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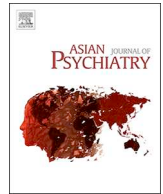
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Contents lists available at ScienceDirect

Asian Journal of Psychiatry

journal homepage: www.elsevier.com/locate/ajp

Letter to the Editor

The neuropsychological impact of E-learning on children



ARTICLE INFO

Keywords:

COVID-19
e-learning
Children
Neuropsychology
Education
Technology

The COVID-19 pandemic has forced school closures worldwide leading nearly 1.95 billion children being out-of-classrooms or away from school in almost 195 countries (Tandon, 2020a; UNESCO, 2020). This has resulted in the boom of e-learning, defined as *the use of internet technologies to deliver a broad array of solutions that enhance knowledge and performance* (Rosenberg and Foshay, 2002, p. 28). Built upon the fabric of Internet and Communication Technology, e-learning is being touted as the most viable alternative to the traditional classroom teaching and learning in days ahead. The COVID-19 pandemic has led to a massive upsurge in the demand for the e-learning platforms worldwide as children have been instructed to attend classes online from their homes to maintain continuity of formal learning (Li and Lalani, 2020). While neuroplasticity offers opportunity to adapt the sudden change in the modality of classroom transaction from face-to-face interaction to the technology-mediated learning, it may wreak havoc for the growing brain of children.

Indeed, being the new partner in their mode of education, e-learning poses an adaptability risk for the young brains. Brain's plasticity sheds light upon how neural circuitry in young brains respond to digital learning, given the fact that the formation of higher-order functions take place during childhood years (Zelazo and Muller, 2002). Several studies indicate that multi-method screen exposure leads to structural changes such as reduced volume of the cortex with loss of integrity pertaining to the white matter region (Takeuchi et al., 2018) and decreased grey matter in prefrontal regions viz. the right frontal pole and anterior cingulate cortex (Loh and Kanai, 2016). Such alterations, consequently, impede attentional competence, processing speed, verbal intelligence, and sustained attention, respectively. Additionally, searching, locating, and reading online content reduces the functional connectivity of regions around temporal gyrus, responsible for long-term memory formation and retrieval of learned material (Liu et al., 2018). It may also be noted that the overuse of visual modality and exposure to the computer screen for long hours may yield adverse effects of the visual system.

A study by Firth et al. (2019) has indicated how functional changes impair attentional capacities, memory processes, and social cognition abilities in individuals. The online platform of learning requires the brain to rapidly switch between tasks, consuming the metabolic energy,

and time at the neural level. The visual stimuli presented are usually complex and multi-method based (involving audio-visual graphics, text, and animations), prompting digital multitasking, resulting in impaired recall. One major reason is the overload upon working memory, which impedes an individual's ability to register, process, and remember information with accuracy. Cognitive overload, as a product of multi-method based learning and divided attention, impacts the quality of comprehension, prioritization, and deep-level processing of incoming information, which in turn, critically determines consolidation of memory into long-term memory (Carr, 2010). Consequently, it leads to poor processing and understanding of what is taught or said. Besides, the absence of school settings impair social cognitive abilities such as empathy, teaming, and peer relationships among children.

New challenges demand novel approaches to the process of teaching-learning. Educators can provide individualized goals, the scope for individual discussions, and provide visual reminders to combat digital distractions. Besides, there is also a need for sensitizing teachers for dealing with the heterogeneity of executive functioning at the grade level by custom designing the contents to be delivered. The daily screen time and access to the devices by children need to be judiciously regulated and supported by all the stakeholders (Jamir et al., 2019; Tandon, 2020b).

It is relevant to note that the SARS outbreak in year 2003 proved as a tipping point to the e-commerce industry, leading to its widespread surge. However, projecting the same trajectory to the e-learning – would be unfair and detrimental for the children in the long run cognitively, emotionally, and socially. They cannot be treated as a commodity to be packed and sold in the market, rather an active agent for a vibrant future. Co-opting the use of technologies for education has been a long-standing controversy. The content taught through various platforms may be relevant, but a class devoid of reflection and review may not plant the seeds of critical and deep thinking skills required in the trajectory of their lives. While presenting the guidelines for a healthy lifestyle for children, the WHO Director had recently opined that “achieving health for all means doing what is best for health right from the beginning of peoples' lives” (WHO, 2019). This needs to be followed earnestly as an overarching principle for setting the right precedent for the future of tomorrow.

<https://doi.org/10.1016/j.ajp.2020.102306>

Received 16 June 2020

Available online 13 July 2020

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Funding

The authors did not receive any fund for this work.

Declaration of Competing Interest

The authors have no conflict of interests.

Acknowledgements

In all gratitude, we would like to express our sincere respect to Mrs. Anju Jha, Prof. Girishwar Misra, Prof. Damodar Suar, and Ms. Shipra Saini for their timely and insightful contribution towards enhancing the depth and readability of the manuscript.

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