



Unpacking the relationship between screen use and educational outcomes in childhood: A systematic literature review

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ABSTRACT

The increasing digitization of society has led to the growing immersion of children in virtual culture, raising concerns about how screen use affects their educational and personal development. Through a Systematic Literature Review (SLR) and Textual Data Mining (TDM), this study explores the profile of digital technology use, behaviour, and effects on childhood. We identify three distinct periods in the study of these effects: pre-2016, focused on addiction and health; 2016–2020, focused on educational applications and the role of families; and post-2020, with an emphasis on negative repercussions for identity construction, health, well-being, and behaviour. Our findings reveal a growing concern about the cognitive and emotional impact of screen use, underscoring the importance of teacher training and digital literacy for children and parents for appropriate and healthy use of technology. In contrast to what has been previously known, this study highlights the dynamic change in issues of concern about childhood screen use over time and emphasizes the need for educational strategies adapted to emerging digital cultural realities. This comprehensive approach offers a deeper insight into the dual role of technology as both an educational tool and a source of risk, providing a foundation for the development of informed and responsible educational practices in the digital age.

1. Introduction

We now live in a society in which little or nothing remains unaffected by technology. Our reality is becoming increasingly unbridled, and our social interaction is ever more digital. This is a society in which the boundary between online and offline is becoming increasingly blurred (Floridi, 2014). It is nigh on impossible to avoid using smartphones, iPads, or laptop in our everyday lives, whether it is because of their appeal when facilitating communication or for undertaking certain routine tasks (García del Dujo et al., 2022). This is also the case among the younger generations, as children today are surrounded by screens connected to the internet.

Given this situation, it is worth asking ourselves what we should do as educators, parents or legislators when faced with the use of screens by the youngest children. To establish a starting point to answer this question, this article aims to review the literature and study the main issues that have interested the scientific community in this regard.

Screens are understood here to refer to all those digital devices that enable us to go online and access a digital and virtual reality,

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with the most popular ones among children being smartphones and tablets (Smahel et al., 2020). Recent years have seen how screens have become just another device in childhood, as an integral part of children's development and education. This is a critical period in which the process of self-discovery is increasingly unfolding in a digital setting (Huber et al., 2018; Mace, 2020). Nevertheless, most research thus far has focused on studying and theorising upon the uses and types thereof that young people and adults make of screens (Domoff et al., 2020; Muñoz-Rodríguez, et al., 2023). Yet children, too, are immersed in this digital culture. According to the UK Office for National Statistics (Stripe, 2020), 89% of children aged between 10 and 15 say they go online every day. In turn, the most recent studies, such as the one conducted by EU Kids Online (Smahel et al., 2020), report that 80% use their smartphones to go online. In terms of online time, the study reports that, on average, children aged between 9 and 11 are online for 2 h per day. These figures were significantly higher during the lockdown and health emergency caused by the COVID-19 pandemic (McClain, 2022). These findings are backed by other studies that reveal how this online time increases as children grow up (Murciano-Hueso et al., 2022). The more salient aspect of these studies, however, is not so much the time or device involved, but instead the risks and benefits that the use of screens entails for children (Lin et al., 2020; Stavrinou et al., 2018). Numerous studies coincide on indicating that childhood does not involve digital skills. Moreover, some studies, such as those conducted by Bautista et al. (2013) and Reid et al. (2023) question the very concept of digital native because it lacks any empirical grounding and is overstated. Although children appear to be immersed in a digital world, where they find it easy to learn how to handle a smartphone or tablet, they do not know how to adopt the necessary critical approach. They are incapable of distinguishing between the benefits and the pitfalls. Although almost 80% of the children involved in the EU Kids Online study (Smahel et al., 2020) claimed they felt safe online, the truth is that there is a growing number of studies that report data misuse and the consumption of harmful or sexual content as from the age of nine (Gkolemi et al., 2022; Torrijos-Fincias et al., 2021), involvement in bullying and cyberbullying (Millan Ghisleri & Caro Samada, 2022) and even addiction to videogames as from the age of 11 (Kilbey, 2017). These behaviours entail a series of risks that will affect the development of their personalities if they are not tackled in time. Nevertheless, the use of screens has also proven to have certain advantages; for example, some experts refer to the way many videogames nurture the development of precision and creativity, and the fostering of a critical mindset (Jin & Lin, 2022; Mullan & Hofferth, 2022).

