(REVIEW ARTICLE)

Nutrition and techniques for memory's enhancement in children with special learning difficulties and the role of ICTs

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Abstract

Specific learning difficulties are neurodevelopmental disorders connected to deficits in working memory. As the suitable nutrition affects both brain devlopment and memory function, it affects positively the ways of coping with learning difficulties. The specific articlee attempts to locate, by means of a literature review, the nutritional elements that are beneficiary in the case of children with learning difficulties, and also to seek the most suitable strategies for the enhancement of their memory. Based on conclusions it was found that the adoption of a balanced diet consisting of fatty acids, trace elements, amino acids, metals and vitamins minimizes the possibility for the appearance of specific learning difficulties. Research has also led to the conclusion that the utilization of ICT, the conquest of metacognition, breathing techniques, the pivotal role of exercise, quality sleep and clinical hypnosis are crucial intervention methods for the enhancement of the memory of children with specific learning difficulties.

Keywords Specific learning disorder; Working memory; Attention; Nutrition; ICT; Metacognition; Conscious breathing; Exercise; Sleep; Clinical hypnosis.

1. Introduction

The term Specific Learning Disorder, according to the revised edition of DSM-V, refers to a set of weaknesses identified both on learning and on an academic skills level which are usually noticeable at the beginning of the school life, when the individual is unable to fulfill school requirements. The Specific Learning Disorder is distinguished in Reading Disorder, Written Expression Disorder and Mathematics Disorder. In Reading Disorder, inability to read or slow reading rhythm, difficulty in oral expression and concept comprehension are observed, while the term "dyslexia" is used alternatively to state a number of weaknesses. Written Expression Disorder is distinguished by the identification of spelling errors and the difficulty to produce written speech, while, finally, Mathematics Disorder concerns the difficulty to understand and memorize mathematical data, but also to carry out arithmetic operations. The term "dyscalculia" is used to determine a set of weaknesses in mathematics [3]. It is in fact worth noting that dyscalculia is more frequently identified in boys, and specifically at a rate of 5-8% internationally [10].

The right diet is a basic condition for children's development, whether they have learning difficulties or normal development [71]. Consequently, since diet is related to good brain function, particularly during the early stage of human life, it is easy to understand why a poor diet in nutritional elements is connected to learning difficulties. It has been found out that ingredients like iron, zinc, choline and fatty acids are necessary for the human body [66], metals are beneficial for children with neurodevelopmental disorders [71], while deficiencies in iodine, vitamins D and B12 affect memory function negatively [40].

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The term "working memory" appeared in 1960 by Baddeley and Hitch. They referred to the existence of a central executive unit which consists of the phonological loop and the visuospatial sketchpad which are responsible for the storage and processing of information [69]. Baddeley included in the same model the episodic buffer [4], while Klinberg identified as working memory that part of the brain which may retain information, while at the same time carrying out complex operations [44]. In conclusion, the deficiencies observed in working memory are responsible for the appearance of many weaknesses, including specific learning difficulties [69].

2. The importance of nutrition for memory and specific learning difficulties

2.1. Fatty acids

Deficiency of fatty acids in the human body is intertwined with dysanagnosia, dysorthography, but also deficiencies observed in dyslexic children's working memory [65]. Both omega-3 docosahexaenoic acid (DHA) and omega-6 arachidonic acid (AA) are of great importance for the correct brain development. Specifically, the existence of omega-3 fatty acids is beneficial for the function of the hippocampus and the prefrontal lobe and therefore contribute in strengthening children's memory and attention [40, 70]. DHA and AA are among highly unsaturated fatty acids (HUFA) which in turn are derived from essential fatty acids (EFA). Inability to convert EFAs to HUFAs is related to the possibility to present dyslexia [9]. For the correct development of the brain, it is necessary to have on a nutrition level a balance between omega-3 and omega-6 fatty acids, although in the last century a preference towards the latter is observed. In a study among 154 pupils in Quebec-Canada, it was shown that high fatty acid levels contribute in the enhancement of children's memory [56], while in another study, lack in polyunsaturated fatty acids (PUFA) is connected to dysanagnosia and dysorthography identified in boys. That is why the administration of polyunsaturated fatty acid supplements is considered especially effective in the case of dysanagnosia and dyslexia. An indicative example is the case of Michael, a boy with dyslexia and serious PUFA deficiency who, after a treatment with nutritional supplements, showed progress in school. The administration of nutritional supplements was also effective in the case of 20 dyslexic pupils who, having taken fish oil supplements for 4 months together with evening primrose oil, showed improvement in reading [2]. The foods where PUFAs can be found are avocado and dried nuts, while foods rich in omega-3 like kiwi and salmon enhance memory significantly [58].

2.2. Iron, Zinc and Iodine

Iron deficiency in early childhood creates difficulties in learning and good memory function [11]. Therefore, in a study carried out in pupils from Nepal it was shown that children whose mothers took iron supplements during pregnancy had enhanced working memory [34]. Iron deficiency increases the possibility for dyscalculia, a fact corroborated by a study in the USA in 5.398 pupils aged 6-16 years [48]. The existence of zinc in the hippocampus is connected with reading facility and success at school [40], while its deficiency brings dysfunction in learning, memory and attention [12]. It is however proven that the administration of zinc together with other supplements, for example iron, iodine, vitamin A, becomes more effective [6]. Iodine deficiency in children's bodies is connected with slower rhythms in learning and lack of motivation for knowledge. In a study carried out in schools in West Africa in which 6-8-year old children participated, found that administering iodine supplements brought about improvement of speech facility and school performance [16].

2.3. Vitamins

Vitamin A deficiency in the body affects negatively memory and learning [70]. Foods rich in vitamin A are liver, milk, eggs, fish, fruit and vegetables [58]. In Israel a study was conducted in order to study the consequences in the speech development of children aged 5-7 who had had low vitamin B1 levels during infancy. The result was that the children in the experimental group with vitamin B1 deficiency showed speech difficulty at a rate of 97% in comparison with 9% in the control group children. In a study conducted by Harrel (1946) in 120 children in an orphanage to whom 2 mg B1 or a placebo was administered daily for one year it was found out that the children who had taken B1 supplements were more intelligent and with enhanced memory. Vitamin B6 deficiency causes a problem in the hippocampus and thus in memory [8]. Vitamin B12 deficiency affects memory function, attention, but also learning negatively [70]. According to a study in 9-year-old children in India it was shown that reduced B12 levels in pregnant women cause deficiencies in short-term memory and the possibility of maintaining children's attention [8, 56]. Vitamin C is necessary in the body for iron absorption [58], while a study was done in pregnant women in Spain regarding the role of vitamin D. The purpose was to find out the effect of vitamin D in the children's cognitive and linguistic level. It was shown that reduced vitamin D levels in the first trimester of the pregnancy are a prognostic factor for low learning performance [7].

