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Social- Emotional Learning , Autism Spectrum Disorder , And ROBOTS

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Abstract:
People with ASD show deficits in their emotional intelligence in terms of expression, and recognition of others' emotions, resulting in difficulties in interactive communication and socialization. Social-emotional learning (SEL) can help children with autism develop an awareness of emotions and build social relationships. The development of SE L can be achieved through strategic methods and media such as interactive technologies and especially robots, which appear to be an important educational tool in the education of individuals with ASD.

Keywords- social-emotional learning, Autism Spectrum Disorder, interactive technologies, and robots

I. Introduction

Most children begin emotional development at birth by expressing emotions, and reading facial expressions, and continue to develop empathy and relationship-building skills as they grow older.

Autism Spectrum Disorder (ASD) is a severe pervasive disorder of a person's development, which accompanies the person throughout his life, affecting his perception, thinking, and behavior, and is characterized, among other things, by significant deficits in social communication and social interaction of the individual with those around him (ICD10; WHO; DSM_5) with significant deficits in the recognition, understanding, and expression of emotions and consequently also in their socialization (Kanner, 1943; Baron-Cohen, 2008; Misailidis, et al. al., 2009; Uljarevic, et al., 2012).

Social and emotional learning (SEL) refers to a wide range of skills that enable a person to achieve social competence (Spence, 2003), verbal and non-verbal attitudes and behaviors that can influence students' success in school and life in skills not measured by assessment tests such as critical thinking, emotion management, conflict resolution, decision making, teamwork. Deficits in these skills make it difficult to integrate people with ASD both in schools and in society, and their education is a challenge for researchers and educators.

The use of ICT in the treatment-education of children on the autism spectrum (Boucenna et al ., 2014) is a research field as children with ASD enjoy playing video games (Durkin, 2010), "engaging" in virtual environments that are predictable and reassuring (Mitchell Mitchell et al ., 2007) as they provide many possibilities to create normal life environments for the trainer (Josma et al ., 2008) and the use of virtual environments to allow practice with social situations that simulate real life.

ICT-based interventions are classified into three main categories (Boucenna et al ., 2014):

a) The iPods and iPad applications
b) The use of robots for children with ASD (Boucenna et et al ., 2014; Huijnen et et al ., 2016; Chaidi, et al., 2021)
c) The use of games with a serious purpose (serious games): "digital games with an educational design for learning beyond entertainment" (Park et al ., 2012)

for improving social interactions in people with ASD as their use in the educational process promotes interactivity and de-escalation of tensions, promotes active educational models, and offers new possibilities for communication/collaboration.

The present work is a literature review that concerns the development of the social and emotional empowerment of students with autism, through technologically enhanced learning and education methods, with the use of interactive technologies and especially robots, useful and effective tools in the development and strengthening of social-emotional skills.

2. Autism Spectrum Disorder

Autism spectrum disorder ASD is a lifelong developmental disorder, a disability that presents with difficulty interacting with other people and the environment (Rajendran, et al., 2000) due to the inability to understand social cues, which prevents individuals from correctly understanding what they see, hear, and feel, resulting in severe deficits in their social relationships, communication, and behavior.

Autism spectrum disorder is a severe, widespread group of behavioral disorders with abnormalities or severe deficits and impaired development in two areas: a) social communication and interaction and b) stereotyped, repetitive patterns of behaviors, activities, and interests (DSM_5, WHO . ICD 10) that affect the perception, thinking and behavior of the individual so that significant difficulties arise in the development of the socio-emotional and communication skills of the individual with his social environment.
(Chaidi, et al., 2010, Chaidi, et al., 2020)

It is a congenital brain disorder that affects the way the brain uses information, and there may be comorbidity with other developmental disorders mental retardation, learning disabilities, epilepsy, deafness, blindness, etc. It manifests itself during the first 2 years of a child's life, and lasts throughout a person's life, although symptoms may improve over time. The main primary deficits presented by people with ASD are excessive isolation, difficulty in creating social contacts, idiosyncratic language communication, and the need for " routine" in the environment in which he lives.

The severity of the characteristics of autism varies from person to person, as there is great heterogeneity but usually includes the following: a) severe language delay, difficulty in communication and the language expression becomes idiosyncratic, stereotyped , repetitive, with echolalia and a typical, monotone voice, b) a deficit in the understanding of social relationships, as the person with ASD a usually does not have eye contact with those around him and shows indifference to play with his peers, c) presents subsequent forms of sensory reactions, gives the impression of being deaf, does not react to sounds or is overly bothered by a simple everyday sound, shows a lack of sensitivity to pain and a lack of response to cold or heat, d) shows “heterogeneous patterns” of mental functioning, as a person with ASD may have islands of intelligence in certain specific areas such as: music, painting or complex mathematical calculations or the apo remembering events and e) seems to have limited interests and activities and is often expressed in mannerisms such as clapping, spinning or shaking (Gena, 2002).

