

Stress, Hormones & the role of ICT in autism

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Abstract. The aim of this study is to investigate the association of stress with autism spectrum disorder, through recent research data, as well as the effect of hormones on this association. In more detail, in the found literature the following parameters of the examined issue are examined: The association of cognition with stress and relaxation with the balance and interference of hormones in these relationships, in general, the effects of stress on the mental health of subjects, markers found in the blood of people with autism and contribute to the diagnosis of the disorder and what happens if men with autism have elevated androgens. Also studied are the effects of stress on learning and motivation of students belonging to the autism spectrum, fetal estrogen in people with autism in the context of molecular psychiatry, autism spectrum disorders, compounds that disrupt the endocrine system and heavy metals in amniotic fluid, altered steroidogenesis in boys with autism spectrum disorders, and changes in steroid metabolites as an indication of autistic disorder. Also, the factors that lead to oxidative stress are analyzed, which vary such as transferrin and ceruloplasmin levels. At the same time, the important role of ICT in children with autism is presented, as the emotional intelligence of people with autism can be developed through the use of specialized applications, mobile applications, intelligence technicians and robots such as the Kaspar robot that aim to develop mental ability. The operation of virtual reality (VR) and machine learning using algorithms is important.

Keywords: autism, disorder, stress, hormones, proteins, ICT, mobile apps, robots, metacognition, emotional intelligence

1. Introduction.

Children with autism express anxiety or tension just like children with normal development. However, social stress - or the fear of making new friends and social situations - is especially common among children with autism. Because children with Autism Spectrum Disorder (ASD) may have difficulty understanding and communicating, we may need to delve into the signals the child is receiving and understand the causes of their stress. Some of the

factors that cause stress in children with ASD are changes in routine, changes in the environment, unknown social situations and sensory sensitivities. The aim of this study is to investigate the association of stress with autism spectrum disorder, through recent research data, as well as the effect of hormones on this association. Furthermore, the importance of ICT in relation to stress in autism will be expanded. Mobile apps and robots have been found to work beneficially by helping with stressful situations. Finally, new technologies contribute to the improvement of people with ASD and lead to the development of their emotional intelligence as well as the evolution of the function of cognition. They also contribute to the rise to the level of the knowledge-consciousness pyramid which refers to the training of mental skills such as working memory, as well as the Maslow pyramid which refers to the realization of personal abilities and self-realization.

2. Stress & Hormones

Metacognition, Stress – Relaxation Balance & Related Hormones. Based on the available literature there is a deep relationship between cognition and those hormones related to stress and the nervous system. Thus, this finding can be used as a basis for planning and subsequent implementation of strategies aimed at stress management (Drigas & Mitsea, 2021).

In the research conducted by Drigas and Mitsea (2021) the aim was to examine the interactive relationship that develops between cognition and the response to stress. More specifically, the researchers sought to detect the interaction between cognition and the sympathetic-parasympathetic nervous system and the main hormones of neurotransmitters that have to do with stress. In order to achieve this goal, the research questions they posed were the following: Can cognition play a regulatory role in stress-related hormones and hyperactivity of the sympathetic nervous system? How can the sympathetic nervous system help regulate uncontrolled or excessive stress? What is the role of the executive functions? and can metacognition stop cells and neurons from degenerating and the brain from shrinking (Drigas & Mitsea, 2021)?

The results of the study were as follows: People who "train" their attention, are also able to more effectively regulate the negative emotions they feel, their bad mood and stress. On the contrary, those who are negatively biased and convinced that they will not succeed show emotional deregulation and their attention is deregulated. Attention training is the first step, the first strategy for regulating primordial emotions. Attention training is directly related to the increase of positive emotions and those with the ability of the individual subject not to be involved in negative information. The most effective strategies for regulating attention are conscious interventions, e.g. breathing exercises and visualization techniques and, more generally, practices that involve both the mind and the body. The regulation of attention lays the foundations for a balanced hormonal system and an autonomic nervous system. The regulation of stress and emotions depends on cognitive skills such as attention. Therefore, people need to adapt to the prevailing conditions and learn to train both the sympathetic and the parasympathetic nervous system. Nutrition is an important factor influencing the threefold

relationship of cognition, hormones and the autonomic nervous system. A well-balanced diet has powerful benefits for reducing stress (Drigas & Mitsea, 2021).

In conclusion, the stress response activates stress hormones and the sympathetic nervous system. Thus, relaxation hormones fall and the parasympathetic system is inactivated. In contrast, relaxation activates the parasympathetic system that restores homeostasis and increases the hormones of happiness. Metacognition controls both systems, depending on existing needs and conditions (Drigas & Mitsea, 2021).

