Dialogues in Clinical Neuroscience & Mental Health

e-ISSN: 2585-2795 • p-ISSN: 2654-1432
DOI: 10.26386/obrela.v6i2.266
p. 59-69

Digital Technologies and Virtual and Augmented Reality Games as ADHD intervention

Aikaterini Doulou, Charalampos Skianis

Abstract

ADHD is more prevalent among young npeople and adolescents than in the past. This disease is accompanied by various learning and behavioral problems since it has problems with cognitive and metacognitive skills. Drigas et al., in their study from 2021, argue that participation in society is only possible if people have acquired these skills. Additionally, through strengthening abilities like self-awareness, self-regulation, and self-control through inner attention, children can learn other ways to manage their cognitive deficits and adjust to varied circumstances. Numerous medical and psychological ways to treat ADHD have been developed due to the considerable advancements in research, and these treatments are known to support symptom control. Alternative modes of intervention that attempt to improve these children's quality of life are studied in the current work, including video games with virtual or augmented reality environments.

Keywords

Attention Deficit Hyperactivity Disorder (ADHD), Social/Emotional Development, ICTs, Metacognition, Video Games, Virtual Reality, Augmented Reality

Corresponding author: Aikaterini Doulou katerina.doulou@gmail.com

Introduction

According to Drigas & Driga (2019), Attention Deficit Hyperactivity Disorder (ADHD) is a complex neurological disorder, which still lacks scientific data concerning its nature and treatment methods. Some factors, such as the family's socioeconomic status, the existence of a psychiatric disorder in the mother, or smoking and alcohol consumption during pregnancy, have been proved to play an important role. The main symptoms of ADHD are lack of attention and impulsivity, resulting from a malfunction in areas of the brain that control executive functions. These functions, such as memory and attention, lay the foundation for an individual's organizational skills, their ability to focus on tasks, control of emotions, and the ability to self-evaluate.

In order to control the symptoms of ADHD, a therapy based on the development of cognitive and metacognitive skills is required. According to Drigas et al. (2021), cognitive and metacognitive skills evolve progressively via an individual's self-awareness of their strengths and weaknesses, their self-observation, self-regulation, adaptation and flexibility in diverse areas (cognitive, emotional, and behavioral), recognition, discernment and mindfulness. People with high social and emotional intelligence are capable of better self-monitoring, a skill that is necessary to control behavior in children with ADHD (Drigas & Papoutsi 2018). Emotional intelligence focuses also on the individual's character and aspects of self-control, such as regulating impulses, which is one of the predominant difficulties of these children (Matthews et al., 2004). According to the 9-level model (pyramid) of emotional intelligence of Drigas & Papoutsi (2018), a person must go through the following stages to reach the highest level of Emotional Intelligence, which is Emotional Unity:

1) Emotional Stimuli (coding of emotional senses, attention)
2) Emotions' Recognition, Perception/Expression of Emotions (memory, perception, recognition, emotions' identification)
3) Self-knowledge (self-perception, awareness, self-observation)
4) Self-management (self-regulation, flexibility, self-control)
5) Social Awareness, Empathy, Emotion Discernment (awareness, monitoring, social recognition & flexibility)
6) Social skills, Specialization in Emotions (reflection, management of social problems)
7) Universality of Emotions, Self-actualization (self-perfection, self-completion)
8) Transcendence (self-reflection, transcendental knowledge)
9) Emotional Unity (pure consciousness & fullness)

The seventh level, "self-actualization", is at the top of Maslow's hierarchy of needs. In order to achieve this condition of becoming, it is necessary to meet needs at lower levels of the pyramid, such as the need for survival, security, social acceptance, and self-esteem (Maslow 1943, 1987). Only when people with ADHD meet their needs, develop their emotional intelligence and improve their metacognitive skills will they be able to master the appropriate cognitive and socio-emotional skills that will allow them to integrate into the social environment (Drigas & Mitsea 2020; Drigas & Mitsea 2021). Medication is considered a first-choice treatment to reduce the symptoms. However, it has several disadvantages due to the side effects caused and the risk of addiction. On the other hand, intervention tools such as new technologies have proved to be just as effective.

2D Video Games

Hakimirad et al. (2019) investigated the effectiveness of the EmoGalaxy video game on the social skills of children with ADHD. The concerned study was conducted in two groups (experiment and control), and the study population included children with ADHD. Specifically, 20 boys aged 7 to 12 years were selected and randomly divided into the experimental group (10 children) and the control group (10 children). The experimental group did fifteen (15) 45-minute long intervention sessions using EmoGalaxy, while the control group did not receive any specific intervention. The students' social skills were assessed via the Gresham & Elliot (1990) Social Skills Assessment Scale before and after the intervention.

In the EmoGalaxy video game the player must travel between four planets. Each planet refers to one of the primary emotions: happiness, sadness, fear, and anger. In each part of the planet, the player can play different games. The game is designed to intervene in three areas of emotional capacity, i.e. emotion recognition, emotion expression, and emotion regulation. For example, on the "frowning" planet anger-related abilities are being exercised. In order to access any game, the player has to show and express the feeling of anger. Through the front camera the game captures the users' faces and recognizes their emotional expression. If the player cannot express the right emotion, the game asks him to recognize an angry face among the characters in the game. In other words, it evaluates a rather basic level of emotional capacity, i.e. recognition. Players receive a score after completing each game. When a player's score reaches a certain level, they collect enough fuel for their spaceship and can travel to the next planet that corresponds to another emotion (Hakimirad et al., 2019).

EmoGalaxy can be played on Android smartphones and tablets with operating systems 4.4 and above, iPhone 5 or later models, and on PCs. The game is two-dimensional and was developed through the Unity 5 application. The results showed a significant difference in the social skills test scores before and after the intervention. EmoGalaxy increased the level of collaboration by 0.46, assertiveness by 0.59, responsibility by 0.25, and self-control by 0.47. The overall social skills were affected by 0.73. According to the results of this study, EmoGalaxy, as a cognitive video game, had a positive effect on all components of social skills of children with ADHD (Hakimirad et al., 2019).

Prins et al., (2013) developed the game "Braingame Brian" to improve the executive functions in children with ADHD. "Braingame Brian", named after the main character Brian, consists of 25 activities lasting 40 to 50 minutes and has seven different worlds: The area around Brian's parents' house, the village, the uninhabited island, the backlands, the beach, the

swamp, and the basement workshop. All characters that live in these worlds have a problem. Brian helps them solve these problems by completing cognitive exercises.

An external support system is used to enhance the child's motivation to complete the training. Data from each training session are sent to a central database. Based on this data, educators receive online feedback on the child's progress. The study included 40 children diagnosed with ADHD (8-12 years old) who were divided into two groups, the experimental group that received intervention through "Braingame Brian" (n = 18) and the control group which didn't receive any form of intervention (n = 22). Questionnaires were given to parents and teachers to assess the difficulties in executive functions, the symptoms of ADHD, and any disruptive behavior problems, before and after the intervention. The results showed that children improved significantly their executive functions (Gioia et al., 2000) and ADHD symptoms (Inattention and Hyperactive-Impulsivity subscale of the Disruptive Behavior Problem Scale) (Pelham et al., 1992). This pilot study shows much promising evidence on the effectiveness of this program. However, "Braingame Brian" should not be considered an autonomous form of treatment but should complement or be integrated in existing ADHD interventions, such as pharmacotherapy and behavioral therapy, in order to deliver therapeutic results (Prins et al., 2013).