The educational approaches of students with ASD should respond to their particular cognitive needs, according to their developmental level and age, to use their abilities, and their interests, to transform their abilities into functional skills Jordan, et al., 1990; 1995) to be conducted in a structured learning environment, with a fixed daily schedule, individual teaching, alternative teaching methods (visualized teaching materials) and enriched educational activities focusing on their preferences and interests (Chaidi, et al., 2010, Chaidi, et al., 2021, Chaidi, et al., 2022).

3. Social -Emotional Learning & ASD

3.1 EQ & ASD

Emotions are considered children's first way of communication, as they can express their basic emotions, joy, sadness, anger, disgust, and surprise (Izard, et al., 1980) from the first weeks of their birth.

Investigators (Leppänen, et al., 2006) argue that the recognition of emotional facial expressions is a manifestation of the development of social skills in typically developing children (Uljarevic, et al., 2012) since the ability to distinguish emotions in another person's facial expressions is considered a key element for the development of social interaction which is developed, improved through experience recognizing facial expressions.(Facial Emotion Recognition,-FER). (Chaidi, et al., (2022)

It has been observed that many individuals with ASD with severe impairments in social interaction show impairment in FER, a fact first noted by Kanner, L. (1943). as is also evident from the definition of autism as an "emotional contact disorder", thus emphasizing the severe socio-emotional deficits of the ASD disorder, which are considered as a "congenital" inability of children to interact emotionally with those around them. (Chaidi, et al., 2022).

Besides, the diagnostic criteria of (DSM_5, WHO, ICD 10) the deficits of individuals with ASD in the recognition and processing of emotions: " manifested in the use of non-verbal behaviors, such as facial expression... " and " lack of social or emotional reciprocity ", thus reflecting deficits in the use and response to emotions summarized in two basic elements: a) the processing of emotions (Begeer, et al., 2008, Herba, et al., 2004, Phillips, et al., 2003). b) the production of an emotional state and its regulation (Uljarevic, et al., 2012, Chaidi, et al., 2022).

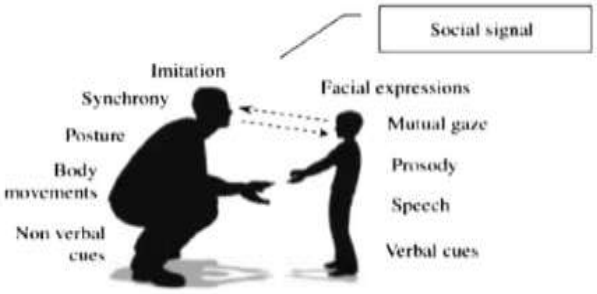


Fig. 1: Reception and production of social signals multimodal verbal and nonverbal cues merge to produce a social signal (Chaby, et al., 2012, Boucenna, et al., 2014)

In people with ASD there is a difficulty in connecting emotion with perception and thinking, and difficulties in understanding and managing emotions, they can manifest and express their emotions with emotional expressions different from the emotional expressions of typically developing children (Misailidi, et al., 2009, Chaidi, et al., 2022).

Haidi, & Papoudi (2010) point out that people with ASD have significant difficulties in recognizing, understanding, and expressing emotions (Misailidi, et al., 2009), they tend 't o avoid human faces, with the result that they have difficulty understanding why facial features "move", and change, as a result, the inability to read emotions in the human face weakens their ability to communicate with those around them (Haidi, et al., 2010) and support (Chaidi, et al., 2020), that people with ASD can be trained in recognizing, expressing and understanding emotions with useful educational tools such as serious games (Grossard, et al., 2017), robots and other interactive technologies (Chaidi, et al., 2022).

3.2 SEL & ASD

In recent years, social and emotional learning (SEL) has been seen as a key and integral element of education and human development. SEL is defined as the process through which all individuals acquire and apply knowledge, skills, and attitudes such as to develop healthy identities, be able to manage emotions to lead to the achievement of personal and collective goals, to feel and show empathy for those around them, to develop and maintain supportive relationships as well as to make responsible and careful decisions (CASEL, 2013; Ellias, et al., 2000; Devaney, et al., 2006) having as a guide the skills of self-perception, self-esteem, and empathy (Wilkinson et al., 2019).

Social-emotional learning competencies are defined as specific skills, habits, and attitudes that fall under the umbrella of social-emotional learning and according to CASEL are five core SEL competencies.

