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Effects of the Use of Technological Devices in Children Aged 4 to 5 Years

Efectos del Uso de Dispositivos Tecnológicos en los Niños de 4 a 5 años

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Abstract
The use of technological devices, such as tablets, smartphones, and televisions, has increased significantly among preschool-aged children. This article analyzes published information on the screen time and habits of children aged 4 to 5 years, including the most commonly used technological devices by families over the past decade. Databases were searched in Latindex, ScienceDirect, Springer, Scopus, and Web of Science, covering research published between 2015 and 2025. The search criteria for publications were (a) use of technological devices in children aged 4 to 5 years, (b) educational and recreational contexts, (c) and (d) among children. Sixty studies reviewed indicate a trend that moderate and supervised use of electronic devices can promote digital and educational skills. However, excessive or uncontrolled use of educational technologies is associated with attention problems, sleep disorders, impaired social relationships, and risks to children's physical health. It concluded that the use of technological devices in children aged 4 to 5 years should be regulated and guided, encouraging activities that complement their overall development and avoiding prolonged unsupervised exposure.

Keywords: Attention Problems, Excessive Use, Overall Development, Screen Time, Technological Devices

1. Introduction

Education is considered the most valuable legacy parents can offer their children. However, when children begin to seek attention, love, care, understanding, and material gifts in return, complications arise. The lack of direct human contact can hinder a child's ability to adapt to their social environment. Therefore, the misuse of technology can be detrimental to brain plasticity, as children miss out on experiences that are crucial for their emotional,

affective, rational, social, and psychological development (Cerisola, 2017). Therefore, encouraging movement, exploration, contact with nature, and interpersonal connections are essential for their overall development. Furthermore, preschoolers who frequently watch television or use a mobile phone or tablet screen are prone to pathological risks such as cognitive, language, or motor development delays (Mendieta, 2017). The risk of exposure to constantly changing images is linked to the development of executive functions, problem-solving, poor academic performance, limited physical activity, poor nutrition, and body overweight (Aveiga et al., 2018). Therefore, every parent needs to keep in mind that, although technology is an important and functional tool, it is their responsibility to control their children's exposure. Thus, problems arise when this technology is used by children without educational reasons, causing them to lack attention and low cognitive skills development. Therefore, parents or responsible adults need to be aware of the impact of technology on child development. The idea that caregivers believe a few hours of screen time will not affect children's development is challenged, as children require time to play, learn, explore, and be creative (Calderón, 2019). However, it is necessary to recognize that the internet has revolutionized the way information is accessed on a global scale. This accessibility has made it an invaluable tool in the educational field. However, when it comes to children and their affinity for technology, experts warn of the harm caused by excessive exposure to technology. Furthermore, the ease of access to content inappropriate for children under 5 requires parental vigilance.

On this point, Fung Fallas et al. (2020) state that studies show a persistent global trend of children's overexposure to screens, which generates emotional, behavioral, and sleep disorders, and poor cognitive and physical development. This research niche addresses the limited availability of studies reviewing the specialized literature on the impact of technology on the development of children under 5 years of age.

The methodology used in this article is based on an exhaustive review of the scientific literature related to the effects of the exposure to technological devices on children aged 4 to 5 years. To this end, hermeneutics was used and a systematic selection of articles was carried out, structured in the following stages: (1) identification of publications, (2) elimination of duplicates, (3) filtering according to the 2015-2025 period, and (4) targeted selection. In the publication identification stage, the following academic databases were considered: Latindex, Scielo, ScienceDirect, Springer, Scopus, Web of Science, and PubMed, covering research published between 2015 and 2025.

The initial search criteria for publications were: (a) use of educational technology in children, (b) impacts of the use of educational technology, (c) samples under 5 years of age, (d) articles in Spanish, Portuguese, and English, (e) period 2015-2025. The review focused on studies examining the link between (1) use of electronic devices, (2) mental health, (3) cognitive development, (4) memory and attention, and (5) executive functions in children between 4 and 5 years of age.

In the elimination stage, the collected information is used to eliminate studies that were repeated in multiple databases or languages other than those specified. The screening stage consisted of an initial review of the titles and abstracts of the remaining articles. Papers addressing the use of technology and cognitive and socio-emotional development in children aged 4 to 5 years or preschoolers were grouped and reviewed in a second round to identify information that contributes to the objective of this research. In the final stage of specific selection of publications for review, controls implemented with more specific criteria to ensure their relevance to the research objective, prioritizing those that focus on screen time in different contexts (a) recreational and academic use of screens, (b) usage patterns that may influence brain development, and (c) academic performance of children who use screens. The initial database search process identified a total of 120 articles. After eliminating duplicates in the corresponding phase, a record of 60 unique articles was obtained. After applying the selection, filtering, and targeted criteria, the corpus was reduced to 30 publications, which were considered for the research.