Stress, Anxiety & Mental Health Problems in Gifted Adolescents. The focus of this research is to investigate the possible link between charisma and excessive stress and mental disorders in general. Existing research data do not converge on a particular position, some support the existence of this link and some do not. Alexopoulou, Batsou and Drigas in the context of their research try to answer the question whether mental disorders and emotional problems are associated with charisma in adolescents. In the category of mental disorders include depressive and suicidal behavior as causes of stress (Alexopoulouetal., 2020). The factors that cause stress in gifted children are the following: the need for acceptance by peers and their desire to be perfect and perform well in their school duties. Charismatic students are often characterized by overstimulation, which leads them to diffuse their energy and imagination in a pointless and strange way. Their overstimulation is mainly due to increased neurotic sensitivity. Charismatic teenagers are considered to be more sensitive than their peers and have strong reactions to the stimuli they receive.

This sensitivity results in them experiencing in their own environment much more sensitively what is happening inside. At the same time, they are more vulnerable. Hypersensitivity occurs early in a person's life and is associated with the individual's life temperamental personality, which for them is a kind of inner strength. For example, stress is manifested in gifted students when they are about to do something new and focus on it for a long time. A gifted student is usually impulsive, anxious, has a fast pace of speech and may have a tick (Alexopoulouetal., 2020).

The social, emotional and cognitive development of gifted adolescents is uneven. Charismatic teenagers are characterized by excellence in their school performance, their perfectionism and their fear of future failure. All of these factors make them vulnerable and may lead to high levels of stress and anxiety. In addition, it should not be overlooked that gifted teenagers have the gift of fully grasping the concepts of life and death, but these issues have an emotional impact on them. They often feel that they are different from their classmates, as their emotional maturity lags behind their cognitive abilities. They constantly struggle to stay on top, to exceed their potential and to meet the expectations of others, resulting in feelings of despair, passive or active aggression and end up being diagnosed with mental disorders. Finally, it should be noted that based on recent research data, charismatic adolescents have the same or lower risk of suffering from anxiety / stress and depression, compared to their non-charismatic peers, and this is a finding that needs further investigation. In general, it is necessary to point out that the number of studies on the above issues is still quite limited and the results are contradictory in some respects (Alexopoulouetal., 2020).

Stress hormones and eating disorders. More generally, genetic, developmental and environmental factors are among the causes of the development of eating disorders, such as anorexia nervosa and bulimia nervosa (NB), among other psychiatric disorders. It has also been suggested by other researchers that people with NA are more likely to have experienced preterm birth or birth trauma (Goodman et al., 2014; Krug et al., 2013 in Chamietal, 2019) and also that Their mothers are more likely to have been exposed to high levels of stress during pregnancy (Krug et al., 2013 in Chamietal., 2019). For this purpose, relevant literature was reviewed, which reported that individuals with eating disorders are very likely to experience stress. People with eating disorders have abnormalities in the structure of the brain, in understanding the meaning of the concept of reward and punishment, and in the balance between the functions of HPA and SMA. Researchers argue that the above may be the goals that treatment may include (Chamietal., 2019).

The Fears and Anxieties of Gifted Learners. Going forward, Lamont (2012)'s article suggests the correlation that can exist between gifted children and stress, fear and insomnia. Charismatic children have been shown to have higher fears than non-charismatic children (Harrison & Van Haneghan, 2011). There are many reasons why this can happen. Specifically, Harrison and VanHaneghan (2011) conducted a survey by handing out questionnaires to 216 students who measured their anxiety, fear and insomnia. Thus, it turned out that really gifted children show more intense fears, anxiety and insomnia. Charismatic children exhibit five overstimulations, responsible for their strongest emotions. (Lamont, 2012).

3. Stress & hormones in autism

Oxidative stress. Oxidative stress is evident in children with autism. More specifically, lipid peroxidation is increased with the indices being particularly high. In contrast, antioxidant proteins such as transferrin, which is responsible for iron deposition, and ceruloplasmin, which are responsible for copper deposition, have been found to be low in people with ASD (Chauhan, 2020). Abnormal levels of transferrin and ceruloplasmin have also been found to contribute to language disorders in people with ASD (Chauhan, Brown, et. Al, 2004). In addition, the imbalance between extracellular and intracellular glutathione levels is associated with oxidative stress (Bjørklund, Meguid, 2020).

At the same time, it has been observed that the nervous system is affected by the intestinal microflora. In autistic children, gastrointestinal dysfunction also appears to be associated with mitochondrial dysfunction, complications of the GIT microbiome, and oxidative stress (Hu, Dong, et. Al. 2020).