- Self-Awareness.
- Self-Management.
- Social Awareness.
- Relationship Skills.
- Responsible Decision-Making.

3.2.1 STRATEGIES

For the development of social-emotional skills, similar strategies are used for a successful education (https://www.panoramaed.com/blog/social-emotional-learning-activities-high-school/ https://www.panoramaed.com/blog/guide-to-

core-sel-competencies)

1: Self-awareness

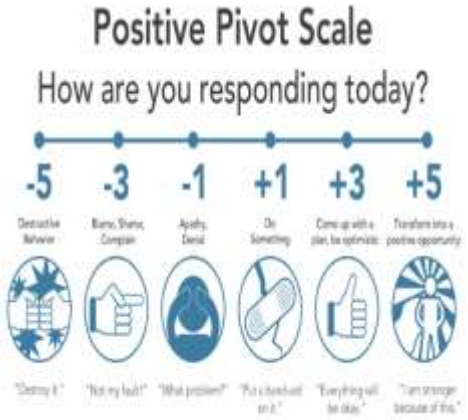
Self-awareness is defined as the ability to understand one's emotions, thoughts, and values, as well as the way emotions, influence one's behavior in various contexts and situations. Does this entail one's ability to recognize one's potential and impose limitations " with a well-grounded sense of confidence and purpose. ” (Casel 2013) Self-awareness usually answers the questions: How do I feel and why? When do I feel angry? What's stressing me out? etc. and consists of the following components: a) Recognition of emotions, b) Self-perception, c) Recognition of strengths, d) Self-confidence, and e) Self-efficacy.

1.1. Self-Awareness Strategy: The Wheel of Emotions

Feelings Wheel helps students to identify their own and others' feelings to identify their feelings and manage them constructively.

How it works: Suppose a child feels angry. He locates the emotion in the circle (in the center). Then in the 2nd circle, he locates an emotion caused by anger. Finally, on the outside, he "discovers" the emotions caused by the corresponding emotion he has chosen

1.2. Self-Awareness Strategy: Positive Pivot



The Positive Pivot Scale is a middle school strategy that suggests ways/solutions for students to respond to a situation on a scale of negative -5 to positive +5.

How it works: The student thinks of a challenge that addresses the specific one. And he is asked to numerically identify it on the Positive Aggregation Scale and then he should think of ways that will lead him to a numerically higher position.

2: Self-management

Self-management is considered the ability to effectively manage one's thoughts, feelings, and behaviors in different situations to achieve one's goals. Self-management is related to the ability to manage stress and the "will" with motivation and strength to achieve personal and collective goals. Self-management consists of a) Impulse control, b) Stress management, c) Self-discipline, d) Self-motivation, e) Goal setting, f) Organizational skills

2.1. Self-Management Strategy: Positive self-talk

Self-talk means talking to myself, talking to myself, out loud or silently or mentally. A positive conversation with ourselves is sure to activate thoughts, and solutions for our possible problems and leads us to think that making mistakes is a part of life.
Two examples of moving from negative to

positive self-talk include:
A) As a teacher: there is a wealth of technology material and you will have to teach the class.
Negative Self-Talk: "This is never going to work! I'm not tech savvy"

Positive Self-Talk: "I can ask someone to help me and it will get easier."

B) As a student: He has an important question for the teacher, but the teacher tells him he doesn't have time to answer it.
Negative Self-Talk: "I can't figure it out on my own!"
Positive Self-Talk: "It will take time, but I can learn this."

2.2. Self-Management Strategy: Setting WOOP Goals

The goal-setting activity helps students find their desires and develop, organize, plan, and implement a plan to fulfill them. WOOP is the initials from each step: identifying your Wish, imagining the Outcome, anticipating the Obstacle, and developing a specific Plan.
W: Name an important wish of yours. (challenging but doable)
O: What will be the most important result of making your wish come true? How will you feel? Imagine the result.
O: What do you consider to be the main obstacle within yourself that can prevent you from realizing your desire? Imagine the obstacle.
P: What is the best effective action to deal with the obstacle? Make a plan with: now and then.

3: Social Awareness

Social awareness is the ability to understand others and empathize, to put oneself in the other's place, without overlooking the different background, culture, and environment of the other because these are important factors in the formation of the individual. In social awareness, we understand others and their accompanying (historical and social elements) patterns of behavior and recognize resources and support from family, school and community, society. Questions for social awareness are: How should _____ feel? How would I feel if I were in his shoes? What should he think? Thanks for sharing it with me! My family deals with it this way, etc
Social awareness includes the following areas: a) Perspective taking, b) Empathy,
c) Appreciating diversity, and d) Respecting others.