In short, although some currently literature shows concern about the use of screens in childhood (Smahel et al., 2020; Touw et al., 2019), some authors highlight that digital immersion is reshaping childhood experiences and understanding the nuanced effects of screen use on educational outcomes is paramount (Domoff, 2020; Kilbey, 2017; Muñoz-Rodríguez, et al., 2023). To prevent the risks and issues arising from screen use that emerge in adolescence, it is important to study what happens in childhood regarding the use of these devices (Stavrinou et al., 2018; Vannucci et al., 2020). As Sanders (2023) and Torrijos et al., (2021) argue, understanding the risks, benefits, uses, types of use, and virtues of screens will enable us to design educational strategies to prevent the negative consequences associated with screen use in youth. That is why we present a study with the purpose to fill a gap in the scientific literature by providing a systematic review of the effects of screen time on children's educational outcomes. As it is done with youth and adolescents (e.g. Torrijos-Fincias et al., 2021; Vannucci, et al., 2020; among others).

In view of this, and embracing the need to gain an in-depth understanding of children's new cultural reality, this article's overriding purpose is to shed light on the user profile, behaviour, and effects (risks and benefits) of digital technology in childhood in order to 1) analyse the trend in the state-of-the-art and the interest this matter has aroused in the scientific community, and especially in the field of education, and 2) identify the main topics addressed regarding the use, performance, and effects of screens in childhood. Specifically, the following questions are addressed:

- 1 What have been the topics of interest addressed by scientific literature on screen use in childhood in recent decades?
- 2 What use do children make of digital technology?
- 3 What risks and benefits does screen use in childhood entail?

By identifying patterns, gaps, and emerging themes, we strive to offer a comprehensive overview that supports educators, parents, and policymakers in navigating the complexities of digital influences on childhood education.

2. Methods

The methodology used here is informed, on the one hand, by the precepts of a Systematic Literature Review (SLR), and more specifically those defined by Snyder (2019) and, on the other, by the characteristics of Text Data Mining (TDM - Lebart & Salem, 1988).

An SLR is a self-contained research method for summarising the main contributions made by scientific studies conducted within a discipline, shedding light on future outputs, while at the same time reducing biases. An SLR therefore needs to respond to clear research questions and objectives designed to generate knowledge within a specific field and aimed at a more or less specific group of scholars. This requires defining the criteria both for including the studies in the review and excluding others. It is also necessary to describe the analysis process that will be implemented once the corpus of studies has been compiled for the review (Snyder, 2019). The aim in this section is to illustrate each one of these aspects.

According to TDM, a complex text may be analysed through multivariate statistical methods involving the creation of a lexical table $X_{p \times n}$ with p words and n articles. TDM allows analysing the content and structure of any text, such as, for example, scientific articles. Generally, TDM allows a large amount of text to be analysed thanks to the use of multivariate statistical analysis methods. For this, a frequency matrix is required, which usually shows the number of repetitions of certain words. From this matrix, researchers usually prefer to use graphical methods (such as Correspondence Factor Analysis or Biplot methods) as they allow a visual interpretation beyond the user's level of statistical knowledge. Our methodology has followed the guidelines provided by Caballero-Julia and

Campillo (2021) for applying a TDM to an SLR.

2.1. Review purpose

This SLR sets out to analyse the evolution of the state-of-the-art on the use of digital devices and their ramifications in childhood. In other words, the aim is to study the interest that the topic has awoken in the scientific community and those aspects that have thus far been explored.

2.2. Procedure

This SLR is therefore organised into the following steps: 1) retrieval of the scientific studies (articles) from international databases (Scopus), 2) selection of those that meet the two inclusion criteria, 3) creation of a frequency table (lexical matrix or table) based on the selected text, and 4) a MANOVA-Biplot text analysis (Vicente, 1992).

2.2.1. Retrieval of articles

This first step has involved the Scopus database as the common international referent for retrieving the articles to be included in the SLR. There are three main reasons for this: firstly, Scopus is the world's largest database; secondly, duplicates are very likely to appear if other databases are included (e.g., Web of Science), and finally, the nature of the TDM used in this SLR permits identifying general trends despite possible absences, as the inclusion of new articles, or even new databases, does not affect the conclusions reached on them beyond certain nuances.

The Scopus online platform has been used to search for those articles using the keywords TITLE-ABS-KEY ((smartphone OR laptop OR tablet) AND children AND (use OR overuse OR surplus OR time OR problem OR benefit OR profit)). This search found a total of 4969 documents. A selection was then made of those articles published in journals covering the following branches of science: Social Sciences, Psychology, Neuroscience, and Computer Science. This screening process produced 863 articles. To carry out their processing, the system was requested to download them in *.csv format, in each case specifying their title, authors, source, year of publication, and abstract. We also added a specific reference (ID) in each case as a unique marker that would enable us to identify each article.