According to a pilot study by Meguid, Dardir et al, (2011) examined children with autism in Egypt. That is, the study included 20 children with autism and 25 children with normal development. The aim was to control the levels of antioxidant enzymes, peroxide dismutase (SOD) and glutathione peroxidase (GSH-Px) and levels of malondialdehyde (MDA), a marker of lipid peroxidation. The results of the study showed that children with ASD and especially

younger, had increased levels of lipid peroxidation and insufficient antioxidant defense mechanism. It is worth noting that timely prediction of such a condition can prevent a dangerous brain injury.

According to Ayadhi (2012), oxidative stress in children with autism is due to the association between serum levels of Sonic hedgehog protein (SHH) and brain-derived neurotrophic factor (BDNF). More specifically, in his study she used polymorphonuclear leukocytes, and found that people with autism produced significantly higher levels of oxygen free radicals (OFR) as well as higher levels of SHH protein.

Important research links the pathophysiology of autism to mercury levels which lead to oxidative stress. The following study compared the cerebellar levels of the oxidative stress index 3-nitrotyrosine (3-NT), mercury (Hg) and the antioxidant selenium (Se) between typical controls and autistic individuals. Tissue homogenates were prepared using the presence of protease inhibitors from the frozen control cerebral tissue (n = 10, mean age, 15.5 years, mean PMI, 15.5 hours) and autistic (n = 9, mean age 12.1). years, average PMI, 19.3 hours). The assay was performed by ELISA, and the results showed that the concentration of cerebellar 3-NT, determined by ELISA, ranged from 13.69 to 49.04 pmol g⁻¹ tissue. the concentration of 3-NT in autistic cases ranged from 3.91 to 333.03 pmol g⁻¹ of tissue. Mean cerebral 3-NT was increased in autism by 68.9% and the increase was statistically significant (p = 0.045) (Sulkowska, Lipinsk, et al, 2008).

Blood Markers in Detection of Autism. The researchers aimed to answer the following questions: The relationship between biomarkers and autism spectrum disorder, the association of biomarkers with the activation of autistic behaviors, and how biomarker balance can be achieved to reduce symptoms. autistic in nature. Biomarkers are substances that are detected in the blood and urine. In children with autism the biomarkers are usually low. Biomarkers include antioxidant enzymes, omega-3 fatty acids, folic acid, vitamin B1 and probiotics. Also, oxidative stress is one of the biomarkers, caused by environmental toxins and toxic substances, such as heavy metals, mercury, pesticides, maternal infections and to which the manifestation of autism spectrum disorder is reduced. Taking into account the research that has been done so far, in addition to heredity, an important role in the occurrence of autism is played by exogenous factors, which if they disappear or decrease there will be a significant improvement in the behavior of the group of people (Stavridou, et al., 2021).

Based on research findings, biomarkers in autism may reflect genetic and neurological changes or epigenetic processes that may be active at certain times. As autism is one of the most well-known physical disorders, research has been done on possible biomarkers. In these studies, the heredity of the autism spectrum disorder was documented. Biomarkers include mitochondrial function, oxidative stress, and immune function. Some of the children diagnosed with autism have a range of mitochondrial functions. The 80% of people with autism have inherited the disorder. Oxidative stress is detected by studying antioxidant enzymes in the blood, peroxidation of fats and oxidation of elevated proteins. In addition, biomarker tests can lead to the treatment of metabolic disorders (Stavridou, et al., 2021).

In conclusion, according to research on autistic people, scientists have concluded that autism is due to both hereditary and environmental factors (oxidative stress, heavy metals, gluten, etc.). Also, the absence of omega-3 fatty acids, vitamin B1, folic acid, and serotonin causes the manifestations of anxiety in autistic individuals. Finally, studies have found that when biomarkers are regulated, there is expected to be an improvement in the behavior of these individuals (Stavridou, et al., 2021).

Treatment of Elevated Male Hormones in Autism. The research of Geier, Kern, King and Sykes (2014) aims to examine the correlation between hyperandrogenism and the characteristics of people with autism. As well as examining the effectiveness of androgen therapies as a means of treating autistic traits in individuals. The symptoms of hyperandrogenism in people belonging to the autism spectrum have been investigated by numerous studies, as well as the effect of these symptoms on the psychological context, brain pathology on tissue culture and androgen levels before and after birth. The data extracted from these studies have led to the conclusion that elevated androgens are associated with the existence of autistic symptoms. Regarding the treatment, in controlled experimental conditions testosterone placebo has been administered to neurotypic individuals and testosterone has been found to increase the symptoms of autistic disorder. Data from clinical trials suggest that anti-androgen drugs have the potential to significantly reduce the symptoms of autism in people diagnosed with autism spectrum disorder. In the light of the strong correlation between hyperandrogenism and autism, it is suggested that people with autism undergo routine tests to monitor androgen growth in order to receive appropriate treatment (Geier et al., 2014).

