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ICTs and Speed Learning in Special Education: High-Consciousness Training Strategies for High-Capacity Learners through Metacognition Lens

Eleni Mitsea[1,2], Athanasios Drigas[1], Charalampos Skianis[2]

[1]N.C.S.R."Demokritos"IIT- Net Media Lab & Mind - Brain R&D, Athens, Greece,
[2]University of the Aegean Information and Communication Systems Engineering Department, Samos, Greece

e.mitsea@gmail.com, dr@iit.demokritos.gr, cskianis@aegean.gr

Abstract. Education in the 21st century is called upon to prepare students with disabilities to enter a high-consciousness society where people can learn, think and react fast. The current review paper aims at investigating the role of fast learning in special education. We trace the essential indicators of speed learning with a special focus on those factors that are most relevant to learning disabilities. Afterward, we present evidence-based training techniques and strategies that rapidly rewire the brain and speed up learning. In addition, we examine the role of ICTs as essential training tools in speed learning. Finally, we discuss the role of metacognition in training fast and conscious learners. The results of this review showed that speed learning training techniques improve all those factors that accelerate learning such as spatial attention, visual span, processing speed, speed reaction, executive functions, metacognition, and consciousness. Most important, fast learning strategies meliorate control processes and spatial intelligence which is extremely fast and powerful. Metacognition provides learners with all those meta-abilites needed to enter a state of peak performance. This study also points to the option of including speed training strategies in schools to create inclusive learning environments and help students with or without disabilities to transcend their limitations and become conscious and high-capacity learners.

Keywords. High-consciousness training techniques, fast brain-rewiring techniques, high-capacity learners, peak states of learning, meta-abilities, effortless learning, attentional stability, self-observation, visuospatial abilities, silence practices, mnemonics, fast calculation, vision training, mental imagery training, speed reading & listening, hypno-training, video games, virtual reality, software

1. Introduction

Experts suggest that if one wants to learn faster, he/she has to think with a beginner's mind or as a child. Indeed, a child's brain can master anything faster. Research has already revealed that children have the potential to learn extremely fast even faster than adults. For instance, children can learn causal relationships more quickly than adults and make far-reaching causal inferences from what they observe. They also are more likely than adults to generalize the unusual conjunctive relationship, because they are less biased by prior assumptions and pay more attention to current evidence (Lukas et al., 2014).

Other studies have shown that children can learn languages more rapidly and effortlessly. Researchers support the idea that it is a matter of neuroplasticity and brain connectivity. According to Olulade et al. (2020), children use both sides of their brain to understand language. However, as they approach adulthood, the brain uses only the left side for this task. Other researchers have concluded that language acquisition is second nature to children because of the dominance of brain areas that control unconscious learning (Thompson et al., 2000).

However, the ability to learn fast declines due to normal aging or other conditions related to learning and other disabilities (Murman, 2017; Manning et al., 2021; Bolfer et al., 2010; Oakhill, Hartt and Samols, 2005). The most significant changes include performance on cognitive tasks that require one to quickly process or transform information to make a decision, including measures of speed of processing, working memory, and executive cognitive function. These declines are due to structural and functional changes in the brain including alterations in neuronal structure, loss of synapses, and dysfunction of neuronal networks with many persons developing cognitive impairments severe enough to impair their everyday functional abilities. (Murman, 2017).

Recent studies reveal that people can reverse this declining tendency and accelerate their learning rate within hours. Studies, for instance, have shown that learning a new skill can rewire the brain just in a few hours. When one is actively learning, the brain processes information and makes new connections, growing and strengthening the synapses that connect neurons to their neighbors. This rewiring process can happen very quickly – within hours of learning a skill. And in some parts of the brain, notably the hippocampus, the brain grows new brain cells as it learns (Xu et al., 2009). Overcoming learning disorders is now becoming a realistic goal for neuroscientists and therapists, who demonstrate significant structural remodeling of the human brain in people with learning disabilities after only a few weeks of daily training (Habib, 2003).

Studies have also shown that although most people are born geniuses, the education system dumbs them down (Land and Jarman, 1993). In a longitudinal test of creative potential, a key element in fast learning, a NASA study found that of 1,600 children between 4- and 5-year-olds, 98 percent scored at "creative genius" level. Five years later, only 30 percent of the same group of children scored at the same level, and again, five years later, only 12 percent. When the same test was administered to adults, it was found that only two percent scored at this genius level.

Over the last decades, the tremendous development of Information and Communication Technologies are changing the world and the way education is conducted. ICT is considered a means to bridge the gap between different groups of people such as the group of people with special educational needs (Drigas & Ioannidou, 2011). Nowadays, researchers except for skills training they have also turned their attention to the role of ICTs in developing super-fast learners' abilities taking into account various theories, models and techniques (Achtman et al., 2008; Safaryan & Mehta, 2021, Drigas and Mitsea, 2021).

However, education in the 21st century is called upon to prepare students, especially those with disabilities to enter a high-consciousness society where people can learn, think and react fast and accurately. For that reason, the current review paper aims at investigating the role of fast learning in special education, tracing the indicators of speed learning, presenting evidence-based training techniques and strategies that speed up learning and examining the role of ICTs as essential training tools in speed learning.

2. Method

The purpose of the current study was to investigate the role of fast learning techniques and ICTs in special education. The method used to write the article was the bibliographic review method. We searched articles through search engines: Google Scholar, Mendeley, PubMed and ResearchGate. The keywords we used to search for articles were: speed learning, fast reading, fast listening, mnemonics, fast calculation, eye training techniques, speed learning technologies, virtual reality, video games, software. One of the limitations of the research was the limited amount of research studies as regards speed reading and speed listening technologies.

3. Results

3.1 Indicators of Speed Learning in Special Education

Why are children like a sponge for learning, but for an adult it's hard to learn at the same rate? To reach the maximum speed of learning, the students, as well as the educators, need to be aware and carefully evaluate the basic factors involved in the acceleration of learning.