2.2.2. Selection of articles

When downloading the literature data, we first discarded those texts without an abstract, and a final screening was performed according to the following exclusion criteria.

1. Articles that did not focus specifically on childhood (aged 0 to 16), thereby discarding those articles reporting on other ages.
2. Articles that did not consider the use of screens or their repercussions in childhood.
3. Articles that involved the COVID-19 lockdown period, as these are deemed to deal with exceptional circumstances.

This screening produced 158 articles.

2.2.3. Creation of a data matrix

A data matrix was then created using the text in the abstracts. This involved generating a text document that could be recognized by IRaMuTeQ (LERASS, n.d.) software with the following structure:

```
**** *ID_1
(first abstract)
**** *ID_2
(second abstract)
**** *ID_3
(third abstract)
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This was immediately followed by the application of a lemmatisation protocol that involved converting the nouns and adjective in Spanish into their masculine singular forms, verbs into the infinitive, and so on (Lebart et al., 2000). The result is an $X_{p \times n}$ lexical matrix with p words and n articles that is recalculated by means of the characterisation value described by Caballero-Julia and Campillo (2021). This allows for computing the relative values of each word in the matrix according to the number of times it appears in each article. This value responds to the following formula:

$$f'_{np} = \frac{f_{np}}{\sqrt{\max_{f_i} \sqrt{\max_{f_j}}}}$$

Finally, the resulting matrix is analysed with a MANOVA-Biplot (Vicente, 1992), which caters for the simultaneous display of the

set of words and articles. The latter are clustered according to three publication periods (pre-2016; 2016–2020; post-2020) constituted according to the variable “year of publication”. This technique is designed to highlight the differences defining the clusters and thus single out the topics specific to each period. In addition, these results were compared to those provided by the ALCESTE method (Reinert, 1990, 1991, 1992) contained in the IRaMuTeQ itself.

The graphical interpretation of the MANOVA-Biplot allows, at first, to distinguish the different publication periods. To do this, the researcher only has to look at the relative position of the centres representing each period, where a big distance implies a difference between them and equal overlaps. In the second step, the graph shows the keywords that cause this differentiation based on their most characteristic content. The vectors representing the words (variables of the analysis) point to the period insofar as they are causing the distinction between groups. The researcher can then reconstruct the typical discourse of the period articles based on these words. Finally, thanks to the variable “Year of publication”, researchers can study the evolution of the topics over the years, see the terms used, the focus of interest of the scientific community and which aspects have ceased to be the subject of study.

3. Results

Fig. 1 shows the flowchart for selecting the articles that has identified a total of 158 articles currently to be found on the Scopus platform and consistent with the target subject matter.

Fig. 2 reveals that the scientific community’s interest in this topic is growing, despite recording several fluctuations in recent years. It is also worth noting that the annual rate of publication has remained constant since 2011, and although some articles were published in 1986, it is mainly since the beginning of this century that scholars have decided to study and publish on the topic.

This initial approach and the calculations made provide a thematic classification with the ALCESTE method (Fig. 3) that reveals three major groupings. The first of these three clusters (*Class 1*, in red) contains those studies that deal with motor behaviours and reactions closely linked to writing skills and recognition. The second cluster (*Class 2*, in green) involves the educational use of digital technology (e.g., digital tools and applications) focusing also on autistic children. The third and last cluster (*Class 3*, in blue) addresses the link between the use of devices (mainly smartphones) and sundry issues such as the lack of sleep, parental relationships, anxiety, and even addiction.