The objective of this work is to analyze published information regarding the screen time and habits of children between 4 and 5 years of age, including the technological devices most commonly used by families in the last 10 years.

2. Development

2.1. Children's exposure to screens

The impact of excessive screen use has been linked to adverse effects on neurodevelopment and cognitive performance, particularly in children and adolescents. Thus, studies conducted by Hideya Yamamoto et al. (2018) show that cognitive dysfunction begins when people use mobile devices for the first time, where the intensity of use is a possible factor in cognitive decline. This can affect learning, memory, and mental health, even contributing to neurodegeneration in extreme cases (Neophytou et al., 2019). Authors such as Zargaryan and Arakelyan (2019) and Arakelyan (2019) agree that the term dementia manifests itself in brain disorders, which cause long-term brain deterioration that can be irreversible and severely affect the individual's autonomy. This involves thought processes and short-term and long-term memories. On this point, Arakelyan (2019) points out that the diagnosis of digital dementia presents with symptoms similar to those of Alzheimer's.

Digital dementia is a real neurological phenomenon, a psychological condition based on the frequent and prolonged use of digital communication technologies. Malfred Spitzer (2020) attributes these phenomena to the underutilization of the brain; however, this causality has not been proven yet. On this point, Sandu and Nistor (2020) found a correlation with the virtualization of social space and a series of phenomena related to digital dementia, the relocation of interactions, and their depersonalization. Thus, the negative impact that digital devices can cause becomes more evident at an early age, where brain plasticity is greater and functional structural changes are more sensitive to external influences. For their part, Small et al. (2020) ratify that the consequences of intensive use of digital technology can alter brain function, affecting areas such as the prefrontal cortex, which is essential for emotional regulation and cognitive control in humans. The neurocognitive changes can cause academic development and social interaction in children who spend time in front of screens.

Another crucial aspect relates to the integrity of white matter in the brains of preschool-aged children. In this sense, Hutton et al. (2020) demonstrate a negative correlation between screen time and the integrity of these brain structures, which are essential for the transmission of information between different areas of the brain. Furthermore, Fung Fallas et al. (2020) argue that children's prolonged exposure to screens promotes a sedentary lifestyle and directly affects motor skills. These are situations that also affect families' quality of life. Salum and Ponce (2021) point out that the brain neuroplasticity of children under 6 years of age is affected when they misuse smartphones, because this is the period of life when the greatest number of modifications in the shape of the brain's gyri and sulci occur, which manifest in intellectual, attitudinal, and behavioral processes. Consequently, they experience low self-esteem in relation to the limited cognitive level they achieve compared to their classmates. Furthermore, this can lead to a reduction in social interaction and other opportunities that contribute to language development, therefore, this impacts the linguistic development of infants (Taco et al., 2021). For their part, Araque-Barboza et al. (2021) emphasize that the quality of sleep is directly related to human quality of life and directly influences cognitive performance. This is because the brain's prefrontal cortex has not yet fully formed. Therefore, it is necessary to generate information campaigns and promote ongoing monitoring of the use of technological devices, especially at night.

Skulmowski and Xu (2022) point out that excessive time spent on digital learning activities increases "extrinsic cognitive load," a situation that impoverishes the assimilation of new concepts due to the large amounts of visual and auditory information a student must assimilate. Furthermore, McArthur et al. (2022) add that prolonged use of screens can lead to cognitive fatigue, which translates into a decrease in motivation and performance. Students who spend more time studying on digital platforms may experience problems such as poor information retention, difficulty staying focused, and slower information processing.

Another aspect to consider is presented by Castro et al. (2022). They state that ocular exposure to blue light plays a major factor in brain activation during the day, thanks to the production of melatonin by the pineal gland, which is responsible for regulating the circadian cycle. However, when this light comes from electronic devices, melatonin secretion is significantly reduced. This phenomenon induces the brain to perceive a fictitious daytime environment, which disrupts the biological clock. Similarly, the study by García-Real and Losada-Puente (2022) recommends reducing children's exposure time before bedtime to improve sleep quality. Furthermore, Hernández

and Loayza (2023) argue that minors are exposed to the use of technological devices between 3 and 5 hours a day, the opportunities for interaction with the people present in their context are reduced, such a situation can cause limitations in information processing, spatial location and oral expression. It should be remembered that it is common to find children who, from the age of 3, are more entertained on a cell phone instead of manual toys. They remain removed from the reality in which they operate. Therefore, caregivers are required to manage the control and accompaniment of minors (Ulloa-López and Rosales, 2025).