Spatial Attention plays a significant role in speed learning as it helps one to constantly monitor and sample his/her environment**.** Classic studies of spatial attention assumed that its effects were continuous over time. However, recent studies have revealed that spatial attention is extremely fluid as it switches at least every 250 milliseconds (Fiebelkorn, Pinsk and Kastner, 2018). However, during this time, the subjects can identify several visual objects considering that it takes 13 milliseconds to see an image (Potter et al., 2014).

Visual/Perceptual Span refers to the amount of visual information that is processed in a given fixation. However, one of the robust findings in research is that the region from which readers obtain information is quite limited (Rayner, 1998). According to Rayner et al. (2010), fast readers (reading at speed 300 wpm) had a larger perceptual span than did slow readers. Kwon, Legge and Dubbels (2007) found that developmental changes in the size of the visual span in school-age children are closely associated with changes in visual processing and reading speed. Belanger et al. (2018) compared the perceptual span of young deaf readers and young hearing children (age 7-15). Deaf readers were found to have a wider perceptual span suggesting the ability of a strong and early reorganization of visual attention in the deaf.

Processing Speed is a general characteristic that determines capacity because processing (encoding, transforming, retrieving) information within working memory takes time. Significant intercorrelations exist between measures of short-term memory capacity, working memory capacity, processing speed, and fluid intelligence. The faster the rate of processing, the greater the amount of information that can be processed in one unit of time. Thus, an individual with above-average working memory capacity may functionally have a greater learning capacity than others (Conway et. al, 2002). Memisevic et al. (2020) examined the predictors of reading speed and comprehension using a sample of 168 third-grade students attending regular schools. It was found that the ideal combination of speed and comprehension requires a powerful working memory and processing speed.

Reaction time refers to the minimal time needed to respond to a stimulus. It is considered a basic measure of processing speed. Recent studies have shown significant correlations between reaction time, processing speed and fluid intelligence (Deary, Der, Ford, 2001). According to Bolfer et al. (2010) children with attention deficit hyperactivity disorder show increased reaction time variabilities, indicating problems with their attentional system, inadequate capacity of perceptual input processes and motor output processes.

Visual processing speed: According to Potter et al. (2014) the time it takes for the human eye to identify an image is 13 milliseconds, 60,000-times faster than text. Lobier et al. (2013) investigated the role of visual processing speed in reading speed. Indeed, they found that visual processing speed predicts speed reading. They also outlined that the link between visual processing and reading speed is the visual attention span. Manning et al. (2021) confirmed that children with dyslexia are slower to process visual information. Children with dyslexia took longer to gather the visual evidence, and were less accurate, than their typically developing peers.

Cognitive load: Cognitive load refers to the amount of information that working memory can hold at one time. Cognitive load depends on: (a) the distracting content occupying working memory, (b) the mental effort required for the task itself, and (c) the storage of short-term memories into long-term memories (Wong et al., 2009). Cognitive overload reduces the speed of learning and is associated with various learning and problem-solving difficulties (Sweller, 1988).

Executive functions refer to a family of mental processes needed to control learning. Core executive functions are inhibition, attentional control, working memory, and cognitive flexibility (including creatively thinking, seeing anything from different perspectives, and quickly and flexibly adapting to changed circumstances) (Diamond, 2013).

Metacognition refers to a set of consciousness-raising skills and strategies through which individuals direct their actions towards optimal performance. Metacognition involves individuals' ability to observe, regulate and adapt their internal cognitive processes, recognize the difference between functional and dysfunctional states of mind and consciously choose those states that awaken the full range of their abilities and identity (Drigas & Mitsea, 2020). According to the study conducted by Oakhill, Hartt and Samols (2005), slow readers with comprehension difficulties showed working memory problems and most important comprehension monitoring problems. In other words, they had difficulties in self-monitoring their understanding.

State of Consciousness: Recent studies have concluded that learning is consciousness-state dependent (Drigas and Pappas, 2017; Drigas and Mitsea, 2021). Drigas and Mitsea (2021) added the idea that consciousness consists of ever-higher states of attention and observation and a set of meta-abilities. Other studies confirm that effective rapid learning is inevitable without consciousness. (Travers, Frith & Shea, 2018).

Neuroplasticity & Brain Connectivity: Seidlitz et al. (2018) found a strong correlation between how well connected an individual's brain regions are and their intelligence. In other words, the stronger the connections, the better the brain is at processing information. However, recent studies reveal reduced brain connectivity between people with severe learning and other disabilities (Siugzdaite et al., 2020).

Physiological balance: Drigas and Mitsea (2021) support the idea that physiological homeostasis brings students to the optimal state of arousal that predicts conscious and rapid learning. According to their study, optimal learning is the outcome of at least three vectors that create a triangular relationship, namely metacognition, sympathetic and parasympathetic nervous system and hormonal balance.

Whole-brain synchronization: Rapid learning can happen before anatomical changes in brain connections take place. According to Antzoulatos and Miller (2014), rapid learning occurs every time the brain waves between distinct brain regions such as the prefrontal cortex and striatum begin to synchronize at the same frequency.

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Curiosity & Motivation: Motivation and curiosity increase the speed of effort that a learner is putting in to achieve a goal. Motivation enhances cognitive processing, increases the initiation and persistence of learning activities. Most important, motivation impels people to set higher goals, cultivates the burning desire to maximize learning, and determines whether an ability would remain dormant or be pushed into the foreground. According to Maslow, beyond motivations lie conscious or unconscious needs that people desire to satisfy. When students' basic needs are being met, students maximize the speed of learning. For instance, when students satisfy their needs of physiological balance, safety, love and belonging, esteem, and self-actualization, they approach their full potential for learning (Maslow, 1946, 1987; Filgona et al., 2020).

Subvocalization/inner monologue means pronouncing -even unconsciously- words in our head while learning. Subvocalization requires redundant cognitive resources and consequently, it slows down the speed of reading and makes comprehension an extremely effortful process (Ferguson, Nielsen & Anderson, 2014).