The treatment of androgens and to balance them is an effective tool that helps significantly in improving the clinical characteristics of patients diagnosed with ASD. By studying the biomedical index when it is elevated beyond the normal reference range, you increase the risk of developing self-injurious behaviors and aggression by people with autism, resulting in people with autism having a low quality of life. Checking all people diagnosed with ASD for elevated androgens and evaluating this increase in relation to each individual's family may help to identify new treatments for people on the autism spectrum. In general, regular screening of all individuals diagnosed with ASD for elevated androgens is recommended as a standard part of the initial clinical evaluation, in order to subsequently implement appropriate treatment for individuals with elevated androgens (Geier et al., 2014).

Effect of stress on learning and motivation-relevance to autism spectrum disorder. Learning and motivation are crucial for children's development and for the acquisition of knowledge and skills. A typical example is the autism spectrum disorder, in which individuals are asked to deal with disorders related to the interaction with those around them, with their communication and behavior. People with autism experience a variety of stressors on a daily basis. Stress is known and now proven to affect learning and motivation. However, people with autism have been found to exhibit increased stress secretions, especially in fear. These reactions are mainly due to the effect of the disorder on the amygdala. In particular, corticotropin-releasing hormone (CRH), which is secreted under stress, is high in children belonging to the autism spectrum and is responsible for mast cell stimulation and myelology. Factors and / or circumstances that could affect the neurodevelopmental pathways involved in learning and

motivation are clearly important and should be recognized in a timely manner (Theocharides & Kavalioti, 2019).

In order to deal with all of the above in a timely and effective manner, it is imperative to manage the conditions prevailing in stressful environments, so as to achieve the reduction of its impact as much as possible. Teachers and counselors can play an important role in identifying and minimizing stressors in a timely manner before any medication intervention becomes necessary. It is currently impossible to administer anti-anxiety medication to children with autism. Natural products can be used as supplements to modify behavior (Theocharides & Kavalioti, 2019).

Foetaloestrogens and autism. Based on this research, there is increased latent prenatal steroid activity in the amniotic fluid of autistic boys, based on the measurement of prenatal androgens and other steroid hormones. To date, it is not clear whether other prenatal steroids also contribute to the likelihood of developing autism. Prenatal estrogens are investigated to see if they play a key role in prenatal developmental cortex in both men and women. The aim of the research of the relevant researchers is to check whether the levels of prenatal estrol, estradiol, estrone and estrone sulfate in the amniotic fluid are related to autism (Born – Cohenetal., 2020).

Specifically, in this study, estradiol, estrone, estriol and progesterone were associated with autism in univariate analyzes after a false-correction rate, a comparison of standardized odds ratios was made, based on which Progesterone had the greatest effect on the likelihood of autism. Based on these findings, prenatal estrogens contribute to the likelihood of developing autism, extending the finding of increased prenatal steroid activity in autism. This probably affects sexual differentiation, development and brain function (Born - Cohenetal., 2020).

The main findings of the study were as follows: Prenatal estradiol, estriol and estrone are elevated in boys diagnosed with autism. This is consistent with the finding for increased prenatal steroidogenesis in the same cohort and provides further evidence for the prenatal steroid theory in individuals with autism. High levels of prenatal estradiol contribute to a greater chance of developing autism than other prenatal sex steroids, including testosterone. Finally, they conclude that prenatal estrogen excess is characteristic of autism and can interact with genetic predisposition and affect neurodevelopment (Born - Cohenetal., 2020).

Autism spectrum disorders, endocrine disrupting compounds and heavy metals in the amniotic fluid: A case-control study. Research data have so far shown that some non-hereditary factors, such as exposure to environmental pollutants, are associated with neurodevelopmental disorders such as autism spectrum disorder. Studies show that compounds that disrupt the endocrine system (EDCs), including polychlorinated biphenyls, organochlorine pesticides, perfluoroalkyls (PFASs) and certain metals, have adverse effects on neurodevelopment. The aim of this study was to measure the amniotic fluid (AF) levels of EDCs and metals as well as the receptors of AF-induced receptors and to investigate the possible relationship between prenatal exposure to EDCs and heavy metals and the risk of occurrence. autism (Longetal., 2019).