2.2. Benefits of Technology in Educational Development

Regarding the positive effects of using technological devices, it is emphasized that technologies in education lie in their ability to transform the educational environment and adapt it to the demands of the 21st century. According to UNESCO's EDUCATION 2030 report (2016), the use of ICTs in education is essential to preparing students for an increasingly interconnected and technological world. Screens, such as television, video games, computers, internet connections, and smartphones, are essential tools for accessing information today.

The effects of screen use are varied, depending on the type of screen, the way they are used, the length of time they is used, and the specific characteristics of each child. However, it should be noted that a large proportion of children and adolescents are in contact with all of them (AAP, 2016). Thus, screens are instruments for visualizing data, games, and sounds, providing an inexhaustible source of ideas and knowledge, allowing users of all ages to interact with realities and people different from what they encounter in their current environment. Furthermore, they are a source of entertainment, and their appropriate use promotes socialization and interpersonal relationships (Chassiakos et al., 2016).

In this context, gamification applications are teaching tools that incorporate game elements to enhance students' logical thinking, memory, and attention. Thus, Espinosa and Gregorio (2018) argue that gamification offers interactive learning through the use of technological tools, becoming an excellent resource for achieving more meaningful and successful learning. Early childhood education faces increasingly complex challenges, not least of which is the need to capture and maintain children's attention in a dynamic and constantly changing educational environment. In this context, gamification is presented as an innovative and effective tool for improving teaching-learning processes, especially in the development of fundamental skills in children aged 4 to 5. The fundamental characteristics of gamification, according to Romero and Espinosa (2019), are motivation, fun, and collaboration, which make up a dynamic and participatory educational environment. Thus, motivation is demonstrated in the interest and attention paid to learning through objectives, incentives, and rewards. Fun is crucial as it is a meaningful and lasting experience. It enhances teachers' actions to effectively capture students' attention. Collaboration can be fostered through games, promoting teamwork and interaction among participants.

Therefore, it is important to note that gamification in early childhood education offers numerous advantages for both children and teachers. For children, gamification rewards work and effort, allowing each child to learn at their own pace and develop their own skills and abilities. It fosters motivation through technological tools integrated with play and fun, thus improving computer use to facilitate the achievement of the objectives set out in the educational curriculum (Jiménez et al., 2019). For teachers, gamification provides various strategies for delivering lessons in a dynamic and meaningful way, moving away from traditional methodologies, facilitating children's motivation, promoting active participation, and offering rewards that maintain their attention. It also improves interaction between teachers and students. It is an accessible and affordable tool that can be easily implemented in the classroom.

In this sense, gamification is defined as a teaching strategy that uses game elements and dynamics in non-game educational contexts. On the other hand, Valenzuela (2021) conceptualizes gamification as fun-centered learning, using play as the main driver to establish meaningful and motivating experiences. They search for their favorite cartoon without supervision from a responsible adult. However, this search must be supervised to prevent access to unwanted content. According to Rodríguez Sas and Estrada (2021), children have the right to explore solutions through trial and error and to navigate the path to adulthood in their own time. Meanwhile, adults must learn to tolerate the wait and uncertainty that comes with supporting them throughout their development. She adds that meaningful interaction between parents or caregivers and children is a fundamental stimulus that contributes to

child development. Therefore, the amount of screen time children spend is associated with cognitive delays and correlates with poor performance in children under 5 years of age. It is the responsibility of social institutions and government policies to implement regulations, recommendations, and outreach and awareness programs. Authors such as Vargas-Murillo (2020) argue that the key to optimizing access to the benefits of using digital devices lies in selecting the appropriate presentation strategy. Hassinger-Das et al. (2020) argue that understanding the content and contexts in which screen devices are used helps us better understand their impact on interaction and communication between children and adults.

