

Language development and exposure to ICT in early childhood: A scoping review of post-covid-19 research

Desarrollo del lenguaje y exposición a las TIC en la primera infancia: scoping review de investigaciones posteriores al confinamiento por COVID-19


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Abstract

Introduction: COVID-19 lockdown imposed a widespread context of home-based education mediated by digital technologies. The scientific community became interested in the phenomena that emerged, and discussions on the impact of technology on child development outside the educational context were revived. **Objective:** This paper analyzes scientific findings on ICT exposure and language development in early childhood, based on scientific literature published in contexts following the COVID-19 lockdown. **Methods:** This is a scoping review grounded in the narrative documentary tradition, with a qualitative epistemological orientation. Fifty-one (51) open-access papers published between 2020 and 2023 in the Web of Science and Science Direct databases were selected following PRISMA-ScR guidelines. A four-phase process was applied: search, selection—using a double-blind screening procedure—organization of the corpus, and thematic analysis. **Results:** Studies reviewed show diverse designs and limited comparability but consistently highlight how ICT impact on early language development depends on mediation, content type, and usage context. **Discussion:** Parenting, cognitive diversity, and communication emerged as key themes, revealing how contextual and individual factors shape recent understandings of ICT use and oral language development in early childhood. **Conclusion:** Unsupervised, prolonged ICT exposure may hinder early oral language development, especially when it replaces caregiver interaction and occurs in inequitable contexts.

Keywords: language development; ICT; early childhood; lockdown.

Resumen

Introducción: El confinamiento por COVID-19 impusieron un contexto generalizado de educación en el hogar mediada por tecnologías digitales. La comunidad científica mostró interés en los fenómenos emergentes, y se reavivaron las discusiones sobre el impacto de la tecnología en el desarrollo infantil fuera del contexto educativo. **Objetivo:** Este artículo analiza los hallazgos científicos sobre la exposición a las TIC y el desarrollo del lenguaje en la primera infancia, basándose en la literatura científica publicada en contextos posteriores al confinamiento por la COVID-19. **Métodos:** Se realizó una scoping review con enfoque cualitativo y fundamentación en la tradición documental narrativa. Se revisaron cincuenta y un (51) artículos de acceso abierto publicados entre 2020 y 2023 en las bases de datos Web of Science y Science Direct, siguiendo las directrices de la guía PRISMA-ScR. El proceso metodológico incluyó cuatro fases: búsqueda, selección mediante procedimiento de doble ciego, organización del corpus y análisis temático. **Resultados:** Los estudios revisados muestran diseños diversos y una comparabilidad limitada, pero destacan de manera consistente cómo el impacto de las TIC en el desarrollo temprano del lenguaje depende de la mediación, el tipo de contenido y el contexto de uso. **Discusión:** La crianza de los hijos, la diversidad cognitiva y la comunicación surgieron como temas clave, revelando cómo los factores contextuales e individuales dan forma a las concepciones recientes sobre el uso de las TIC y el desarrollo del lenguaje oral en la primera infancia. **Conclusión:** La exposición prolongada y sin supervisión a las TIC puede obstaculizar el desarrollo temprano del lenguaje oral, especialmente cuando sustituye la interacción con los cuidadores y se produce en contextos desiguales.

Palabras clave: desarrollo del lenguaje; TIC; primera infancia; confinamiento.



INTRODUCTION

During the COVID-19 lockdown, educational institutions were forced to operate in digital spaces, thereby establishing the internet and screens as a widespread necessity to mediate teaching and learning. This shift also accelerated our reliance on technology as a means of human socialization in all its forms (Martínez González, 2020). Research on this context tend to analyze the educational use of technologies in formal processes. For example, there is information on how students perceive Information and Communication Technologies (ICT) in education (Castro-Campos & Forero-Hernández, 2022), or how ICT fostered effectively the childhood development in the education context (Egert et al., 2022). But children were exposed to screens and similar technologies not only inside the school but also outside of it, and even during their earliest years of life.

In early childhood, daily interactions with and through digital devices have become increasingly common. Therefore, it is essential to examine how exposure to ICT affects childhood development in non-educational environments, including its potential effects and repercussions (Avalos González & Salazar Mastache, 2022). Existing evidence shows that ICT use has a significant impact on social and communication skills, particularly among young children who often engage with screens without adult supervision (Rodríguez del Río, 2021). If we accept the premise that social interaction is a key factor in language development, important questions arise: What happens when such interaction is mediated by ICT? How is language constructed in these contexts? These questions underscore the importance of examining the influence of ICT on the development of children's oral language.

In this context, ICTs refer to digital technologies primarily used for processing, storing, exchanging, or creating information in various forms, such as images, videos, and other multimedia texts (Ayala Ñiquen & Gonzales Sánchez, 2015). Examples of these technologies include devices such as televisions, mobile phones, tablets, and radios, which are commonly used in contexts of information management, communication, and entertainment. Therefore, we focus on studying the influence of these artefacts specifically when they are not employed for educational or social leadership purposes, excluding research on Technologies for Learning and Knowledge (TLK) as well as Empowerment and Participation Technologies (EPT) (Ramirez-Izquierdo et al., 2023).

This research approaches childhood development from the perspective of language. Although there are many paradigms for language development, such as the behaviorist, neurological, psycholinguistic, and sociolinguistic (Owen, 2005), the neurodevelopmental approach was selected. Therefore, the language is studied «as a socially shared code or conventional system for representing concepts through the use of arbitrary symbols and rule-governed combinations of those symbols» (Owens, 2016, p. 18). In early childhood, language is normally built through oral speech, with the socially intended use of phonemes. In that case, language development is a process related to sounds, cognition, symbols, socialization, and communication. Children are encouraged to learn language sounds (phonemes) to support their natural psychological growth, improve their social interactions, and ultimately boost their academic success (Flores-Flores et al., 2022, p.