The findings of the study were as follows: PFAS and metals were detectable in AF samples. Cases of people with autism showed significantly lower levels of PFAS AF than controls and the adjusted odds ratio for perfluorooctane sulfonate (PFOS) exposure, was significantly inversely associated with the risk of autism. Atrial fibrillation is poorly associated with autism spectrum disorder. No significant correlations were observed between AF-induced receptor interactions and autism (Longetal., 2019).

Alteration of the steroidogenesis in boys with autism spectrum disorders. The etiology of autism spectrum disorders (ASD) remains unknown, but correlations have been found between prenatal hormonal changes and the risk of developing autism. The effects of these changes on steroidogenesis during postnatal development have not yet been fully elucidated. The aim of this research study is to analyze the metabolic course of steroids in preadolescent and neurotypical boys. Eighty-two steroidogenic biomarkers were detected using sequential gas chromatography-mass spectrometry. Changes were observed and recorded throughout the alternative posterior pathway of androgen synthesis to a lower level in the group of boys with autism (Janšákováetal., 2020).

Based on the results of the research, there is a suppressed production of prednenolone sulfate and a reduced HSD3B2 activity in the group of people with autism, which is partly in line with the results reported in older children, in whom the adrenal retina significantly affects the levels steroids. At the same time, the suppressed activity of the enzyme CYP7B1 was found, which easily metabolizes sex hormone precursors on the one hand, but increases the anti-glucocorticoid activity of 7α -hydroxy-DHEA through competition with cortisone for HSD11B1 on the other. The multivariate model noted significant correlations between behavioral indicators and circulating steroids. Of the dependent variables, the best correlation was found for social interaction. The observed changes give room for their use as biomarkers while revealing the etiology of autistic disorder (Janšáková etal., 2020).

A reply to 'Alteration of steroidogenesis in boys with autism spectrum disorders. Based on previous research, steroidogenesis in boys with autism spectrum disorders differed from that in healthy boys. study included comprehensive GC-MS analyzes of blood samples from boys with autism and showed changes in steroid hormones, particularly higher levels of androgens before adolescence in boys with autism than in healthy ones. More specifically, lower levels of androstane sulfate were found by researchers in boys with pre-adolescent autism than in the sample of boys with adolescence autism. Thus, the relationship with the onset of adolescence may be a key factor in explaining the different outcomes (Gasseretal., 2021). In all likelihood, all of the above differences in findings go back to lower middle age and, consequently, to adolescence. In fact, human steroidogenesis is highly dependent on age, especially in children and adolescents, which supports the relevance of this argument. Nevertheless, additional factors may contribute to differences in findings, such as (i) the measurement of plasma steroid hormones versus urine, (ii) the posterior pathway of androgen synthesis, and (iii) the altered activity of enzyme pathways. (Gasseretal., 2021).

Steroid Metabolites Support Evidence of Autism as a Spectrum. Numerous indications for the intervention of steroid metabolites have been demonstrated by the presence of strong lesions in Kanner syndrome compared to Asperger syndrome (Gasseretal., 2019).

The results were as follows: The highest levels of most steroid metabolites were detected in boys with Kanner syndrome and Asperger syndrome, according to the results of the tests in which they participated. These differences were more pronounced in people with Kanner syndrome than in Asperger's syndrome. At the same time, a specific and unique pattern of changes in androsterone, ethiochlanolone, progesterone, tetrahydrocortisone and tetrahydrocortisol was found in boys with Kanner syndrome and Asperger syndrome. Interestingly, in the study participants only the groups of androsterone, etiocholanolone, progesterone, tetrahydrocortisone, tetrahydrocortisol and 5 α -tetrahydrocortisol were positively correlated. In the Asperger syndrome group, all metabolites showed a positive correlation. In the Kanner syndrome group, 5-a tetrahydrocortisol with androsterone showed a positive correlation (Gasseretal., 2019).

In conclusion, due to the differences in the level of lesion, it is argued that Asperger syndrome is on the mild side of the autism spectrum and that Kanner syndrome is on the severe side, but the lesion patterns give different phenotypic expressions (Gasseretal., 2019).

Parental Stress in Families of Children with Disabilities According to research, as reported by Dervishalia (2013), denial, distrust, and grief of parents are among the most common reactions in such cases. However, there are many parents who are relieved to hear the diagnosis, as it puts an end to their doubts and they are given some answers (Dervishalia, 2013). It is worth noting that the source of parental stress is the maladaptive and provocative behaviors of children. At the same time, many children do not have the ability and ability to take care of themselves, which triggers the anxiety of parents, since they will have to devote more time to their children (Dervishalia, 2013). In addition, the special requirements of health care, the constant supervision, the limited personal time of the parents for fun and rest are some of the elements that lead to their exhaustion (Dervishalia, 2013).