2.4. The role of white foods and the Mediterranean diet

According to studies diet affects neurodevelopmental disorders; in fact, 15 white foods are mentioned which should best be avoided, as they affect negatively not only brain function, but health generally. Among harmful foods is sugar which was found to be connected with children's attention deficit. Similar studies mention the negative consequences for the brain from salt consumption in high quantities, while the exclusion of foods with flour as their main ingredient enhances the children's learning capacity and attention. In addition, trans fatty acids in processed foods contribute in deficient memory function, as they do not allow the absorption of omega-3 fatty acids from the body, while regarding white rice, it would be better to prefer brown rice which contains metals and vitamins. Furthermore, fluor in drinking water is connected with the weakness in cognitive functions and low intelligence indicator, while alcohol creates problems in memory, attention and visual-spatial intelligence, particularly in adolescents. It would also be good to avoid the consumption of red meat, as it affects brain processes negatively. On the contrary, the selection of the Mediterranean diet may prove beneficial [17]. This is also confirmed by the study by Papanastasiou & Drigas (2023) regarding children's eating habits and the appearance of dyslexia. The sample who participated in the study consisted of 210 students aged between 18-30 years divided in two groups, one consisting of students with neurodevelopmental disorders – of whom 27 had dyslexia - and one consisting of 149 normally developing students. A questionnaire was used as research tool which was completed online aiming to find out whether the young people follow the Mediterranean diet. The results showed that the students with dyslexia do not seem to adopt a Mediterranean diet program. In conclusion, the children who did not choose the Mediterranean diet had increased possibilities to show specific learning disorders [62].

2.5. Nutrition and ICT

According to Drigas & Karyotaki (2013) ICT applications may be utilized in the matter of nutrition, as they are affordable. An indicative example is the mobile application CHAT which, among other things, also provides the user with the possibility to communicate with a nutrition expert [70]. Hebden et al. (2012) mentioned the creation of intelligent applications aiming to inform persons of younger age regarding the benefits of a healthy diet. Also, Hong et al. (2008) created an online application with the purpose to educate children in nutritional matters. With its help children are made aware about the nutritional value of foods, they choose the dish they like based on their age and the calories they want to consume, while they can also watch a video recording about the preparation of a healthy meal [21].

3. ICT and working memory

In this section, we must highlight the productive and effective role of all digital technologies in the field of education in general, healthy nutrition as well as in attention and memory training. These technologies, which include mobile devices (72-75), a variety of ICTs (76-95), AI & STEM ROBOTICS and games, (96–103), facilitate and improve educational procedures such as assessment, intervention, and instruction. In addition, the use of ICTs in conjunction with theories and models of metacognition, mindfulness, meditation, and emotional intelligence cultivation [104-137], accelerates and enhances educational practices and outcomes, particularly in learning disabilities.

More specifically, the utilization of ICT in education contributes in knowledge assimilation and achievement of better school performance in comparison with traditional means, such as illustrated books [20, 18, 37]. The application Mnemo Wiki helps enhance the memory in children with specific learning disorders, as it provides the possibility to process and organize the visual material to be used in teaching. Also, the application Cogmed has a positive impact on the working memory of children in pre-school and school age, as it contains many exercises for visual intelligence and verbal ability, thanks to which the child learns to codify data [20]. Thanks to the application Paper-based Pen children with learning difficulties or memory deficiency can take notes, while by touching the "intelligent" pen they are able to listen again to the course lecture [39]. The application COGITO includes exercises aiming to strengthen memory [55], while the application APLo helps in identifying learning difficulties [19]. A particularly popular application is CoPS, as it checks the memory of children aged 4 to 8 years, while the application AWMA is designed for children with deficiencies in working memory and consists of two types: a short one (AWMA-S) and an extended one (AWMA-L) [23, 27, 44].

The defective memory function affects children's school performance and consequently their self-esteem. Computers as intervention tools for memory enhancement are considered necessary [44]. Specifically, the application eduSensus consists of digital form programs which enrich dyslectic children's vocabulary, simultaneously improving their memory and attention. The game "Shoes and Squares" improves children's memory and attention, as they try to predict the outcome of a situation through various object alternations. Through the augmented reality application AR alphabet book the alphabet is taught by utilizing a camera and a computer and in this way children's memory is strengthened [27, 44]. The application KindSAR enhances memory, attention and cultivates the vocabulary of pre-school-age children. A robot

is telling a story and thus children conquer knowledge in an enthusiastic way [27]. Moreover, robots PlayROB and IROMEC contribute in metacognition conquest as well as in increasing memory capacity [22].

3.1. Serious games

Serious games are new gaming technologies with educational or remedial purpose, covering in this way the needs of children and users for whom technology is a part of their daily life. The philosophy of serious games is based on the theories of Piaget's constructivism and Vygotsky's gnosticism. The latter claimed that education through play provides the experience of social interaction which turns to mental knowledge [60]. According to Papanastasiou et al. (2022) children learn creatively thanks to serious games, which contribute simultaneously in enhancing memory and attention by energizing feelings. Digital Games-Based Learning improves memory, enhances cognitive functions and so are accepted by English educators at a rate of 83% [59]. Additionally, the applications BCI (Brain Computer Interface) are crucial both to the improvement of working memory and attention. These applications are the connecting link between persons with kinetic or neurodevelopmental problems and devices like computers. Thanks to them it is possible even for the individual's thought or will to act to be "translated" into an order for the computer and therefore to be realized. In this way, the needs of vulnerable persons are served and they can be functional thanks to some applications. A representative example is the applications BCI which, using eye movement or thought creation on the part of the user, contribute to the enhancement of memory and attention [61].

