

IMPLICATIONS OF THE USE OF DIGITAL TECHNOLOGIES IN CHILD DEVELOPMENT

Implicações do uso das tecnologias digitais no desenvolvimento infantil

Implicaciones del uso de las tecnologías digitales en el desarrollo infantil

Dulce Galvão*, Ana Soares**, Carolina Nunes***, Daniela Oliveira****

ABSTRACT

Background: digital technology plays a central role in society and is deeply integrated into everyday life. Children are increasingly exposed to these resources. **Objectives:** to analyze the implications of digital technology use on children's development in scientific literature. **Methodology:** the question asked, "What are the implications of digital technology use on child development?". A critical literature review was conducted between March and June 2025, searching for articles on EBSCOhost that included parents and/or children aged 0-18 years, published between 2020 and 2025, in Portuguese, English, or Spanish, with open access and fully available. Review articles and studies with participants with neurodevelopmental disorders were excluded. **Results:** eleven studies were included. Moderate and appropriate use of digital technology can have positive effects—promoting autonomy, life satisfaction, and some communication skills. Excessive and unsupervised use is associated with difficulties in cognitive, emotional, social, and motor development, especially when it occurs early and prolonged. Delays in expressive and receptive language, poorer performance on cognitive tasks, attention difficulties, and deficits in social and emotional skills have been identified. **Conclusion:** the use of digital technology in childhood must be carefully mediated and supervised to produce benefits.

Keywords: child; digital technology; child development

*PhD., Nursing School of the University of Coimbra, Coimbra, Portugal – <https://orcid.org/0000-0002-2496-2162>

**BSc., Nursing School of the University of Coimbra, Coimbra, Portugal – <https://orcid.org/0009-0002-5235-185X>

***BSc., Nursing School of the University of Coimbra, Coimbra, Portugal – <https://orcid.org/0009-0009-6264-6716>

****BSc., Nursing School of the University of Coimbra, Coimbra, Portugal – <https://orcid.org/0009-0008-8594-2035>

Corresponding Author:
Dulce Galvão
dgalvao@esenfc.pt

How to cite:

Galvão, D., Soares, A., Nunes, C., & Oliveira, D. (2026). Implications of the use of digital technologies in child development. *Revista de Investigação & Inovação em Saúde*, 9, 1-13. <https://doi.org/10.37914/riis.v9.505>

Received: 22/08/2025
Accepted: 26/01/2026

RESUMO

Enquadramento: a tecnologia digital representa papel central na sociedade, estando profundamente integrada no quotidiano. Verifica-se uma crescente exposição da população infantil a estes recursos. **Objetivos:** analisar, na produção científica, implicações do uso das tecnologias digitais no desenvolvimento das crianças. **Metodologia:** questiona-se "Quais as implicações do uso da tecnologia digital no desenvolvimento infantil?". Revisão Crítica da Literatura, realizada entre março/junho/2025, com pesquisa de artigos na EBSCOhost, que incluíssem pais e/ou crianças dos 0-18 anos, publicados entre 2020-2025, em português, inglês ou espanhol, de acesso livre e totalmente disponíveis. Excluíram-se artigos de revisão e estudos com participantes com perturbações do neurodesenvolvimento. **Resultados:** incluíram-se onze estudos. O uso moderado e adequado da tecnologia digital pode ter efeitos positivos - promoção da autonomia, satisfação com a vida e de algumas competências comunicativas. O uso excessivo e sem supervisão está associado a dificuldades no desenvolvimento cognitivo, emocional, social e motor, sobretudo quando ocorre de forma precoce e prolongada. Identificaram-se atrasos na linguagem expressiva e recetiva, desempenho inferior em tarefas cognitivas, dificuldades ao nível da atenção e défices nas competências sociais e emocionais. **Conclusão:** o uso da tecnologia digital na infância deve ser cuidadosamente mediado e supervisionado para apresentar benefícios.

Palavras-chave: criança; tecnologia digital; desenvolvimento infantil

RESUMEN

Marco contextual: la tecnología digital desempeña papel fundamental en la sociedad y está profundamente integrada en la vida cotidiana. Los niños están cada vez más expuestos a estos recursos. **Objetivos:** analizar las implicaciones del uso de la tecnología digital en el desarrollo de los niños en la literatura científica. **Metodología:** la pregunta planteada fue: "¿Cuáles son las implicaciones del uso de la tecnología digital en el desarrollo infantil?". Se realizó una revisión crítica de la literatura entre marzo y junio de 2025, buscando artículos en EBSCOhost que incluyeran a padres y/o niños de 0 a 18 años, publicados entre 2020 y 2025, en portugués, inglés o español, con acceso abierto y totalmente disponibles. Se excluyeron los artículos de revisión y los estudios con participantes con trastornos del neurodesarrollo. **Resultados:** se incluyeron once estudios. El uso moderado y adecuado de la tecnología digital puede tener efectos positivos, promoviendo la autonomía, la satisfacción vital y algunas habilidades comunicativas. El uso excesivo y sin supervisión se asocia con dificultades en el desarrollo cognitivo, emocional, social y motor, especialmente cuando se presenta de forma temprana y prolongada. Se han identificado retrasos en el lenguaje expresivo y receptivo, menor rendimiento en tareas cognitivas, dificultades de atención y déficit en las habilidades socioemocionales. **Conclusión:** el uso de la tecnología digital en la infancia debe ser cuidadosamente mediado y supervisado para obtener beneficios.