HRV in people with autism spectrum disorder. According to research by Hufnagel, Chambres et. al, (2017) methods of analyzing the HRV response can now detect stress levels in children with autism. More specifically, the electrocardiogram recording is typically divided into 5-minute blocks of one or the other a priori predetermined period of time. . During the HRV method, the abrupt change is detected and then the mean HRV value is calculated between two successive abrupt changes. The abrupt change detection is an individual-based statistical approach without a control group (Hufnagel, Chambres et al, 2017).

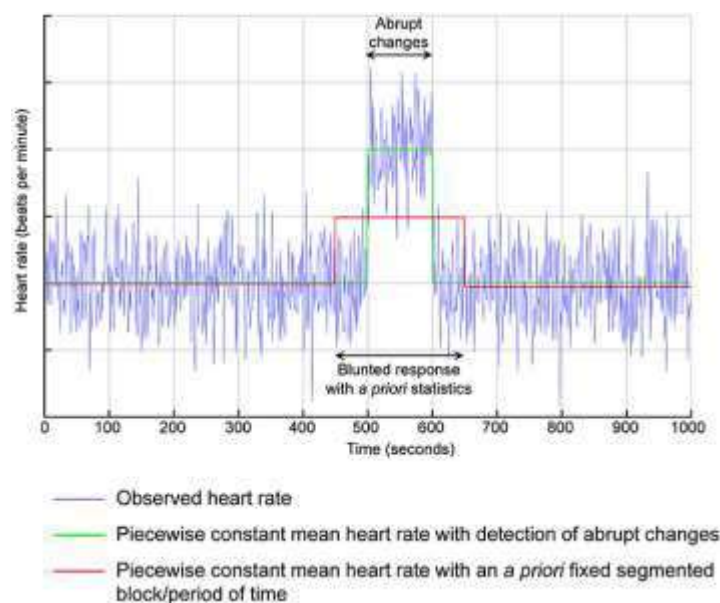


Figure 1. Detection of abrupt changes

4. The role of ICT about the stress in autism

Emotional Intelligence in autism. The cognitive deficits that characterize people belonging to the autism spectrum are as follows: Quality deficiencies in language and communication, and deficits in memory kapakimi city. In addition to the cognitive deficits directly linked to autism, researchers are focusing on both the characteristics of these individuals and their functionality, and use robots as intervention and treatment tools in people diagnosed with autism (Drigas & Sideraki, 2021).

Now, computer programs are also useful for recognizing emotions and facial expressions in people with autism. Golan et al (2006) used the 'Mind Reading ogram, which aims to identify emotions through a taxonomy system that detects emotions and emotional states, in people with high-functioning autism. Therefore, these programs seem to help children. with autism to improve the recognition of their emotions and develop new skills in a more accurate, interesting and effective way (Vakola, Rizos, Drigas 2019).

Diagnosis of autism through AI. Studies focusing on the self-reported process, which require self-related in relation to other-related seizures, show reduced activation in the PCC (cingulate posterior cortex) and mPFC (prefrontal cortex). A study comparing the neural response to ventral mPFC with stimulation of self-related seizures relative to other-related seizures showed preferential activation of this area for self-related seizures in neurotypically controlled adults, but not in adults with ASD. Analysis of multivariate models further shows that in adults with ASD, that the PCC in particular, are not sensitive to the semantic processing of words that suggest social interactions (Sideraki & Drigas, 2021).

Virtual Reality. Yang conducted a study in adults with high-functioning ASD. The adults received Virtual Reality Social Cognition Training which was intended to enhance socio-emotional processing and socio-cognitive reasoning skills in children and young adults with ASD. The results showed that a virtual role-play intervention program there were improvements in emotion recognition (Papoutsis, Drigas, Skiani. 2021).

Programmable robots for higher mental abilities. According to Drigas, Mitsea et.al (2020) robotics is a very important way for people with autism to be able to develop their mental skills by creating a creative and collective thinking that will help solve problems. More specifically, through programming children will be able to distinguish similarities and plan a step-by-step process.

Esteban et al. created the robot therapy (RAT). The Wizard of Oz (WoZ) robot was used in the first phase of the research. RET robots were then used. When the two phases were completed, they were compared with Standard Human Therapy (SHT). The results showed higher efficiency through interaction with robots and their use seemed very effective for children with autism. (Ntaountaki, Lorentzou, et al. 2019).