3.2. Video games

The occupation with video games improves children's memory and attention. So, Drigas et al. (2013) studied through literature review the contribution of video games in enhancing working memory, while Weng et al. (2014) expressed the opinion that computers and tablets help children with learning difficulties better absorb knowledge. Baniqued et al. (2014) also claim that thanks to video games the adolescents' attention remains concentrated, while it has been found out that the portable application CogSkills improves the memory in pre-school children [41]. Nouchi et al. (2013) investigated the influence of specific video games on memory and attention. The sample of participants consisted of 32 individuals divided into two groups: in one the game Brain Age was utilized and in the other the game Tetris. The participants had to play video games for one month for 15 minutes at least 5 days a week. The results showed that Brain Age strengthened working memory, while Tetris improved the persons' attention. Similar conclusions regarding the effect of video games on memory were produced by the study of Colzato et al. (2013). The sample consisted of 52 participants divided into two groups, with experienced and inexperienced players respectively. The result was that in experienced players the working memory was functioning better [42]. Finally, it has been found out that 3D video games like Super Mario 3D World improve the part of memory linked to the hippocampus [63].

4. Metacognitive strategies

The deficient memory function in children with learning difficulties hinders new knowledge building on already existing knowledge, the comprehension and classification of complex concepts. However, thanks to the cultivation of metacognitive skills based on self-control, self-regulation and adaptation, memory can be significantly enhanced. Utilization of ICTs, like mobile applications and virtual reality applications enhance memory through the education of children's metacognitive skills. Moreover, the utilization of memory strategies in connection with technology applications contributes significantly in memory enhancement. Therefore, the Method of Loki which is based on associative event sequence, contributes in strengthening the individual's attention and the speedy transmission of information from the working to the long-term memory. Moreover, the mind map, where a central concept is linked to the individual concepts through branching, helps memorize information, while the technique of double codification, during which the information is visualized in order to be retained in memory, also brings results. Moreover, when pupils read aloud, it helps them retain and codify knowledge in their memory, whereas repetition, acrostics, acronyms, slogans and neurolinguistic programming are also memory-improving techniques. However, as pupils often find difficulty in cultivating their metacognitive skills and teachers are not appropriately trained to teach them, the utilization of virtual reality applications seems the only solution. Within the framework of the virtual reality environment attention may be controlled and therefore working memory may function better. Vindenes et al. (2018) created the application "Mnemosyne" in which individuals, with a screen tied to their head, discover and collect memory cubes. It was consequently shown, based on research carried out in 18 individuals regarding the effectiveness of the specific application, that it contributes significantly in information memorization. Similar conclusions regarding the role of mobile application in improving memory were reached in the study by Hermes et al. (2019) in a sample of 14 persons, but also in the study by Scullin et al. (2022) in a sample of 52 participants [30].

It has been found that children with specific learning difficulties are lacking in metacognitive skills [53]. Metacognition which is so necessary for learning and for the spiritual culture of the individual, can be conquered by enhancing working

memory [5]. Drigas & Mitsea (2020; 2021, as cited in Mitsea et al., 2022) define metacognition as the set of skills that allow self-observation, self-regulation and adaptation to cognitive processes, so that the individual can reach the highest effectiveness level and for this reason (metacognition) can be acquired by practicing mindfulness. Drigas & Mitsea (2020, as cited in Mitsea et al., 2022) moreover, determined the eight stages followed in the course towards mindfulness: understanding of the theoretical background, empirical perception, conscious self-observation, conscious self-regulation, conscious adaptation, conscious distinction and mnemosyne [51]. Mindfulness may be conquered in many ways. One is exercising focused and open attention [24, 53]. In the case of focused attention, the yoga-technique "Trataka" is utilized, where the individual focuses on the flame of a candle and so strengthens both working memory and visual-spatial attention. In the case of open attention, the individual, without focusing his/her interest on something specific, "observes" every piece of information in his/her surroundings. Also, silence as a way of mindfulness contributes to the speedy decoding and prioritization of information, while visualization, as shown by the study by Hudetz et al. (2000) in 30 persons, has a positive impact on working memory. Moreover, the expression of gratefulness to the universe has a crucial impact on the function of the amygdala which is responsible for the appearance of learning difficulties, while neurolinguistic programming through the formation of positive attitudes and perceptions helps children with learning difficulties cultivate their metacognitive skills. There are also specialized mindfulness techniques which cultivate metacognitive skills in the issue of dyslexia. So, Tarrasch et al. (2016) studied the effectiveness of the program Mindfulness-Based Stress Reduction (MBSR). The participants' sample included 24 individuals who were mainly trained by using meditation and mindfulness exercises. Based on results, this program improves reading facility and attention. Additionally, Pradham et al. (2017) studied the effectiveness of the intervention program Mindfulness-Based Rehabilitation of Reading, Attention & Memory within the framework of which the techniques of focused attention and meditation are combined. In the study three children aged 8 to 10 years participated and it was shown that this intervention contributes to school progress [53].

There is no doubt that, in order to conquer metacognitive skills, which are so necessary for children with learning difficulties, virtual reality applications are particularly effective. Specifically, utilizing virtual reality in neurolinguistic programming has a crucial impact on the improvement of the children's memory. Banakou et al. (2018, as cited in Drigas & Mitsea, 2021; Drigas et al., 2022) investigated how the individual's "incarnation" in an avatar contributes positively in cognitive processes like those of the working memory. The sample of participants consisted of 15 individuals incarnated in Einstein's avatar and in the avatar of a peer. The results showed that the individuals who virtually represented Einstein, and especially those with low self-esteem, showed better performances in cognitive functions. In addition, utilizing through virtual reality the loci method can improve memory and spatial perception, as was shown in the study by Krokos et al. (2019) carried out in 40 persons [31]. Finally, metacognition can be conquered thanks to education through STEAM. Studies have shown that learning through STEAM does not only benefit the formally developing students, but also children with learning difficulties [47].