Palabras clave: niño; tecnología digital; desarrollo infantil



INTRODUCTION

Children, defined as any human being under the age of 18 (Portuguese Committee for UNICEF, 2019), are fundamentally distinguished by two processes: “development” and “growth” (Jordanova, 2022). These two processes represent the totality of the transformations that occur throughout the life cycle (Ahsan et al., 2024). However, “development” refers to a gradual process of transformation and expansion, regulated by genetic factors and influenced by environmental factors and external stimuli, thus enabling progression from less complex to more advanced stages (Ahsan et al., 2024). On the other hand, ‘growth’ is associated with physical increase, expressed through gains in body mass and height (Ahsan et al., 2024). Although they have distinct meanings, these processes are interdependent, occurring simultaneously and continuously throughout life (Ahsan et al., 2024).

Child development can be understood as a dynamic, continuous and complex process involving various physical, cognitive, emotional and social transformations from birth to adolescence (Jordanova, 2022). This process is influenced by genetic and environmental factors and is particularly sensitive to external stimuli, especially in the early years of life. Concurrently, growth refers to the physical increase expressed by the increase in body mass and height, occurring interdependently with development throughout the life cycle (Ahsan et al., 2024). In this context, environmental stimuli play a decisive role in child development, with digital technology being one of the most prevalent stimuli in contemporary society. Digital technology has assumed an increasingly central role in everyday societal life, inevitably extending to

children and adolescents (Mthethwa et al., 2021). The use of digital devices, such as mobile phones, tablets, computers, televisions, and video games, has become unavoidable, given their impact areas across multiple domains, including communication, entertainment, work, and learning. Evidence indicates that early exposure to digital devices is a growing reality, significantly shaping and influencing children's daily lives. Regarding children and adolescents, there is a noticeable increase in exposure to technology, which may prove advantageous, when mediated by appropriate guidance and clearly defined limits. However, excessive and unregulated use of these devices can have significant consequences for a child's overall development (Mthethwa et al., 2021).

Lopes et al. (2022) report that approximately 46% of children aged 9 to 16 already own a smartphone, with this prevalence increasing as age advances. According to Lamego (2023), a significant percentage of children are exposed to digital technology at an early age.

The author observed that 2.8% of children are introduced to digital devices before six months of age, while 21.5% begin exposure between six and twelve months, and another 21.5% between three and five years. The highest prevalence of screen exposure (48.6%) occurs in the age group of 12 to 24 months.

Furthermore, Lamego (2023) reports that the most commonly used digital devices are smartphones (67.3%) and television (80.4%), with 50.5% of children incorporating these devices into their daily routines. The primary reason for frequent device use is entertainment, reported by 40.2% of children, followed by use during leisure time or family meals (29%).

Studies from European countries, Brazil, the United States, and Australia show that approximately two-thirds of kids between the ages of four and 17 exceed the recommended screen time, surpassing it by up to two hours. Additionally, one in three children aged six to ten exceeds the recommended limit by two or more hours on weekdays. In the three to five age group, studies reveal that 73.1% of children exceed the recommendations during the week, with a significant increase to 93.7% during the weekend (Rodrigues et al., 2020).

Faced with this reality, the American Academy of Paediatrics (AAP), and the World Health Organisation (WHO) have established guidelines regarding recommended periods for of digital technology use, with the aim of enabling young people to benefit from its opportunities while protecting themselves from avoidable physical, social, and emotional harm (Rafael et al., 2020).

The AAP, WHO, and Indian Academy of Paediatrics (IAP) recommend that children under two years of age avoid screen exposure, except in specific situations, such as video calls with family members. For children aged two to five years, daily screen time should be limited to a maximum of one hour, with an emphasis on age-appropriate content and adult supervision. For children and adolescents aged six to 18 years, a maximum limit of two hours of exposure per day should be established (Kulkarni & Waknis, 2025).

The use of digital technologies may influence the development process in both beneficial and harmful ways, depending on the frequency, content, and context of use (Mthethwa et al., 2021). The literature highlights the innovative impact of using digital device use in educational context, promoting global-scale

interactions and enabling the broader knowledge sharing (Mthethwa et al., 2021). However, inappropriate and unsupervised use of technology may negatively affect child development across multiple domains, including vision, hearing, cognition, pain, sleep, mental health, obesity, and social interaction (Cullen et al., 2024). Such impacts occur due to inadequate brain and mental development, resulting from deprivation of age-appropriate visual, auditory, olfactory, and tactile stimuli. These stimuli play a key role in activating different brain regions and regulating neurotransmitter production (Rosa & de Souza, 2021). Based on these premises and considering the existing concerns, interest emerged in the topic 'Implications of Digital Technology Use on Child Development'. The objectives of this study are to analyse, in the scientific literature on the implications of digital technology use in children's development; to identify the positive and negative effects of digital technology use on child development; to examine the relationship between screen exposure time and its effects on different aspects of child development; and to explore recommendations and strategies for the healthy use of digital technologies in children.