Robins and his colleagues also conducted a study in 170 children using the Kaspar robot in children with autism. From the children's interaction with the robot it seemed that it helped them to develop communication skills and recognition of their emotions as well as to better harmonize with the environment (Vakola & Drigas 2020)

Machine Learning. In his study, Kosmicki sought to classify people into two categories to determine whether or not they belong to the autism spectrum. Use algorithms and ADOS features. The results of the machine learning methods can be validated through autism prediction as the results were very accurate (Anagnostopoulou, Alexandropoulou, et al, 2020).

Mobile applications. Stathopoulou, Loukeris et al, (2020), studied the usefulness of mobile applications such as Android tablets. , for the implementation of educational interventions. It was observed that children with autism were able to react properly to various social situations guided by appropriate social behaviors.

Touch tablets have been found to be of interest to children with ASD. With the use of tablets it seems that children show more attention to teaching and learning process having a higher motivation compared to simple teaching methods (Stathopoulou, Karampatzaki, Tsiros, et al., 2019).

Moreover, children with autism can use a visual program application in order to develop a proper social behavior. This developer relies on images with which the child can create his personal daily schedule. and can be used by children aged 4 and over. More specifically, children with autism can understand how much time has passed through icons and the progress bar, and have all their work focused (Xanthopoulou, Kokalia, Drigas, 2019).

According to the study Papoutsis, Driga and Skiani (2018), it is important to create more applications that meet the specifics of autistic people. More specifically, it is important to create applications that will focus on making people with autism aware of their emotions and focus on their body language with the goal of developing their emotional intelligence and cultivating social interaction.

5. Conclusions.

Based on the studied researches, the conclusions that emerge are the following: People who "train" their attention, are also able to more effectively regulate the negative emotions they feel, their bad mood and stress. On the contrary, those who are negatively biased and convinced that they will not succeed show emotional deregulation and their attention is also deregulated. The most effective strategies for regulating attention are the conscious interventions. The regulation of stress and emotions depends on cognitive skills such as attention. The stress response activates stress hormones and the sympathetic nervous system. The factors that cause stress in gifted children are: the need for acceptance by peers and their desire to be perfect and perform well in their school duties. Adolescents are characterized mainly by excellence in their school performance, their perfectionism and their fear of future failure. All of these factors make them vulnerable and may lead to high levels of stress and anxiety. People with autism experience a variety of stressors on a daily basis. Stress is known and now proven to affect learning and motivation. However, people with autism have been found to exhibit increased stress secretions, especially in fear. These reactions are mainly due to the effect of the disorder on the tonsil.

Autism is caused by both hereditary and environmental factors (oxidative stress, heavy metals, gluten, etc.). Also, the absence of omega-3 fatty acids, vitamin B1, folic acid, and serotonin causes the manifestations of anxiety in autistic people. Finally, studies have shown that when biomarkers are regulated, there is expected to be an improvement in the behavior of these individuals. Androgen therapy or balance therapy is an effective tool that significantly helps to improve the clinical characteristics of patients diagnosed with ASD. Checking all people diagnosed with ASD for elevated androgens and evaluating this increase in relation to each individual's family may help to identify new treatments for people on the autism spectrum. In general, regular screening of all individuals diagnosed with ASD for elevated androgens is recommended as a standard part of the initial clinical evaluation, in order to then apply appropriate treatment for individuals with elevated androgens.

Prenatal estradiol, estriol and estrone are elevated in boys diagnosed with autism. This is consistent with the finding for increased prenatal steroidogenesis in the same cohort and provides further evidence for prenatal steroid theory in individuals with autism. High levels of prenatal estradiol contribute to a greater chance of autism than other prenatal sex steroids, including testosterone. Finally, they conclude that prenatal estrogen excess is characteristic of autism and can interact with genetic predisposition and affect neurodevelopment.

PFAS and metals were detectable in AF samples. Cases of people with autism showed significantly lower AF levels of PFAS than controls and the adjusted odds ratio (OR) for perfluorooctane sulfonate exposure (PFOS). The major component, including related PFAS,

copper, iron, and estrogenic activity, was significantly inversely associated with the risk of autism. Atrial fibrillation is poorly associated with autism spectrum disorder. No significant correlations were observed between AF-induced receptor interactions and autism.

Continuing, there is a suppressed production of prednisolone sulfate and a decreased HSD3B2 activity in the autistic group, which is partly in line with the results reported in older children, in whom the adrenal retina significantly affects steroid levels. At the same time, the suppressed activity of the enzyme CYP7B1 was found, which easily metabolizes sex hormone precursors on the one hand, but increases the anti-glucocorticoid activity of 7α -hydroxy-DHEA through competition with cortisone for HSD11B1 on the other. The multivariate model noted significant correlations between behavioral indicators and circulating steroids. Of the dependent variables, the best correlation was found for social interaction. The observed changes give space for their use as biomarkers while revealing the etiology of autistic disorder.

