about a given picture, an animation of the corresponding emotion was presented on the screen as reinforcement. The program was tested on individuals with high-functioning autism or Asperger-syndrome by showing them the whole face or just the eyes of the persons in order to identify the emotions. Results support the usefulness of the program to teach the detection of facial affect. However, the improvement found is limited to a circumscribed area of social-communicative function and generalization is not ensured [15].

Konstantinidis et al. (2009) created an Affective Computer-Aided Learning Platform for Children with Autism (ACALPA) to enhance or mediate the teacher-child educational process. It is based on various interaction procedures according to the disability level of the autistic person in question. Several modules comprise the platform. Each of them represents a specific learning domain. One module is related to identify emotional states by visual expressions. The instructions are given either by an affective avatar, synthesized speech in autistic person’s native language, written in the screen, or a combination of these. ACALPA was implemented in a specialised school for people with autism and results indicated that the platform played an important role in emotion recognition and that an interactive learning environment might facilitate the educational procedure for people with autism [16].

Alves et al. (2013) presented the LIFEisGAME prototype-Ipad version which is a game that promotes facial recognition and helps individuals with ASD to understand emotions in order to develop empathy using real-time automatic facial expression analysis and virtual character synthesis. It includes five games modes. LIFEisGAME prototype was tested on 11 children with ASD, with ages varying from 5-15 years old and was played during a 15 minute game session. The results were promising and indicated the usefulness of the game to promote emotional understanding, bringing positive outcomes to quality of life for children with autism [17].

Kaliouby et al. (2005) presented “The emotional hearing aid” – a portable assistive computer device to help children diagnosed with Asperger Syndrome read, understand and react to facial expressions in a socially – appro-

priate way facilitating the process of empathy. It consists of a personal digital assistant (PDA), an earpiece speaker and a wearable camcorder. In developing the emotional hearing aid an automated mind – reading systems that infers complex mental states from facial expressions in real – time video, and a reaction advisor that suggests appropriate reaction for the user to take in real time have been implemented [18].

Tanaka et al. (2008) designed “Let’s Face It! Skills Battery (LFI! Battery)”, a computer - based assessment, organized into a theoretical hierarchy of face processing domains that reinforce the child’s ability to attend to faces, recognize facial identity and emotional expressions and interpret facial cues within a social context. The LFI! Battery was tested on participants with ASD and typically developing control (TDC) participants that were matched for age and IQ. Findings show that participants with ASD were able to label the basic facial emotions (with the exception of angry expression) on par with age- and IQ-matched typically developing participants. However, participants with ASD were impaired in their ability to generalize facial emotions across different identities and a tendency to recognize the mouth feature holistically and the eyes as isolated parts. The results also indicate that a relatively short-term intervention program can produce measurable improvements in the face recognition skills of children with autism [19], [20].

Golan et al. (2006) presented “Mind Reading”, an interactive multimedia program developed to teach adults with Asperger syndrome and high-functioning autism about emotions and mental states. It is based on a taxonomic system of 412 emotions and mental states, clustered into 24 emotion groups, and six developmental levels from four years old to adulthood. Mind Reading uses video, audio and written text to systematically introduce and teach basic and complex emotions. Users were able to explore emotions in the emotion library, partake in lessons and quizzes in the learning center and play games about emotions in the game zone. Results showed that following 10–20 hours of using the software over a period of 10–15 weeks, users significantly improved their ability to recognize complex emotions and mental states from both faces and voices, when compared to their performance before the intervention and compared with a control group [21].

LaCava et al. (2007) extended the work done by Golan and Baron Cohen (2006) by evaluating the efficacy of Mind Reading with a sample of eight American children with ASD age eight to eleven. Using a pre-test/post-test design, this study found that children improved on their ability to identify emotion from faces, after exposure to the multimedia training program. Additionally, participants were able to generalize emotion recognition skills to voices, but not faces that were not directly incorporated into the training program. Children, parents, and teachers indicated satisfaction with the format and content of the program and found it to be a highly motivating educational tool. Nonetheless, there was not strong support for the transfer of these skills to emotion recognition to more realistic and meaningful contexts [22].