The inclusion of year of publication as an analysis criterion (pre-2016; 2016–2020; post-2020) and the search for each period’s defining discourses (subject matters) reveal a clear distinction between them. Fig. 4 presents the sum of articles published before 2016 in the lower part of quadrants three and four, surrounded by words such as *addiction*, *mental*, *teach*, *toy*, *performance*, *technology*, *health*, and *attitude*, amongst others. Over the course of time, scholars have continued to study the consequences of the use of digital devices, and in the 2016–2020 period they have focused on studying the relationships between these devices and their therapeutic and educational application for treating cases of autism and dyslexia, for example. This thematic aspect is related to classes 1 and 2 in Fig. 3, where they share the first quadrant. In this same space, we may also highlight words such as *family*, *father*, *access*, *adolescent*, *regulation*, and *mobile*, amongst others, finding ourselves midway between the articles published in 2016–2020 and those before that period. This to some extent reveals a growing interest in the educational aspect of the use of digital devices. In the third and final period, this interest evolves toward the use of smartphones and their relationship with different kinds of issues of a psychosocial nature, such as those listed in Class 3 in Fig. 3.

We may therefore contend that the first period (pre-2016) corresponds to the beginning of concerns over *addictive effects and, in general terms, over the healthy use of technological devices*. The second period (2016–2020) combines the study of the applications and ramifications of the use of digital devices with a markedly educational nature, focusing also on the role families play in dealing with

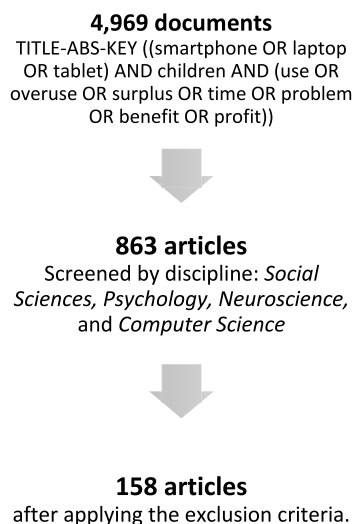


Fig. 1. Flowchart for selecting articles.

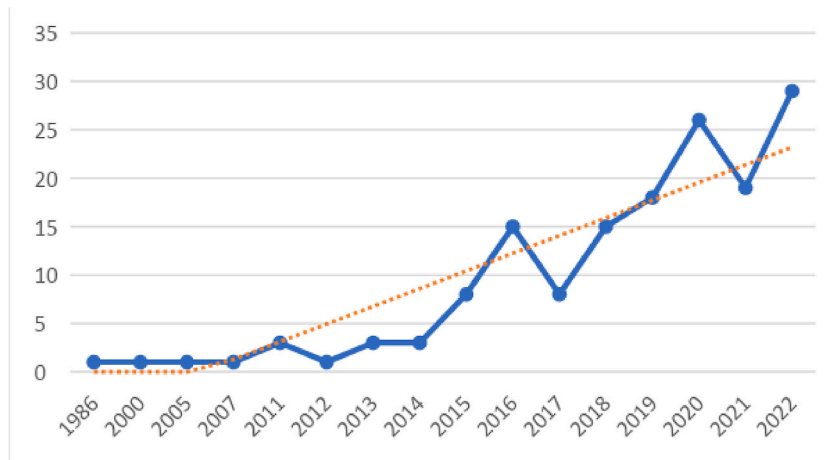


Fig. 2. Rate of publications selected.

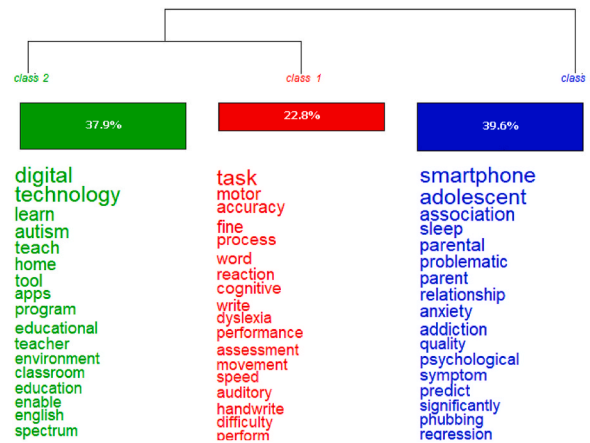


Fig. 3. Dendrogram for classifying text according to the ALCESTE method.

new digital challenges. In the third period, which besides sharing the interest in families contains the latest publications (post-2020), centring on the negative effects on identity building, health, wellbeing, and behaviour involving the use of such devices as smartphones.

4. Discussion

4.1. Trend in publications and thematic lines

The analysis of the literature conducted here has enabled us to discover the effects (risks and benefits) that digital technology has in childhood, as well as the user profile and behaviour of children in front of screens. As regards the first objective, *analysing the trend in publications and the interest this topic has aroused among the scientific community, and especially in the field of education*, the literature reveals that the use of screens in childhood has long been a topic of interest, as confirmed by certain studies such as those by [Maynard and Cheyne \(2005\)](#) and [Kerawalla et al. \(2007\)](#) in which they begin to question whether the first technological devices used in digital education effectively helped children to learn. Nonetheless, a particular interest in this subject matter emerged in the first decade of this century, with a sharp growth in the scientific output on digital technology within the field of education. This stands to reason, as this period signalled the start of the widespread use of smartphones and iPads in our society, beginning to be accepted as just another digital device available to children ([Wiles et al., 2016](#)), with the added benefit of enabling them to access and interact within another space, namely, the virtual environment. In terms of the field of education, this is precisely the time when the premise of “one laptop per child” began to be widely embraced in most of Europe’s schools ([Ames, 2016](#); [Levy, 2011](#); [Yang et al., 2013](#)).

Once the use of these devices had become commonplace at home and at school over the period 2016–2020, and as was to be expected, academia showed an interest in studying the type of use children were making of these devices both at school (e.g., [Choi et al., 2018](#); [Fekonja-Pekljaj and Marjanovič-Umek, 2015](#)) and outside it (e.g., [Cho & Lee, 2017](#); [Sergi et al., 2017](#)). This period also saw

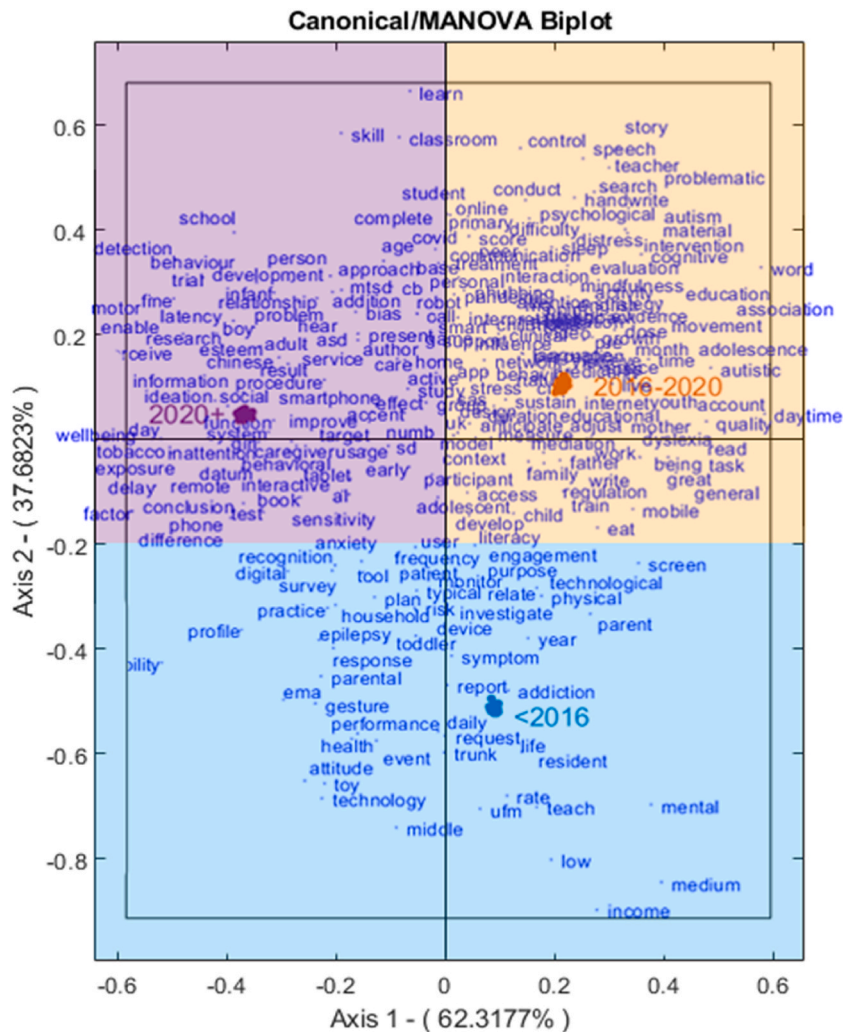


Fig. 4. Canonical/MANOVA Biplot applied to the SLR according to the time of publication.