5. Breathing

Breathing exercises are another mindfulness technique, as according to Drigas & Mitsea (2022) three metacognition characteristics are identified in them: observation, regulation and adaptation. In this way, specific parts of the brain are affected which determine the function of cognitive processes [53]. So, thanks to breathing regulation, disorders like learning difficulties can be treated effectively. In this effort, technology applications, like robots, virtual reality and digital games, particularly affordable and widely available, have a valuable contribution. According to Fensterseifer et al. (2013) breathing through the mouth is associated with the onset of learning difficulties, while according to other studies breathing the wrong way affects working memory negatively and creates a perception problem in Language and Mathematics. These are the reasons that led to the conclusion that breathing through the nose improves both memory and attention [54], while the rhythm of breathing regulates the function of the hippocampus and the amygdala, which are associated with the above-mentioned cognitive functions [26]. Based on research carried out in 100 pupils aged 10-17 years, it was found that the selection of specific breathing techniques contributes positively in strengthening memory, while the study by Tasan et al. (2021) carried out in 140 pupils, showed that breathing practice helps a lot in the case of inability to produce and comprehend speech [54]. Bhaskar et al. (2020) in a study they carried out in 44 persons in total, found that the breathing technique SKY (Sudarshan Kriya Yoga), which starts in slow rhythms and intensifies as time passes, improved memory, but also the attention of the participants. Moreover, the study carried out by Telles et al. (2012) in 29 persons led to the conclusion that breathing through the right nostril enhances memory and attention. But in practicing conscious breathing, as well as treating learning difficulties, the ICTs and specifically virtual reality applications can be utilized. Therefore, the study by Weerdmeester et al. (2021), in which 86 children participated, showed that the virtual reality video game DEEP which practices the deep breathing technique, improves the individual's attention, while similar results were shown in the study by Yüksel et al. (2020) carried out 29 adolescents [52]. Finally, the robot Somnox sleep is an alternative way to treat neurodevelopmental disorders, such as

learning difficulties. It is a pillow shaped like a bean and whenever the person hugs it, it brings about relaxation in the rhythm of breathing [54].

6. Exercise

Children presenting deficiencies in working memory cannot execute complex cognitive processes, such as e. g. text comprehension or solving mathematical exercises. It has been found, however, that physical exercise contributes crucially in memory enhancing [5]. Studies carried out in people and animals regarding this issue have shown that exercise activates processes related to brain plasticity [35]. Sibley & Etnier (2003) have concluded after a study that exercise and school success are directly connected [64], while Reynolds et al. (2007) showed with the help of a study that exercise has a positive impact on both learning and strengthening working memory in children with learning difficulties [45]. Moreover, in a random sample study carried out by Reynolds & Nicolson (2007) it was shown that doing exercises related to the vestibular system, such as balancing on one leg, enhanced cognitive ability, working memory and attention in 36 dyslexic pupils [64]. According to other studies, aerobics improves memory and reduces memory gaps (created by the entry of a piece of new information in the brain, which replaces already existing ones or vice versa) by increasing hippocampus activity [15]. Moreover, after the realization of the intervention program "FIFA 11 For Health" lasting for 11 weeks, it was shown that team sports like football, enhance memory significantly, while similar results were observed after the application of a program including jumping rope exercises [5].

So, Abduh et al. (2018) researched the influence of intervention programs Brain Gym and Brain Training on the working memory of children with learning difficulties in a primary school in the city of Bangi. In the study, 15 children participated, who were separated in 3 groups of 5 persons each, and within the framework of the intervention which lasted for 4 weeks, there was a combination of physical activity and education by means of an electronic environment. The group Brain Gym applied the specific program at the start of the class, while the group Brain Training in free time. Brain Training also included five games (among which Cogmed) which users could download from Google Play. Finally, the control group did not follow an intervention program. The function of working memory was checked before and after the intervention with specific tools. The conclusion reached was that intervention programs applied in both groups enhanced spectacularly the children's working memory [1].

Similarly, McNerney & Radvansky (2014) carried out research in order to study the impact of physical exercise in memory improvement. Two experimental studies took place: the first included 136 persons aged 19 years studying at Notre Dame University and were divided in two equal groups. In the framework of the specific study, physical exercise preceded learning. In the second experimental study 132 persons aged 19 took part, also students at Notre Dame University separated in two equal groups. But in the framework of the specific experiment, physical exercise followed learning. According to the study results, exercise – regardless whether it precedes or follows learning – contributes in improving the person's memory [50].

7. Sleep and clinical hypnosis

Many contemporary studies prove that there is a direct correlation between sleep and memory function, but the first study dates from 1924 when it was shown that night sleep has a positive impact on memory [38]. Sleep problems may be responsible for cognitive deficiencies, as studies prove that sleep before homework prepares the mind for the coming knowledge, while sleep after homework contributes in knowledge assimilation and long-term memory function [35]. So, Seehagen et al. (2015) studied the impact of sleep on the memory of one-year-old children. Puppets were used for to conduct the study and the results showed that the children who had slept remembered better what they had seen in comparison with those who had not. Also, Lam et al. (2011) concluded after a study they conducted in children aged 3-5 years that night sleep benefits cognitive functions, while De Bruin et al. (2017) as part of the review of 16 studies in a sample of adolescents aged 10-19 years found out that quality sleep enhances memory. Similarly, the study by Araujo & Almondes (2013) showed that lack of sleep in children and adolescents has a negative impact on working memory and attention. During sleep-learning the brain is educated during sleep and strategies that contribute in learning are developed. Consequently, all above-mentioned study conclusions can be utilized as a starting point for the design of intervention programs in memory improvement issues [38].

Clinical hypnosis is an important way of intervention for children and adolescents, although the research on its benefits in the case of specific learning difficulties is still at an early stage [28]. Drigas et al. (2022) mention that clinical hypnosis reconstructs the cognitive and metacognitive skills, restructures the brain and facilitates learning [29]. In addition, hypnosis forms the capacity of working memory through education of the attention and mental visualization, a fact verified by the study by Lindelov et al. (2017). Also, Incognito et al. (2019) found in a study conducted in 250 students

that clinical hypnosis contributes in solving visual-spatial deficiencies in children with dyslexia and dyscalculia [28]. Hypnosis is also conducted through virtual reality applications (VRH-Virtual Reality Hypnosis) and in this way imagination, cognitive and metacognitive skills are cultivated, while the individual's memory and attention improve [28, 29]. Hypnosis through virtual reality applies sleep-therapy techniques using a screen fastened on the individual's head [28].

