

## The impact of digital devices on the mental and physical health of primary school children: systematic review

### El impacto de los dispositivos digitales en la salud mental y física de los escolares de primaria: revisión sistemática

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**Abstract.** The use of digital technology has permeated the lives of elementary school children, affecting aspects of their mental and physical health. While these technologies offer various benefits, there are concerns about their negative impacts such as anxiety, sleep disturbances and decreased physical activity. This study aims to evaluate the impact of digital devices on primary school children's mental and physical health through a systematic review. Using the PRISMA method, literature from PubMed, and Scopus was selected based on quality, relevance, and completeness of data. Of the initial 150 publications, 7 articles were relevant after being pre-analyzed. The results showed that physical activity is important for the health of children who actively use digital devices. Some active apps and video games increase physical activity and emotional well-being, but excessive use may pose a risk for anxiety, depression and obesity. Digital device use affects the mental and physical health of primary school children. The conclusion of this study is that parents and educators should supervise the use of digital devices to reduce negative impacts and optimally utilize technology to support children's development.

**Keywords:** Digital technology; Mental health; Physical health; Elementary school children

**Resumen.** El uso de la tecnología digital ha impregnado la vida de los niños de primaria, afectando a aspectos de su salud mental y física. Aunque estas tecnologías ofrecen diversos beneficios, preocupa su impacto negativo, como la ansiedad, los trastornos del sueño y la disminución de la actividad física. Este estudio pretende evaluar el impacto de los dispositivos digitales en la salud mental y física de los niños de primaria mediante una revisión sistemática. Siguiendo el método PRISMA, se seleccionó la bibliografía de PubMed y Scopus en función de la calidad, la relevancia y la exhaustividad de los datos. De las 150 publicaciones iniciales, 7 artículos fueron relevantes tras ser analizados previamente. Los resultados mostraron que la actividad física es importante para la salud de los niños que utilizan activamente dispositivos digitales. Algunas aplicaciones y videojuegos activos aumentan la actividad física y el bienestar emocional, pero un uso excesivo puede suponer un riesgo de ansiedad, depresión y obesidad. El uso de dispositivos digitales afecta a la salud mental y física de los niños de primaria. La conclusión de este estudio es que los padres y educadores deben supervisar el uso de los dispositivos digitales para reducir los efectos negativos y utilizar de forma óptima la tecnología para favorecer el desarrollo de los niños.

**Palabras clave:** Tecnología digital; Salud mental; Salud física; Alumnos de primaria

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### Introduction

In today's digital era, the use of technology has penetrated almost every aspect of life, including education. Elementary school children are a group that is highly affected by the development of digital technology. (Washbrooke, 2023; Denys & Klimczuk, 2023). The use of digital devices such as smart phones, tablets, and interactive video games has become an important part of children's daily lives. (Li, 2023; Kotrla Topić et al., 2023). While this technology offers various benefits, such as easy access to information and interactive learning tools, there are concerns raised regarding its impact on children's mental and physical health. (Ivanova, 2023). Previous literature shows that the use of digital technology in education can support more interactive and enjoyable learning for children. (Teichert & Salman, 2023; Teichert & Salman, 2023; Teichert & Salman, 2023). On the other hand, several studies have also revealed potential risks, such as increased anxiety, sleep disturbances, and decreased physical activity due to digital device addiction. (Nakshine et al., 2022; Dresplangley & Hutt, 2022; Machado de Oliveira et al., 2023;

Gundagi & R, 2023; Shetty et al., 2022).

However, a previous literature review by (Ricci et al., 2023), related to the impact of technology use on children's health only discusses the positive and negative impacts of technology use on children. To date, there is no systematic review that comprehensively evaluates the impact of digital devices on the mental and physical health of primary school children, so this study is very important. (Ivanova, 2021; Tsang et al., 2023). The main problem faced in this study is the lack of a thorough systematic review and meta-analysis of the impact of digital devices on the mental and physical health of primary school children. (Tsang et al., 2023; Pinilla et al., 2024). Many individual studies have addressed specific aspects of digital technology use, but there has been no concerted effort to combine these findings in a comprehensive and systematic analysis. Therefore, this study aims to fill this gap by using the Systematic Reviews and Meta-Analyses method (PRISMA) (Arabiat et al., 2023). In an effort to address this research problem, a literature review was conducted to identify, evaluate, and synthesize the results of previous studies related to the use of digital technology and its impact on the mental and

physical health of primary school children. (Donthu et al., 2022). Several studies have shown that mobile apps and interactive video games can be used as tools to develop children's social, cognitive and physical skills. (Aghanyan, 2023). In addition, this technology can also help reduce stress and improve children's emotional well-being if used properly. (Mahawan et al., 2024; Moerman et al., 2019; Limone & Toto, 2021). However, there are also studies that show that overuse of digital devices can have a negative impact on children's mental health, such as increasing the risk of anxiety and depression. (Tliah et al., 2023; Tsang et al., 2023; Li, 2023; Gracia et al., 2023; Dibben et al., 2023). In addition, lack of physical activity due to digital device addiction can also lead to physical health problems such as obesity (Dibben et al., 2023; Gundagi & R, 2023; Gupta, 2022; (Bukhalenkova et al., 2022; Doruk et al., 2023; Septianto et al., 2024); (Denys & Klimczuk, 2023).