3.1. Social Awareness Strategy: The Listening Circle

The Listening Circle teaches empathy, provides an opportunity to hear different perspectives on situations, and builds community. In a listening circle, students gain space to share their point of view, to express prompts such as: "Who do you look up to the most and why?" and "What advice would you give yourself today and why?"

4: Relationship Skills

Relationship skills are the ability to create and maintain stable, healthy, and supportive relationships that will help us get along with people or groups from different backgrounds. To achieve the above, the basic conditions are the ability to communicate, active listening, cooperation, negotiation and conflict resolution, getting along in different socio-cultural environments, taking initiatives in positions of responsibility, offering help, etc. The questions related to relationship skills are: Made me feel ___, Can you explain what you mean by that? I disagree with you because ____, etc. questions to clarify and promote the dialogue.
Relationship skills include the skills of a) Communication, b) Social Engagement, c) Relationship Building, and d) Teamwork.

4.1. Relationship Skills Strategy: Count Me Down

Count Me Down is a strategy that prompts students to discover ways of coping that are sometimes similar and sometimes different among their peers to develop a more effective understanding of peers, strengthen empathy, and demonstrate respect for diversity.
An example of a strategy prompt is the following:

1. List 3 unique things about your family.
2. Mention 2 challenges you are currently facing.
3. Describe 1 goal or dream you have.

4.2. Relationship Skills Strategy: Rose, Bud, Thorn

Rose, Bud, and Thorn is a strategy to identify positive events and areas that need strengthening and support and turn "thorns" - negative events into "roses" - positive events by examining - discovering ways to achieve this.
During this strategy, students share a fact:

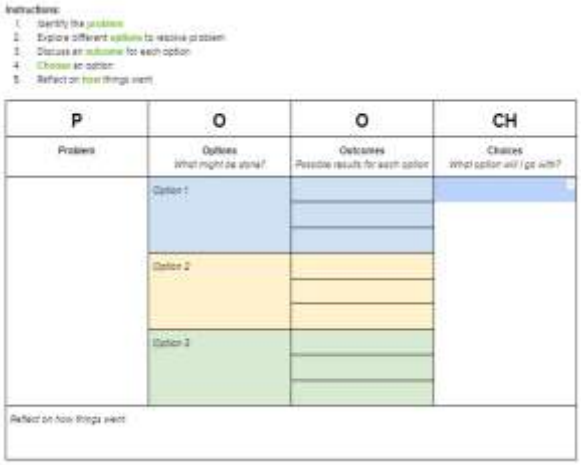
1. Rose: Something positive happened last week.
2. Bud: Something to look forward to next week.
3. Thorn: Something you need help with next week.

5: Responsible Decision Making

Responsible decision-making is the ability to analyze a problem, in all its elements, ethical standards, and concerns, and then make the best choice of safety solution and evaluate the benefits and consequences of various actions that will lead to the happy outcome of the problem for personal, social and collective well-being. Responsible decision-making involves questions such as: How will this affect others? Worth? Why should I make this choice? Will this help me/us? etc

Responsible decision-making consists of the following stages: a) Identifying problems, b) Analyzing situations, c) Solving problems, d) Evaluating, e) Reflecting, and f) Ethical responsibility.

5.1. Responsible Decision-Making Strategy: The POOCH Protocol



POOCH is a problem-solving process that helps students generate solutions to problems by listing possible options and outcomes through 5 steps:

1. Identify the problem.
2. Explore different options to solve the problem.
3. Discuss an outcome for each choice.
4. Select an option.
5. Think about how things turned out.

6. Social-Emotional Learning Activities for High School

Social-emotional learning skills not only improve students' everyday life but also their academic performance. They help them develop, improve, and regulate their emotions to resolve conflicts, make friends, and avoid risky-inappropriate behaviors with ethical and safe choices, ingredients that lead to academic and professional success.

Indicative activities related to the main responsibilities of CASEL of SEL :

- Punch up to five (self-administration)
- Different Perspectives on Literature (Social Awareness)
- Social Contract (Relationship Skills)
- Important Online Messages (Relationship Skills)
- Responsible Citizens (Responsible Decision Making)

4. Interactive Technologies In Social - Emotional Learning

In recent years, there has been talking about the importance of using interactive technologies, ICT, virtual environments (VE), serious games, AVATARS, ROBOTS, MOBILE., and other devices: screens, touch, WII, etc. (Boucenna et al., 2014). The goal of interactive technologies and social-emotional learning programs is to bring people with ASD into contact with other users and especially through the use of interactive games and the participation of people with ASD to improve the skill of cooperation with others, to provide stimuli and triggers to improve behaviors. Electronic environments offer people with ASD pleasure as the environment is controlled, which is a demand for people with ASD. (Green, 1993).

