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The Impact Of Virtual Environments On Children's Neurocognitive Structure: A Study Of Backgrounds And Dimensions

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Abstract:

This study aims to explore the digital environment, which has become the prevailing landscape for modern individuals, particularly as we navigate the 21st century as fully-fledged digital citizens. This environment is represented by screens in various forms, sizes, and features—such as televisions, mobile phones, and tablets—whether or not they are connected to the internet. These devices captivate curiosity, hold attention, and foster a persistent desire to engage, making them a central part of daily life for adults. More importantly, they have a profound and growing impact on children. In light of the widespread availability and low cost of these digital devices in households globally, this descriptive study investigates the potential effects of screens on children's neurocognitive development.

Keywords: Digital Space, Virtual Environment, Neurocognitive Development, Child.

Introduction:

The world of the 21st century can be likened to a cluster of closely interconnected communities, thanks to advancements in technology that have erased the boundaries between nations and peoples. Communication technologies, supported by the internet, television networks, and satellites, have enabled access to any place at any time with just a single click. Whether through a television, smartphone, or tablet, people can track events and news from around the globe. These devices have also become integral to various essential aspects of modern life, such as education, shopping, entertainment, research, and work, making them nearly indispensable.
One of the key factors contributing to the increased use of screens among Algerian children is the accessibility of the internet through devices like computers, tablets, smartphones, and even modern televisions. These technologies allow children to explore their own virtual worlds, anytime and anywhere, often unnoticed by adults. As they become absorbed in this virtual realm, they leave behind the real world and immerse themselves in environments where everything is simulated.
The level of exposure children have to these screens varies in terms of intensity, time spent, and the nature of the content they are consuming. Digital devices are readily available in most family settings, whether through parents, siblings, or during visits to relatives. This prevalence is largely due to the affordable cost of these devices, driven by commercial competition. Similarly, telecommunications companies in Algeria (such as Mobilis, Djezzy, and Ooredoo) offer various internet packages, supported by Algeria Telecom, making internet access widely available. Consequently, children often have unsupervised access to the internet, which they use on devices of different sizes and forms, with varying effects.

1. Research Problem:

Healthy child development requires the fulfilment of various needs that families must provide. These primary material and psychological needs—such as food, clothing, shelter, a sense of belonging, security, love, and healthcare—are all based on at least a basic understanding and awareness of parenting principles. These principles ensure the child is raised in a healthy environment, free from risks and disturbances, leading to balanced growth across different areas, including sensory-motor, neurocognitive, linguistic, and psychosocial development.
To achieve this, it is essential to provide a stable family environment, especially during the early stages of development. This includes regulating the child's biological rhythms, such as sleep and wake cycles, and monitoring other learning patterns like attention and cognitive skills. However, parents' efforts to maintain such a conducive environment are increasingly challenged by the changes in the family's material, psychological, and social structures. The integration of

digital technologies into daily life has reached a point where it influences behaviour patterns, sleep schedules, attention spans, cognitive functions, and communication within the family.

Technological advancements of the late 20th century sparked a qualitative shift and revolution in the world of communication, particularly with the rise of global developments, knowledge explosions, and the widespread use of the internet, mobile phones, and screens among all age groups. Children, adolescents, and what researchers refer to as the "digital generation" or "internet generation" have been particularly affected. Today, it is rare to find a household without at least one electronic device or screen.

One of the major issues posed by digital developments for younger generations, even for very young children, is that "digital citizens" have grown up knowing no other lifestyle than the one shaped by internet culture, laptops, and mobile phones. This digital lifestyle has freed them from the constraints of local customs and hierarchical authorities. It allows them to personalize screen-based activities, access services, and connect with global information networks and social media. This digital citizen may ultimately lose touch with reality, as many young people today use technology in ways that are counterproductive to the potential benefits it offers (Greenfield, Susan, 2017, p. 112).

With alternatives to reading books and novels, such as watching movies and videos, and the option to listen to news broadcasts instead of reading newspapers, it is no surprise that screens have become the fastest-growing, most influential, and most captivating medium for all age groups, particularly young children. These children still rely heavily on sensory stimuli—visual and auditory—for their neural and social interactions, and these stimuli form the basis of how screens operate.