3.2 High-Consciousness Training Techniques & Strategies in Special Education

Speed Reading Techniques

Speed reading is a type of skilled reading in which readers attempt to increase their rate of reading without commensurate loss in comprehension (Buchweitz et al., 2014). Speed reading programs deal with the: a. limited perceptual span, b. low perceptual reaction time, c. vocalization, d. faulty eye movements, e. regression, f. faulty habits of attention and concentration, g. lack of practice in reading, h. fear of losing comprehension, i. habitual slow reading, j. poor evaluation of which aspects are important and which are unimportant, k. the effort to remember everything rather than to remember selectively (Rayner et al., 2016; Yunus, 2016).

Miyata et al. (2012) examined the effectiveness of the Park-Sasaki method in reading speed, sentence comprehension and eye movements while reading short novels. Park-Sasaki method combines visual training with a relaxed and concentrated state of mind, as in meditation. The results revealed significant correlations between reading speed, comprehension scores and eye-movement measures. It was observed that speed reading was not only associated with shorter fixation times and fewer regressive saccades but also with larger horizontal saccadic movements. Most important, speed reading was associated with a higher state of mindfulness.

Buchweitz et al. (2014) investigated how speed reading and listening modulate brain activation and comprehension. Text and speech were presented at normal and fast presentation rates. Specifically, the students were instructed to read (experiment 1) and listen to (experiment 2) each passage carefully and to respond with a button-press to a visually presented true-or-false comprehension probe that followed each passage. The results showed that speed presentation resulted in better activation of visual and auditory sensory regions as well as frontal areas associated with strategic and working memory. The researchers concluded that speed listening and reading with high levels of comprehension demands a powerful working memory to keep the information active.

Tran and Nation (2014) investigated the relationship between EFL reading speed, reading comprehension and memory span. Looking at the comprehension scores as well as the memory span tests, the researchers found that the speed-reading course not only improved students' memory span and reading speed without a comprehension decrease but also this improvement was transferred to other types of reading.

Fujimaki et al. (2004) used fMRI to investigate the neural mechanisms activated during a speed-reading task. The participants were four trained subjects who were capable of a technique of rapid reading and four who were untrained. The results showed that there was a decreased activation for trained subjects during extremely rapid reading in the left superior and middle temporal gyri (or near Wernicke's area and in Broca's area). These results suggest that the trained speed readers bypass phonological processes while reading.

Fergunson et al. (2014) examined whether speed reading training could reduce subvocalization, the practice of articulating words in an individual's thoughts. To investigate this hypothesis, the researchers measured resting-state functional connectivity in brain regions responsible for language processes after a course of speed reading in nine healthy adolescents. After training, it was found a significantly decreased correlation between the left Broca area and right Broka homologue and between right Broca homologue and right Wernicke hologue. These results might be consistent with a decrease in subvocalization during the resting-state paradigm.

Zhu et al. (2019) investigated the impact of perceptual learning on visual span and speed reading. They randomly assigned 26 normally sighted subjects to either an experimental group or a control group. Pre- and post-tests were administered to assess visual span and reading speed. After training, crowding was decreased while the visual span size significantly increased by 11.7 bits and reading speed followed by 50.8 %. These results suggest that perceptual learning constitutes an effective strategy for visual span expansion and speed reading.

The quantum speed reading technique is a completely new technique for reading books without looking at the pages. According to Shah, Lahiri & Sen (2017), this technique is not solely about reading. It can also be utilized in several other creative ways for problem-solving and memorizing, attention improvement, intuition development, stress reduction as well as positive thinking. Some activities which are included in quantum speed reading are the following: image training, eye training (3D vision training), side to side eye movement, up and down eye movement, moving eyes diagonally, near and far focus, visualization training, breathing training.

Eye training techniques:

Eyesight plays a significant role in the simultaneous, rapid and efficient processing of information while facilitating various cognitive processes. Eye exercises are closely related to attentional control and other neuroplasticity phenomena (Di Noto, Uta & DeSouza, 2013). Di Noto et al. (2013) examined whether short-term eye exercises improve cognitive performance on a visual and memory task. Specifically, the researchers used a rapid serial visual presentation task (RSVP) to assess any effects of an eye movement training program in visual attention, response time, accuracy, and letter identification. The final post-training RSVP assessment revealed that the experimental group (n=10) outperformed the control group (n=10) on accuracy and letter identification. The subjects improved their performance in one of the two most rapid levels of RSVP task suggesting a high level of reactivity and adaptability of the visuomotor and attentional systems. These results suggest that eye exercises may prove useful in rapidly enhancing cognitive performance on tasks related to attention and memory. In addition, they might be a valuable tool for the rehabilitation of various visual and cognitive deficits. Rawston et al. (2005) concluded that eye exercises have the significant potential to enhance a wide range of conditions including learning disabilities (i.e., attention deficit disorder, dyslexia) and visual field defects like amblyopia.

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Speed Listening Techniques

Orr, Friedman and Williams (1965) investigated whether training with the use of distortion-free, time-compressed speech could increase human capacity to receive spoken language without significant loss of comprehension. 32 college students (16 in the experimental, 16 in the control groups) received systematic practice in listening to progressively increased rates of speech from 325 to 475 words per minute. Results indicated that increases up to double the normal rate produced no significant loss in comprehension for experimental subjects. Statistically significant differences between the performance of the experimental and control groups at higher rates indicated comprehension of rapid speech to be a trainable phenomenon. The data suggested that listening to speeded speech may have a beneficial effect on reading skills.

Auditory perceptual training familiarizes the brain to listen through active engagement with sounds, whereby listeners typically learn to make perceptual distinctions between sounds presented systematically. Training on perceptual distinctions implies the individual's ability to actively listen to auditory stimuli. According to Ferguson and Henshaw (2015), auditory training can improve the speed of processing, speech perception as well as complex cognitive skills such as executive functions including working memory and attention in adverse conditions for adults with hearing loss.

Active, reflective and empathetic listening involves one's ability to place all attention and awareness at the disposal of another person, keeping eye contact, observing and listening without interrupting. Active listening is a difficult discipline. It requires intense concentration and attention to everything the person is conveying, both verbally and nonverbally. It requires the listener to empty themselves of personal concerns, distractions and preconceptions, in other words, to be open-minded. Active listeners are far from passive. Instead, they require active engagement and higher reflective skills (Robertson, 2005).