Electronic environments are suitable for education as they provide a pleasant environment with methods that provide the opportunity for people with ASD to "function" according to their abilities and the peculiarities of traditional educational methods that make it difficult for people with ASD (Frith, et al., 1991) that require quick and flexible thinking and responding. There is an ever-increasing development of interactive environments for the education, and treatment of individuals with ASD. through educational software platforms (Luneski, et al., 2008). Using an interactive and attractive way of approaching learning, moving images, videos, photographs, or sketches of real objects of everyday life, encourage, and prompt people with ASD to develop or improve the ability to discriminate, and identify by distinguishing objects based on size, color, their type, etc. or associate objects with sounds and words, Also, it should be mentioned that for a more complete understanding of the

instructions and the whole task they are accompanied by verbal and visual guidance with Makaton or pecs symbols so thatpeople with ASD develop autonomy and autonomy them and to minimize the "help" of the teacher (La´nyi et al., 2004)

4.1 ICT & ASD

Emphasized by researchers (Karagiannidis**,** 2006) that the main areas of development involved in the education of people with ASD are: a) **learning** technologies: development of ICT applications and services with the ultimate goal of supporting education, b) **assistive** technologies): development of ICT applications and services (hardware and software) with the goal of accessibility for the disabled in computing systems and c) **human**-computer interaction: development of user interfaces that provide usability, ensuring the "acceptability" of ICT applications by all users.

The need to teach knowledge and skills to use the computer as a means of education and entertainment for children with special needs is recognized as it offers the possibility of introducing the student with autism into a controlled environment that is predictable and does not contain social stimuli and helps the student maintain attention and concentration on an activity. It can also provide the ablest students with autism with channels of "safer" written communication with other people who are far away from them. Jordan & Powell (1997), argue that "any person with A SD can be comfortable with computers and can develop a good rapport with someone else working on H/Y with them.'

In particular, computers are considered a suitable medium for teaching people with autism (Jordan et al., 1990, 1995) because:

• limit sensory stimuli

• have predictable and "law-abiding" "behavior" and are therefore controllable devices

• do not penalize wrong answers

• it is an educational tool that can be further improved

• enable non-verbal or verbal expression.

Research on computer use for students with autism revealed the following [78]: (a) increased focused attention; (b) increase in total attention span. (c) increase in sedentary behavior. (d) increase in fine motor skills. (e) increasing generalization skills (from computer to related non-computer activities); (f) reduction of arousal. (g) reduction of self-stimulatory behavior; and (h) reduction of perseverative responses. (Pappas, et al., 2018, Drigas, et al., 2011, Drigas, et al., 2004, Drigas, et al., 2004a, Drigas, et al., 2011, Charami, et al., 2014, Drigas , et al., 2005, Drigas, et al., 2016, Drigas, et al., 2017)

To teach the handling of H/Y, the teacher must, as much as possible, use material with a realistic character, choosing activities that are first implemented in the classroom and then appear on the computer screen. This will help the student to understand that the H/Y screen and its content are about depicting the real world and not something unreal (Drigas et al., 2004; Drigas, et al., A., 2013; Pappas, et al., 2018; Papanastasiou, et al., 2018., Drigas, et al., 2016, Papanastasiou, et al., 2020, Drigas, et al., 2005, Pappas, et al., 2018, Pappas, et al. al., 2019, Drigas, et al., 2009) For learning to use the programs and the tools they offer, the visualized instructions form limited conditions, they are particularly helpful since the student can consult them at every stage of contact of with the computer. The teacher should always plan the activities so that they stimulate the student's interest and help him to generalize his acquired knowledge. (Theodorou, et al., 2017, Drigas, et al., 2015, Pappas, et al . ., 2015, Drigas, et al., 2014, Alexopoulou, et al., 2019, Pappas, et al., 2015, Drigas, et al., 2013, Drigas, et al., 2014, Drigas, et al., 2019, Bakola, et al., 2019, Kontostavlou, et al., 2019, Drigas, et al., 2016, Drigas, et al., 2006. Drigas et al., 2006)

Also, the teacher should ensure that H/Y engagement does not become an obsession by setting clear time limits and turn-taking for use by other students or using the computer as a means of rewarding the desired behavior of students with ASD.