Beumont and Sofronoff (2008) developed “The Junior Detective Training Program” an intervention program that included a computer game, small group sessions, parent training sessions and teacher handouts to teach social skills and emotional understanding to children with Asperger syndrome. The computer game was developed such

that the user was a detective who specialized in decoding other's mental and emotional states. Both human and computer-animated characters were utilized to teach emotion recognition and social problem solving. Support and mission outcomes were individualized and varied depending on how a user completed a given task. The study was tested on 49 children with Asperger syndrome between 7.5 and 11 years of age. Overall, findings from this study suggest that the Junior Detective Training Program may be an effective tool for teaching social functioning and emotion recognition to children with Asperger syndrome. However, although components of the intervention were developed specifically to enhance skill generalization, this study did not measure the generalization of targeted skills to real life social contexts [23].

Cheng et al. (2010) introduced a "Collaborative Virtual Learning Environment (CVLE) – empathy system" to promote the understanding of empathy for children with ASCs. The virtual environment is a restaurant presented to participants on a laptop. The CVLE-empathy system allows children to choose expressive avatars that represent themselves and through novel social events highlighting empathic situations children with ASCs practice empathy in a social context and express their emotional states to other users. The study was tested on three participants, lasted five months and the results showed that the CVLE-empathy system had positive effects on the development of empathy and generalized this understanding of empathy to their daily lives [24].

Baron – Cohen et al. (2001) developed the 'Reading the Mind in the Eyes' Test in 1997 but there was a revised version in 2001. It requires the participant to identify the mental state of the person in the photo just from information around the eye region of the face. This instrument measures both emotion recognition, cognitive empathy and mental state. Each correctly answered item is awarded one point and each incorrectly answered or unanswered item is scored as zero. The final score is sum of all acquired points. The Eyes test, originally developed as a sensitive measure of subtle cognitive deficits in individuals with autism spectrum conditions (ASC), correlates with scores on the self-report Empathy Quotient (EQ) in the general population. Results showed that individuals with AS or HFA, despite having at least normal intelligence, have specific difficulties in identifying subtle mental states and cognitive empathy [25].

Golan et al. (2006) presented "The Cambridge Mindreading Face-Voice Battery" for adults (assessed the recognition of 20 emotional concepts from facial expression video clips and speech segment audio clips taken from Mind Reading. After each clip was shown, participants were asked to choose which of four emotion words best described how the person in the clip was feeling). The CAM-C consists of two subtests—Face ER (Emotion Recognition) and Voice ER— each involving 45 questions, for a total of 90 items. The battery was given to males and females with AS and matched controls. Results showed that individuals with Asperger Syndrome (AS), when compared to control group, had more difficulties in recognizing mental states and emotions from both faces and voices [26].

Hopkins et al. (2011) evaluated the effectiveness of using a computer-based interactive simulation program as a vehicle for enhancing observed and reported social skills for children with Autism Spectrum Disorders (ASD).

FaceSay uses an interactive approach with computer animated avatars, both humans and animals, to create a more life-like software program to teach face and emotion recognition skills. After observing the computer intervention sessions, children completed post – test measures. The children with LFA (low-functioning autism) demonstrated improvements in two areas of the intervention: emotion recognition and social interactions. The children with HFA (high functioning autism) demonstrated improvements in all three areas: facial recognition, emotion recognition, and social interactions [27].

Schulte-Rüther et al. (2011) examined subjects with ASD in an explicit empathizing task. Subjects were asked to empathize with emotional facial expressions presented on a computer screen by "feeling into" the depicted person and either to judge the emotional state of each face (other-task), or to report the emotions elicited in themselves by the emotional faces (self-task). Furthermore all participants completed the Autism Spectrum Questionnaire (AQ) and the Empathy Questionnaire (EQ). ASD subjects performed almost equally to the control group during the other-task, but showed less emotionally congruent responses in the self-task [28].

#### *D. Attention deficit hyperactivity disorder (ADHD) and Attention deficit disorder (ADD) learners*

Braaten and Rosen (2000) presented different stories to 6-12 years old patients with ADHD and healthy controls. Participant were instructed to answer questions about the feelings of the protagonist, their own feelings and the reason for their feelings. ADHD patients less frequently matched the emotion they identified in the protagonist with the one identified in themselves and gave fewer protagonist – centered interpretations [29].