In fact, human steroidogenesis is highly dependent on age, especially in children and adolescents, which supports the relevance of this argument. Nevertheless, additional factors may contribute to differences in findings, such as (i) the measurement of plasma steroid hormones versus urine, (ii) the posterior pathway of androgen synthesis, and (iii) the altered activity of enzyme pathways. Higher levels of most steroid metabolites were detected in boys with Kanner syndrome and Asperger syndrome, according to the results of the tests in which they participated. These differences were more pronounced in people with Kanner syndrome than in Asperger's syndrome. At the same time, a specific and unique pattern of alteration of androsterone, ethiochlanolone, progesterone, tetrahydrocortisone and tetrahydrocortisol was found in boys with Kanner syndrome and Asperger syndrome.

Furthermore, from the present research we understand how important the evolution of ICT is for the development and improvement of the functionality of people with ASD. More specifically, programmed robots are a special stimulus that contributes to the development of mental abilities of people with autism through interaction with them. The Kaspar robot contributes to communication skills and the RAT robot you call as a robot that contributes to healing. At the same time, in the development of mental functions, mobile applications seemed to work beneficially.

On the other hand, artificial intelligence (AI) contributes to the diagnosis of autism by giving us more details about the brain disorders that exist. The association of autism with reduced activation of PCC (congenital posterior cortex) and mPFC (prefrontal cortex) has been established. In this way we are able to identify characteristic deficits in the emotional intelligence of people with ASD.

Mobile applications [40-43] such as Android tablets, which seem to attract the interest of people with autism, contribute to the development of emotional intelligence. Their use is based on images and the child can create his own personal daily life with them. In this way, the applications are appropriately designed based on the particularities of the child with autism, so that he can develop his social interaction and delimit time according to the order of the images.

The use of ICT also seems to contribute to the improvement and rise of individuals to the levels of the knowledge-consciousness pyramid. More specifically, cognitive ability consists of

important skills such as the proper functioning of working memory, short-term memory and attention. Based on the pyramid of knowledge and following each level one can develop their cognitive functions. The purpose of this process is to optimize the adaptation to equivalent needs and requirements that arise throughout the learning process (Drigas, A. & Pappas, M. 2017).

The Eight Inteligences: Visual-Spatial Intelligence is related to the ability to perceive visual-spatial stimuli. Verbal-Linguistic Intelligence concerns particular skills in different spoken and written functions of language. Bodily-Kinesthetic Intelligence refers to the ability to control body movements and skillful handling of objects. Logical-Mathematical Intelligence refers to arithmetic skills and mathematical thinking, as well as the ability to handle logical and numerical patterns. Inter-Personal Intelligence intelligence contains abilities to discern the purposes, the motivations and the moods of the others. Intra-Personal Intelligence is related to the ability of an individual to control his/her own feeling and self-knowledge. Musical Intelligence involves sensitivity to sounds, abilities to appreciate rhythm, execute and composite musical structures. Naturalistic Intelligence refers to the ability of an individual to detect and connect different elements in nature as well as the ability to recognize natural forms and patterns (Drigas, A. & Pappas, M. 2017).

Moreover, people with autism as they interact with new technologies can develop their mental functions by raising levels of cognition and emotional intelligence. The rise from the lowest to the highest levels of metacognition is directly intertwined with both advanced forms of self-knowledge and high levels of self-observation, which in turn presuppose ever-higher control processes. Each level of metacognition also describes a higher order control system, which operates according to a set of rules (Drigas & Mitsea, 2021), [44-46]

The study of Drigas & Papoutsi (2018), below is the Pyramid of Emotional Intelligence, which develops from one level to another through metacognitive processes.

It consists of a 9-level model: Emotional unity (Pure Consciousness, Filling & Emptiness), Transcendence (Self-reflection, Transcendental Knowledge), Universality of Emotions, Self-Realization (Self-Perfection, Self-Achievement), Social Skills, Specialization in Emotion Review, Management), Social Awareness, Empathy ,Emotion Discernment (Awareness, Monitoring, Social Recognition & Flexibility), Self-management (Self-regulation, Flexibility, Self-control), Self-knowledge (Self-perception, Awareness, Self-observation), Recognition Perception-Expression of Emotions (Memory, Perception, Recognition, Signaling of Emotions), Emotional stimuli (Coding of Emotional Senses, Attention).



Figure 1 : A New Layered Model on Emotional Intelligence

According to Maslow's pyramid, self-realization is great. Self-realization is the realization of personal potential, self-fulfillment, the pursuit of personal development and top experiences (Drigas, Papoutsi 2018).

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