Among other benefits, it has been proven that these devices enable the exercise of critical thinking and can improve the quality of the teaching-learning process. Zamora (2020) adds that another relevant aspect to consider relates to the knowledge that teachers and caregivers have regarding the use of digital tools. Villafuerte-Holguín (2022) argues that the use of video games and computer applications contributes to improving the concentration time of children who have or have not been diagnosed with Attention Deficit Hyperactivity Disorder. Finally, Escobar et al. (2024) argue that digital tools should be recognized as contributing to the development of cognitive skills and fostering equitable access to information globally.

According to Hamp et al. (2025), mothers tend to use digital media more than fathers as a socioemotional buffer to calm their children's behavior. This practice increases in large families or in families where the primary caregiver's time is limited. However, it has been found that parents who are unsure of their parenting skills tend to use digital media as a tool to distract their children.

2.3. Parents' Role in Regulating the Use of Technology Devices in Early Childhood

The American Psychological Association [AAP] (2016) strongly states that young children should not be exposed to digital devices before the age of 18 months. And between 18 and 24 months, such exposure should be monitored by caregivers. Actions to prevent overexposure include implementing rules for device management, controlling content selection, allocating a maximum of 2 hours of TV viewing per day, and ensuring the constant presence of parents. The removal of TVs from bedrooms and not using them while meals are being served should be explored. The use of age-inappropriate content blocking software should be explored, and the distance between the TV and the user should be at least 6 times the diameter of the screen (Garmendia Larrañaga et al., 2016).

Thus, Seo and Lee (2017) and Pérez (2019) argue that parental mediation, or the type of training or parenting intervention regarding children's technology use, can take different forms. The most common is restrictive, which occurs when caregivers use rules to control children's device use; for example, they decide the timing, content, and length of use.

Despite the positive effect of co-use mediation on child development, it is rarely used. Some caregivers even find it difficult to practice because they often provide children with devices when they are busy and unable to engage in activities with them (Mendieta, 2017). Therefore, it is argued that parents are a vital factor when teaching children how to use devices, considering that children would spend a lot of time self-exposed to screens in the absence of a supervisor (Bartau-Rojas et al., 2018; Nimrod et al., 2019). Furthermore, Peñafiel Rodriguez (2021) argues that games motivate children to participate in learning activities. They allow teachers to develop new teaching and learning strategies that enhance professional practice.

According to Pons et al. (2021), changes in child-rearing habits are currently observed due to work and academic reasons faced by parents. Thus, a reduction in the time allocated to child-rearing is observed; therefore, children during this time are immersed in technological life, making their development within society increasingly difficult.

In this sense, daily routines are recommended to maintain order in children's development (Romero et al., 2020). Therefore, active mediation by parents and educators is crucial to teaching children to use technology appropriately (Vanden Abeele et al., 2020).

According to Moreno Carmona et al. (2021), there are two types of recommended mediation: instructional mediation, in which the caregiver provides recommendations and suggestions on device use, in addition to helping the child identify appropriate and inappropriate content, and co-use mediation, characterized by the presence and attention of caregivers when the child uses the device.

For their part, Twenge & Farley (2021) recommend that adults supervise device use and encourage physical and social activities, as the appropriate use of educational technology can contribute to the development of useful skills without compromising mental health or cognitive development.

The second form of parental mediation is supervision; caregivers stay in the same room as the child and constantly monitor what they are doing with the device (Nimrod et al., 2019; Mata Calderón and Carmiol, 2022). Furthermore, teacher training, which includes a review of theoretical approaches, lays the foundation for achieving more meaningful learning through the development of memory that, over the years, will enable abstraction, reasoning, assimilation, and problem-solving in educational processes (Velásquez-Pérez et al., 2023). However, studies provide evidence that the use of educational technology can improve student participation, motivation, and academic performance; however, its ubiquitous nature creates distractions and decreases users' ability to concentrate, which impacts academic performance (Clemente-Suárez et al., 2024). Other effects of uncontrolled digital device use are linked to physical health, cognitive abilities, and language development. Therefore, it is emphasized that parental involvement and the quality of parent-child interactions can mitigate the impact of digital devices on children's cognitive and psychological development (Fumagalli et al., 2024).

Socioemotional skills significantly influence children's interpersonal relationships and social adaptation (Alwaely et al., 2020). According to Castro et al. (2022), studies have not been able to determine the cause of the increase in myopia in children due to the existence of multiple factors. However, it is recommended to avoid prolonged exposure to screens because it can cause this and other health impacts.