METHODOLOGICAL REVIEW PROCEDURES

A critical literature review was conducted from March to June 2025, following six fundamental stages for its development: identification of the topic and formulation of the research question; delineation of inclusion and exclusion criteria; delineation of the information to be extracted and subsequent organization of the selected studies into categories; critical evaluation of the included studies; interpretation of the obtained results and presentation

of the review in the form of a synthesis of the knowledge produced (Jesson & Lacey, 2006).

Thus, the following questions were formulated: ‘What are the implications of digital technology use for child development?’ and ‘What recommendations and strategies exist for the healthy use of digital technologies in children?’

Inclusion criteria comprised articles from primary studies were selected regardless of the methodology used, provided they included parents and/or children aged 0 to 18 years and addressed the use of digital technologies and child development. The search was limited temporally to studies published between 2020 and 2025 with the aim of analysing the most recent scientific evidence. The review included exclusively studies published in Portuguese, English, or Spanish that were freely and fully accessible in full text. Regarding the exclusion criteria, it was decided not to consider secondary studies, nor studies that included parents and/or children with specific neurodevelopmental disorders, namely Attention Deficit Hyperactivity Disorder, Autism Spectrum Disorder, intellectual disability, learning disorders, and language disorders.

The bibliographic search was conducted independently by three researchers, who selected studies based on predefined inclusion and exclusion criteria. Any disagreements were resolved by consensus. On 9 May, using the EBSCOhost search engine, the following databases were selected: CINAHL Ultimate, MEDLINE Ultimate, CINAHL Complete, MEDLINE Complete, MedicLatina, Psychology and Behavioural Sciences Collection. The Medical Subject Headings (MeSH) descriptors “child development”, “infant”, “technology”, “social development”, “emotional

development”, “social media” and the CINAHL Headings “child”, “infant”, “technology”, “child development”, “emotional development”, “social development” and “social media” were used, and the general terms and their respective synonyms in natural language “young*”, “teenager”, “paediatric”, “kids”, “digital technology”, “online technology”, “digital devices”, “educational technology”, “screen time”, “interactive technology”, “emerging technology”, “educational apps”, “childhood progress”, “psychomotor development”. The Boolean operators “AND” and “OR” were also used.

A preliminary restrictive search was first conducted using the search expression in the title field: TI (child OR young OR teenager OR infants OR paediatric OR kids) AND TI (digital technology OR social media OR online technology OR digital devices OR educational technology OR screen time OR interactive technology OR emerging technology OR educational apps) AND TI (child development OR childhood progress OR psychomotor development OR emotional development OR social development), which yielded a total of 40 studies. After applying filters, 37 studies remained. Of this set, 14 studies were retrieved from the CINAHL Ultimate database, 14 from CINAHL Complete, 7 from MEDLINE Complete, and 2 from the Psychology and Behavioural Sciences Collection.

Subsequently, a more comprehensive abstract-based search was conducted, using the same search expression: AB (child* OR young* OR teenager OR infants OR paediatric OR kids) AND AB (digital technology OR social media OR online technology OR digital devices OR educational technology OR screen time OR interactive technology OR emerging technology OR educational apps) AND AB (child

development OR childhood progress OR psychomotor development OR emotional development OR social development), yielding 1,494 studies. After applying filters, a total of 501 studies were obtained. Among these, 143 were available in the CINAHL Complete database, 119 in CINAHL Ultimate, 108 in MEDLINE Complete, 89 in MEDLINE Ultimate, and 42 in the Psychology and Behavioural Sciences Collection.

A total of 538 studies were retrieved. Following title screening, 72 studies were retained. After abstract review, 49 studies were excluded for failing to meet

study objectives, resulting in a total of 23 studies for full-text reading and analysis. After full-text evaluation, twelve studies were rejected for not fully aligning the scope of the research. Thus, eleven studies were selected for inclusion in the review, of which seven were from MEDLINE Ultimate, two from CINAHL Ultimate, and two from the Psychology and Behavioral Sciences Collection.

To better understand the research process, a Research Flowchart was created, as shown in Figure 1.