8. Other memory-improving strategies

Educating the working memory is not carried out by universal design; the specific characteristics of the children must be taken into account, in order to adapt the strategies accordingly [46]. First of all, working memory can be improved through repetition and utilization of metacognitive strategies [49]. Cowan (2014) claims that the repetition technique, based on word memorization or on the creation of correlations in order to retain the necessary information, improves working memory [14]. Guided repetition in particular, has a positive impact on memory, as within its framework the children's attention focuses on the objects they must remember [57]. Moreover, an intervention program aiming at attention regulation, improves working memory significantly [43], while the contribution of the teachers in issues of memory improvement may be crucial [36]. The appropriate interventions moreover strengthen working memory on the one hand, and on the other learning difficulties are reduced [33]. It would therefore be good if teachers adapt the extent of the material to be taught to children's needs [36] and assign to them tiered difficulty exercises [32]. Moreover, if pupils take noted during class, it may help them significantly in enhancing working memory [36]. Colmar et al. (2014; 2015; 2016) created the intervention program Memory Mates with the purpose to educate pupils in memory-improving techniques. In this program there are 10 images connected to attention and working memory, as well as instructions addressed to teachers regarding the way to utilize Memory Mates in the class environment. Educating pupils in the utilization of the 10 strategies helped them better understand the lesson and actively participate in it. Consequently, after the application of Memory Mates, in six fourth class sections of a primary school over a period of 8 months, it was found that the pupils' metacognitive skills in working memory issues were cultivated [13]. Finally, music is a memory-enhancing technique, a fact that also helps teaching [67]. Although musical technology may be utilized in the educational sector, as it contributes in learning, it is still considered necessary to conduct further studies, in order to research its contribution meticulously [68].

9. Conclusion

Because specific learning difficulties are connected with deficient memory function, it is evident that every nutritional choice that functions as an accelerator contributes in their resolution. So, foods rich in fatty acids enhance memory and improve dyslexia and dysanagnosia symptoms, while iron protects from a possible appearance of dyscalculia. Excluding sugar from the diet enhances memory function, while the adoption of the Mediterranean diet limits the possibility for the appearance of learning difficulties. Additionally, using ICTs contributes crucially in turning children towards healthy choices.

Utilizing ICTs in education and specifically computer and mobile applications, augmented reality applications, video games, digital games and robots improve the memory of children with learning difficulties. Working memory may also be strengthened by developing metacognitive strategies, like mindfulness exercises, meditation and repetition.

Additionally, breathing with the right rhythm affects the function of the hippocampus a fact connected to memory. Studies have shown that the practice of children's and adolescents' breathing contributed in improving their memory [52-54]. Physical exercise like aerobics and team sports is another effective way to improve memory. Finally, both quality sleep and clinical hypnosis affect significantly in improving the memory of children with learning difficulties.

To conclude, nutrition and all the above-mentioned means of improving memory (ICTs, metacognition, breathing, exercise, sleep and clinical hypnosis) are ways of holistic intervention in children with specific learning difficulties.

Compliance with ethical standards

Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

References

[1]   Abduh, B., & Tahar, M. M. (2018). The Effectiveness of Brain Gym and Brain Training Intervention on Working Memory Performance of Student with Learning Disability. Journal of ICSAR, 2(2), 105-111. DOI: 10.17977/um005v2i22018p105.

[2]   Aleci, C. (2017). Rationale of Polyunsaturated Fatty Acids Supplementation in the Frame of the Magnocellular Theory of Dyslexia. Journal of Advances in Medical and Pharmaceutical Sciences, 12(4), 1-9. DOI: 10.9734/JAMPS/2017/32962.

[3]   American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). American Psychiatric Association.

[4]   Angelopoulou, E., & Drigas, A. (2021). Working memory, attention and their relationship: A theoretical overview. Research Society and Development, 10(5), 1-8. http://dx.doi.org/10.33448/rsd-v10i5.15288.

[5]   Angelopoulou, E., & Drigas, A. (2022). Working memory interventions via physical activity and ICTs: A strategic issue for the improvement of school students' learning performance. Technium Social Sciences Journal, 30, 200-213. DOI: 10.47577/tssj.v30i1.6296.

[6]   Anjos, T., Altmäe, S., Emmett, P., Tiemeier, H., Closa-Monastero, R., Luque, V., Wiseman, S., Pérez-García, M., Lattka, E., Demmelmair, H., Egan, B., Straub, N., Szajewska, H., Evans, J., Horton, C., Paus, T., Isaacs, E., Willem van Klinken, J., Koletzko, B., & Campoy, C. (2013). Nutrition and neurodevelopment in children: focus on NUTRIMENTHE project. European Journal of Nutrition, 52, 1825-1842. DOI: 10.1007/s00394-013-0560-4.

[7]   Arija, V., & Canals, J. (2021). Effect of Maternal Nutrition on Cognitive Function of Children. Nutrients, 13, 1644. https://doi.org/10.3390/nu13051644.

[8]   Benton, D. (2012). Vitamins and neural and cognitive developmental outcomes in children. Proceedings of the Nutrition Society, 71, 14-26. DOI: 10.1017/S0029665111003247.

[9]   Caylak, E. (2010). The biochemical and cognitive explanation of developmental dyslexia. Journal of Pediatric Biochemistry, 1(03), 239-268. DOI: 10.3233/JPB-2010-0020.

[10]   Chatzivasileiou, P., & Drigas, A. (2022). ICTs for the Assessment of the Cognitive and Metacognitive abilities of the students with Specific Learning Disorder in Mathematics. Technium Social Sciences Journal, 31, 131-152. DOI: 10.47577/tssj.v31i1.6424.

[11]   Cofnas, N. (2018). Is vegetarianism healthy for children? Critical Reviews in Food Science and Nutrition, 59(13), 2052-2060. https://doi.org/10.1080/10408398.2018.1437024.

[12]   Cohen Kadosh, K., Muhardi, L., Parikh, P., Basso, M., Jan Mohamed, H. J., Prawitasari, T., Samuel, F., Ma, G., & Geurts, J. M. W. (2021). Nutritional Support of Neurodevelopment and Cognitive Function in Infants and Young Children - An Update and Novel Insights. Nutrients, 13(199), 1-25. https://doi.org/10.3390/nu13010199.

[13]   Colmar, S., & Double, K. (2017). Working Memory Interventions With Children: Classrooms or Computers? Journal of Psychologists and Counsellors in Schools, 1-14. DOI: 10.1017/jgc.2017.11.

[14]   Cowan, N. (2014). Working Memory Underpins Cognitive Development, Learning, and Education. Educational Psychology Review, 26(2), 197-223. DOI: 10.1007/s10648-013-9246-y.