the first studies on the impact that the use of screens, especially smartphones and tablets, has on children’s physical and mental development. Accordingly, and on the one hand, the first studies appeared that relate the use of screens to issues affecting children’s health, with an indirect effect on their learning process. They all already express concern about the dangers entailed by overexposure to screens in childhood. We therefore encounter studies that focus on the low quality of sleep associated with the overuse of screens (Hidalgo-Caumo et al., 2020; Nathanson & Beyens, 2018; Parent et al., 2016), and the link between a sedentary lifestyle and the use of digital devices associated with child obesity (López et al., 2019; Robinson et al., 2022). There are even studies that report a general impairment of mental health (Twenge, Martin, & Campbell, 2018) among children that spend too much time in front of screens. In turn, there are studies that address the effect that the use of smartphone, tablets and sundry applications have on the learning processes of children with disorders such as autism (Fage et al., 2016).

From 2020 onwards, there has been a continuation of some of the research streams first adopted in the 2016–2020 period, presenting original perspectives that respond to fresh challenges and realities. Firstly, regarding the use of screens, research has focused on investigating the consequences of smartphone addiction in the later stages of childhood (e.g., Abu-Taieh et al., 2022; Fisher, 2023; Park et al., 2022; Song, 2021).

Secondly, the research into the part families play in the healthy use of screens has moved on from an analysis of their supervision of the time spent on smartphones and now focuses on how parenting styles affect the use and misuse of digital devices in the home (Chaibal & Chaiyakul, 2022; Sebre et al., 2023) and, therefore, a child’s education and development. In turn, 2020, has also marked the start of a clear concern for the study of the effects screens have on childhood from the emerging field of educational neuroscience (e.g., Jin & Lin, 2022; Tan & Zhou, 2022; Yang et al., 2023).

Finally, a common topic studied over the course of these years has involved the risks and benefits entailed by the use of technology in childhood. Nevertheless, despite being a recurrent theme over the past twenty years, this line of research has its own unique feature, as the initial study of the impact that technology had on children from an educational perspective focused on highlighting its

advantages (e.g., Furió et al., 2013; Maynard & Cheyne, 2005; Thorsteinsson & Niculescu, 2012), whereas more recent research has highlighted the risks and hazards of the use of smartphones and tablets in childhood (e.g., Desirée, Anja, Jörg, & Kathrin, 2023; Helm & McDermott, 2022; Yang et al., 2023).

4.2. Main topics in scientific output on screens and children

As regards the second objective *Identifying the main topics addressed concerning the use, behaviour and effects of technologies in childhood*, Fig. 3 presents the three main blocks to be addressed forthwith.

4.2.1. Cluster 1. educational neuroscience

As noted in the preceding section, educational neuroscience is one of the emerging fields that encompasses a large part of the scientific literature on the use of screens. This is confirmed in the first cluster (Class 1, in red) in Fig. 3, which features a raft of studies on the effects of screens on different skills that are vitally important in the learning process, such as attention (Jin & Lin, 2022; Tan & Zhou, 2022), memory (Veraksa et al., 2021), and executive functions (Yang et al., 2023).

Along these same lines, there is also a series of studies on how screens affect motor skills, with seemingly very diverse findings. On the one hand, studies such as the one conducted by Souto et al. (2019) report that the development of fine motor skills in early childhood is favoured by the use of screens. By contrast, Chaibal and Chaiyakul (2022) conclude that the use of screens in childhood impairs the development of gross motor skills.

Secondly, there is a batch of studies on how the abuse of screens in childhood impairs the development and performance of executive functions (Yang et al., 2023) and inhibitory control (Helm & McDermott, 2022; Sebre et al., 2023).

Thirdly, most of the publications in this cluster report on the effects of technology in mental processes related to attention and attention deficit hyperactivity disorder (ADHD). The research into this matter presents several contradictions. On the one hand, there are studies that find a clear relationship between ADHD in childhood and Problematic Internet Use (PIU), coinciding in that a prolonged exposure to screens among young children reduces their ability to pay attention (Fisher, 2023; Jin & Lin, 2021; Lin et al., 2020), increases their impulsiveness and hyperactivity (Sebre et al., 2023; Tan & Zhou, 2022), and aggravates the symptoms and manifestations of ADHD. On the other hand, a recent longitudinal study finds that the use of screens does not affect hyperactivity or the ability to pay attention (Konok & Szóke, 2022).