Technology use among primary school children has a significant positive impact on mental and physical health. Technology, such as mobile apps and interactive video games, can be used to develop children's social, cognitive and physical skills. Some studies suggest that these technologies can reduce stress and improve children's emotional well-being, provided they are used judiciously (Aghanyan, 2023; Mahawan et al., 2024). Active video games, for example, have been shown to be effective in increasing physical activity and cardiovascular health, as they require children to move physically during play (Yun et al., 2023). In addition, apps designed to teach mindfulness skills can help children manage their stress and anxiety, contributing to better mental health (Borjalilu, 2023; Kirk et al., 2023). Therefore, technology can be a valuable tool to support the mental and physical health development of primary school children, if used appropriately and supervised by parents and educators.

Therefore, this study aims to provide a clearer and more comprehensive picture of how digital technology affects the mental and physical health of primary school children (Ahsan & Abualait, 2024; Pinilla et al., 2024; Doruk et al., 2023). A review of the literature related to the solutions proposed in this study shows that well-designed digital technology-based interventions can provide significant benefits to children's mental and physical health. For example, video games that require children to move physically have been shown to be effective in increasing physical activity and cardiovascular health (Astuti et al., 2024). In addition, mobile apps designed to teach mindfulness skills can also help children manage their stress and anxiety (Borjalilu, 2023; Kirk et al., 2023; Bear et

al., 2022). However, although there are many studies examining the use of digital technology in the context of children's mental and physical health, there are still many gaps in the literature that need to be filled. Some studies have limited research designs, while others do not evaluate the long-term impact of digital technology use. Therefore, this study sought to comprehensively evaluate the existing literature and identify areas that require further research. The main objective of this study was to evaluate the impact of digital devices on the mental and physical health of primary school children through a systematic review. This research focuses on the use of digital technologies, such as mobile apps and interactive video games, and how these technologies can be used to develop children's mental and physical health. The novelty of this study lies in its comprehensive and systematic approach in reviewing the existing literature, as well as in the identification of research gaps that can form the basis for further research in the future. Therefore, this study not only aims to synthesize findings from previous research, but also provide practical guidance for educators, parents, and policy makers in optimally utilizing digital technologies to support the mental and physical health development of primary school children.

## Method

The research method involved systematically searching the literature from various trusted databases, such as PubMed, and Scopus. The keywords used in the literature search include 'Digital devices, health, mental and physical well-being of primary school children'. The main focus in source selection was article quality, topic relevance, and data completeness. Exclusion criteria included articles not published in journals indexed by Scimago Journal Rank (SJR) and Pubmed, articles not written in English or other languages, articles published before 2013, and articles that did not explicitly mention digital tools on mental and physical health of primary school children. The initial search procedure identified 150 publications through databases (Pubmed: 63 articles, and Scopus: 87 articles). After applying exclusion criteria, only 7 relevant articles remained. Many articles were eliminated because they did not mention digital tools on primary school children's mental and physical health. All selected articles were extracted and analyzed using Mendeley software to eliminate duplication. This study aims to provide an in-depth understanding of how the use of digital tools affects the mental and physical health of primary school children, with the hope of providing a foundation for better educational policies and practices in this digital age.