Wrońska et al. (2015) introduced a new interactive game designed to improve reading and comprehension skills in children with ADHD. The LyC (Lectura y Comprensión) game was developed for the iPad and is based on techniques used in health-promoting serious games. That research was conducted in a control group of six children (two boys and four girls) of typical development and aged 8 to 12 years, who were not diagnosed with ADHD. The game was developed using an Apple iPad 2 running on iOS 7.2, the XCode 5 programming platform, and the SQLite and MySQL databases. Its content was based on attention-catching exercises during reading and image observing, which are available on the website (Programa de Entrenamiento de Instrucciones Escritas Nivel Medio, 2013). Specifically, the application consists of nine interactive exercises of different levels of difficulty, and the game includes three stages. First, the player must read the text that contains critical information. Then, he must comprehend and process the information. Finally, the player must select the correct answer among the multiple given answers. The answer is selected by dragging and dropping a button from the toolbox to the correct image.

The evaluation of the game consists of two parts. First, the evaluation of data that contain the scores of the children who played the game, and second, the evaluation of the system's usability based on the SUS questionnaire. Two parameters were recorded during each child's assessment: the time they took to complete each exercise and the overall score of answers (for every wrong response, the corresponding score was 0). These results were sent to the SQLite database, which stored them on the device. Immediately after completing the game, the children were asked to complete the SUS questionnaire to evaluate the game's usability. The questionnaire consisted of ten sentences, each of which had to be graded using the Likert scale that ranges from 1 (strongly disagree) to 5 (strongly agree) (Wrońska et al. 2015).

The outcome showed that the game is user-friendly and easy to complete, as confirmed by the SUS questionnaire's score. The study's main findings were that in the first stage of the game, the participants explored how to play, and the rules were not very clear to them. Also, age and gender differences were not as significant as the game evolved (Wrońska et al. 2015).

Virtual Reality (VR) Games

Yanguas et al. (2021) designed a video game using virtual reality (VR), which included a gamified chess version called "The Secret Trail of Moon" (TSTM). *Chess* is a game based on simple rules but requires a high cognitive level that includes among others attention, executive functions, and memory (Song et al., 2020; Langner et al., 2019). TSTM aimed to create an innovative and motivating tool for the cognitive therapy of patients diagnosed with ADHD. This video game consists of 6 work areas. Each area is designed to improve a different area of disability in patients with ADHD: attention, working memory, planning, spatial capacity, impulse control, and reasoning. The video game's innovative approach is the usage of chess as a main feature. In TSTM, chess appears in three different forms: A) As a work area, which consists of chess lessons and exercises B) As a central theme of the work area, where the elements of the chessboard and its pieces are used for cognitive exercises, not needing however to know the rules of chess. For example, in the "Smasher" game the player must pay attention to press the X button on the game controller whenever the "pawn-horse" sequence appears. C) As part of the video game plot. For example, the player is in a forest with chess elements who narrate the history of this particular world. During his journey, along with the animals that accompany him, he will unlock information about the relationship between the forest and chess. The ultimate test of the video game is to play a game of chess against the enemy.

The initial design of the video game has been revised following a user-oriented model (Fullerton, 2014). During the usability study, the researchers received feedback from patients who tried different video game versions. This feedback allowed them to make improvements in the game's layout, according to the needs and preferences of the patients. The Unity Game Engine and Sony PlayStation VR were used to develop the video game. The study involved 105 patients diagnosed with ADHD and on regular medication who were randomly divided into 1) Control team, 2) Online chess therapy team, and 3) TSTM team. All patients and their parents were assessed before and after the intervention. The training lasted 12 weeks. The central hypothesis was that the patients trained in TSTM or in online chess would improve their executive functions compared to the patients who do not participate in any intervention (control group) (Yanguas et al., 2021).

The results showed that TSTM was fun, understandable, easy to use, and with appealing graphics, resulting in ade-

quate participation of most players. Also, the patients in the TSTM intervention group improved their executive functions more and had fewer undesirable behaviors than those in the online chess intervention group or in the control group (Yanguas et al., 2021).

Yang-Kun et al. (2020) used virtual reality games as means of intervention for attention, abstract reasoning, and complex information processing in children with ADHD. This study includes two stages: In the first stage, semi-structured interviews were conducted with psychotherapists and physiotherapists in order to understand the treatment methods for children with ADHD and to evaluate the difficulties so as to develop guidelines for what games to select. In the second stage, the virtual reality game console HTC VIVE (HTC, Taiwan) was used to develop a 3-month, three-times-per-week training program for children with ADHD. The study involved three children aged 8-12 years, diagnosed with ADHD but without any other illnesses or disorders and who had not previously received any VR-based training.

During the sessions each child's parents were present in the room but did not participate in the game. The experiment consisted of three designed games, which focused on exercising the visual-motor coordination ability of the participants and had different levels of difficulty. Participants were assessed through four tests, before and after each session: 1) Non-verbal intelligence assessment (fourth edition) TONI-4 (Mungkhetklang et al. 2016), 2) Attention test for primary school children (ATESC), a scale developed in Taiwan by Lin and Chou (2010), 3) Wisconsin Card Classification Test (WCST) (Heaton 1981), 4) The Chinese version of the revised Swanson, Nolan, and Pelham (SNAP-IV) (Swanson et al. 1992).

Within each 3-week cycle, the difficulty level increased from beginner to advanced. In the final three weeks, each child decided for himself/herself which game it would play during the sessions. The researchers compared the children's attention, abstract reasoning, logic, and complex information processing before and after this program. The results revealed that the children with ADHD improved their attention span, hyperactivity/impulsivity, and decreased provocative behaviors. More specifically, in terms of performance regarding intelligence, cognitive function, and critical thinking, the results of the TONI-4 assessment revealed that participant A increased his score from 78 to 87, participant B maintained his score of 84, and participant C achieved the highest progress in his score (from 65 to 83). In total, participants' scores improved after the experiment. The ATESC results showed that the participants' scores in the five attention exercises improved particularly after the experiment. One participant improved his abstract reasoning and information processing, while the other two showed reduced performance. Participant A made fewer persistence errors, while participants B and C did not improve their performance in this area (Yang-Kun et al., 2020).

Bland'on Diego et al. (2016) used in their research the virtual reality 3D video game Harvest Challenge to assess and train attention and self-regulation in children with ADHD. Attention levels were mapped from 0 to 100 percent, using a Brain-Computer Interface system (MindWaveBCI) by placing an electrode on the frontal lobe. In addition, EEG signals were recorded in the state of resting. Neurofeedback therapies and interactive games are therapeutically ideal; they improve the disorder's symptoms due to the high motivation they create (Drigas & Bravou, 2012).