Studies have revealed that speed listening is achievable. People with peripheral vision develop fast listening skills to compensate for their visual problems. They can learn to understand spoken language at rates up to 22 syllables per second, while this rate in normal listeners is about 8 syllables per second (Dietrich, Hertrich & Ackermann, 2013).

Fast calculation techniques

In competitive examinations, students find it difficult to solve aptitude questions effectively and rapidly. Even though students can understand the problem, they are often not able to speed up the calculation process. Vedic Mathematics is an ancient Indian system of mathematical calculations or operations techniques with 16-word formulae and some sub-formulae. In the Vedic system, difficult problems or huge sums can be solved immediately (Prasad, 2016). Prasad (2016) investigated the effectiveness of the Vedic mathematic techniques on speed calculation in a group of 25 competitive examination writing students. The students were asked to solve questions with and without using Vedic techniques. The results showed that the Vedic methods significantly improved the speed of calculations under competitive examinations. Gopinath and Krishnan (2018) examined the efficacy of Vedic mathematics techniques on children with specific learning difficulties. Children who underwent training performed significantly better on arithmetic tests at post-training assessment. The study points to the option of including Vedic Mathematics Training in schools to help children understand mathematics concepts faster.

Fast memory techniques

Wolgemuth, Cobb and Alwell (2008) conducted a systematic review to evaluate the effectiveness of mnemonic interventions on academic outcomes for 669 youth with learning disabilities, behavioral/emotional problems, or mild developmental disabilities. The findings of their review strongly supported the efficacy of mnemonic interventions in the rapid improvement of attention, memory, and higher mental abilities.

Mnemotechnics boost the brain's ability to alter its functional and structural architecture. Engvig et al. (2010) examined the short-term effects of an intensive memory training program on cognition and brain structure in healthy volunteers. The memory trainers completed an 8-week training program aimed at improving memory utilizing the Method of Loci, while control participants did not receive any intervention. All participants underwent magnetic resonance imaging (MRI) scans and memory testing pre and post 8 weeks of training or no training, respectively. The results revealed that memory training improved source memory performance. Memory trainers also showed regional increases in cortical thickness compared with controls. Furthermore, thickness change in the right fusiform and lateral orbitofrontal cortex correlated positively with improvement in source memory performance, suggesting a possible functional significance of the structural changes. These findings demonstrate that mnemotechnics may induce short-term structural changes in the human brain, indicating structural brain plasticity.

Maguire et al. (2003) examined individuals renowned for their superior memory capabilities. Using neuropsychological measures, as well as structural and functional brain imaging, they found that superior memory was not driven by exceptional intellectual abilities. On the contrary, memory superpowers were due to systematic training on the spatial mnemonic strategy known as the method of loci, by which people use routes to visualize to-be-remembered items at salient routes during recall. They concluded that super memory depends on spatial learning strategies engaging brain regions such as the hippocampus.

Wagner et al. (2021) examined the effectiveness of the 'method of loci' considering the criteria of duration and neural imprint. Memory champions and beginners participated in memory training methods including the method of loci or working memory training, while some participants received no intervention. The results showed that the method of loci improved consolidation and recall. The speed of information transferred from working memory to long-term increased while memories were less likely to fade. The participants responded overall with greater speed. This technique improved control skills, attention, and organizational flexibility. It was also observed enhanced connectivity between the neocortex and hippocampus, which is associated with the process of consolidation. Finally, the researchers correlated these improvements with the involvement of the dopaminergic and noradrenergic systems. The method also improved innovation in thinking, visual-spatial processes, and the ability to manage prior knowledge flexibly.

Emotional engagement: Emotion plays a particularly significant role in processes like encoding, consolidation and retrieval. By adding emotional content to the information to be learned, learners can better recall information (Van Kesteren & Meeter, 2020). It is no coincidence that the same structures that participate in memories processing (prefrontal cortex, amygdala, and hippocampus) are also involved in the processing of emotions. The development of emotional skills such as students' ability to recognize and express their emotions can greatly enhance recall processes (Buchanan, 2007).

Sensory engagement: Sensory stimulation can keep memories "alive" by enhancing both the process of coding and recall. Multisensory learning could significantly contribute to this goal (Van Kesteren & Meeter, 2020).

Observation, self-observation, and attention to "difficult" information: Systematic monitoring is required during the process of recalling identification of misunderstandings, memory alterations, or even false memories and as a consequence contributes to taking fast, accurate and creative decisions (Van Kesteren & Meeter, 2020).

Learning by teaching: Research has revealed that the learning by teaching method could be seen as a conscious practice of retrieval and knowledge re-organization. Through the aforementioned method, students ‘re-download’ their knowledge which entails information reprocessing on a much deeper level (Koh, Lee & Lim, 2018; Nestojko et al. 2014).

Repetition, practice and conscious re-activation of previous memories: According to the ‘use it or lose it’ principle, maintenance and consolidation processes require repeated retrieval strategies. Research has shown that systematic repetition of the already learned information at regular intervals activates and re-organizes brain areas that play a critical role in the speed and effortless learning (Eriksson, Kalpouzos, & Nyberg, 2011).

Mental State Training Techniques

Silence techniques

Dulcic (2021) examined the role of silence practices on fast and conscious learning reviewing evidence-based research. Silence practices aim at the pacification of the mind boosting observation of the conscious experience, attentional flexibility, and self-regulation skills. The literature review showed that the practices of silence restore homeostasis to the ideal levels for fast learning. Systematic silence training supports the inter-connectivity of the neural networks that are responsible for attention control, emotional regulation and fast learning and contributes to the neurogenesis of structures that are critical for fundamental memory and intelligence processes. Deep silence accelerates information encoding, enhances the ability of attention regulation in everyday non-meditative states with an additional impact on time perception (Dulcic, 2021; Wittmann & Schmidt, 2014).