Finally, familiarization with H/Y is considered an important area of education for people with autism that can be utilized as a recreational activity or even a pre-professional skill. (Chaidi, et al., 2021)

4.2. Special Inrut Devices: Touch Screens and Others Technologies

The development in the field of ICTs takes place in leaps and bounds and could not fail to have changes in the use of tools in the education of people with ASD. New sophisticated forms of ICT are presented in more attractive forms and allow input and use with a touch screen for input feedback instead of a simple mouse device [84]. (Konstantinidis, et al., 2008). Scientists (Boucenna, et, al., 2014) report that in scientific research they use technological devices that enable multiple users to touch detect multiple simultaneous touches by two to four users were used. (Gal et al., 2005).

Other researchers (Strickland, et al., 1996) report that the rehabilitation of individuals with ASD using virtual reality (VR) includes visual devices to represent the 3D virtual world.

Other alternative methods of interactive environments include remote controls such as the Wii-mote (commercial game console) (Gonzalez, et al., 2007; Konstantinidis, et al., 2008) web camera, eye tracker, and data glove. (Takacs, 2005)

Also, scientists through video projectors present the educational material on the wall of the room trying to create virtual worlds (Horace, et al., 2006).

Researchers (Kagohara, et al., 2013). In a review of 15 studies involving 47 individuals with ASD on the use of iPods, iPads (by Apple), and related devices used to educate individuals with ASD in the following five domains: (a) academic, (b) communication, (c) employment, (d) free time, and (e) transition to school environments the results showed that the devices greatly positively helped people with ASD.

Research on the usefulness of the iPad as a communication device compared to a picture card communication system found that communication skills sometimes improved when using the iPad and sometimes remained the same, while other research (Murdock, et al., 2013) on iPad use to improve pretend play skills using a play story argue that there was an improvement.

Video modeling is a new way of teaching. The authors (Jowett, et al., 2012) evaluated its effectiveness in teaching basic numeracy skills to a 5-year-old boy diagnosed with ASD with positive results, confirming that video- modeling using an iPad, gradual fading of video prompts, reinforcement, prompting in vivo and for-chains may be an effective technique for teaching numeracy skills to children with ASD.

The authors (Flores, et al., 2012) showed that augmentative and alternative communication (AAC) interventions improve the communication-social skills of children with ASD: mobile phones, MP3 players, and tablets.

4.3. Serious Games

The researchers, (Machalicek, et al., 2012) in a systematic literature review of studies, using computational interventions (ICTs) to improve the social and emotional skills of people with ASD), report that these results studies have shown that the effect of CBI on social and emotional skills was mixed, with most studies reporting an improvement and development of the social-emotional skills of people with ASD after their training, pointing out that Serious Games can be just as effective as face-to-face education. (Papanastasiou, et al., 2017, Kokkalia, et al., 2017, Drigas, et al., 2015, Papanastasiou, et al., 2017, Drigas, et al., 2014, Kokkalia, et al., 2016)

Serious purpose games are categorized according to their purpose into 2 major categories: a) Serious games for education are designed to help the teacher or student during the teaching and/or learning process to understand money, develop social and communication skills, learn First Aid and storytelling. b) therapeutic games aim at the development of Visual motor Coordination, Social Skills, Sensory Integration, Electroencephalogram (EEG) games, and Social Behaviors. (Noor, et al., 2012)

According to (Grossard, et, al., 2017) new search was limited to 31 articles about serious games, between January 2001 and April 2014, and they were designed that improve social skills. Sixteen of these games targeted facial emotion recognition or production. They support that " Although social skills required in real-life involve rich combinations of perspective-taking, emotional regulation, cognitive flexibility, appropriate use of language and so on, the literature search

conducted here emphasized that a significant part of the effort devoted that serious game design has been focusing on the basics ability of emotion recognition, which sustains those more complex forms of social competencies" (Chaidi, et al., 2020.)

4.4. Virtual Environments

Virtual environments (EU) in the last decade have developed as another area in social interventions for autistic children (Bellani, et al., 2011) as VEs "simulate" specific social situations in which the person with ASD can participate in role-playing everyday social scenarios 3 D, and narrative scenarios by eliminating anxiety through the stable and predictable environment (Parsons, et al., 2000) using moving images, animations, sounds and voices, effects (Trepagnier, et al., 1999) that children prefer and like.

Studies have shown that through VE people with ASD learn simple social skills using technology (Parsons, et al., 2000, Parsons, et al., 2006, Strickland, 1996) and they enjoy it and are more interested in interaction than other games (Konstantinidis, et al., 2009). Virtual peers (Tartaro, 2007) are characters in life-size, they have speech, and movement, they are characters that look like "real" children, and they respond and interact.