[15]   Crawford, L. K., Li, H., Zou, L., Wei, G., & Loprinzi, P. D. (2020). Hypothesized Mechanisms Through Which Exercise May Attenuate Memory Interference. Medicina, 56, 129: 1-15. DOI: 10.3390/medicina56030129.

[16]   Dani, J., Burrill, C., & Demmig-Adams, B. (2005). The remarkable role of nutrition in learning and behaviour. Nutrition & Food Science, 35(4), 258-263. DOI: 10.1108/00346650510605658.

[17]   Driga, A. M., Zavitsanou, A., & Drigas, A. (2023). Negative impacts of 15 white foods on health and brain and the role of mobiles in healthy living education. Journal health and technology – JHT, 2(2), 1-25. https://doi.org/10.47820/jht.v2i2.35.

[18] Drigas, A. S., Pappas, M., & Lytras, M. (2016). Emerging technologies for ICT based education for dyscalculia: Implications for computer engineering education. International Journal of Engineering Education, 32(4), 1604-1610. https://www.researchgate.net/publication/309922334.

[19] Drigas, A., & Batziaka, E. (2016). Dyslexia and ICTs, Assessment and Early Intervention in Kindergarten. International Journal of Emerging Technologies in Learning (iJET), 11(2), 53-56. http://dx.doi.org/10.3991/ijet.v11i02.5193.

[20] Drigas, A., & Dourou, A. (2013). A Review on ICT Based Applications for Intervention and Assistance of People with Memory Deficits. International Journal of Emerging Technologies in Learning (iJET), 8(5), 47-49. http://dx.doi.org/10.3991/ijet.v8i5.3009.

[21] Drigas, A., & Karyotaki, M. (2013). E-learning and ICTs Applications in Nutrition Science. International Journal of Recent Contributions from Engineering Science & IT (iJES), 1(2), 4-10. DOI: 10.3991/ijes.v1i2.3279.

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

[23] Drigas, A., & Kokkalia, G. (2014). ICTs and Special Education in Kindergarten. International Journal of Emerging Technologies in Learning (iJET), 9(4), 35-42. http://dx.doi.org/10.3991/ijet.v9i4.3662.

[24] Drigas, A., & Mitsea, E. (2021). Metacognition, stress-relaxation balance & related hormones. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 9(1), 4-16. https://doi.org/10.3991/ijes.v9i1.19623.

[25] Drigas, A., & Mitsea, E. (2021). Neuro-linguistic programming & VR via the 8 pillars of metacognition X 8 layers of consciousness X 8 intelligences. Technium Social Sciences Journal, 26, 159-176. https://doi.org/10.47577/tssj.v26i1.5273.

[26] Drigas, A., & Mitsea, E. (2022). Conscious Breathing: a Powerful Tool for Physical & Neuropsychological Regulation. The role of Mobile Apps. Technium Social Sciences Journal, 28, 135-158. DOI: 10.47577/tssj.v28i1.5922.

[27] Drigas, A., Kokkalia, G., & Lytras, M. (2015). ICT and collaborative co-learning in preschool children who face memory difficulties. Computers in Human Behavior, 51, 645-651. http://dx.doi.org/10.1016/j.chb.2015.01.019.

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

[29] Drigas, A., Mitsea, E., & Skianis, C. (2022). Clinical Hypnosis & VR, Subconscious Restructuring-Brain Rewiring & the Entanglement with the 8 Pillars of Metacognition X 8 Layers of Consciousness X 8 Intelligences. International Journal of Online Engineering (iJOE), 18(1), 78-94. https://doi.org/10.3991/ijoe.v18i01.26859.

[30] Drigas, A., Mitsea, E., & Skianis, C. (2022). Metamemory: Metacognitive Strategies for Improved Memory Operations and the Role of VR and Mobiles. Behavioral Sciences, 12(450), 1-16. https://doi.org/10.3390/bs12110450.

[31] Drigas, A., Mitsea, E., & Skianis, C. (2022). Virtual Reality and Metacognition Training Techniques for Learning Disabilities. Sustainability, 14, 10170, 1-19. https://doi.org/10.3390/su141610170.

[32] Elosúa, M. R., García-Madruga, J. A., Vila, J. O., Gómez-Veiga, I., & Gil, L. (2013). Improving reading comprehension: From metacognitive intervention on strategies to the intervention on working memory executive processes. Universitas Psychologica, 12(5), 1425-1438. DOI: 10.11144/Javeriana.UPSY12-5.ircm.

[33] Gathercole, S., Alloway, T. P., Willis, C., & Adams, A. M. (2006). Working memory in children with reading disabilities. Journal of Experimental Child Psychology, 93(3), 265-281. DOI: 10.1016/j.jecp.2005.08.003.

[34] Georgieff, M. K., Ramel, S. E., & Cusick, S. E. (2018). Nutritional Influences on Brain Development. Acta Paediatrica, 107(8), 1310-1321. DOI: 10.1111/apa.14287.

[35] Harvey, A. G., Lee, J., Williams, J., Hollon, S. D., Walker, M. P., Thompson, M. A., & Smith, R. (2014). Improving Outcome of Psychosocial Treatments by Enhancing Memory and Learning. Perspectives on Psychological Science, 9(2), 161-179. DOI: 10.1177/1745691614521781.

[36] Holmes, J., Gathercole, S. E., & Dunning, D. L. (2010). Poor working memory: Impact and interventions. Advances in Child Development and Behavior, 39, 1-43. https://doi.org/10.1016/B978-0-12-374748-8.00001-9.

[37] Kakoura, E., & Drigas, A. (2023). Digital Tools for Children with Reading Difficulties. World Journal of Biology Pharmacy and Health Sciences, 14(3), 129-136. https://doi.org/10.30574/wjbphs.2023.14.3.0252.

[38] Kapsi, S., Katsantoni, S., & Drigas, A. (2020). The Role of Sleep and Impact on Brain and Learning. International Journal of Recent Contributions from Engineering Science & IT (iJES), 8(3), 59-68. https://doi.org/10.3991/ijes.v8i3.17099.

[39] Karagianni, E., & Drigas, A. (2023). New Technologies for Inclusive Learning for Students with Special Educational Needs. International Journal of Online and Biomedical Engineering (iJOE), 19(5), 4-21. https://doi.org/10.3991/ijoe.v19i05.36417.

[40] Karavida, V., Tympa, E., & Charissi, A. (2019). The Role of Nutrients in Child's Brain Development. Journal of Education and Human Development, 8(2), 176-180. https://doi.org/10.15640/jehd.v8n2a18.