Two intervention sessions were performed in a specialized local institution (Instituto de Audiolog'ıa Integrated-IdeAl) with the participation of nine children aged 5 to 12 years and diagnosed with ADHD. The 30-minute sessions were divided into two phases, the first lasting 5 minutes and the second lasting 25 minutes. In the first phase, the child listened to soothing music while being monitored using the MindWave device that recorded their EEG signals through the OpenViBE open-source software. In the second phase, three different stages of interaction were developed:

Equipment: The game starts with adventure sports in an ecological farm. The first goal for the player is to collect the equipment needed for a safe ride, which requires an increase in attention levels (more than 50%) and following of rules. Players must effectively choose a helmet, a pair of gloves, a rope, and sneakers through the visual stimuli they see on the screen.

Path repair: The player must reach the top of a mountain to get the rope. For this reason, a series of wooden stairs were placed on a long path where some disasters occurred. Therefore, players will need to increase their level of attention to repair the track.

Carrot Harvest: At this point players interact with virtual objects. The user is placed in a big field of carrot harvest and is equipped with a basket to collect as many carrots as possible, raising and maintaining his/her attention levels until the vegetables are collected. If players reduce their attention levels, the carrots hide under the ground, thus not being collectable. The video game ends after time is up (30 minutes) (Bland'on Diego et al., 2016).

The results showed that by playing the video game Harvest Challenge, the children improved their performance, which reflects an enhanced ability to maintain continuous attention and self-regulation (Bland'on Diego et al. 2016). The results also showed a higher activity in alpha and beta waves that are widely associated with hyperactivity (Lansbergen et al., 2011).

Augmented Reality Games (AR)

Barba et al. (2019) created the program BRAVO (Beyond the tReatment of Attention loss hyperactiVity disOrder). This virtual and augmented reality environment applies rehabilitation exercises in the form of serious games for children with ADHD and supports therapists in managing the rehabilitation program.

The child is the main user of the system. Once the child is in front of the treatment room, an automatic face recognition procedure activates the system's authentication process, and the child meets with his/her personal virtual avatar. The avatar will always be friendly disposed towards the child's psychological profile so that they always feel welcomed by a familiar face. In addition to being displayed on a screen at the entrance and exit of the treatment room, the avatar also

accompanies the child during the entire treatment process in the form of a digital hologram (displayed via Microsoft Hololens) (Barba et al. 2019).

The BRAVO platform collects data via sensors (EEG helmet and bracelet to detect pressure levels and performance during the game), processes the user's emotional state, and exchanges data with other system components facilitating game adjustments in real-time. It also contains a therapist's toolkit, which can be used to monitor treatment and to obtain suggestions regarding the game and recommended difficulty levels (Barba et al., 2019).

The BRAVO environment consists of three serious games that will be aiming to enable compliance with rules and to improve attention, prediction of outcomes of actions and social skills.

1) Topological Categories: The game is designed to be played via an HTC Vive and a controller, allowing the user to move in a virtual environment just as they would in a real one. In the game, users will explore three different environments (a classroom, a bedroom, and a garden), where they will be asked to complete particular tasks.
2) Infinite Runner: This is an 8-level game, aiming to educate on respecting the rules, active listening, and awareness of the player's limits. The game will be played using a Kinect device that allows the game avatar to move simply by using the human body: in fact, the player's movements are decoded without the need of wearing any additional equipment. Inside the game, the user is placed in a virtual environment that depicts a country or a city street, where he is asked to follow a path while running. As the game progresses, the player must maneuver in the right directions to avoid various obstacles or to collect any requested item.
3) Space Travel Trainer: This is a 7-level game with the educational goal of teaching patients to plan their actions and manage their social relationships. The game is controlled via the Kinect device, which allows the detection of the player's hands movements. In the game, the player acts as an astronaut who aims to direct the spaceship to the planet of his friends. During his/her journey, he/she has to face various challenges: he/she needs to learn how to solve complex problems, how to make the right decision at the right time (improving his decision-making skills), but above all, how to interact with the members of his/her team (in order to defeat the enemy) (Barba at al. 2019).

The final stage of BRAVO will run for 27 weeks to evaluate the benefits. For this purpose, 60 new patients will participate, divided into the following age groups: 1) 3-6 years, 2) 6-9 years, and 3) 9-12 years. Each age group will be randomly divided into two other equally sized groups. The first group will serve as a control group undergoing traditional treatment, while the second will be the test group, receiving the new treatment in the augmented and virtual game environment. During the administration of treatments both groups will be assessed in three phases: before, during and after the intervention. In order to assess the real impact of the BRAVO system, usability and effectiveness tests will be applied (Barba et al., 2019).

Alqithami et al. (2019) aimed to design and simulate a cognitive model that can be used as an alternative intervention to traditional CBT (Cognitive Behavioral Therapy). This model takes advantage of current augmented reality developments to engage patients both in real and virtual game-based environments. Augmented reality combines real and three-dimensional virtual content through an interactive environment (Azuma, 1997). Compared to virtual reality that portrays the real world in 3D graphics on a computer screen (Burdea & Coiffet, 2003), augmented reality optimizes interactions with 3D objects in a real environment (Billinghurst et al., 2015).

The augmented reality game of Alqithami et al. (2019) was designed using the Microsoft-HoloLens emulator and the Unity application, and was tested in a case study. This game simulates two 3D balls: one is the target ball, while the other is not. The player must follow the instructions and hit the target ball in a specified time period to be counted as successful hit. If he fails doing so, his attempt will be added to the sum of unsuccessful hits as an omission or error. The child may play several rounds of the game during one therapy session. The number of rounds played depends on their performance during the game and their overall skill level. Each game consists of 10 one-minute trials. In each trial the "target" and "non-target" balls will appear to the child. During the trial the child will be directed to catch the target ball so to drop it during the trial interval. The time elapsed from the beginning of the trial to hitting the target is the response time. If the response time decreases, this indicates that the child's performance has improved. If the child is not able to catch any of the balls, this omission error may indicate inattention. If the child catches the non-target ball, this error indicates impulsivity (Alqithami et al., 2019).

This study was divided into two parts. The first part, examined the effect of successful and unsuccessful attempts on the performance index, while the second part assessed the effect of the child's involvement. The results showed an improvement in the child's attention to select the desired object, which added positively to his performance index. Alqithami et al. (2019) argue that through augmented reality games, every child can develop traits such as adaptability, smartness, responsiveness, and accuracy. They also consider that using AR environments is more appropriate than VR environments, as it allows children to observe their current position while a game is introduced in their space.

Avila et al. (2018) aimed to improve attention in children with ADHD using Augmented Reality Serious Games (ARSG). Through a prototype game called ATHYNOS, they tried to emphasize the therapeutic benefits of using an AR environment. The purpose of ATHYNOS is to develop cognitive skills such as visual-motor coordination, feedback, interactivity, problem-solving, and selective and focused attention. Unity 3D in combination with Software Development Kit (SDK) and Vuforia Engine was used to develop the game. Regarding the game's graphics, Adobe Illustrator was used to develop the images (characters, scenes, scripts, and environments), Adobe After Effects for animation, and Adobe Premiere Pro for professional video editing. Finally, listening tools such as Ableton Live and Adobe Audition were used to create a music sequence.

At the beginning of the game, the therapist explains the procedure. Then, in order to start the game, each child must log on via one of the six avatars. After that, a main menu of scenes appears, containing two types of treatments (Missing Character, and Shape and Match) with three levels of difficulty, depending on the child's abilities. Shape and Match, for example, contains basic arithmetic operations, geometric shapes, sequences, and mathematical reasoning. The aim for the child is to match objects on the left side of a scene with those on the right and move them together to the center of the screen. In the end, the results are displayed (Avila et al., 2018).