Such examples are a) a virtual cafe for children with ASD developed by researchers (Mitchell, et al., 2007) to improve problems in social interaction. Participants had to perform a series of specific tasks using a mouse and their social understanding of decision-making was assessed in two different social scenarios: a cafe and a bus with variable results.

b) The you believers (Herrera, et al., 2008) created a virtual supermarket on a flat-screen monitor to teach 2 children, 8 and 15 years old, the process of imaginative and abstract play, interacting with the objects in imaginative ways, such as flying pants turns into a highway.

Assessing the results using a test of the use of functional objects, the symbolic play test (SPT) (1976), the test of pretend play (Topp) (1997), and the Imagination and magic comprehension test. The children improved on all tests except the SPT, concluding that their virtual reality environment is a tool that improves the symbolic thinking skills of individuals and that these skills translate into specific symbolic play behaviors, emphasizing the interaction of children with the touch screen and the instructor.

The above was also enhanced by the use of Diamond Touch (Circle Twelve Inc., Framingham, Mass., USA), a multi-touch, multi-user display panel that allows users to interact with objects on the tabletop screen. at the **same time** through touch in a "fantasy" setting where the actions and decisions of the players have consequences in the virtual world and in real-time. Diamond Touch technology has been integrated into the Story Table interface allowing multiple children to create an imaginary story together by creating virtual characters and triggering various incidents on the screen enhancing joint attention, communication and negotiation.

Researchers (Bauminger, et al., 2007) evaluated this system with 6 children with ASD per pair, aged 9-11 years, to teach and reinforce basic social skills: performing joint activities, helping each other, encouraging, persuasion, and negotiating through stories. They assessed behaviors by watching the video recordings of the Story Table sessions. but also the Lego-like assembly game, Marble Works, and claim that the results showed an improvement and development of social interaction between pairs of children.

4.5 Avatar

Nowadays, avatars, humanoid or not, are considered to promote the educational process (Konstantinidis, et al., 2009) and improve the social skills of the people who use them. (Hopkins, et al., 2011) Researchers emphasize that: a) people with ASD through avatars understand facial expressions (Konstantinidis, et al., 2009, Orvalho, et al., 2009) enhancing and promoting the educational process (Konstantinidis, et al., 2009) especially when avatars have a voice, animations and not photos of real persons (Bekele, et al.,2013) b) Avatars enhance the level of interaction in VE, teacher-student and student-student (Fabri, et al., 2007). Scientists (Rosset, et al., 2008) report that children with ASD

like watching cartoons and that "autistic children know more about cartoons than people."

4.6. Telerehabilitation for Autism

Telerehabilitation is an emerging method and is defined as the application of telecommunications, remote sensing, and operation technologies, as well as computer technologies to help provide remote medical rehabilitation services (Boucenna, et al., 2014) to reduce time and cost. of rehabilitation services. The authors (Diamond, et al., 2003) point out that telerehabilitation is included in a category of services: telehealth, which uses telecommunications to provide health information and care at a distance. Telehealth includes 3 categories: telemedicine, telehealth, and e-health/education.

The use of telepathy in children with ASD is being used by researchers at the UC Davis MIND Institute who are looking at technological tools that will allow families of people with ASD and therapists to interact remotely (Vismara, et al., 2010). Although there is interest in such services, there is little information on how they can be implemented.

The Vismara study used telemedicine technology to provide manualized parent intervention for families of children with ASD, ages 12–36 months, 12 weekly 1- hour sessions with direct supervision and teaching of the Denver Early Intervention Model (ESDM)
(Dawson, et al., 2009; de Rengerve´, et al., 2010). It was applied as a teaching method for the development and improvement of parents' intervention strategies in the socio-emotional, and communicative development and mastery of the play style of children with ASD. The resulting evidence led to positive conclusions that: (a) parents can implement ESDM with greater ease after coaching and (b) there was an increase in the abundance of spontaneous words, gestures, and imitative behaviors from children, although additional training is needed research to confirm the above.

5. Robots

The use of robotics in special education and training is a promising means to strengthen, develop and improve the social-emotional skills of children with ASD (Kefalis, et al., 2019, Drigas, et al., 2013, Drigas, et al. al., 2004, Drigas, et al., 2005, Drigas et al., 2009, Vrettaros, et al., 2009, Drigas, et al., 2013, Drigas, et al., 2012, Drigas, et al., 2014, Anagnostopoulou, et al., 2020, Pappas, et al., 2016, Chaidi, et al., 2021). There are many types of research done concerning assistive robotics that is conducted on 3 main axes: physical robot design, human-robot interaction design, and robot evaluations in therapy-like environments (Scassellati, et al., 2012; Boucenna, et al., 2014) focusing on two abilities: imitation and attention, which are deficient in children with ASD but important in children's development. (Carpenter, et al., 1998, Jones, 2007; Jones, 2009; Tomasello, et al., 1986; Syriopoulou-Delli, et al., 2019).