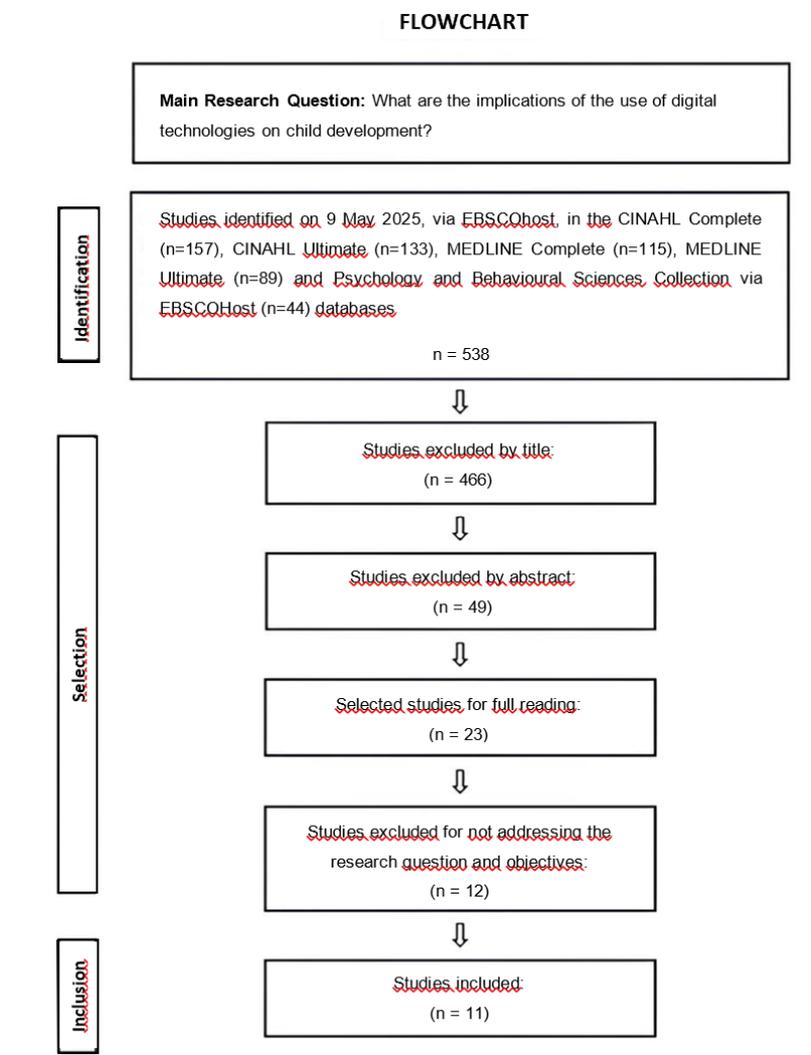


Figure 1

Flowchart of the stages of identification, selection, and inclusion of articles

For the presentation and discussion of the results, the studies were coded sequentially from E1 to E11.

RESULTS

The eleven included studies were published in English. Between 2020 and 2024, two studies were published per year, while only one study was published in 2025. This temporal distribution indicates a sustained academic interest in the topic over recent years.

Regarding the geographical origin of the publications, there is significant diversity in international contexts, covering countries such as Ireland, Germany, India, Canada, Finland, China, Japan, Brazil, and France. All studies used a quantitative methodological approach, with sample sizes ranging from 57 to 13,915 participants, including children, parents and/or caregivers. Table 1 summarises the main characteristics of the included studies.

Table 1

Characteristics of the selected studies (n=11)

Study/Authors	Place of Publication/ Year	Methodology	Objectives	Sample
E1/ (Beatty & Egan)	Ireland/ 2020	Quantitative	Examine the role of screen time and various screen activities (television, video, or educational games) on nonverbal reasoning ability in 9,001 five-year-old children.	9,001 children aged 5 years old.
E2/ (Suggate & Martzog)	Germany/ 2020	Quantitative	Evaluate the influence of screen time on the development of children's mental visualisation at two different points in time, 10 months apart.	266 children aged between 3 and 9 years old.
E3/ (Varadarajan et al.)	India/ 2021	Quantitative	Evaluate screen time, identify associated demographic factors, and analyse the impact on areas of child development.	718 children.
E4/ (MacGowan & Schmidt)	Canada/ 2021	Quantitative	Examine the association between the amount of screen time exposure during the preschool year (Time 1: Age 4) and social cognitive development after 1 year at the start of schooling (Time 2: Age 5).	57 children with typical development.
E5/ (Mustonen et al.)	Finland/ 2022	Quantitative	Examine the association between children's screen time, mothers' screen time, and different aspects of children's language skills.	164 children aged between 2.5 and 4.1 years old.
E6/ (Zhao et al.)	China/ 2022	Quantitative	Investigate the trajectory of screen time from 6 to 72 months of age and its association with children's development at 71 months.	262 mothers.
E7/ (Takahashi et al.)	Japan/ 2023	Quantitative	Examine the association between screen time among 1-year-old children and 5 domains of developmental delay (communication, fine motor skills, problem solving, and personal and social skills) at 2 and 4 years of age.	7,097 mother-child pairs.
E8/ (Meng et al.)	China/ 2023	Quantitative	To develop a moderated mediation model investigating the mediating role of meaning in life and the moderating role of childhood psychological maltreatment.	1,198 adolescents from four provinces and municipalities in China.
E9/ (Gomes et al)	Brazil / 2024	Quantitative	Explore the relationship between child development, daily habits, and consumption of ultra-processed foods with screen exposure in 4-year-old children.	362 caregiver-child pairs.

