HOLOGRAPHIC REALITY IN EDUCATION: THE FUTURE OF AN INNOVATIVE CLASSROOM

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ABSTRACT

Latest research suggests that the most effective methods on education are those which utilize technological tools that provide an interactive approach to learning. Exploratory technology which involves augmented reality applications in the regular school program, gives the opportunity to young learners to become autonomous and active in their thinking, by stimulating multidimensionally their brains. Based upon this claim, this paper aims to present and propose the application, in every classroom, of an exploratory technology (specifically holographic reality), adapted to a new model which emphasizes the personal learning style of every student. This will result in the improvement of the learning process since multidimensional stimuli will create new cognitive paths, affecting the level of assimilation, regardless of any possible special learning needs. This new approach will be supported by the latest research findings in the field of Neuroscience and their implications on the process of learning and memory.

KEYWORDS

Neuroplasticity, Learning Disabilities, Holograms, Holographic Reality, Brain Stimulation, Augmented Environment

1. BACKGROUND INFORMATION

The learning process is highly dependent on neuroplasticity (Zhang and Kourtzi, 2010). Neuroplasticity is the ability of the brain to change and reorganize itself in order to adapt in new situations. During this reorganization, new neural connections are formed (neurogenesis), and the synaptic structures change in response to environmental alterations. However, for the rewiring to be successful, the neurons need to be efficiently stimulated through training. Learning disabilities are primarily neurobiological in origin and are characterised as a group of disorders that affect the acquisition and comprehension of information.

With the concept of neuroplasticity in mind, the Eaton Arrowsmith School (EAS) helps children with learning disabilities such as dyslexia and Attention Deficit Hyperactivity Disorder (ADHD) to overcome educational obstacles by reorganizing their brains. This reformation involves a regimen of cognitive exercises that are founded based on principles of neuroplasticity. Kleim and Jones describe the ten principles of experience-dependent neuroplasticity as: 1) “Use it or Lose it”. Neural circuits associated with a certain function begin to degrade if individuals do not perform said function regularly, 2) “Use it and improve it”. Training of a particular function could result to enhancement of said function, 3) “Specificity”. The type of training determines the type of plasticity, 4) “Repetition Matters”. Sufficient repetition is required for plasticity to be induced, 5) “Intensity Matters”. Induction of plasticity requires not only sufficient repetition but sufficient intensity as well, 6) “Time Matters”. Different types of plasticity occur at different times during training, 7) “Salience Matters”. Training must be salient enough to induce plasticity, 8) “Age Matters”. Plasticity induction by training, occurs more readily in younger brains, 9) “Transference”. In response to one training experience, plasticity can lead to enhanced acquisition of similar behaviours and 10) “Interference”. Hence, by creating personalised training exercises that address each individual and disorder separately, EAS managed to help thousands of children with learning disabilities and improve their cognitive functions.

The inclusion of each learner on a regular classroom environment, regardless of any special learning needs, is lacking in the majority of educational systems. New technological approaches can help resolve this problem. Personalized tools, such as assimilation tools, can be used to help learners with disabilities to efficiently transform the information they receive into action, therefore enhancing the development of their higher order cognitive skills. According to De Freitas and Levene, 2004, higher order cognitive skills can be achieved through an "interactive simulation-based learning system", since simulations allow individuals to have repeated trials without risking the loss of valuable information (De Freitas and Levene, 2004).

2. CONSIDERATIONS FOR IMPLEMENTATION

In order to measure the changes that should be induced in the brain during the use of holographic applications, previous literature suggests the use of EEG (electro-encephalograph) (Zhang and Kourtzi, 2010). With EEG we can measure and analyze the power spectra of alpha, beta and theta waves.

It is claimed that learners with special learning needs (SLN) can effectively decode graphic symbols when they can have physical contact and experience with these symbols in space. Hence, by exploring the environment from visual to physical context, learners achieve increased engagement. It is assumed that immersive games such as the virtual representation of the alphabet in space through holographic reality, would help learners to acquire the tasks by physically engaging in the process of learning with the activation of gross motor skills, realizing the meaning and the representation of the symbol in the simulated real-life context. Through this process, we want to demonstrate that when learners have the opportunity to explore the symbol with gross motor skills involvement, synchronicity between brain waves occurs and long term potentiation (LTP) is reached. This way, memory consolidation which depends on LTP, contributing factor of synaptic plasticity, is reached thus affecting brain plasticity. Memory consolidation integrates repetitive reactivation of the memory store (engram) leading to its transformation into long-term memories (Born and Rasch, 2013).

By purposefully planning personalized learning and by following cyclical procedures to ensure impact, the learners ascertain critical skills and a sense of real presence. Simulation tools in education, specifically holograms and their application on school subjects, such as languages and history could bring a breakthrough in teaching methodology. The correspondence between real life experiences and action games can lead to a thorough understanding and intake of information. Evidence propose that visuo-motor and visual attention skills boost specific domains that can make learning faster; empower semantic memory and increase spatial resolution of visual processing (Green and Bavelier, 2007).

Through the targeted use of holographic application in specific classroom activities the visual, auditory and kinesthetic stimuli of learners will be activated by the realistic representation of symbols and contexts in space through holographic reality. Therefore, learners of all learning profiles, will have the opportunity to conceptualize ideas in reality through their unique brain functions.

Future work includes the creation: i) of new three-dimensional interactive contents for targeted learning environments and ii) of prototype contents relevant to specific subjects and their adaptation to the learners' profiles. In addition, further research regarding the applications of holographic reality adapted to personal learning styles, on the augmented environment is required (Koutromanos, Sofos and Avraamidou, 2015).

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