This same cluster contains a large body of studies on how the use of screens negatively affects a successful process of learning to read (Salmerón et al., 2021; Tatar & Gerde, 2022) and write (Bonneton-Botté, et al., 2020) when teachers and families have not been instructed in making an appropriate use of them accordingly (Chen et al., 2021).

4.2.2. Cluster II. Educational use of screens

As regards the second cluster (Class 2, in green), most of the studies have focused on the use of digital technologies in the teaching-learning process, above all on the factors and features in schooling (environment, teachers, programming ...). The corresponding studies report both the positive and the negative aspects of the classroom use of screens. For example, some studies find that the use of tablets or interactive whiteboards in the classroom supports the learning process by allowing for greater ease of movement, thereby improving communication and fostering teamwork and collaboration (Martín et al., 2018; Neumann et al., 2018). Furthermore, the proper use of screens in the classroom has also been shown to enhance children's academic performance in skills related to language and mathematics (Kerawalla, et al., 2007; Sergi et al., 2017). Nevertheless, other studies (Ames, 2016; Fekonja-Peklaj et al., 2015; Nikolopoulou, 2021) find certain risks reported directly by teachers, such as their major concern over not being able to supervise what the children are actually doing with the screens in the classroom, which sometimes increases the likelihood of their pupils being involved in cases of bullying and cyberbullying (Gómez et al., 2020; Lee, 2018).

In short, it is no surprise that the ubiquity and versatility of digital devices have meant that many studies have concluded that it is extremely important for teachers to receive proper training to ensure the correct use of screens in the classroom (e.g., Cranmer, 2020; Nikolopoulou, 2021; Otterborn et al., 2019; Touw et al., 2019).

Finally, albeit to a lesser extent, this second cluster also contains a series of studies on the autism spectrum disorder. In this case, some studies draw attention to the risks involved in the excessive use of screens among children with autism (Zainelabdin, 2020), while others have focused on developing technological solutions and applications that help these children to learn (Fage et al., 2016; Geissler et al., 2022).

4.2.3. Cluster III. Good and bad uses of smartphones in childhood. Causes and consequences

Finally, there is a third cluster of articles (Class 3, in blue) that study the pros and cons of smartphones in childhood. Most of these publications have focused on the mental, personal, and social ramifications of the excessive use of screens among children. Beginning with the negative consequences, many countries have recorded a clear tendency toward Problematic Smartphone Use (PSU) in childhood (Lai et al., 2022; Nakayama et al., 2020). PSU is associated with the risk of exposure to phubbing (Li, Mu, Sun, & Kwok, 2022) or bullying (Schmuck et al., 2023), daytime sleepiness and problems related to sleep deprivation (Caumo et al., 2020; Chiu et al., 2022; Nathanson & Beyens, 2018), which have a significant impact on children's cognitive and emotional development at a critically important time for their mental and personal development. Moreover, the excessive use of smartphones in childhood is linked to higher levels of perceived depression, anxiety, and stress (Okada et al., 2021) and unregulated emotional states (Cho & Lee, 2017). All these aspects ultimately have a major impact on learning processes and practices in the classroom and on academic performance (Cerniglia et al., 2021; Halil, 2019). As regards the studies that reveal the benefits of screens, there is research that finds how educational

applications and games drive pupils' motivation and help them to significantly engage with the learning process (Hassan & Mahmud, 2015). What's more, they allow customising the learning process and improving social skills ((Neumann et al., 2018; Okada et al., 2021), enabling shier individuals to inquire and participate through virtual communication channels. A further finding has been that when appropriate use is made of screens in the classroom, they improve those skills related to teamwork and cooperation (e.g., Furió et al., 2013; Thorsteinsson & Niculescu, 2012). Sergi et al. (2017) and Choi et al. (2018) contend that in certain cases they improve performance and the use of procedural strategies for resolving problems.