Given the above, can screens truly be considered a source of danger to the neurocognitive development of our children?

2. **Defining Key Concepts in the Study**:

2.1 Cyberspace:

One of the most enduring and widely used terms to describe the world created by the internet and related digital domains is cyberspace. This term entered the English language through the 1984 science fiction novel Neuromancer by William Gibson. The novel had a prophetic quality, as it described an online world that bears some resemblance to today's internet, although the internet itself did not exist in that form when Gibson wrote the novel. Despite the fact that Gibson had not used the fledgling network at the time, the power of the word "cyberspace" became more important than its predictive element. It quickly spread as the term for the space created by electronic communication (T. V Reed, p. 46).

2.2 Cognitive Structure:

According to David P. Ausubel, cognitive structure is the foundation of the thinking process in learners. He emphasizes the importance of practice in shaping this cognitive structure. Practice modifies the learner's cognitive framework and responses, influencing what they learn and how they acquire new material in the future. Practice also affects memory and enhances the stability and clarity of new meanings, which in turn increases the effectiveness of learning and recall (Razouqi, Raad, Suhail, Jamila, 2016, p. 56).

3. Study Objectives:

The current study aims to achieve the following:

- 3.1 Provide a brief understanding of the digital world of screens.
- 3.2 Explore the effects of screens on the child's brain.
- 3.3 Identify the motivations for screen use and the possibility of digital addiction.

4. Study Importance:

- 4.1 highlight the widespread presence of screens in the child's family and school environments.
- 4.2 address the lack or absence of protective supervision for children as they engage excessively with digital screens.
- 4.3 examine the emergence of unhealthy behavioural and developmental patterns among children who use screens.
- 4.4 investigate the issues of time management, the decline of traditional reading habits, and attention problems among digital children, exploring the underlying causes and possible solutions.
- 4.5 Draw attention to the scarcity of local Algerian studies on digital children, especially given the lack of family oversight concerning the content, duration, and nature of screen exposure.

5. Previous Studies:

Research on digital devices is diverse and has linked various factors, from the use of television in the 1970s to the emergence of terms like compulsive internet use or internet addiction , accompanied by withdrawal symptoms. These behaviours are often associated with different types of screens, especially beginning in the early 1990s.

- 5.1 One study measured the understanding of preschool children regarding a television program tailored to their age group using a standardized evaluation method. The results showed that the majority of the children understood less than half of the information tested. Since the children who were asked questions during the program did not show better comprehension than those who were asked at the end, it was ruled out that memory, rather than understanding, was the decisive factor (Winn, Marie, Al-Sobhi, and Abdul Fattah, 1999, p. 53).

Additionally, many studies mentioned in Susan Greenfield's book Mind Change (2014) confirm a causal relationship between the improvement of attention skills and the practice of video games by children. However, these studies also suggest that digital technologies may lead to memory issues among children, as they do not allow the brain to exert the natural effort required to stimulate neurons and enhance memory function.

There is a lack of studies that have explored the relationship between children's neurocognitive structures in the digital space and the effects of digital technologies—whether connected to the internet or not. The question of how children's memory and attention are impacted by living in a digital environment remains open to further exploration, necessitating new studies using methodologies closer to experimentation rather than mere description and analysis.

6. **Limiting the Effects of Digital Devices**:

In the United States, there are 160 branches of Waldorf Schools , which share an educational philosophy that emphasizes physical activity, creativity, and hands-on learning. These schools strictly prohibit the use of digital devices, believing that computers hinder creative thinking, movement, human interaction, and limit attention span. Notably, The New York Times reported that the Waldorf School in Los Altos is a top choice for parents (Greenfield, Susan, 2017, p. 259).

Researchers from the University of Birmingham in the UK have found that excessive reliance on computers and search engines weakens human memory. Many adults, for example, struggle to recall their own work or family members' phone numbers. The study, which included 6,000 adults from the UK, France, Germany, Italy, Spain, Belgium, the Netherlands, and Luxembourg, found that one-third of participants resorted to using computers or mobile phones to remember information, with the highest percentage in the UK, where over half of the respondents turned to electronic searches for answers.

In the UK, 45% of adults could recall the landline numbers they had memorized in childhood, while only 29% could remember their children's phone numbers, and 43% remembered their work numbers.