[41] Karyotaki, M., & Drigas, A. (2015). Online and other ICT Applications for Cognitive Training and Assessment. International Journal of Online Engineering (iJOE), 11(2), 36-42. http://dx.doi.org/10.3991/ijoe.v11i2.4360.

[42] Kefalis, C., Kontostavlou, E. Z., & Drigas, A. (2020). The Effects of Video Games in Memory and Attention. International Journal of Engineering Pedagogy (iJEP), 10(1), 51-61. https://doi.org/10.3991/ijep.v10i1.11290.

[43] Klingberg, T. (2010). Training and plasticity of working memory. Trends in Cognitive Sciences, 14(7), 317-324. DOI: 10.1016/j.tics.2010.05.002.

[44] Kokkalia, G., & Drigas, A. (2015). Working Memory and ADHD in Preschool Education. The Role of ICT'S as a Diagnostic and Intervention Tool: An Overview. International Journal of Emerging Technologies in Learning (iJET), 10(5), 4-9. http://dx.doi.org/10.3991/ijet.v10i5.4359.

[45] Kumari, P. P., & Raj, P. (2016). Role of Physical Activity in Learning Disability: A Review. Clinical and Experimental Psychology, 2(1), 1-3. DOI: 2471-2701-1000118.

[46] Lanfranchi, S., & Carretti, B. (2016). Editorial: Improving Working Memory in Learning and Intellectual Disabilities. Frontiers in Psychology, 7:725, 1-3. DOI: 10.3389/fpsyg.2016.00725.

[47] Lytra, N., & Drigas, A. (2021). STEAM education – Metacognition – Specific Learning Disabilities. Scientific Electronic Archives, 14(10), 41-48. DOI: http://dx.doi.org/10.36560/141020211442.

[48] Madan, N., Rusia, U., Sikka, M., Sharma, S., & Shankar, N. (2011). Developmental and Neurophysiologic Deficits in Iron Deficiency in Children. The Indian Journal of Pediatrics, 78, 58-64. DOI: 10.1007/s12098-010-0192-0.

[49] Malekpour, M., Aghababaei, S., & Abedi, A. (2013). Working memory and learning disabilities. International Journal of Developmental Disabilities, 59(1), 35-46. DOI: 10.1179/2047387711Y.0000000011.

[50] McNerney, M. W. & Radvansky, G. A. (2015). Mind racing: The influence of exercise on long-term memory consolidation. Memory, 23(8), 1140-1151. http://dx.doi.org/10.1080/09658211.2014.962545.

[51] Mitsea, E., Drigas, A., & Mantas, P. (2021). Soft Skills & Metacognition as Inclusion Amplifiers in the 21st Century. International Journal of Online and Biomedical Engineering (iJOE), 17(4), 121-132. https://doi.org/10.3991/ijoe.v17i04.20567.

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

[53] Mitsea, E., Drigas, A., & Skianis, C. (2022). Mindfulness Strategies for Metacognitive Skills Training in Special Education: The Role of Virtual Reality. Technium Social Sciences Journal, 35, 232-262. DOI: 10.47577/tssj.v35i1.7275.

[54] Mitsea, E., Drigas, A., & Skianis, C., (2022). Cutting-Edge Technologies in Breathwork for Learning Disabilities in Special Education. Technium Social Sciences Journal, 34, 136-157. DOI: 10.47577/tssj.v34i1.7102.

[55] Morrison, A. B., & Chein, J. M. (2011). Does working memory training work? The promise and challenges of enhancing cognition by training memory. Psychonomic Bulletin & Review, 18, 46-60. DOI: 10.3758/s13423-010-0034-0.

[56] Nyaradi, A., Li, J., Hickling, S., Foster, J., & Oddy, W. H. (2013). The role of nutrition in children's neurocognitive development, from pregnancy through childhood. Frontiers in Human Neuroscience, 7(97), 1-16. DOI: 10.3389/fnhum.2013.00097.

[57] Oberauer, K. (2019). Is Rehearsal an Effective Maintenance Strategy for Working Memory? Trends in Cognitive Sciences, 23(9), 798-809. https://doi.org/10.1016/j.tics.2019.06.002.

[58] Ojo, Y. (2016). Nutrition and Cognition in School-Aged Children: A Brief Review. International Journal of Educational Benchmark (IJEB), 4(1), 122-137. https://www.researchgate.net/publication/365383309.

[59] Papanastasiou, G., Drigas, A., & Skianis, C. (2022). Serious Games: How do they impact special education needs children. Technium Education and Humanities, 2(3), 41-58. DOI: 10.47577/teh.v2i3.7407.

[60] Papanastasiou, G., Drigas, A., Skianis, C., & Lytras, M. (2017). Serious games in K-12 education: Benefits and impacts on students with attention, memory and developmental disabilities. Program Electronic Library and Information Systems, 51(4), 424-440. DOI: 10.1108/PROG-02-2016-0020.

[61] Papanastasiou, G., Drigas, A., Skianis, C., & Lytras, M. (2020). Brain computer interface based applications for training and rehabilitation of students with neurodevelopmental disorders. A literature review. Heliyon, 6, 1-13. DOI: 10.1016/j.heliyon.2020.e04250.

[62] Papanastasiou, P., & Drigas, A. (2023). The mediterranean diet, lifestyle factors, dyslexia, ADHD in university students of Greece. Brazilian Journal of Science, 2(7), 92-102. https://doi.org/10.14295/bjs.v2i7.335.

[63] Pappas, M., & Drigas, A. (2019). Computerized Training for Neuroplasticity and Cognitive Improvement. International Journal of Engineering Pedagogy (iJEP), 9(4), 50-62. https://doi.org/10.3991/ijep.v9i4.10285.

[64] Ploughman, M. (2008). Exercise is brain food: The effects of physical activity on cognitive function. Developmental Neurorehabilitation, 11(3), 236-240. https://doi.org/10.1080/17518420801997007.

[65] Richardson, A. J., & Phil, D. (2001). Fatty Acids in Dyslexia, Dyspraxia, ADHD and the Autistic Spectrum. Nutrition Practitioner, 3(3), 18-24. https://www.researchgate.net/publication/228731622.