This cluster also contains a series of studies that express both concern and interest over the relationship between parenting styles, the way children use screens in the home, and the consequences this entails. Accordingly, there are several studies that link the Problematic Use of the Internet (PIU) in childhood to sundry factors such as an inappropriate parenting style (Chaibal & Chaikyakul, 2022; Cho & Lee, 2017; Sebre et al., 2023), especially an insecure sense of attachment, whereby many parents are absent because of their own excessive use of screens (Lai et al., 2022; Sebre et al., 2023). PIU is also related to the use of screens as a means of punishment and reward (Eichen et al., 2021). There are also several studies that express concern over the fact that many parents, whilst fully aware that their children may become "hooked" on screens, allow them to go online without any supervision of the content they access (Chen et al., 2021; Eichen et al., 2021; Işikoğlu et al., 2023), in order to keep them quiet while they are doing the housework or are otherwise engaged. By contrast, other studies posit that affective childrearing (Bae, 2015), better communication between parents and children (Park et al., 2022), and starting school at a young age (Gou & Dezuanni, 2018) are related to the reduced use of screens in everyday life.

There is clearly a need, therefore, to implement family education schemes to guide parents and children towards a healthier coexistence, especially when studies such as the one conducted by Isikoglu et al. (2021) reveal that the findings of research into parental guidelines and digital literacy and mentoring schemes for children are contradictory and inconsistent.

5. Conclusions

Screens have become a new cultural reality in childhood, as shown by the vast amount of scientific output on the uses of technology among younger children. Our intention is clearly not to demonise screens, but instead to admit that the new generations are not digital natives. We therefore agree with most of the studies reviewed in that children's healthy use of screens depends largely on parents and teachers having the right tools to circumvent the risks involved in children's overexposure to screens. It is therefore vitally important to promote digital literacy from a young age (e.g., Desirée, Anja, Jörg, & Kathrin, 2023; Eichen et al., 2021; Eskandari et al., 2023; Martín et al., 2018), on the one hand, and digital awareness and education among parents, on the other (e.g., Cho & Lee, 2017; Işikoğlu et al., 2023; Burku & Hope, 2022).

If there is one conclusion to be drawn from this SLR, it is that technology clearly has an impact not only on aspects related to children's sound mental and physical development, but also on the building of their own identity, one of the ways that children have to understand and experience the world around them. From an educational perspective, we should understand that screens are not simply another device in a child's hands, as they are also a setting, environment, and context that permits the incorporation of processes of communication, interrelations, and action. Screens are therefore a cultural tool in the initial phases of identity building. We are not therefore dealing with a technological problem that calls for pedagogical approaches for implementing a critical digital education to develop a responsible and unfettered identity, a critical and civic online mindset. Faced with this reality, there is a need to supersede an education based on the restrictions of times and usages. Screens are here to stay, and they are devices that reconfigure us as users, being able to adapt our minds to new spaces of action. We need to advance toward a system of education that makes new generations aware of the fact that regardless of the use we make of this technology, it may entail a series of negative consequences that we are unaware of. In short, we should educate future generations bearing in mind today's technological revolution, reformulating digital literacy mechanisms. We need to realise that we are now living in a reality astride the boundary between online and offline that is becoming increasingly blurred; we therefore need to explore the risks that children are exposed to in what is now referred to as an onlife.