E10/ (Yang et al.)	France / 2024	Quantitative	Assessing associations between screen use and cognitive development in the French national birth cohort.	At 2 years of age: 13,915; At 3.5 years of age: 12,016 children.
E11/ (Kulkarni & Waknis)	India / 2025	Quantitative	Investigate screen time patterns and explore the relationship between screen time exposure and pragmatic development in children aged 1 to 4 years.	60 children aged between 1 and 4 years old.

Following a comprehensive review of the articles, the most relevant information was systematised, resulting in the emergence of four main thematic blocks (Table 2). The first block highlights the positive effects of digital technologies on the development of teenagers and preschool children when parental mediation is present (E8 and E11). The second thematic block addresses the negative impacts of digital technologies on the cognitive, linguistic, emotional, social, and motor domains of child and adolescent development,

as evidenced by ten of the included studies (E1, E2, E3, E4, E5, E6, E7, E9, E10, and E11). The third block explores the relationship between exposure duration to digital technologies and their effects on the various domains of child development, also identified in ten of the included studies (E1, E2, E3, E4, E5, E6, E7, E9, E10, and E11). The fourth thematic block highlights recommendations and strategies for the healthy use of digital technologies in children, as discussed in studies E5 and E11.

Table 2

Synthesis of the information from the included studies

Thematic block	Description / Age Group	Related studies
Positive effects of digital technologies on child development	Beneficial effects associated with digital use in adolescents, and, when mediated, in preschool-aged children	(E8 and E11)
Negative effects of digital technology use on child development	Adverse impacts on cognitive, linguistic, social, and motor domains in samples of children and adolescents	(E1, E2, E3, E4, E5, E6, E7, E9, E10 and E11)
Correlation between the amount of time spent using digital technologies and their effects on distinct aspects of child development	Associations between screen time and developmental impacts	(E1, E2, E3, E4, E5, E6, E7, E9, E10 and E11)
Guidelines and strategies to foster healthy and balanced digital technology use in children	Age-adjusted limits and parental mediation as strategies for fostering beneficial digital technology use	(E5 and E11)

DISCUSSION

The integrated analysis of the eleven studies revealed that the effects of digital technologies on child development differ markedly according to age, context of use, and duration of exposure, emphasizing that these effects are neither uniformly negative nor uniformly positive.

Among studies centered on preschool and school-aged children, high exposure to digital devices was predominantly associated with negative outcomes across multiple developmental domains.

Study E1 (Beatty & Egan, 2020) demonstrated that 5-year-old children who spend more than three hours per day in front of screens tend to exhibit poorer

performance on nonverbal reasoning tasks. Consistently, E6 (Zhao et al., 2022) reported that gradual and continuous exposure to digital technologies throughout development is associated with significantly lower scores across several cognitive domains, including verbal comprehension, working memory, general ability, cognitive proficiency, and perceptual reasoning. Furthermore, the authors highlighted that intense exposure during early developmental stages may result in observable repercussions by 72 months of age, particularly in cognitive proficiency, processing speed, and working memory, as well as the emergence of hyperactivity symptoms and attentional difficulties. These findings are further supported by studies E2 and E4.

In study E2, Suggate and Martzog (2020), identified a negative correlation between prolonged screen exposure and the development of mental imagery abilities, as well as response accuracy and speed. These effects are attributed to sensory narrowing caused by continuous exposure to pre-constructed images presented in rapid succession via digital devices. Corroborating these findings, MacGowan & Schmidt (2021), in study E4, observed that increased screen time and video game use were associated with reduced performance on the Picture Vocabulary Test (PVT) and Theory of Mind (ToM) tasks.

Collectively, these findings suggest that prolonged exposure to digital devices, particularly during critical periods of child development, fosters low-interactivity sensory experiences, most notably through video games, which may compromise the development of fundamental cognitive processes. Such exposure reduces opportunities for active knowledge construction and the development of mental schemas.

In this regard, E9 (Gomes et al., 2024) reinforces this line of evidence by demonstrating that four-year-old children with high levels of screen exposure show significantly poorer cognitive outcomes. This effect is particularly pronounced in family contexts characterized by a lack of enriching stimuli and by the presence of screens during mealtimes. Furthermore, from a cognitive development perspective, E11 (Kulkarni & Waknis, 2025) reports that children's ability to transfer and interpret information in the absence of social interactions with family members and peers, may be negatively affected by excessive screen use. This overexposure is associated with serious health and developmental problems, including obesity, cognitive and language delays, and delayed social development.