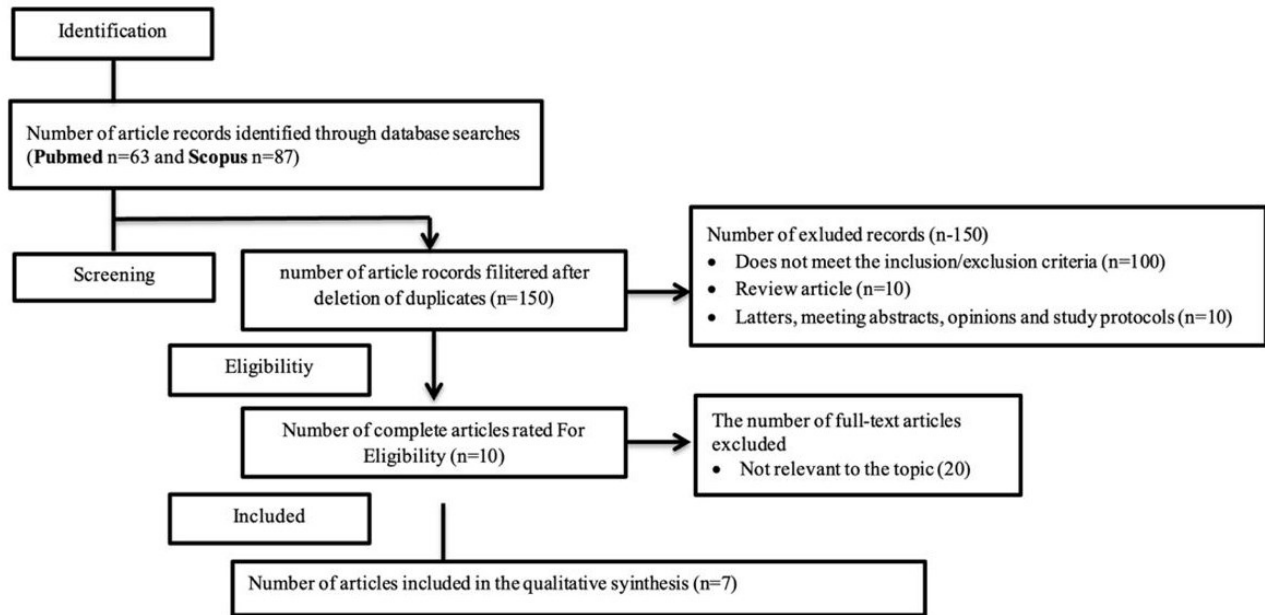


Figure. Selection process of articles used to utilize PRISMA guidelines

## Result

Researchers have linked digital devices to mental and physical health in elementary school children. These differences in findings may be due to factors such as the type of intervention, duration of the study, and individual characteristics of the participants. Despite these differences, the majority of studies emphasize the important role of physical activity

in children to improve mental and physical health in primary school children who actively use digital devices. However, few studies directly integrate the influence of digital devices on mental and physical health in elementary school children. The results of the literature review shown in Table 1 are described and discussed in one article.

Table 1.

Summary of Articles on The Impact of Digital Devices on the Mental and Physical Health of Primary School Children: Systematic Review

Name and Year	Title	Research findings
(Pinilla et al., 2024)	Physical literacy and mental health: Associations in elementary and secondary physical education students.	This study found that there is a positive and significant correlation between physical literacy and life satisfaction in primary and secondary school students. Physical literacy contributes to students' mental health, improving self-confidence, self-understanding and life satisfaction regardless of gender or school location.
(Kliziene et al., 2021)	Effects of a Physical Education Program on Physical Activity and Emotional Well-Being among Primary School Children	This study found that an eight-month physical education program positively impacted the physical activity and emotional well-being of primary school children (aged 6-7 and 8-9 years) across three key dimensions: somatic anxiety, personal anxiety and social anxiety. The program increased physical activity and decreased anxiety levels in children, showing reductions in depression, isolation, somatic complaints, aggression, and delinquent behavior. These results demonstrate the importance of well-structured physical education interventions in improving physical and emotional well-being in children, as well as the relevance of these programs for public health policy.
(Vega Orozco et al., 2023)	Effect of morning physical activation on the school performance of primary school children	Research shows that a morning physical activity program of 60 30-minute sessions improves the academic performance of elementary school students, especially in mathematics. Results showed significant improvements in the math scores of students from grades one to four, with no differences by gender.
(Sarroeira et al., 2022)	Relaxation methods based interventions in a school context from a perspective of health and well-being promotion: a systematic review	This research shows that relaxation-based interventions in schools can reduce anxiety and improve autonomic functions in children. This method also promotes independence, initiative, social interaction, mental health, and short-term memory development, contributing to students' well-being and life skills.
(Davies et al., 2021)	Preventive Digital Mental Health for Children in Primary Schools: Acceptability and Feasibility Study	The main findings of this study suggest that a digital mental health intervention implemented in primary schools in Greater Manchester is acceptable and feasible. Although most children and teaching staff found the intervention useful and easy to use, there were some barriers to implementation, such as technical issues related to access and low parental engagement. This research highlights the importance of ongoing support from school staff and parents as well as technological