[66] Rosales, F. J., Reznick, J. S., & Zeisel, S. H. (2009). Understanding the Role of Nutrition in the Brain & Behavioral Development of Toddlers and Preschool Children: Identifying and Overcoming Methodological Barriers. Nutritional Neuroscience, 12(5), 190-202. DOI: 10.1179/147683009X423454.

[67] Skeja, E. (2014). The Impact of Cognitive Intervention Program and Music Therapy in Learning Disabilities. Procedia – Social and Behavioral Sciences, 159, 605-609. DOI: 10.1016/j.sbspro.2014.12.433.

[68] Theodorou, P., & Drigas, A. S. (2017). ICTs and Music in Generic Learning Disabilities. International Journal of Emerging Technologies in Learning (iJET), 12(4), 101-110. https://doi.org/10.3991/ijet.v12i04.6588.

[69] Zavitsanou, A. M., & Drigas, A. (2021). Attention and Working Memory. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 9(1), 81-91. https://doi.org/10.3991/ijes.v9i1.19933.

[70] Zavitsanou, A., & Drigas, A. (2021). Nutrition in mental and physical health. Technium Social Sciences Journal, 23, 66-77. DOI: 10.47577/tssj.v23i1.4126.

[71] Zavitsanou, A., Salapata, Y., & Stathopoulou, A. (2022). Special nutrition for Students with Special Education Needs, and the ICT's role for their Health education. TechHub Journal, 2(2), 82-97. https://www.researchgate.net/publication/366411617.

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

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

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

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

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

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

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

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

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

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

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

[83] S Politi-Georgousi, A Drigas 2020 Mobile Applications, an Emerging Powerful Tool for Dyslexia Screening and Intervention: A Systematic Literature Review International Association of Online Engineering

[84] A Drigas, P Theodorou, 2016 ICTs and music in special learning disabilities International Journal of Recent Contributions from Engineering, Science & IT …

[85] Galitskaya, V., & Drigas, A. (2020). Special Education: Teaching Geometry with ICTs. International Journal of Emerging Technologies in Learning (iJET), 15(06), pp. 173–182. https://doi.org/10.3991/ijet.v15i06.11242

[86] Moraiti, I. ., Fotoglou, A. ., Dona, K. ., Katsimperi, A. ., Tsionakas, K. ., & Drigas, A. (2022). IoT in Special Education. Technium Social Sciences Journal, 30(1), 55–63. https://doi.org/10.47577/tssj.v30i1.6307

[87] Alexopoulou, A., Batsou, A., & Drigas, A. S. (2019). Effectiveness of Assessment, Diagnostic and Intervention ICT Tools for Children and Adolescents with ADHD. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 7(3), pp. 51–63. https://doi.org/10.3991/ijes.v7i3.11178

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

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

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

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

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

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

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

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

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

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

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

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

[100] Drigas A, Kouremenos S, Vrettos S, Vrettaros J, Kouremenos S, 2004 An expert system for job matching of the unemployed Expert Systems with Applications 26 (2), 217-224 https://doi.org/10.1016/S0957-4174(03)00136-2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[124] Drigas A, Mitsea E 2022 Conscious Breathing: a Powerful Tool for Physical & Neuropsychological Regulation. The role of Mobile Apps Technium Social Sciences Journal 28, 135-158. https://doi.org/10.47577/tssj.v28i1.5922

[125] Drigas A, Mitsea E, C Skianis 2022 Neuro-Linguistic Programming, Positive Psychology & VR in Special Education. Scientific Electronic Archives 15 (1) https://doi.org/10.36560/15120221497

[126] Drigas A, Mitsea E 2021 Neuro-Linguistic Programming & VR via the 8 Pillars of Metacognition X 8 Layers of Consciousness X 8 Intelligences Technium Soc. Sci. J. 26(1), 159–176. https://doi.org/10.47577/tssj.v26i1.5273

[127] Drigas A, Mitsea E, Skianis C 2021. The Role of Clinical Hypnosis and VR in Special Education International Journal of Recent Contributions from Engineering Science & IT (IJES) 9(4), 4-17.

[128] E Mitsea, A Drigas, C Skianis 2022 Metacognition in Autism Spectrum Disorder: Digital Technologies in Metacognitive Skills Training Technium Social Sciences Journal, 153-173

[129] Kontostavlou, E. Z., & Drigas, A. (2021). How Metacognition Supports Giftedness in Leadership: A Review of Contemporary Literature. International Journal of Advanced Corporate Learning (iJAC), 14(2), pp. 4–16. https://doi.org/10.3991/ijac.v14i2.23237

[130] Vouglanis T, Driga A M, Drigas A 2022 Charismatic Children: Heredity, Environment and ICTs, Technium Sustainability 2,5 1-15https://doi.org/10.47577/sustainability.v2i5.7378

[131] Chaidi, I. ., & Drigas, A. (2022). Social and Emotional Skills of children with ASD: Assessment with Emotional Comprehension Test (TEC) in a Greek context and the role of ICTs. Technium Social Sciences Journal, 33(1), 146–163. https://doi.org/10.47577/tssj.v33i1.6857

[132] Vouglanis, T. ., Driga, A. M., & Drigas, A. (2022). Physical and mental exercise to create new congenial neurons, to increase intelligence and the role of ICTs. Technium BioChemMed, 3(3), 21–36. https://doi.org/10.47577/biochemmed.v3i3.7325

[133] Chaidi , I. ., & Drigas, A. (2022). Emotional intelligence and learning, and the role of ICTs. Technium Social Sciences Journal, 35(1), 56–78. https://doi.org/10.47577/tssj.v35i1.7249

[134] Mitsea E, Lytra N, A Akrivopoulou, A Drigas 2020 Metacognition, Mindfulness and Robots for Autism Inclusion. Int. J. Recent Contributions Eng. Sci. IT 8 (2), 4-20. https://doi.org/10.3991/ijes.v8i2.14213

[135] Kapsi S, Katsantoni S, Drigas A 2020 The Role of Sleep and Impact on Brain and Learning. Int. J. Recent Contributions Eng. Sci. IT 8 (3), 59-68. https://doi.org/10.3991/ijes.v8i3.17099

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

[137] Papoutsi C, Drigas A, C Skianis 2021 Virtual and augmented reality for developing emotional intelligence skills Int. J. Recent Contrib. Eng. Sci. IT (IJES) 9 (3), 35-53. https://doi.org/10.3991/ijes.v9i3.23939