Fast learning is strongly associated with neuroplasticity phenomena which in turn depends mostly on our conscious choices. It is well-known that adult neurogenesis adds plasticity to the dentate gyrus of the hippocampus, a brain area that plays a significant role in fast and flexible learning integrating current information into previously established representations. Kriste et al. (2013) found that two hours of silence contribute to hippocampal neurogenesis. The researchers exposed mice to four different conditions: (a) white noise, (b) mouse pup calls, (c) Mozart piano music and (d) silence. They found that silence and Mozart music increased precursor cell proliferation. However, after seven days, only silence remained associated with increases in new cells in the hippocampus. The researchers supported the idea that silence stimulates neurogenesis because it is considered highly atypical and consequently it is perceived as alerting for future cognitive challenges. In other words, silence brings a state of preparedness for novel information and behavioral contingencies and thus increases the ability to adapt to environmental challenges.

According to Valle's (2019) metareview, silence practices have a significant impact on developing mental and emotional stability, opening to unconscious processes, increasing intuitive sensibilities, being aware of the distinction between cognitive understanding and pre-reflective knowing, having a quieter and less reactive mind, resolving inner and outer conflicts, promoting physical and emotional healing, increasing spiritual awareness, and exploring one's inner self.

Mindfulness techniques

Manglani et al. (2020) compared the impact of 4-week mindfulness-based training on processing speed and working memory. Sixty-one participants with multiple sclerosis were randomized to mindfulness-based training, an adaptive computerized cognitive training, or a waitlist control group. The results showed that mindfulness training significantly improved processing speed and working memory. The researchers outlined that there was a mutually reinforcing relationship between the stage of awareness, the level of speed processing and the working memory capacity. Thus, changes in the mental state may bring gains in working memory capacity.

The corpus callosum is the largest inter-connecting fiber structure in the human brain and constitutes the superhighway for inter-connecting the two sides of the brain with the brain areas that are responsible for higher speed mental abilities (Hinkley et al., 2012). According to Hinkley et al. (2012), there is a strong correlation between cognitive deficits and lack of normal callosal development. Luders et al. (2012) suggest a close link between long-term meditation practices and the neurogenesis of the corpus callosum. They analyzed 30 meditators and 30 controls. Callosal measures were larger in long-term meditators compared to controls, particularly in anterior callosal sections. Thicker callosal regions reflect increased hemispheric integration during cerebral processes involving (pre)frontal regions.

Lutz et al. (2008) found that intensive attentional training, as cultivated in meditation, improves individuals' capacity to effortlessly stabilize the content of attention. It also improves attentional acuity, one’s ability to remain vigilant and monitor distractors without losing focus and reduces reaction time variability. The authors supported the idea that mental training has a positive impact on the oscillatory mode of the brain with a reduction of the cortical processing and the enhancement of the rhythmic mode of attention. Mental training affects both distracter and target processing, by enhancing the entrainment of neuronal oscillations to sensory input rhythms, a mechanism important for controlling the content of attention.

Singh et al. (2016) evaluated the effectiveness of a mental training program on math problem-solving and active engagement in math instruction. Participants were students diagnosed with ADHD. Results showed significant improvements for ADHD students in both active engagement and math problem solving after the meditation practice phase. Singh et al. (2016) concluded that meditation may accelerate academic achievement especially for those with learning disabilities.

Tarrasch et al. (2016) explored the effects of a Mindfulness-Based Stress Reduction intervention on reading, attention, and well-being among 19 readers with developmental dyslexia and/or attention deficits. The results showed that most participants made fewer reading errors with a significant reduction of 19% from their original number of errors. This improvement in reading resulted from improved sustained attention. The reading improvement was significant for the dyslexic participants who also had attention deficits, and there were significant correlations between reduced reading errors and decreases in impulsivity. The researchers associated reading improvements with increased mindfulness following the workshop. Thus, these results reveal the close relationship between reading, attention training and mindfulness state. Mindfulness reduced impulsivity and improved sustained attention, and this, in turn, improved reading of adults with developmental dyslexia and ADHD.

Breathing techniques

Ma et al. (2017) aimed to investigate the effect of diaphragmatic breathing on cognition, affect, and cortisol responses to stress. Forty participants were randomly assigned to either a breathing intervention group or a control group. The experimental group received intensive training for 20 sessions, implemented over 8 weeks, while the control group did not receive treatment. All participants completed pre-and post-tests of sustained attention. The results showed that breathing techniques had a significant impact on sustained attention significantly improved.

Garg et al. (2016) studied the effect of nostril breathing on verbal and spatial memory scores. A total of 51 subjects were divided into three groups. Each group was imparted one of the three different types of nostril breathing practices such as Right Nostril Breathing, Left Nostril Breathing, and Alternate Nostril Breathing for 1 week (45 minutes daily). Before and after intervention they were given a memory test. The results showed that nostril breathing improved recall memory. Specifically, there was a significant increase ($p<0.005$) in recall of digit span-forward, digit-span backward, associate learning and spatial memory scores.

Gupta et al. (2017) examined the effectiveness of breathing techniques (deep breathing and alternate nostril breathing) across 48 elementary students with low performance in English and Mathematics. The exercises were performed every morning for about 5 minutes under the guidance of a teacher who received relevant training. After one semester the gap between students with low and high achievement decreased with significant improvements for students with learning disabilities. The researchers concluded that breathing techniques improved metacognitive functions such as self-regulation and attention control.

Peper et al. (2016) described 103 students' self-reported effect of an experiential classroom activity including diaphragmatic breathing on their ability to solve math problems. Most students were completely surprised how their breathing patterns affected their ability to perform a simple math test. Numerous students have reported that when they implemented this slow breathing approach at the moment they felt anxiety, their anxiety slightly decreased and they would perform better on exams.

Visualization techniques

Pearson (2019) studied mental imagery, its neural mechanisms as well as its relationship with cognition. It was found that mental imagery involves inter-connected areas such as frontal areas, hippocampus, default mode network involved in spatial and sensory control processes. It was also found that mental imagery plays a crucial role in higher cognition. Specifically, mental imagery is associated with attentional flexibility, better perception, visual working memory, reading comprehension, arithmetic skills, decision making, problem-solving and motor control.