The research was conducted with 11 children with ADHD (9 boys and 2 girls), aged between 7-10 years. There were 8 sessions per participant. In each session, the time for completing the activities was recorded. The descriptive statistical analysis that followed confirmed that the participants who played ATHYNOS during the eight sessions managed to improve significantly their time management and social skills in their daily life. The findings showed also that the players' attention meliorated, improving in turn their ability to handle frustration and reducing significantly the time needed to complete the game. It was also observed that the children's times and successes were homogeneous in both cases, thus showing that all the children had similar abilities. Avila et al. (2018) argue that this game promotes voluntary participation and requires a constant interest in problem-solving, contributing this way to the improvement of learning. In addition, according to the therapist's feedback, almost all children showed a great interest and motivation, a fact that made him feel highly satisfied.

Discussion

Concluding we have to underline the role of digital technologies in education domain and especially in ADHD intervention, that is very productive and successful, facilitates and improves the assessment, the intervention and the intervention procedures via Mobiles [45-53], various ICTs applications [54-85], AI & STEM ROBOTICS [86-96], and games [97-104]. Additionally the combination of ICTs with theories and models of metacognition, mindfulness, meditation and emotional intelligence cultivation [105-139] as well as with environmental factors and nutrition [41-44], accelerates and improves more over the educational practices and results, especially for ADHD rehabilitation.

More specifically playing a video game requires using executive, organizational and metacognitive skills. The most important utilized skills during games are memory and attention skills (Kulman, 2010). There is an interrelationship between memory and attention when performing a task. Their role is crucial to the cognitive functions of individuals with ADHD, since the higher the working memory level is, the longer is the attention span. Children with ADHD are more likely to have working memory deficits. (Angelopoulou & Drigas, 2021). Serious games, creating virtual and augmented reality (AR) environments through the use of new technologies, are ready to play a significant role in therapeutic interventions, especially in treating ADHD symptoms. In their study on the effects of hypnosis via virtual reality on children with disabilities, Drigas & Mitsea (2021) concluded that virtual reality (VR) environments could eliminate the symptoms of inattention, distraction, and hyperactivity. Furthermore, VR environments make participants' reactions faster and more accurate, cultivate many aspects of executive functions, and enhance emotional regulation.

Because children with ADHD get bored quickly, it is essential to attract their attention on a continuous basis. Video games make this possible because they require the child to remain focused and busy the entire time, and furthermore having all senses alert, which makes these games even more interesting for the user (Kulman, 2010). The findings of the present bibliographic research conclude that serious games with the use of ICTs have a positive effect on all components of social skills in children with ADHD (Hakimirad et al., 2019). Children improve significantly their executive functions and ADHD symptoms (Prins et al., 2013) and also exhibit less adverse behaviors (Yanguas et al., 2021). Furthermore, the research of Yang-Kun et al. (2020) revealed that through serious games children with ADHD improve their performance in attention, hyperactivity/impulsivity, critical thinking, abstract reasoning, and information processing.

Alqithami et al. (2019) argue that, through games in augmented reality environments, every child can develop traits such as adaptability, smartness, responsiveness, and accuracy. They assert also that AR environments are more appropriate than VR environments, as they allow children to be aware of their current position while a game is being introduced in their space. Participants who played their program improved significantly their time management and social skills in their daily lives, and improved also their attention, their ability to handle frustration, and reduced notably their time for completing gaming activities.

The discussion around the causes of ADHD and corresponding rehabilitation methods is a reflection of the fluidity of our knowledge in these areas. Further research is needed to develop alternative therapies with the use of serious games in virtual and augmented reality environments, to improve these children's cognitive and metacognitive skills and enable them to integrate into the social environment.

Refferences

1. Alqithami Saad, Alzahrani Musaad, Alzahrani Abdulkareem & Ahmed Mustafa (2019). AR-Therapist: Design and Simulation of an AR-Game Environment as a CBT for Patients with ADHD. Healthcare, 7, 146. DOI: 10.3390/healthcare7040146.
2. Avila-Pesantez Diego, Vaca-Cardenas Leticia, Rivera Luis A., Aguayo Stteffano & Zuñiga Lourdes (2018). Towards the Improvement of ADHD Children through Augmented Reality Serious Games: Preliminary Results. Conference: Global Engineering Education Conference (EDUCON). DOI: 10.1109/EDUCON.2018.8363318.
3. Azuma, R.T. (1997). A Survey of Augmented Reality. Presence: Teleoperators Virtual Environ., 6, 355-385. DOI: 10.1162/pres.1997.6.4.355