Based on Piaget's Theory of Cognitive Development, these findings raise substantial concerns regarding the impact of excessive digital technology use on children's cognitive development. According to this theoretical framework, knowledge is actively constructed by the child through continuous and reciprocal interaction with both the physical and social environments. Within this process, motor activity, concrete object manipulation, and active, direct exploration of the environment are considered as fundamental elements for the formation, organization, and consolidation of mental schemas. During the early years of life, particularly throughout the sensorimotor and preoperational stages, cognitive development is grounded on direct and concrete interactions with the surrounding environment. From this perspective, the premature replacement of such experiences with passive forms of interaction, namely, exposure to digital technology, may compromise the harmonious

development of cognitive abilities, as it restricts access to stimuli that promote experimentation, exploration, and meaningful learning (Pakpahan & Saragih, 2022). A strong association with poor development of pragmatic skills was also observed in study E11, namely, an insufficient ability to use language effectively and appropriately across different social contexts. Reinforcing this evidence, Yang et al. (2024), in E10, demonstrated that between the ages of two and 5.5 years, each additional hour of screen exposure is associated with a decline in cognitive skills, most notably in language, with negative effects persisting throughout development. In the linguistic and social domains, studies E3 and E5 report convergent findings, emphasizing that excessive screen exposure, particularly when experienced in isolation and without family interaction, negatively impacts on both language development and socially mediated communication. Varadarajan et al. (2021), in study E3, reported that 73.3% of children under two years old and 73.0% of children aged two and above exhibited delays in both receptive and expressive language. These delays reflect difficulties in comprehension and expression, compromising children's overall communication and, subsequently, social interaction in social contexts. Mustonen et al. (2022), in study E5, complement these findings by demonstrating that screen use without active interaction is associated with reduced exposure to linguistic stimuli, thereby hindering lexical, phonological, and communicative development. Motor development disorders have also been documented. Takahashi et al. (2023), in study E7, identified impairments in both fine motor skills (4.6%) and gross motor skills (4.9%) in children exposed to

high levels of screen time, with effects observable at ages two and four. Gomes et al. (2024), in study E9, corroborate these findings, reporting that greater exposure to digital devices is associated with lower scores in motor development domain.

Although the majority of scientific evidence predominantly highlights the negative effects of digital technology use on child development, it is important to acknowledge that technology can also contribute positively to child development, when used appropriately, particularly during adolescence. According to Meng et al. (2023), in study E8, the use of social media and mobile digital devices can serve as a means of promoting adolescents' emotional well-being, enhancing a sense of purpose and life satisfaction through self-expression and the strengthening of social bonds. Such experiences fulfil fundamental psychological needs, including belonging, autonomy, and self-esteem, thereby fostering well-being and a greater perception of life satisfaction. This perspective aligns with Lev Vygotsky's Sociocultural Theory of Development, which underscores the central role of social and cultural interactions in shaping human development, particularly during periods of identity formation and the establishment of complex social competencies (Kouicem, 2020). According to Kouicem (2020), for Vygotsky, learning and cognitive development arise within a socially mediated context, in which language, as a central cultural tool, plays a structuring role. Thus, the conscious and guided use of digital technologies, such as social media, can be understood as a form of symbolic mediation, enhancing identity formation, emotional co-regulation, and the development of social skills (Kouicem, 2020).

Complementing this perspective, Kulkarni and Waknis (2025), demonstrate, in study E11, that when recommended guidelines are followed, screen exposure time can be positively correlated with communication skills and functional language use across diverse contexts, particularly when co-viewing and parental mediation are present in preschool-aged children. This observation is consistent with Vygotsky's concept of the Zone of Proximal Development (ZPD) (Kouicem, 2020), as adult presence, through supervision, in this case, can expand children's learning potential and promote a richer appropriation of digital tools as cultural instruments for development (Kouicem, 2020). The severity of negative effects on child development is related to the degree of adherence to recommendations regarding digital device use (Kulkarni & Waknis, 2025). Mustonen et al. (2022) explicitly highlight the risks associated with screen exposure and the lack of content supervision on cognitive, emotional, and social development. Despite these risks, the authors advance practical recommendations, emphasizing the need for consistent, age-appropriate boundaries to ensure that family interaction time remains meaningful and developmentally enriching. In this context, parental mediation is identified as a key moderating variable. Kulkarni and Waknis (2025), in study E11, argue that digital technology use should be carefully regulated and supervised, and complemented by co-viewing practices and guided parental discussion, thereby transforming screen use into a potentially beneficial context for the development of children's pragmatic language skills. Accordingly, when these recommendations are consistently implemented, they

contribute to the creation of a context that supports dynamic and engaging learning, thereby playing a significant role in children's educational development. In E11, Kulkarni and Waknis (2025) further reinforced the guidelines issued by the American Academy of Pediatrics (AAP), the World Health Organization (WHO), and the Indian Academy of Pediatrics (IAP).