Joffe, Cain and Marić (2007) evaluated the effectiveness of a mental imagery training program on comprehension of children with specific language impairment (SLI). Nine children with SLI were trained to produce mental images for sentences and stories in five 30-min sessions. Their ability to answer questions about short narratives was assessed pre-and post-intervention and compared with the performance of sixteen same-age typically developing controls. The findings demonstrated that a short mental imagery intervention is an effective way to accelerate comprehension of children with specific language impairment.

Hudetz, Hudetz and Klayman (2000) tested the hypothesis that relaxation by guided imagery improves working-memory performance. Thirty healthy participants (ages 17–56 years) were divided into three groups (relaxation guided imagery, music, and control) at random. The principal finding was that relaxation by guided imagery significantly increased the performance on the working memory tests. The researchers concluded that the amount of information processing and the quality of learning experiences may be accelerated by guided imagery.

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Hypno-training techniques

Fast learning involves also non-conscious processes. Learning except for new knowledge acquisition requires also the students’ ability to unlearn and relearn, in other words, the ability to extricate themselves from usual ways of doing or thinking so that they can learn something new in a better way. Hypno-training via hypnosis or/and neuro-linguistic programming techniques constitute extremely promising methods in speeding up conscious learning (Drigas and Mitsea, 2021).

Drigas and Mitsea investigated the impact of clinical hypnosis on people with physical, emotional, behavioral, or learning disabilities. It was found that hypnosis can modify motivations, enhance intrinsic motivations and boost positive emotions. It eliminates symptoms of inattentiveness, distraction, and hyperactivity. It makes participants’ reactions faster and more accurate. It cultivates many aspects of executive functions and boosts emotional regulation (Hiltunen et al., 2014; Virta et al., 2015). Hypnosis’ tools are considered attention and mental imagery and for that reason, it is associated with better working memory capacity and visuospatial skills. It also facilitates retrieval of information (Incognito et al., 2019; Lindeløv, Overgaard & Overgaard, 2017). Regarding language difficulties, hypnosis regulates speech and fluency, it boosts reading and listening speed and comprehension (Sehan, Harun & Ahmad, 2017).

Balance and Coordination Techniques

Buchele et al. (2018) examined the effects of 4-week, daily 6-minutes coordinated-bilateral physical activity on attention and concentration in 116 school-aged children with and without learning disabilities. The bilateral coordination training showed significant increases in students’ processing speed, focused attention, concentration performance, and attention span over the control group.

Schlaug, Jäncke, Huang, Staiger και Steinmetz (1995) found that systematic training on hands parallel motion brings plastic changes in the corpus callosum, the brain structure which is responsible for the interhemispheric communication.

Rogge et al. (2008) found that a 12-week balance training program can induce structural plasticity in the superior temporal cortex, visual association cortex, posterior cingulate cortex and superior frontal sulcus. These regions are known to be involved in the integration of spatial information from different sensory signals. Moreover, these areas contribute to higher cognitive functions such as memory and spatial cognition.

Kouhbanani et al. (2020) examined the effects of a perceptual-motor training program on executive functions of children with non-verbal learning disorder. The experimental group received an intervention program based on key elements of perceptual-motor skills including balance, tone awareness, space awareness, shape perception, visual and auditory perception, kinesthetic-tactile perception, and eye-hand/foot coordination. The results showed that perceptual-motor training contributed to improvement in all aspects of executive functions.

Positive thinking techniques

According to Carpenter et al. (2013), positive feelings induction has a significant impact on working memory capacity and as a consequence on complex decision making and creative reasoning. Induced positive emotions help individuals to make better choices, to think carefully, flexibly, and efficiently about multiple factors in a situation. The researchers also assumed that positivity may improve monitoring processes and learning from feedback. Thus, positive emotional training can support higher cognitive functions that are responsible for fast and conscious learning.

Leung, Mikami and Yoshikawa (2019) investigated whether and how positive psychology is associated with second language mental process during reading. They monitored the eye movements of a group of Japanese learners of English in a sentence reading task and they found that positive psychology broadens readers' attentional scope during reading.

3.3 The role of ICTs on High-Speed Learning

It is well-known that the visual periphery plays a critical role in key visual functions. However, most people including visually impaired individuals tend to underutilize peripheral vision, even in absence of obvious peripheral deficits. Nyquist et al. (2016) examined whether 8 hours of perceptual training via kid-friendly video games could help children with low vision to improve their peripheral vision. It was found that low vision children saw significant improvement in their peripheral vision. Training effects were larger in the far periphery and appeared to be stable 12 months after training. The authors outlined that the positive effects of video game training might be due to the sustained attention to multiple dynamic targets while concurrently requiring rapid attending and perception of unpredictable events. Thus, perceptual training via video games could help individuals with visual deficits to improve peripheral vision and as a consequence to speed up their learning.

Achtman et al. (2008) examined the role of action video games in promoting visual plasticity and visual skills enhancement. According to their review, video game training (VRT) enhanced visuospatial attention. In addition, VRT helped users to recover faster from the attentional blink which means that their attentional resources recovered faster after being directed to a target. In addition, video game players were more able to distribute attention and track more objects at once. They also found that VGT improved visual acuity, visual periphery and facilitated fundamental aspects of speed visual processing. In addition, after VGT crowding was reduced. In other words, people were more able to identify letters when surrounded by other letters. Finally, action video games augmented attentional abilities and speeded up reaction time, hand-eye coordination and decision making. According to this point of view, poor vision students (i.e. amblyopes) or students with learning disabilities could benefit from VGT overcoming limitations in their learning capacity.

Safaryan and Mehta (2021) found that immersive virtual reality "retrains" the hippocampus by amplifying the hippocampal theta rhythm. Theta waves are slow waves that spark in the brain when one is in a relaxed state of mind. Theta waves, which wash over the hippocampus, trigger a flow state. This state is critical for our ability to learn, memorize, retain sensory information. It also plays a crucial role in brain plasticity. Most important, during the VR experience, the researchers observed a new brain rhythm (eta oscillations: one half as slow as normal theta waves) which may be associated with parallel streams of information processing and as a consequence improved learning.