4. Barba Maria Cristina, Covino Attilio, De Luca Valerio, De Paolis Lucio Tommaso, D'Errico Giovanni, Di Bitonto Pierpaolo, Di Gestore Simona, Magliaro Serena, Nunnari Fabrizio, Paladini Giovanna Ilenia, Potenza Ada & Schena Annamaria (2019). BRAVO: A Gaming Environment for the Treatment of ADHD. International Conference on Augmented Reality, Virtual Reality and Computer Graphics, pp. 394-407.
5. Bashiri A., Ghazisaeedi M., Shahmoradi L. (2017). The opportunities of virtual reality in the rehabilitation of children with attention deficit hyperactivity disorder: A literature review. Korean J. Pediatr., 60, 337-343.
6. Billinghurst M., Clark A. & Lee G. (2015) A Survey of Augmented Reality. Found. Trends Hum. Comput. Interact., 8, 73-272.
7. Bland´on Diego Zamora, Munoz John Edison, Lopez David Sebastian & Gallo Oscar Henao (2016). Influence of a BCI neurofeedback videogame in children with ADHD. Quantifying the brain activity through an EEG signal processing dedicated toolbox. Conference: IEEE 11th Colombian Computing Conference (CCC). DOI: 10.1109/ColumbianCC.2016.7750788
8. Burdea, G.C. & Coiffet, P. (2003) Virtual Reality Technology. John Wiley & Sons.
9. Colombo V., Baldassini D., Mottura S., Sacco M., Crepaldi M., Antonietti A. (2017). Antonyms: A serious game for enhancing inhibition mechanisms in children with Attention Deficit/Hyperactivity Disorder (ADHD). In Proceedings of the International Conference on Virtual Rehabilitation (ICVR), Montreal, QC, Canada, 19-22 June, pp. 1-2.
10. Drigas, A. S. & Papoutsi C. (2018). A New Layered Model on Emotional Intelligence. Behav Sci (Basel), 8(5): 45. DOI: 10.3390/bs8050045.
11. Drigas, A.S., Driga, M. A. (2019). ADHD in the Early Years: Pre-Natal and Early Causes and Alternative Ways of Dealing. International Journal of Emerging Technologies in Learning (iJET). 15(13):95-102, 2019. DOI: 10.3991/ijoe.v15i13.11203
12. Drigas, A.S., Mitsea, E. (2020). The 8 Pillars of Metacognition. International Journal of Emerging Technologies in Learning (iJET). Vol.15, n.21, p.162-178. DOI: 10.3991/ijet.v15i21.14907
13. Drigas A. S. & Mitsea E. (2021). Metacognition, Stress – Relaxation Balance & Related Hormones. International Journal of Recent Contributions from Engineering Science & IT (iJES), 9(1):4-15. DOI: 10.3991/ijes.v9i1.19623
14. Drigas A. S. & Mitsea E. (2021). 8 Pillars X 8 Layers Model of Metacognition Educational Strategies, Exercises &Trainings. International Journal of Online and Biomedical Engineering (iJOE), 17(8):115-134. DOI: 10.3991/ijoe.v17i08.23563
15. Drigas Athanasios & Bravou Vasiliki (2021). BCI-based games and ADHD. Research Society and Development 10(4):1-6, DOI: 10.33448/rsd-v10i4.13942
16. Drigas Athanasios, Angelopoulou Effrosyni & Karabatzaki Zoi (2021). Assessing working memory in general education students for ADHD detection. Research Society and Development, 10(10):e138101018766, DOI: 10.33448/rsd-v10i10.18766
17. Drigas Athanasios, Mitsea Eleni & Skianis Charalabos (2021). The Role of Clinical Hypnosis & VR in Special Education. International Journal of Recent Contributions from Engineering Science & IT (iJES) 9(4):4-17, DOI: 10.3991/ijes.v9i4.26147
18. Fullerton T. (2014). Game Design Workshop, 3rd Edition: A Playcentric Approach to Creating Innovative Games.AK Peters/CRC Press.
19. Gioia G.A., Isquith P.K., Guy S.C., Kenworthy L. (2000) Behavior rating inventory of executive functions. Child Neuropsychol, 6:235-238.
20. Gresham F. M and Elliott S. N. (1990). Social Skills Rating System Manual. Circle Pines, MN: American Guidance Services. Inc. Publishers building.
21. Hakimirad Elham, Kashani-Vahid Leila, Hosseini Marzieh Sadat & Moradi Hadi (2019) in IEEE Conference on International Serious Games Symposium (ISGS), Tehran, Iran, 26-26 Dec. 2019.
22. Heaton RK (1981) Wisconsin card sorting test manual. Psychological Assessment Resource Inc, Odessa.
23. Kulman, I., Stoner, G., Ruffolo, L., Marshall, S., Slater, J., Dyl, A., and Cheng, A. (2010). Teaching executive functions, self-management, and values through popular video-game play. In Schrier, K. and Gibson, D. (Eds), Designing games for ethics: Models, techniques and frameworks. Hershey PA: IGI Global.
24. Langner R., Eickhoff S.B. & Bilalić M. (2019). A network view on brain regions involved in experts' object and pattern recognition: Implications for the neural mechanisms of skilled visual perception. Brain Cogn., 131:74-86.
25. Lansbergen M. M., Arns M., Van Dongen-Boomsma M., D. & Buitelaar J. K. (2011). The increase in theta/beta ratio on resting-state eeg in boys with attention-deficit/hyperactivity disorder is mediated by slow alpha peak frequency. Progress in Neuro-Psychopharmacology and Biological Psychiatry, vol. 35, no. 1, pp. 47-52.
26. Lin HY, Chou TJ (2010) The development of attention test for elementary school children. Bull Spec Educ 35(2):29-53.
27. Marzocchi G.M., Re A.M., Cornoldi C. (2010). BIA Batteria Italiana per l-ADHID per la Valutazione dei Bambini con Deficit di Attenzione-Iperattività. Con DVD e CD-ROM, Edizioni Erickson: Trento, Italy.
28. Maslow, A. H. (1987). Motivation and personality (3rd ed.). Boston, MA: Addison-Wesley.
29. Maslow, A. H. (1943). A theory of human motivation. Psychological Review, 50, 370-396.
30. Mungkhetklang C, Crewther SG, Bavin EL et al (2016) Comparison of measures of ability in adolescents with intellectual disability. Front Psychol 7:683.
31. Pelham W.E., Gnagny E.M., Greenslade K.E., Milich R. (1992). Teacher ratings of DSM-III-R symptoms for disruptive behaviour disorder. J Am Acad Child Adolesc Psychiatry, 31: 210-218.
32. Prins Pier J.M., Ten Brink, Esther, Dovis Sebastiaan, Ponsioen Albert, Geurts Hilde M., Vries Marieke, and Van der Oord Saskia (2013). "Braingame Brian": Toward an Executive Function Training Program with Game Elements for Children with ADHD and Cognitive Control Problems. GAMES FOR HEALTH JOURNAL: Research, Development, and Clinical Applications, Volume 2, Number 1, DOI: 10.1089/g4h.2013.0004
33. Programa de Entrenamiento de Instrucciones Escritas Nivel Medio, 2013. Available online: http://www.orientacionandujar.es/2013/05/23/programa-de-entrenamiento-de-intruccionesescritasnivel-medio/ (accessed on 20 May 2014).
34. Song L., Peng Q., Liu S. & Wang J. (2020). Changed hub and functional connectivity patterns of the posterior fusiform gyrus in chess experts. Brain Imaging Behav., 14(3):797805.
35. Swanson JM, Nolan W, Pelham WE (1992) School-based assessment and interventions for ADD students. K. C. Publishing, Irvine