From a theoretical standpoint, the effects of digital technology exposure on child development can be more comprehensively understood through the integration of sociocultural and ecological perspectives. While Vygotsky's Sociocultural Theory emphasizes the mediating role of social interaction and guided participation in learning processes, Bronfenbrenner's Bioecological Theory of Human Development - particularly its more recent Neocological formulation (Guy-Evans, 2024) - highlights the dynamic interplay between individuals and the multiple environmental systems in which development occurs. This framework underscores the importance of contextual factors, such as family practices, parental mediation, and broader societal guidelines, in shaping the developmental impact of digital technologies. Co-viewing of content and adult-guided discussion emerge as strategies capable of transforming digital experiences into enriched learning opportunities. From this perspective, the impacts of digital technology should be examined not merely in terms of its presence or absence in children's lives, but primarily according to how it is used and the contexts in which such use occurs (Guy-Evans, 2024).

As a limitation of this study, the absence of research conducted in Portugal should be noted. This lack of national evidence may have resulted in a gap in

understanding how Portuguese children use digital technology.

CONCLUSION

The adverse effects of excessive digital technology use on child development are particularly evident when screen exposure is prolonged, isolated, and lacking meaningful social mediation, affecting cognitive, linguistic, social, and motor domains.

The selected studies consistently revealed a strong relationship between digital technology use and its effects, both positive and negative, on child development, indicating that the severity of negative development outcomes is directly related to the degree of adherence to recommendations on the use of digital devices. A clear negative association was identified between excessive use of digital technologies and children's cognitive performance, as well as a strong association with poor development of pragmatic skills, namely an insufficient ability to use language effectively and appropriately in different social contexts. Furthermore, prolonged screen exposure, particularly when occurring isolated and without family interaction, has a negative impact on linguistic, social and motor development.

In contrast, screen exposure has been positively associated with communication skills and functional language use, particularly when co-viewing and parental mediation occur. potential positive effects emerge in certain situations, such as adolescents' emotional well-being and contexts involving active parental mediation, age-appropriate limits, and shared participatory experiences. The use of social media and mobile digital devices may promote adolescents' emotional well-being by enhancing sense

of meaning and life satisfaction through personal expression and the strengthening of social bonds. These findings support recommendations that promote conscious, regulated, and developmentally appropriate use of digital technologies, including limits on screen exposure time, adult mediation, and the integration of technological experiences with socially interactive activities. Scientific evidence underscores the importance of mindful and regulated digital technology use. Accordingly, the implementation of age-adjusted limits and active adult involvement in monitoring and guiding digital device use is recommended. Nurses, as healthcare professionals actively engaged with children and their families, are pivotal in promoting health initiatives, enabling informed decision-making concerning digital technology use.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest that could compromise the impartiality of the article (personal, commercial, academic, political, or financial).

FUNDING

The authors declare that this study did not receive any funding.

REFERENCES

Ahsan, M., Akram, M., Iftikhar, M., Rehman, T. U., Sierra, F. G., Hasibuzzaman, M. A., Ozdemir, F. A., Solowski, G., Fitria, N., Altable, M., & Sfera, A. (2024). Growth and development. *Journal of Clinical Research and Reports*, 16(3). <https://doi.org/10.31579/2690-1919/394>