Lastly, we would like to highlight that our work advances knowledge in this field in two significant ways. First, by examining the trends in publications, our study systematically outlines the tri-phasic evolution of academic concern and interest. We trace a clear trajectory: starting from initial concerns about health implications, moving through a detailed examination of educational and psychosocial impacts, and arriving at the current digital era. This analysis not only reveals gaps in the existing literature but also provides a historical perspective crucial for understanding the present context and guiding future research.

Second, our findings offer valuable insights for professionals in the educational sector. By shedding light on the realities of screen usage, our research enables the design of programs and interventions that align with the needs of families and children. Furthermore, it contributes to the crafting of evidence-based policy guidelines.

In addition, our study propels the discourse forward by setting the groundwork for nuanced investigations into the relationships between screen time, gender differences, and contextual variations. This opens avenues for future scholarly exploration. Moreover, our systematic literature review (SLR) results underscore the scarcity of research on gender differences in screen usage during childhood. Investigating these differences could yield crucial insights for creating more personalized prevention and intervention strategies, a need that has been recognized in other age groups, such as adolescents and young adults.

Limitations and future research

This study, despite its detailed analysis and significant contributions to the understanding of the relationship between screen use and educational outcomes in childhood, has certain limitations that should be acknowledged. First, the methodology is based exclusively on the literature review obtained from the Scopus database. Although Scopus is widely recognized for its comprehensive

coverage, exclusion of other databases could limit the breadth of the literature reviewed and potentially omit relevant studies. However, it is important to clarify that we included all articles available in Scopus, regardless of the language of the original manuscript. Our primary source was the abstract of each study, which is always available in English in this database, allowing us to access global research subjected to double-blind peer review, ensuring the quality and relevance of the included studies. In addition, the use of specific keywords without including terms such as 'computers', 'internet - online', 'students', 'school', etc., could have limited the capture of studies focused on specific educational programs. These methodological decisions could influence the generalizability of our findings. The rapid evolution of digital technology and its educational applications suggests that our results will need constant updating. Finally, although we attempted to cover a broad spectrum of educational outcomes, the impact of screens on non-academic aspects of child development, such as mental health and social skills, requires further investigation.

Based on the limitations identified and the findings of this study, we suggest several directions for future research. Longitudinal studies that follow children over time would help clarify causal relationships between screen use and educational outcomes. Research should expand to include a wider range of digital devices and educational applications, especially those that are emerging in the market. It is crucial to explore the impact of sociocultural and economic context on the relationship between screen use and children's learning, as these factors may moderate or mediate the observed effects. In addition, investigating the perceptions and practices of educators and parents regarding screen use would provide valuable insights for the development of practical guidelines and educational policies. Finally, we encourage studies that examine the effects of screens on non-academic aspects of child development, providing a more holistic understanding of the role of digital technology in childhood.

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Declaration of competing interest

The authors report no conflicts of interest.

CRediT authorship contribution statement

Daniel Caballero-Julia: Supervision, Methodology, Formal analysis, Data curation. **Judith Martín-Lucas:** Writing – original draft, Investigation, Data curation, Conceptualization. **Luis E. Andrade-Silva:** Writing – original draft, Data curation.

Data availability

Data will be made available on request.

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