This is confirmed by Fung Fallas et al. (2020) when they state that the omnipresence of ICTs has made them commonly used tools for communication. It is expected that parents, aunts, uncles, and cousins will show their children photographs of themselves using their cell phones. They suggest that technological devices can be used to deal with emergencies. Children should be prevented from being contacted by strangers to avoid grooming, cyberbullying, sexting and sextortion, unwanted online purchases, and access to websites with inappropriate content. Device usage schedules should be encouraged, access to applications inappropriate for minors should be controlled, and geolocation should be enabled on devices to track the child's location.

According to the WHO, screen time for children under 4 years of age should be limited to 1 hour per day and under the supervision of a caregiver. For children between 5 and 12 years of age, no exact limits on screen time have been established. However, the need to engage in activities that keep them away from a sedentary lifestyle and ensure adequate sleep is ensured is emphasized (World Health Organization, 2019). Jiménez-Morales et al. (2020) suggest that the educational and professional level of mothers and fathers is a factor that favors a better understanding of the use of smart screens, which foster critical thinking and digital media literacy.

Changes in the labor market and technological advancement have changed child-rearing styles, with the latter falling heavily on grandparents. The risks of this order may be higher in rural contexts where children are often abandoned for hours. Thus, Shi et al. (2025) present four digital parenting and grandparental parenting styles among caregivers of abandoned and non-abandoned infants: (1) restrictive mediation, (2) permissive mediation, (3) guidance, and (4) supervision. It is striking that the results show that the supervisory style decreases the likelihood that abandoned infants will experience cognitive delays, while the permissive digital parenting style increases it (Shi et al., 2025).

For their part, Ruijia et al. (2025) found that the impact of ICTs has shown positive results in the development of language, subject knowledge, and students' cognitive skills.

According to Adam et al. (2025), interactive learning media based on digital technology significantly enhance cognitive development in primary school students. They assert that success factors for maximizing educational impact are teacher training and infrastructure support.

3. Conclusions

Based on the results of this review, the authors of this study indicate that there are numerous articles confirming the existence of a high prevalence of excessive screen time in children and adolescents, which can lead to irreversible impacts on physical and emotional health, including emotional syndromes, sleep disorders, and behavioral disorders, which affect children's cognitive development. Therefore, health professionals and teachers should disseminate knowledge about children's screen use and exposure time to improve their quality of life.

Consistent with the position of Fung Fallas et al. (2020), who stated that children's overexposure to screens can affect their mental and physical health in the medium term, the authors emphasize the need to implement awareness-raising actions for the population. They add that this encourages sedentary behavior, as well as instructing parents and caregivers to act as role models, creating an environment that promotes and models physical activity.

Promoting healthy habits should be a central objective in prevention strategies, integrating approaches that include both education about the negative effects of technology and the encouragement of alternative activities that promote physical and emotional well-being. These interventions must be adapted to the cultural and family realities of each community, taking into account the specific values and contexts that affect children and young people's behavior regarding the use of electronic devices. Regarding public education and health policies, these should include the implementation of regulations that regulate screen time in school and family settings, offering spaces for digital health and wellness education that allow students to learn to manage their time in a balanced way.

In line with the statements by Rodriguez Sas and Estrada (2021), the authors emphasize that educational programs should place greater emphasis on the importance of activities and sports to improve children's health. Only through a comprehensive approach that balances technology with healthy practices will we contribute to a more balanced and sustainable lifestyle for future generations. On this point, the authors agree with the position of Velásquez-Pérez et al. (2023) that professional educators must consider the contextual and personal needs of their students and implement timely and consistent learning strategies. Thus, teachers need to guide families regarding the impact of children's overexposure to screens.

This work found that factors such as age, gender, and socioeconomic status affect the use of digital devices on cognitive development (Clemente-Suárez et al., 2024). Studies consider the variables of parental education, marital status, employment, and child behavioral variables such as emotional activity and urgency. Research on human-computer interaction identified individual predictors of smartphone use habits, personality, attachment style, and executive functioning. In this sense, the position of Taco et al. (2021) is ratified when they state that the overexposure of minors to digital devices impacts the components that make up language, such as the formulation of sentences and use of grammatical rules, the articulation of phonemes, limited vocabulary, and reduced social and communication skills. Therefore, it is suggested that corrective interventions involve parents in children's language practices from their family and surrounding environments.

In line with the experience of Franz-Torres et al. (2023), a limitation of this systematic review is the selection of keywords used in the search for publications. In conclusion, the review conducted provides insight into the landscape of screen use of children under 5 years of age and opportunities to understand the different methodological approaches in the review of the studies considered. The authors propose a line of research for future studies focusing on Anxiety and children's exposure to screens.

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