- Beatty, C., & Egan, S. M. M. (2020). The role of screen time and screen activity in the nonverbal reasoning of 5-year-olds: cross-sectional findings from a large birth cohort study. *Cyberpsychology, Behavior, and Social Networking*, 23(6), 406-411. <https://doi.org/10.1089/cyber.2019.0420>
- Comité Português para a UNICEF. (2019). *Convenção sobre os Direitos da Criança e Protocolos Facultativos* (Edição revista). https://www.unicef.pt/media/2766/unicef_convenc-a-o_dos_direitos_da_crianca.pdf
- Cullen, J., Muntz, A., Marsh, S., Simmonds, L., Mayes, J., O'Neill, K., & Duncan, S. (2024). Impacts of digital technologies on child and adolescent health: recommendations for safer screen use in educational settings. *New Zealand Medical Journal*, 137(1593). <https://doi.org/10.26635/6965.6565>
- Gomes, G. M. D., Souza, R. C. V., Santos, T. N., & Santos, L. C. (2024). Screen exposure in 4-year-old children: association with development, daily habits, and ultraprocessed food consumption. *International Journal of Environmental Research and Public Health*, 21(11), 1504. <https://doi.org/10.3390/ijerph21111504>
- Guy-Evans, O. (2024). Bronfenbrenner's ecological systems theory. *Simply Psychology*. <https://www.simplypsychology.org/bronfenbrenner.html>
- Jesson, J., & Lacey, F. (2006). How to do (or not to do) a critical literature review. *Pharmacy Education*, 6(1). <https://core.ac.uk/reader/78879170>
- Jordanova, N. P. (2022). Identification and management of child development: practice parameters. *Archives of Public Health*, 14(1), 126-134. <https://doi.org/10.3889/aph.2022.6040>
- Kouicem, K. (2020). Constructivist theories of Piaget and Vygotsky: Implications for pedagogical practice. *Psychological & Educational Studies*, 13(3). <https://asjp.cerist.dz/en/downArticle/117/13/3/125613>
- Kulkarni, K., & Waknis, A. P. (2025). Screen-time and pragmatic development of toddlers and preschool children. *Journal of Indian Speech Language & Hearing Association*, 38(1). https://doi.org/10.4103/jisha.jisha_1_24
- Lamego, A. I. N. (2023). *Impacto do uso de dispositivos digitais em idade pré-escolar* [Tese de Mestrado, UBI - Universidade da Beira Interior]. uBibliorum - Repositório Digital da UBI. <http://hdl.handle.net/10400.6/13500>
- Lopes, S., Silva, B., & Araújo F. (2022). Students' knowledge of cervical posture while using the smartphone. *Revista de Investigação & Inovação em Saúde*, 5(1), 23-32. <https://doi.org/10.37914/riis.v5i1.174>
- MacGowan, T. L., & Schmidt, L. (2021). Preschoolers' social cognitive development in the age of screen time ubiquity. *Cyberpsychology, Behavior, and Social Networking*, 24(2), 141-144. <https://doi.org/10.1089/cyber.2020.0093>
- Meng, S., Kong, F., Dong, W., Zhang, Y., Yu, T., & Jin, X. (2023). Mobile social media use and life satisfaction among adolescents: a moderated mediation model. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1117745>
- Mthethwa, W. S., Kabala, T., & Kubheka, B. Z. (2021). Choosing a healthy childhood development in the digital era. *Journal of Pediatric & Child Health Care*, 6(3), 1048. <https://doi.org/10.26420/jpediatrchildhealthcare.2021.1048>
- Mustonen, R., Torppa, R., & Stolt, S. (2022). Screen time of preschool-aged children and their mothers, and children's language development. *Children*, 9(10), 1577. <https://doi.org/10.3390/children9101577>
- Pakpahan, F. H., & Saragih, M. (2022). Theory of cognitive development by Jean Piaget. *Journal of Applied Linguistics*, 2(1), 25-34. <https://doi.org/10.52622/joal.v2i2.79>
- Rafael, A., Gouveia, M., Fernandes, S. G., Costa, A. V., Melo, S., Borges, S., Calejo, J., Mendes, G., & Costa, A. V. (2020). Screen time and psychopathology in children and adolescents. *Journal of Child Psychology*, 6(2), 45-60. <https://doi.org/10.51338/rppsm.2020.v6.i2.161>
- Rodrigues, D., Gama, A., Machado-Rodrigues, A. M., Nogueira, H., Silva, M. R. G., Rosado-Marques, V., & Padez, C. (2020). Social inequalities in traditional and emerging screen devices among Portuguese children: a cross-sectional study. *BMC Public Health*, 20(1), 1-12. <https://doi.org/10.1186/s12889-020-09026-4>
- Rosa, P. M. F., & de Souza, C. H. M. (2021). Ciberdependência e infância: as influências das tecnologias digitais no desenvolvimento da criança. *Brazilian Journal of Development*, 7(3), 23311-23321. <https://doi.org/10.34117/bjdv7n3-172>
- Suggate, S. P., & Martzog, P. (2020). Screen-time influences children's mental imagery performance. *Developmental Science*, 23(6), e12978. <https://doi.org/10.1111/desc.12978>

Takahashi, I., Obara, T., Ishikuro, M., Murakami, K., Ueno, F., Noda, A., Onuma, T., Shinoda, G., Nishimura, T., Tsuchiya, K. J., & Kuriyama, S. (2023). Screen time at age 1 year and communication and problem-solving development delay at 2 and 4 years. *JAMA Pediatrics*, *177*(10), 1039-1046. <https://doi.org/10.1001/jamapediatrics.2023.3057>

Varadarajan, S., Venguidesvarane, A. G., Ramaswamy, K. N., Rajamohan, M., Krupa, M., & Christadoss, S. B. W. (2021). Prevalence of excessive screen time and its association with developmental delay in children aged <5 years: a population-based cross-sectional study in India. *PLOS ONE*, *16*(7), e0254102. <https://doi.org/10.1371/journal.pone.0254102>

Yang, S., Saïd, M., Peyre, H., Ramus, F., Taine, M., Law, E. C., Dufourg, M. N., Heude, B., Charles, M. A., & Bernard, J. Y. (2024). Associations of screen use with cognitive development in early childhood: the ELFE birth cohort. *Journal of Child Psychology and Psychiatry*, *65*(5), 680-693. <https://doi.org/10.1111/jcpp.13887>

Zhao, J., Yu, Z., Sun, Z., Wu, S., Zhang, J., Zhang, D., Zhang, Y., & Jiang, F. (2022). Association between screen time trajectory and early childhood development in children in China. *JAMA Pediatrics*, *176*(8), 768-775. <https://doi.org/10.1001/jamapediatrics.2022.1630>