Krokos, Plaisant and Varshney (2019) combined virtual reality with the spatial mnemonic technique known as the memory palace. According to the researchers, virtual reality affords people superior spatial awareness by leveraging their vestibular and proprioceptive senses. emory palace as a spatial mnemonic helps individuals remember information by organizing it spatially and associating it with salient features in that environment. The researchers explored whether using virtual memory palaces in a head-mounted display with head-tracking (HMD condition) would allow 40 participants to better recall information than when using a traditional desktop display with a mouse-based interaction (desktop condition). The results revealed that virtual memory palaces provided superior memory recall ability and spatial awareness compared to the desktop condition.

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According to Drigas, Dede and Dedes (2020), virtual reality, as well as mobile applications, can boost mental imagery and offer great opportunities to people who encounter learning and other disabilities to meliorate their mental state, brain activity, memory, higher spatial abilities, higher mental abilities (i.e. critical thinking, mental flexibility) and expand their perception.

Many researchers propose the practice of mindfulness techniques in virtual environments. Asati and Miyachi (2019) evaluated the effectiveness of a VR Mindfulness meditation on sustained attention. The researchers created a relaxing environment in virtual reality including an archery game with multiple targets. The virtual environment presented idyllic landscapes accompanied by relaxing music and the feeling of the wind blowing. In the experiment, the attention span of 12 adults was tested before and after the virtual reality session by a non-action video game and Muse headband EEG signals. The game also required coordination and reaction speed. After the 10-minute virtual reality session participants' game scores increased. The brain wave data revealed that the participants experienced higher levels of relaxation. In addition, the number of times they self-regulated increased trying to switch from arousal to a relaxing state. According to the researchers, these interventions could be applied to the school settings as they are extremely short, easy, and combine relaxation, improved attention, speed reaction and coordination, which are basic components in fast learning.

Virtual reality provides the ideal environment for the application of subconscious training techniques like those of hypnosis and neurolinguistic programming (NLP). NLP techniques such as those of modeling successful behaviors, positive affirmations, metaphors, perspective-taking, reframing, detachment, embodiment, self-dialogue, visualization work extremely well in a virtual environment promoting memory restructuring and helping users to improve metacognition and intelligence (intellectual, emotional and spiritual), make conscious decisions, recognize hidden abilities, develop intuition and curiosity (Drigas and Mitsea, 2021).

Breznitz et al. (2013) evaluated the effectiveness of a computerized reading acceleration training protocol on dyslexic students' reading accuracy and comprehension. Training followed a multi-session procedure which included silent reading with increasingly more demanding time constraints (letter-by-letter masking forced students to read at a rate faster than their habitual reading rate). The results showed that dyslexic students' reading times were shortened, fluency and comprehension were significantly improved. Importantly, the positive results remained after 6 months and transferred to everyday text-reading performance. The authors concluded that reading improves when readers are induced to read faster. Time constraints helped readers to establish more effective reading routines and contributed to rapid information processing, perception's and eye movements' improvement.

Irausquin, Drent and Verhoeven (2005) found that school children, trained with speed reading, have improved reading fluency with no reduction of comprehension. Specifically, they evaluated the effects of computer-presented automatization/speed exercises in a group of 14 poor readers in comparison to a matched control group of 14 poor readers that received computer-presented exercises aimed at the use of context for word identification and comprehension. Results showed that the "speed" group progressed more than the context group in word and text reading efficiency, and the effect transferred to more complex word types. Both groups progressed to the same extent as regard accuracy, but the speed group made more progress in speed.

Rapid serial visual presentation (RSVP) represents one of the promising methods for faster reading. RSVP consists of displaying in sequential order one or more words at a time, thus minimizing saccades and eye blinks. Benedetto (2015) studied the effects of a speed reading app (the RSVP app 'Spritz') on comprehension, visual fatigue, performance, task load and ocular behavior. They had sixty participants read on a computer screen a selected part of a book either with Spritz or in the traditional way. However, they found that Spritz impairs literal comprehension and increases visual fatigue.

4. Discussion & Conclusions

Although the effectiveness of speed-reading programs has not been sufficiently demonstrated, there is evidence that the right design of the intervention plays a significant role in achieving the ideal combination of speed with accuracy and comprehension. According to this review, speed and comprehension are complementary. Speed leads to better comprehension and comprehension requires speed. Speed training programs that recognize the role of the optimal state of mind in speed reading and include visual span training, eye exercises, relaxation techniques, visualization techniques boost active and speed reading by reducing subvocalization, expanding the attentional span and improving working memory capacity. Reading better is very important since it implies improvements in all other subjects (i.e science, mathematics). Finally, it is necessary to outline that trained speed readers bypass phonological processes while reading.

Speed listening interventions increase the capacity of receiving spoken language without significant loss of comprehension. In addition, fast listening training can boost speed reading. Most importantly, these interventions confirm that comprehension of rapid speech is trainable. Auditory training can improve speed listening as it familiarizes the brain to actively listen, enhances the speed of processing, speech perception as well as executive functions including working memory and attention. Active listening training techniques accelerate learning because these techniques empty individuals of personal concerns, distractions, and preconceptions. Active listening makes subjects more open, empathetic, active and reflective. Fast reading and fast listening training seem to significantly help people with learning or sensory disabilities.

Fast calculation techniques could help students with learning difficulties in mathematics (i.e. dyscalculia) to perform better on arithmetic tests under stressful and competitive situations.