Yuill and Lyon (2007) investigated children with ADHD by presented them with emotional and non – emotional situations. They were instructed to match emotional facial expressions to the protagonist (emotional task) and to match photographs (non – emotional task). Children with ADHD performed more poorly than the control group in the emotional task. However, they also show impairments when they had to make judgements about non – emotional characteristics of faces suggesting that deficits do not reflect specific social cognition impairments per se [30].

Marton et al. (2009) examined empathy and social perspective taking in 8 to 12 year old children with and without Attention – Deficit/ Hyperactivity Disorder (ADHD). For this study well - established questionnaires and scales were used as tools to measure empathy and social perspective in order to export results. The "Index of Empathy for Children and Adolescents" and the "Interpersonal Negotiation Strategies" are measures used to assess empathy and its relation to social development. The study has been tested to 92 children, 50 with a diagnosis of ADHD and 42 typically developing comparison children. As far as empathy is concerned the results indicated that children with ADHD were less empathic than comparison children but with no significant difference and furthermore that greater deficits in empathy are associated with oppositional and conduct problems rather than ADHD [31].

#### *E. General learning disabilities*

Kam et al. (2004) examined the effectiveness of the PATHS curriculum (Promoting Alternative Thinking

Strategies) on the adjustment of school-age children with special needs. The PATHS preventive intervention program is based on the ABCD (affective– behavioral–cognitive–dynamic) model of development. PATHS focuses on building emotional awareness and emotional regulation skills in early school years and integrating the skills in self - control with social problem–solving skills. PATHS takes a classroom-wide approach, and the curriculum is intertwined with the existing curriculum in the school. It also promotes a change in classroom atmosphere to increase empathy and openness in dealing with emotional needs. PATHS includes many activities to achieve the aims mentioned above. The curriculum was tested on 133 students studying on elementary schools and the results indicated that long term implementation of PATHS has positive effects but more research on bigger samples has to be done [32].

Spackman et al. (2005) examined the emotion recognition of children with language impairment by using facial expressions on photographs and music by listening to experts and indicated what emotion was being expressed. The study was tested on 43 children with learning impairments and 43 typically developing, age-matched peers, sampled from the age ranges of 5 to 8 and 9 to 12 years. The results showed that there was no difference at identifying happiness, anger, sadness and fear but children with learning impairments showed some difficulties from typical children in surprise and disgust. Furthermore results indicated differences from typical children in identifying the emotion expressed in music excerpts [33].

Bloom et al. (2009) examined abilities of adolescents to recognize, express, and understand facial expressions of emotion. The study was tested on 69 participants which were divided into three groups: 23 adolescents with NVLD (nonverbal learning difficulties), 23 matched adolescents without learning disabilities, and a comparable group of 23 adolescents with GLD (general learning difficulties). Relative scales were used including Wechsler Intelligence Scale for Children–Third Edition, Recognition measure: Pictures of Facial Affect (PFA), Expression measure and Understanding measure. It was discovered that adolescents with GLD were significantly worse at recognizing facial expressions of emotions than adolescents with NVLD and without LD, with no difference between the NVLD and NLD groups [34].

González et al. (2006) developed Proyecto Aprender, an accessible educational online resource targeting children with special educational needs. The overall objective is to build up and develop the physical, emotional, cognitive and communicational skills of learners with special educational needs, using new information and communications technologies to promote, to the greatest possible extent, their personal autonomy and social integration. For this purpose the project includes several multimedia activities for the learning objects and some of them has to do with the emotions and the development of empathy [35], [36].

### III. CONCLUSIONS

Empathy is without question an important ability. It allows us to tune into how someone else is feeling, or what they might be thinking. Empathy allows us to understand the intentions of others, predict their behavior, and experience an emotion triggered by their emotion. In short, empathy allows us to interact effectively in the social world.

The articles reviewed above discussed the application of innovative computer technology to assessment, intervention and cultivation of empathy. Programs utilized interactive multimedia to introduce individuals with SEN to social communication concepts such as empathy, emotion recognition and social skills. There has been conducted great progress in the design and the development of ICT software programs to provide students with special educational needs the opportunity and the capability to develop empathy.

The development of future interactive multimedia programs should focus on ways to assess and enhance this capacity. Further research is needed not only to evaluate and explore empathy in children and adults with special educational needs but also to determine intervention methods that will help these children enhance both their cognitive ability and their understanding of various expressions of emotion (cognitive and affective empathy). This paper shows that computers may also be able to serve as tools that help improve affective communication for all.

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