The study also revealed that people now use computers as "memory extensions," leading to the emergence of a new term: digital amnesia . People tend to forget information, relying instead on retrieving it through electronic devices. One of the study's co-authors, Maria Wimber, noted that searching for information electronically prevents the formation of long-term memories. The brain strengthens memory each time we recall information, while it discards unnecessary information that may distract us. Therefore, retrieving information through recall is an effective way to create lasting memories, while repeated online searches do not establish a strong, long-term memory. The research concluded that this over-reliance on computers has long-term consequences, as information found through quick searches tends to be quickly forgotten (Lebanese Media Group, 2015).

The ongoing shift in how we may all live in the near future is a critical topic—arguably the most important issue of our time. Why? Because a life centered around smartphones, iPads, laptops, and Xbox consoles could radically change not only our lifestyles but also our identities and inner thoughts in unprecedented ways. As a neuroscientist, I am fascinated by the potential effects of a screen-based existence on how we think and feel. I want to explore how this remarkably adaptable organ, the brain, responds to what I call the "digital wildfire" (Greenfield, Susan, 2017, p. 18).

While there is some evidence that internet browsing is replacing traditional television viewing, the time spent watching online programs—averaging about 6.8 hours per week—far exceeds the decline in weekly television viewing, which has dropped by only 7 minutes. More importantly, the total time spent watching content controlled by networks (television plus network websites) has increased by around 4 hours per week (Greenfield, Susan, 2017, p. 237).

Another comfort is the belief that the next generation will be fine, thanks to parents who take control and intervene when necessary. Unfortunately, this idea has already proven to be a failure, for reasons we will explore soon. Many parents complain that they cannot control what their children do online, while others have given up altogether, unable to pull their children away from screens and back into the three-dimensional world (Greenfield, Susan, 2017, p. 20).

It is unrealistic to suggest abandoning all digital devices, some of which have become essential to modern life—like mobile phones, for instance. However, the belief that simply pressing a button to turn on the TV can calm a crying child is a significant mistake, especially during the preschool years.

Conclusion:

The exposure of many young children to various types of screens and two-dimensional digital spaces, morning and night, within the environments where they engage in cognitive, social, and psychological interactions without supervision, is a serious issue from the perspective of neurodevelopment. The ongoing and hidden interactions between these children and the virtual world they visit daily raise significant concerns. Studying the effects of digital devices on our brains requires a thorough understanding of this increasingly captivating digital world.

At the same time, acknowledging the potential impacts on children in Algeria is only a matter of time, as the widespread, unsupervised use of the internet and digital devices in families, schools, and society at large continues to

grow. This situation demands immediate action to address the repercussions of such interactions and their long-term effects on the cognitive, perceptual, and neuropsychological development of adolescents.

Study Recommendations:

In light of the findings of this research paper, several practical suggestions can be made, including the following:

- Conduct studies examining the extent to which school-aged children are connected to digital spaces and measure the emergence of neurocognitive problems.
- Carry out longitudinal studies involving various sectors such as education, health, and higher education, to comprehensively assess the scope and impact of digital technology usage in family and school environments.
- Encourage responsible authorities, academics, and civil society to recognize the seriousness of the situation and to focus on researching this multi-faceted public health issue.
- Urge parents to continuously and regularly monitor their children at home and in educational institutions, and to enforce supervision over internet use and digital devices.
- Require educational and health institutions to raise awareness among parents and users about the importance of moderate, positive, and educational usage of digital spaces.
- Encourage teachers to implement strategies to raise awareness about the risks and negative aspects of excessive screen time, particularly regarding time management, study habits, and the misuse of these technologies for entertainment at the expense of academic achievement and cognitive development.
- Organize national and international conferences and symposiums where relevant stakeholders and experts can discuss the key issues facing the digital generation, which could help improve the educational and digital landscape in Algeria.
- Incorporate ethical and health education into school curricula, addressing the excessive use of the internet and unsupervised exposure to digital screens, particularly during early childhood and preschool years. This should be integrated into various subjects and activities to the extent permitted by the nature of these subjects, while emphasizing the importance of behavioral and ethical standards in technology use.
- Awaken the motivation to act and think logically about protecting the mental well-being of our children.

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