36. Thurstone L. & Yela (2012). CARAS-R-Percepción de diferencias [FACES-Perception of differences]. Madrid: TEA Ediciones.
37. Van der Oord S., Ponsioen A.J.G.B., Geurts H.M., et al. (2012) A pilot study of the efficacy of a computerized EF remediation training with game elements for children with ADHD in an outpatient setting: Outcome on parent-and teacher-rated executive functioning and ADHD behavior. J Atten Disord, [Epub ahead of print]. DOI: 10.1177/ 1087054712453167.
38. Wrońska Natalia, Zapirain Begoña García, Mendez-Zorrilla Amaia (2015). An iPad-Based Tool for Improving the Skills of Children with Attention Deficit Disorder. International Journal of Environmental Research and Public Health 12(6):6261-6280, DOI: 10.3390/ijerph120606261
39. Yang-Kun Ou, Yu-Lin Wang, Hua-Cheng Chang, Shih-Yin Yen, Yu-Hua Zheng, Bih-O. Lee (2020). Development of virtual reality rehabilitation games for children with attention-deficit hyperactivity disorder. Journal of Ambient Intelligence and Humanized Computing, 11:5713-5720, https://doi.org/10.1007/s12652-020-01945-9
40. Yanguas Rodrigo, M., Moratinos Martin, M., Tardon Gonzalez, C., Fontecilla Blasco, H. (2021). A Virtual Reality Game (The Secret Trail of Moon) for Treating Attention-Deficit/Hyperactivity Disorder: Development and Usability Study. JMIR Serious Games; 9(3):e26824, DOI: 10.2196/26824
41. Stavridou Th., Driga, A.M., Drigas, A.S., Blood Markers in Detection of Autism,International Journal of Recent Contributions from Engineering Science & IT (iJES) 9(2):79-86. 2021.
42. Zavitsanou, A., & Drigas, A. (2021). Nutrition in mental and physical health. Technium Soc. Sci. J., 23, 67.
43. Driga, A.M., Drigas, A.S. "Climate Change 101: How Everyday Activities Contribute to the Ever-Growing Issue", International Journal of Recent Contributions from Engineering, Science & IT, vol. 7(1), pp. 22-31, 2019. https://doi.org/10.3991/ijes.v7i1.10031
44. Driga, A.M., and Drigas, A.S. "ADHD in the Early Years: Pre-Natal and Early Causes and Alternative Ways of Dealing." International Journal of Online and Biomedical Engineering (IJOE), vol. 15, no. 13, 2019, p. 95., DOI: 10.3991/ijoe.v15i13.11203
45. Vlachou J. and Drigas, A. S., "Mobile technology for students and adults with Autistic Spectrum Disorders (ASD)," International Journal of Interactive Mobile Technologies, vol. 11(1), pp. 4-17, 2017
46. Papoutsi C., Drigas, A. S., and C. Skianis, "Mobile Applications to Improve Emotional Intelligence in Autism – A Review," Int. J. Interact. Mob. Technol. (iJIM); Vol 12, No 6, 2018.
47. Karabatzaki, Z., Stathopoulou, A., Kokkalia, G., Dimitriou, E., Loukeri, P., Economou A., & Drigas, A. (2018). Mobile Application Tools for Students in Secondary Education. An Evaluation Study. International Journal of Interactive Mobile Technologies (iJIM), 12(2), 142-161.
48. Stathopoulou A., Loukeris D., Karabatzaki Z., Politi E., Salapata Y., and Drigas, A. S., "Evaluation of Mobile Apps Effectiveness in Children with Autism Social Training via Digital Social Stories," Int. J. Interact. Mob. Technol. (iJIM); Vol 14, No 03, 2020.
49. Stathopoulou, et all Mobile assessment procedures for mental health and literacy skills in education. International Journal of Interactive Mobile Technologies, 12(3), 21-37, 2018.
50. Drigas, A., Kokkalia, G. & Lytras, M. D. (2015). Mobile and Multimedia Learning in Preschool Education. J. Mobile Multimedia, 11(1/2), 119-133.
51. Stathopoulou, A., Karabatzaki, Z., Kokkalia, G., Dimitriou, E., Loukeri, P.I., Economou, A., and Drigas, A. (2018). Mobile assessment procedures for mental health and literacy skills in education. International Journal of Interactive Mobile Technologies (iJIM), 12(3):21-37. https://doi.org/10.3991/ijim.v12i3.8038
52. G Kokkalia, AS Drigas, A Economou 2016 Mobile learning for preschool education. International Journal of Interactive Mobile Technologies 10 (4).
53. A Stathopoulou, Z Karabatzaki, D Tsiros, S Katsantoni, A Drigas 2022 Mobile apps the educational solution for autistic students in secondary education International Association of Online Engineering.
54. Drigas, A. S., & Ioannidou, R. E. (2011, September). ICTs in special education: A review. In World Summit on Knowledge Society (pp. 357-364). Springer, Berlin, Heidelberg.
55. Drigas, A. S., J.Vrettaros, L.Stavrou, D.Kouremenos, E-learning Environment for Deaf people in the E-Commerce and New Technologies Sector, WSEAS Transactions on Information Science and Applications, Issue 5, Volume 1, November 2004.
56. Drigas, A.S., Vrettaros, J. and Kouremenos, D. (2004a) 'Teleeducation and e-learning services for teaching English as a second language to deaf people, whose first language is the sign language', WSEAS Transactions on Information Science and Applications, Vol. 1, No. 3, pp. 834-842.
57. Drigas, A., Koukianakis, L., Papagerasimou, Y., Towards an ICT-based psychology: Epsychology, Computers in Human Behavior, 2011, 27:1416-1423. https://doi.org/10.1016/j.chb.2010.07.045
58. Charami, F., & Drigas, A. (2014). ICTs in English Learning and Teaching. International Journal of Engineering and Science. Vol. 2(4):4-10. DOI: 10.3991/ijes.v2i4.4016
59. Drigas A.S., Kouremenos D (2005) An e-learning system for the deaf people. In: WSEAS transaction on advances in engineering education, vol 2, issue 1, pp. 20-24.
60. Drigas A., Pappas M, and Lytras M., "Emerging technologies for ict based education for dyscalculia: Implications for computer engineering education," International Journal of Engineering Education, vol. 32, no. 4, pp. 1604-1610, 2016.
61. Drigas, A. & Kokkalia, G. 2017. ICTs and Special Education in Kindergarten. International Journal of Emerging Technologies in Learning 9 (4), 35-42.
62. Drigas A., and Koukianakis L., A Modular Environment for E-learning and E-psychology Applications, WSEAS Transactions on Information Science and Application, Vol. 3, 2004, pp. 2062-2067.
63. Drigas, A., Leliopoulos, P.: Business to consumer (B2C) e-commerce decade evolution. Int. J. Knowl. Soc. Res. (IJKSR) 4(4), 1-10 (2013)
64. Pappas M, Drigas A, Papagerasimou Y, Dimitriou H, Katsanou N, Papakonstantinou S, et al. Female Entrepreneurship and Employability in the Digital Era: The Case of Greece. Journal of Open Innovation: Technology, Market, and Complexity. 2018; 4(2): 1.
65. Papanastasiou G., Drigas, A. S., Skianis Ch., M. Lytras & E. Papanastasiou, "Patient-Centric ICTs based Healthcare for students with learning, physical and/or sensory disabilities," Telemat Inform, vol. 35, no. 4, pp. 654-664, 2018. https://doi. org/10.1016/j.tele.2017.09.002
66. Drigas, A., & Kontopoulou, M. T. L. (2016). ICTs based Physics Learning. International Journal of Engineering Pedagogy (iJEP), 6(3), 53-59. https://doi.org/10.3991/ijep.v6i3. 5899
67. Papanastasiou, G., Drigas, A., Skianis, C., and Lytras, M. (2020).