The findings of this review strongly support the efficacy of mnemonic interventions in rapid and less effortful learning. Specifically, it was found that memory techniques (especially spatial memory techniques) rapidly improve attention, memory and other higher mental abilities. Mnemonics boost the brain's ability to alter its functional and structural architecture. An 8-week training program utilizing spatial memory strategies (i.e. the Method of Loci) results in regional increases in cortical thickness and hippocampal neurogenesis. Mnemotechnics improve encoding, maintenance, consolidation and retrieval, as well as the speed of information transferred from working memory to long-term memory. They also make the memories more durable. Individuals respond with greater speed. It was also observed enhanced connectivity between the neocortex and hippocampus, which is associated with the process of consolidation. These methods also improved innovation in thinking, visual-spatial processes, and the ability to manage prior knowledge flexibly.

The research also revealed that speed learning is state-dependent. Mental training techniques like silence techniques, mindfulness and breathing techniques introduce individuals to a state of awareness (internal and external), preparedness for novel information, mental stability and curiosity. The research revealed that mental training develops individuals' ability to better observe a bigger part of the conscious experience with increased attentional flexibility

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and self-regulation capacity. Through open monitoring, people expand perception since they can also observe what focus attention oblige them to ignore. These practices restore homeostasis to the ideal attentional levels for fast learning and are associated with neurogenesis, increased neuronal inter-connectivity and brain synchronicity. Mental training also improves intuition abilities. The state of mindfulness significantly improves attention, processing speed, working memory, while it is associated with speed reading, increased comprehension and better math skills. Thus, we conclude that beyond speed learning lies the metacognitive ability to control attention through observation where presence comes in.

Visualization techniques like mental imagery training and guided imagery improve attentional flexibility, expand perception, enhance visual working memory capacity, reading comprehension, arithmetic skills, decision making, problem-solving and motor control.

Hypno-training techniques boost individuals' ability to extricate themselves from usual ways of doing or thinking so that they can learn something new in a better way. Hypno-training is a promising method for people with physical, emotional-behavioral, or learning disabilities since it re-organizes motivations and rapidly improves intelligence (intellectual and emotional). It eliminates symptoms of inattentiveness, distraction, and hyperactivity and therefore makes participants' reactions faster and more accurate. It also cultivates various aspects of executive functions. Hypno-training techniques are also associated with better working memory capacity, better visuospatial skills, improved retrieval of information, reading and listening speed with increased comprehension.

Balance and coordination exercises have a significant role in speed learning. Coordinated bilateral physical activities improve processing speed, focused attention, concentration performance, and attention span. Hands' parallel motion brings plastic changes in the corpus callosum, the brain structure which is responsible for interhemispheric communication. Balance training program induces structural plasticity in brain regions involved in the integration of spatial information from different sensory signals and higher cognitive functions such as memory and spatial cognition.

Speed learning is inevitable without positive psychology. The research revealed that positive emotional training can expand attentional span, enhance higher mental abilities as well as the metacognitive abilities of monitoring and evaluating feedback.

Finally, it is necessary to outline that in addition to mental training techniques, the learner should be aware of the role of sleep, exercise and nutrition in rapid learning (Kapsi, Katsantoni, & Drigas, 2020; Zavitsanou & Drigas, 2021). Mazza et. (2016) found that sleep between learning sessions is associated with faster recalling and learning in less time as well as less effort. Other researchers have shown that brief aerobic exercise and moderate running enhance visual attentional control, perceptual speed, parallel processing speed and inhibition (Legrand et a., 2018; Damrongthai et al., 2021).

This review also revealed that ICTs have the potential to speed up conscious learning. Video games, virtual reality, mobile applications and software could be used to train all those abilities needed for high speed and conscious learning like visual acuity, perceptual span, processing speed and reaction time. In addition, it was found that these technologies could provide the ideal environment for the implementation of high-speed learning training techniques. For instance, virtual reality provides the ideal environment for mindfulness training and hypno-training. In addition, mnemonics could be applied in virtual environments.

Finally, it is necessary to outline the role of metacognition in creating speed learning environments according to the 8X8 model of metacognition (Drigas and Mitsea, 2021). Speed learners should develop all those meta-abilities that enable them to know when and how to enter their 'best of you' state, the peak moment of attention, alertness, and wonder, slowing down or speeding up their mental efforts while learning. In other words, they should be able to consciously observe, regulate and adjust their learning considering their goals, their mental powers as well as the demands of the tasks. Speed learners must be aware of their study behaviors, to choose the appropriate strategies to minimize effort and maximize capacity and effortless competence. They should be able to focus on strengths and utilize their limitations as learning opportunities, to be flexible enough to recognize and replace the habits that slow down the speed of learning with more positive and effective strategies. According to the layered model of metacognition (Drigas and Mitsea, 2021), moving up the hierarchy of metacognitive learning strategies, people reach a higher point of consciousness regarding their needs, motives, abilities, emotions (namely meta-needs, meta-motivations, meta-abilities (i.e. meta-attentional and meta-emotional). Each level coincides with a higher level of meta-learning where higher speed, perception and comprehension take place. Speed learning is all about transcendence, in other words, people should transcend limitations to enter the state of high-speed learning. According to this point of view, schools must not segregate students (especially those belonging to vulnerable groups) but provide them with the aforementioned meta-learning environments that actualize their inner needs and transform them into high-capacity learners.

We conclude that fast learning training techniques improve all those factors that accelerate learning such as spatial attention, visual span, processing speed, speed reaction, executive functions (working memory, attention control, mental flexibility), metacognition (self-observation, self-regulation and adaptation) and conscious awareness.

Most important, fast learning strategies meliorate control processes (either effortful or effortless) and spatial intelligence which is extremely fast and powerful. The phrase 'a picture worths 1.000 words' is extremely relevant and useful, considering that: (a) 90 percent of the information transmitted and processed to the brain is visual, (b) human eyes are capable of registering at least 36,000 visual messages per hour, (c) the time it takes for the human eye to identify and process an image is 13 milliseconds, 60,000-times faster than text, (d) people can recognize several thousands of visual objects in great details even with a single viewing of a few milliseconds per image and (e) visual long-term memory has a massive storage capacity (Potter et al., 2014; Brady et al., 2008; Delorme, Poncet & Fabre-Thorpe, 2018). Thus, this review study points to the option of including high-speed training techniques in schools to help children with or without disabilities to become conscious and high-capacity learners.

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