(Murden et al., 2023)	Comment on Marsigliante et al. Effects on Children's Physical and Mental Well-Being of a Physical-Activity-Based School Intervention Program: A Randomized Study. <i>Int. J. Environ. Res. Public Health</i> 2023, 20, 192	adaptations to ensure long-term implementation success in educational contexts. This study critiqued articles that examined the impact of physical activity-based interventions in schools on children's physical and mental well-being. The main findings showed that there were significant errors in the statistical analysis used, including errors in the interpretation of nominal significance, unaccounted for cluster randomization, and inappropriate presentation of results. These errors made the conclusions drawn from the study unsound. The authors of this article offer revised statistical analyses to ensure that the reported results are more valid and reliable, and suggest collaborations to improve data analysis and interpretation.
(Leng et al., 2020)	Factors predicting screen time related to physical and behavioural complaints in primary school children	This study identified that the use of electronic devices by primary school children in Bau district, Sarawak, Malaysia, was associated with various physical and behavioral complaints. The most common physical complaints included headaches, neck, shoulder and back pain, and eye strain. Meanwhile, behavioral complaints included decreased interest in learning, less participation in outdoor activities, and disagreements with parents. Logistic regression analysis showed that reclining position and dark room lighting significantly increased the risk of such complaints. Therefore, it is recommended that children use electronic devices in a sitting position with adequate lighting.

## Discussion

The use of digital devices by primary school-aged children has increased significantly in recent years, mainly because these devices offer various conveniences in learning and entertainment. However, there are growing concerns regarding their impact on children's mental and physical health. As shown in table 1, several studies highlight the link between excessive use of digital devices and various health problems such as obesity, sleep disorders and behavioral problems. (Davies et al., 2021) education and teacher support in schools in terms of delivering mental health interventions in primary school children has a positive impact especially if the delivery of such interventions involves the role of parents. On the other hand, positive parenting can be a protective barrier that can reduce these negative impacts. This is in line with the view that physical education and physical activity play an important role in improving children's overall well-being. (Kliziene et al., 2021) found that an eight-month physical education program can improve physical activity and emotional well-being of primary school-aged children, by reducing somatic anxiety, personal anxiety, and social anxiety.

Meanwhile, research by (Vega Orozco et al., 2023; Drozdowska et al., 2020) showed that morning physical activity can improve the academic performance of elementary school students, especially in math. Interventions based on relaxation methods, as reviewed by (Sarroeira et al., 2022; Musindo et al., 2023), also showed potential in improving cognitive function and mental well-being of children. However, there is still a lack of comprehensive studies on the specific impact of digital devices on the mental and physical health of primary school children. As expressed by (Murden et al., 2023; Crider et al., 2022), the importance of proper statistical analysis and clear presentation of results is vital in maintaining scientific integrity. Errors in analysis can lead to incorrect conclusions and affect the policies that are made based on the research.

As recommendations for future research, there is a need

for in-depth longitudinal studies of the long-term impact of digital device use, particularly tablets and smartphones, on the mental and physical health of primary school children, with a focus on the relationship between duration of digital device use and increased risk of anxiety disorders and obesity. Future research will measure anxiety levels in children who use digital devices for more than two hours a day, using measurement tools such as the Anxiety Scale for Children (SCAS). In addition, other studies will analyse the relationship between digital device use and increased body mass index (BMI) as an early indicator of obesity. It is hoped that the results of this study will provide clearer insights into the specific mechanisms linking digital device use to anxiety disorders and obesity in primary school children, and provide a scientific basis for more effective interventions to limit digital device use for better mental and physical health.

Overall, the available literature suggests that while digital devices have the potential to support learning and entertainment, it is important to regulate their use to avoid overuse. Support from family, school and public health policy environments is critical in ensuring that children can benefit from these technologies without experiencing significant negative impacts on their health. Along with this, efforts to increase physical activity among primary school children should continue to be encouraged, given its wide-ranging benefits to children's physical and mental health.

## Conclusion

This article reviews the impact of digital device use on the mental and physical health of primary school children through a systematic review. Of the initial 150 publications, only 7 articles were relevant and analysed. The results show that physical activity remains crucial for children who actively use digital devices. Therefore, close supervision is needed so that technology is optimally used to support children's growth and development. Certain active apps and video games can increase physical activity and emotional well-being, but overuse

can increase the risk of anxiety and depression. It was concluded that the active role of teachers and parents in delivering mental health interventions to primary school children had a significant positive impact. Parental involvement, along with educational support from teachers, can amplify the positive outcomes of this intervention, especially in reducing anxiety and improving overall well-being, which is in line with future research recommendations regarding the relationship between duration of digital device use and increased risk of anxiety disorders and obesity. Future research will measure anxiety levels in children who use digital devices for more than two hours a day, using measurement tools such as the Anxiety Scale for Children (SCAS). In addition, positive parenting can be an important safeguard in reducing negative impacts, reinforcing the benefits of physical education and physical activity programs.

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