Brain computer interface based applications for training and rehabilitation of students with neurodevelopmental disorders. A literature review. Heliyon 6:e04250. DOI: 10.1016/j.heliyon.2020.e04250
68. Drigas, A. S., John Vrettaros, and Dimitris Kouremenos, 2005. "An e-learning management system for the deaf people," AIKED '05: Proceedings of the Fourth WSEAS International Conference on Artificial Intelligence, Knowledge Engineering Data Bases, article number 28.
69. Pappas, M., Demertzi, E., Papagerasimou, Y., Koukianakis, L., Kouremenos, D., Loukidis, I. and Drigas, A. 2018. E-Learning for deaf adults from a user-centered perspective. Education Sciences 8(206): 3-15.
70. Marios A. Pappas, Eleftheria Demertzi, Yannis Papagerasimou, Lefteris Koukianakis, Nikitas Voukelatos, and Drigas, A. S., 2019. Cognitive Based E-Learning Design for Older Adults. Social Sciences 8, 1 (Jan. 2019), 6. https://doi.org/10.3390/socsci801000
71. Drigas, A. S., Leyteris Koukianakis: Government online: An e-government platform to improve public administration operations and services delivery to the citizen. WSKS (1), volume 5736 de Lecture Notes in Computer Science, 523-532. Springer, 2009.
72. Theodorou, P.; Drigas, A. ICTs and Music in Generic Learning Disabilities. Int. J. Emerg. Technol. Learn. 2017, 12, 101-110.
73. Pappas, M.A., & Drigas, A.S. (2015). ICT based screening tools and etiology of dyscalculia. International Journal of Engineering Pedagogy, 3, 61-66.
74. Drigas, A., & Kostas, I. (2014). On Line and other ICTs Applications for teaching math in Special Education. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 2(4), pp. 46. http://dx.doi.org/10.3991/ijes.v2i4.4204
75. Alexopoulou, A, Batsou, A, Drigas, A. (2019). Resilience and academic underachievement in gifted students: causes, consequences and strategic methods of prevention and intervention. International Journal of Online and Biomedical Engineering (iJOE), vol. 15, no. 14, pp. 78.
76. Pappas, M. A., & Drigas, A. S. (2015). ICT Based Screening Tools and Etiology of Dyscalculia. International Journal of Engineering Pedagogy, 5(3).
77. Drigas, A. & Ioannidou, R. E. (2013). Special education and ICT's. International Journal of Emerging Technologies in Learning 8(2), 41-47.
78. Drigas, A., & Papanastasiou, G. (2014). Interactive White Boards in Preschool and Primary Education. International Journal of Online and Biomedical Engineering (iJOE), 10(4), 46-51. https://doi.org/10.3991/ijoe.v10i4.3754
79. Drigas, A. S. and Politi-Georgousi, S. (2019). Icts as a distinct detection approach for dyslexia screening: A contemporary view. International Journal of Online and Biomedical Engineering (iJOE), 15(13):46-60.
80. Lizeta N. Bakola, Nikolaos D. Rizos, Drigas, A. S., "ICTs for Emotional and Social Skills Development for Children with ADHD and ASD Co-existence"International Journal of Emerging Technologies in Learning (iJET), https://doi.org/10.3991/ijet.v14i05.9430
81. Kontostavlou, E.Z., & Drigas, A.S. (2019). The Use of Information and Communications Technology (ICT) in Gifted Students. International Journal of Recent Contributions from Engineering, Science and IT, 7(2), 60-67. DOI: 10.3991/ijes.v7i2.10815
82. Drigas, A. S., and Vlachou J. A., "Information and communication technologies (ICTs) and autistic spectrum disorders (ASD)," Int. J. Recent Contrib. Eng. Sci. IT (iJES), vol. 4, no. 1, p. 4, 2016. https://doi.org/10.3991/ijes.v4i1.5352
83. Drigas, A. S., Koukianakis, L., Papagerasimou, Y. (2006) "An elearning environment for nontraditional students with sight disabilities.", Frontiers in Education Conference, 36th Annual. IEEE, pp. 23-27.
84. Drigas A., and Koukianakis L. An open distance learning e-system to support SMEs e-enterprising. In proceeding of 5th WSEAS Internationalconference on Artificial intelligence, knowledge engineering, data bases (AIKED 2006). Spain.
85. A.S. Drigas, L.G. Koukianakis, Y.V. Papagerasimou 2005. A system for e-inclusion for individuals with sight disabilities Wseas transactions on circuits and systems 4 (11), 1776-1780.
86. Drigas, A. S., Rodi-Eleni Ioannidou, A Review on Artificial Intelligence in Special Education, Information Systems, Elearning, and Knowledge Management Research Communications in Computer and Information Science Volume 278, pp. 385-391, 2013 http://dx.doi.org/10.1007/978-3-642-35879-1_46
87. Drigas, A., Vrettaros, J.: An Intelligent Tool for Building e-Learning Contend-Material Using Natural Language in Digital Libraries. WSEAS Transactions on Information Science and Applications 5(1) (2004) 1197-1205.
88. Drigas, A.S., Vrettaros, J., Koukianakis, L.G. and Glentzes, J.G. (2005). A Virtual Lab and e-learning system for renewable energy sources. Int. Conf. on Educational Tech.
89. Drigas AS, Argyri K, Vrettaros J (2009). Decade review (1999-2009): artificial intelligence techniques in student modeling. In: World Summit on Knowledge Society. Springer, pp. 552-564.
90. Vrettaros, J., Tagoulis, A., Giannopoulou, N., & Drigas, A. (2009). An empirical study on the use of Web 2.0 by Greek adult instructors in educational procedures. World Summit on Knowledge System (WSKS), 49, 164-170. http://dx.doi.org/10.1007/978-3-642-04757-2_18
91. Drigas, A., Dourou, A. (2013). A Review on ICTs, E-Learning and Artificial Intelligence for Dyslexic's Assistance. iJet, 8(4), 63-67.
92. Anagnostopoulou, P., Alexandropoulou, V., Lorentzou, G., Lykothanasi, A., Ntaountaki, P., & Drigas, A. (2020). Artificial intelligence in autism assessment. International Journal of Emerging Technologies in Learning, 15(6), 95-107. https://doi.org/10.3991/ijet.v15i06.11231
93. Pappas, M., & Drigas, A. (2016). Incorporation of artificial intelligence tutoring techniques in mathematics. International Journal of Engineering Pedagogy, 6(4), 12-16. https://doi.org/10.3991/ijep.v6i4.6063
94. N Lytra, A Drigas 2021STEAM education-metacognition–Specific Learning Disabilities Scientific Electronic Archives 14 (10)
95. E. Mitsea, N. Lytra, A. Akrivopoulou, A. Drigas 2020. Metacognition, Mindfulness and Robots for Autism Inclusion. Int. J. Recent Contributions Eng. Sci. IT 8 (2), 4-20
96. E. Chaidi, C Kefalis, Y. Papagerasimou, A. Drigas 2021. Educational robotics in Primary Education. A case in Greece. Research, Society and Development 10 (9), e17110916371-e17110916371
97. I. Chaidi, A. Drigas 2022. Digital games & special education Technium Social Sciences Journal 34, 214-236.
98. Papanastasiou, G. P., Drigas, A. S., & Skianis, C. (2017). Serious games in preschool and primary education: Benefits and impacts on curriculum course syllabus. International Journal of