In a literature review (Syriopoulou-Delli, et al., 2019) the results of twelve (12) studies are evaluated, and the conclusions are analyzed and presented regarding the effect of robotics on the development of the social-emotional interaction of children with ASD in the following areas: eye contact, verbal communication, imitation. From the conclusions, it is clear that there is a positive effect. (Figure 2, 3)

Fig.2: Independent variables of the surveys (Syriopoulou- Delli, & Gkiolnta, (2019).

Research Number	Research	Number of Participants	Robot name	Age of Participants	IQ	Gender of Participants (boys/girls)
1	A. Pop et al. (2014)	11	Probo	4-7	ASD	11/0
2	Conti et al. (2015)	3	NAO	11-12	Mild Mental Retardation / Severe Mental Retardation	3/0
3	Costa et al. (2015)	8	Kaspar	6-9	ASD	8/0
4	Costa et al. (2013)	8	Kaspar	6-10	ASD	8/0
5	Feil-Seifer et al. (2011)	8	Bandit	5-10	ASD	
6	Hana-fiah et al. (2012)	1	NAO	10	107	1/0
7	Huskens et al. (2013)	6	NAO	8-14	85-111	6/0
8	Kim et al. (2013)	24	Pleo	4-12	≥70	21/3
9	Kim et al. (2012)	18	Pleo	9-14	ASD	15/3
10	Severson et al. (2008)	11	AIBO	5-8	ASD	10/1
11	Wainer et al. (2014)	6	Kaspar	8-9	ASD	5/1
12	Yussof et al. (2013)	2	NAO	6-9	ASD	2/0

Fig. 3: Dependent variables of the survey (Syriopoulou- Delli,& Gkiolnta, (2019).

Number	Eye Contact	Verbal Communication	Imitation	Proximity / Touch	Game Skills	Stereotypes	Satisfaction
1	x	x			x	x	
2	x		x	x			
3	x		x	x			
4	x						
5							x
6	x					x	
7		x					
8		x					
9							x
10		x			x	x	
11	x	x			x		x
12						x	

In a systematic review (Cano, et al., 2021) 46 articles, some of them were designed exclusively for children with ASD, such as Jibo, Cozmo, Keepon, KASPAR, and Zeno. The studies that were examined emphasize that the training of people with ASD in social-emotional learning is "helped" by social robots when the following are met:

- The appearance of the physical robot can help it to empathize with the child.
- Communication channels (verbal and non-verbal) to express an appropriate emotional state.
- Types of sensors to perceive emotions, and techniques to recognize a target's emotion.
- Theories of psychology that can support learning socio-emotional skills.
- Empathic behavior responses are autonomous.

Also, it is emphasized in the research that it is necessary to have design guidelines for Robots in terms of appearance, movement, and expressiveness. This points to the necessity for the collaboration of experts from different disciplines to achieve the desired results.

6. Conclusions

The incorporation of digital technologies in the education domain is very productive and successful, facilitates and improves the educational procedures via Mobiles (Vlachou, et al., 2017, Papoutsi, et al., 2018, Karabatzaki, et al., 2018, Drigas, et al. al., 2017, Stathopoulou, et al., 2020, Stathopoulou, et al, 2015, Stathopoulou, et al., 2018, Drigas, et al.,

2014, Kokkalia, et al., 2016), **various ICTs applications**, **AI & STEM. Additionally, Various strategies and techniques can be incorporated into educational approaches via IoT and the combination of ICTs with theories and models of metacognition, mindfulness, meditation, and emotional intelligence cultivation** (Mitsea, et al., 2019, 2020, 2021, Papoutsi, et al., 2016, 2017, 2019, 2020, Pappas, et al., 2017, Karyotaki, et al., 2014, 2015, 2016, 2017, 2019, Drigas, et al., 2020, Kokkalia, et al., 2019, Drigas, et al., 2021, Papoutsi, et al . ., 2019, Chaidi, et al., 2020, Chaidi, et al., 2021, Drigas, et al., 2018, Mitsea, et al., 2021, Angelopoulou, et al., 2021, Tourimpampa, et al . ., 2018) **as well as with environmental factors and nutrition** (Stavridou, et al., 2021, Zavitsanou, et al., 2021, Driga, et al., 2019, Driga, et al., 2019), **accelerates and improves more over the educational practices and results.**

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