Emerging Technologies in Learning, 12(1), 44-56. https://doi.org/10.3991/ijet.v12i01.6065
99. Kokkalia, G., Drigas, A., Economou, A., Roussos, P., & Choli, S. (2017). The use of serious games in preschool education. International Journal of Emerging Technologies in Learning, 12(11), 15-27. https://doi.org/10.3991/ijet.v12i11.6991
100. Drigas, A. S., and Pappas M.A. "On line and other Game-Based Learning for Mathematics." International Journal of Online Engineering (iJOE) 11.4, 62-67, 2015 https://doi.org/10.3991/ijoe.v11i4.4742
101. Papanastasiou, G., Drigas, A., Skianis, C., & Lytras, M. D. (2017). Serious games in K-12 education: Benefits and impacts on students with attention, memory and developmental disabilities. Program, 51(4), 424-440. https://doi.org/10.1108/prog-02-2016-0020
102. Drigas, A. S., & Kokkalia, G. K. (2014). ICTs in Kindergarten. International Journal of Emerging Technologies in Learning, 9(2). https://doi.org/10.3991/ijet.v9i2.3278
103. A. Doulou, A. Drigas 2022. Electronic, VR & Augmented Reality Games for Intervention in ADHD Technium Social Sciences Journal
104. Kokkalia, G., Drigas, A., & Economou, A. (2016). The role of games in special preschool education. International Journal of Emerging Technologies in Learning (iJET), 11(12), 30-35.
105. Drigas, A., & Mitsea, E. (2020). The 8 Pillars of Metacognition. International Journal of Emerging Technologies in Learning (iJET), 15(21), 162-178. https://doi.org/10.3991/ijet. v15i21.14907
106. Drigas, A., & Papoutsi, C. (2019). Emotional intelligence as an important asset for HR in organizations: Leaders and employees. International Journal of Advanced Corporate Learning, 12(1). https://doi.org/10.3991/ijac.v12i1.9637
107. Drigas, A. S., and M. Pappas. "The Consciousness-Intelligence-Knowledge Pyramid: An 8x8 Layer Model," International Journal of Recent Contributions from Engineering, Science & IT (iJES), vol. 5, no.3, pp. 14-25, 2017. https://doi.org/10.3991/ijes.v5i3.7680
108. Drigas, A., Karyotaki, M. (2017). Attentional control and other executive functions. Int J Emerg Technol Learn iJET 12(03):219-233.Drigas A, Karyotaki M 2014. Learning Tools and Application for Cognitive Improvement. International Journal of Engineering Pedagogy, 4(3): 71-77. From (Retrieved on 13 May 2016)
109. Drigas, A., & Mitsea, E. (2021). 8 Pillars X 8 Layers Model of Metacognition: Educational Strategies, Exercises &Trainings. International Journal of Online & Biomedical Engineering, 17(8). https://doi.org/10.3991/ijoe.v17i08.23563
110. Drigas, A., Papoutsi, C. (2020). The Need for Emotional Intelligence Training Education in Critical and Stressful Situations: The Case of COVID-19. Int. J. Recent Contrib. Eng. Sci. IT 8 (3), 20-35. 10.3991/ijes.v8i3.17235
111. Drigas, A., & Mitsea, E. (2020). The Triangle of Spiritual Intelligence, Metacognition and Consciousness. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 8(1), 4-23. https://doi.org/10.3991/ijes.v8i1.12503
112. Kokkalia, G., Drigas, A., Economou, A., & Roussos, P. (2019). School readiness from kindergarten to primary school. International Journal of Emerging Technologies in Learning, 14(11), 4-18.
113. 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
114. Pappas, M., Drigas, A. Computerized Training for Neuroplasticity and Cognitive Improvement. International Journal of Engineering Pedagogy. 2019;.(4):50-62
115. Papoutsi, C. and Drigas, A. (2017) Empathy and Mobile Applications. International Journal of Interactive Mobile Technologies 11. 57. https://doi.org/10.3991/ijim.v11i3.6385
116. Papoutsi, C. & Drigas, A. (2016). Games for Empathy for Social Impact. International Journal of Engineering Pedagogy 6(4), 36-40.
117. Karyotaki, M., & Drigas, A. (2015). Online and other ICT Applications for Cognitive Training and Assessment. International Journal of Online and Biomedical Engineering. 11(2), 36-42.
118. Papoutsi, C., Drigas, A., & Skianis, C. (2019). Emotional intelligence as an important asset for HR in organizations: Attitudes and working variables. International Journal of Advanced Corporate Learning, 12(2), 21-35. https://doi.org/10.3991/ijac.v12i2.9620
119. Chaidi, I. and Drigas, A. S., "Autism, Expression, and Understanding of Emotions: Literature Review," Int. J. Online Biomed. Eng., vol. 16, no. 02, pp. 94-111, 2020. https://doi.org/10.3991/ijoe.v16i02.11991
120. Drigas, A. S., & Karyotaki, M. (2019). A Layered Model of Human Consciousness. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 7(3), 41- 50. https://doi.org/10.3991/ijes.v7i3.11117
121. Drigas, A. S., Karyotaki, M., & Skianis, C. (2018). An Integrated Approach to Neuro-development, Neuroplasticity and Cognitive Improvement. International Journal of Recent Contributions from Engineering, Science & IT (iJES), 6(3), 4-18.
122. Karyotaki M. and Drigas, A. S., "Latest trends in problem solving assessment," International Journal of Recent contributions from Engineering, Science & IT (iJES), vol. 4, no. 2, 2016. [Online serial]. Available: https://online-journals.org/index.php/i-jes/article/view/5800/. [Accessed Aug. 21, 2019]. https://doi.org/10.3991/ijes.v4i2.5800
123. Mitsea E., Drigas, A. S., and Mantas P., "Soft Skills & Metacognition as Inclusion Amplifiers in the 21st Century," Int. J. Online Biomed. Eng. IJOE, vol. 17, no. 04, Art. no. 04, Apr. 2021. https://doi.org/10.3991/ijoe.v17i04.20567
124. Angelopoulou, E. Drigas, A. (2021). Working Memory, Attention and their Relationship: A theoretical Overview. Research. Society and Development,10(5), 1-8. https://doi.org/10.33448/rsd-v10i5.15288
125. Tourimpampa, A., Drigas, A., Economou, A., & Roussos, P. (2018). Perception and text comprehension. It'sa matter of perception! International Journal of Emerging Technologies in Learning (iJET). Retrieved from https://online-journals.org/index.php/ijet/article/view/7909/5051
126. A. Drigas, E. Mitsea 2020. A metacognition based 8 pillars mindfulness model and training strategies. International Journal of Recent Contributions from Engineering, Science & IT …
127. C. Papoutsi, A. Drigas, C. Skianis 2021. Virtual and augmented reality for developing emotional intelligence skills Int. J. Recent Contrib. Eng. Sci. IT (IJES) 9 (3), 35-53.
128. S. Kapsi, S. Katsantoni, A. Drigas 2020. The Role of Sleep and Impact on Brain and Learning. Int. J. Recent Contributions Eng. Sci. IT 8 (3), 59-68.
129. A. Drigas, E Mitsea, C. Skianis 2021. The Role of Clinical Hypnosis and VR in Special Education International Journal of Recent Contributions from Engineering Science & IT …

130. V. Galitskaya, A. Drigas 2021. The importance of working memory in children with Dyscalculia and Ageometria Scientific Electronic Archives 14 (10).
131. I. Chaidi, A. Drigas 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)…
132. A. Drigas, E. Mitsea 2021. Neuro-Linguistic Programming & VR via the 8 Pillars of Metacognition X 8 Layers of Consciousness X 8 Intelligences Technium Soc. Sci. J. 26, 159.
133. A. Drigas, E. Mitsea 2022. Conscious Breathing: a Powerful Tool for Physical & Neuropsychological Regulation. The role of Mobile Apps Technium Social Sciences Journal.
134. A. Drigas, E. Mitsea, 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 18 (1).
135. A. Drigas, M. Karyotaki 2019. Attention and its Role: Theories and Models. International Journal of Emerging Technologies in Learning 14 (12), 169-182.
136. A. Drigas, M. Karyotaki 2019. Executive Functioning and Problem Solving: A Bidirectional Relation. International Journal of Engineering Pedagogy (iJEP) 9 (3).
137. V. Bamicha, A. Drigas 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 … Technium Social Sciences Journal 33, 42-72.
138. A. Drigas, E. Mitsea, C. Skianis 2022. Neuro-Linguistic Programming, Positive Psychology & VR in Special Education. Scientific Electronic Archives 15 (1).