62). Consequently, language is a social process that necessitates interaction (Flores-Flores et al., 2022, p. 63).

In this regard, Campos Soto and Garrido Durán (2017) argue that the relationship between technologies and negative cognitive outcomes is not determined by time, mode, or frequency of use, but rather by the purpose, meaning, or function of the technology. Cerisola (2017) suggests that when the use of technological media is unintentional and uncontrolled, it can diminish performance in preschool children. Excessive television consumption is linked to children with difficult temperaments, self-regulation issues, or social-emotional problems, as they may have been exposed to screens as a method of reassurance (Cerisola, 2017, p. 128). These issues do not arise from screen time alone but stem from the challenges of maintaining intentional monitoring over extended periods.

Screen exposure is linked to reduced development or delays in social, cognitive, and language skills (Cerisola, 2017). One potential consequence is increased difficulty in communication, likely due to inadequate language development (Henriquez Bustos et al., 2020). It is essential to consider the combination of innate neurobiological factors and natural environmental interactions, as these are fundamental to the development of oral language (Campos Soto & Garrido Durán, 2017). Moreover, oral language acquisition requires the ability to represent and symbolize through the imitation of linguistic models provided by adults who are physically and emotionally present.

Children between the ages of 2 and 3 develop linguistic skills that enable the symbolic appropriation of their world and culture, using signs or words to name their realities. Thus, language serves as a cultural tool (MEN, 2017, p. 73). Between the ages of 3 and 5, language further evolves into a tool for socializing, inquiring, and learning about their surroundings, both socially and physically, based on their existing knowledge (MEN, 2017). The critical role of adult supervision in children's social integration has been recognized since the 20th century, although some literature has erroneously assessed this phenomenon merely in terms of success or failure (Jaimes Carvajal & Rodriguez Luna, 1997). It is now understood that "Expressing oneself verbally or gesturally is a skill that, although acquired naturally in daily interactions, requires clear guidance from an adult" (MEN, 2017, p. 99). In this light, an essential question emerges: what is the current state of scientific knowledge regarding the effects of ICT exposure on oral language development in early childhood, particularly in post-lockdown for COVID-19 contexts?

As a result, current discussions regarding ICT exposure and the role of adult mediation have gained new urgency in the aftermath of the COVID-19 lockdown. Although previous research has addressed the educational use of ICT and its role in learning processes, there remains a lack of systematic analysis on how these technologies—used outside educational environments—may influence the development of oral language in early childhood. This study seeks to contribute to this gap by critically examining recent academic literature focused on this phenomenon. The general objective is to analyze the findings on ICT exposure and language development in early childhood, based on scientific literature published in contexts following the COVID-19 lockdown.

METHODOLOGY

Type of research and methodological protocol

This review corresponds to a scoping review. It has an exploratory purpose and focuses on recent scientific literature concerning exposure to Information and Communication Technologies (ICT) and the development of oral language in early childhood, particularly in the aftermath of the COVID-19 lockdown. Therefore, this study does not qualify as a bibliometric review because it does not employ citation metrics, productivity indicators, or co-authorship analyses. Instead, it follows a qualitative epistemological approach, consistent with what Creswell (1998) describes as inquiry that emphasizes understanding meanings. Aligned with the narrative documentary tradition (Alayza Degola, 2020), this review privileges conceptual depth, interpretive synthesis, and thematic reconstruction over quantitative generalization. It explores the field discursively, seeking to identify interpretive patterns and theoretical gaps.

Methodologically, the review was designed to respond to the general objective of this research. It adopts the PRISMA-ScR guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews), as proposed by Page et al. (2021), which is appropriate for identifying the conceptual patterns, recurring focuses, and analytical gaps within a field of study. In accordance with this approach, the review does not include a systematic quality appraisal of the selected papers (Mattos et al., 2023), as its main goal is not evaluative but cartographic in nature, aimed at mapping the boundaries and trends in the current academic discourse.

This review does not seek to establish causal correlations or produce generalizable findings. Its contribution lies in critically synthesizing the interpretive frameworks and thematic configurations that currently shape the academic discussion on the relationship between ICT exposure and oral language development in early childhood.

Definition of categories

In the preliminary phase, it was essential to specify the central categories guiding the review: ICT exposure and oral language development in early childhood. These categories were theoretically delimited based on the introduction and operationalized as descriptors for the search strategy. To ensure terminological consistency, the descriptors were aligned with the UNESCO Thesaurus.

Phases of the review process

The methodological procedure was structured into four consecutive and interconnected phases: search, selection, organization of the corpus, and thematic analysis. This sequence was adapted from Alayza Degola's (2020) model for documentary reviews in educational research (Figure 1), and reflects key methodological principles recommended for scoping studies, including clarity in stage definition, emphasis on breadth over depth, and synthesis without quality appraisal (Levac et al., 2010).

The methodological structure of this scoping review follows the logic of documentary analysis, with a strong emphasis on interpretive synthesis. This approach is consistent with recent qualitative reviews that adopt exploratory frameworks to map conceptual

developments (Cifuentes & Marín-Gutiérrez, 2024; Lira-Aguirre et al., 2024; Vásquez-Rizo et al., 2022). These references guided the design of this study's phases. However, in contrast to those reviews, which include systematic quality assessments of methodologies or instruments, this scoping review omits such appraisal in accordance with the principles of the PRISMA-ScR guidelines (Mattos et al., 2023; Page et al., 2021). While the structure of the phases could be related to models such as SALSA, this study relies primarily on the model proposed by Alayza Degola due to its alignment with the interpretive focus and narrative logic of the review.

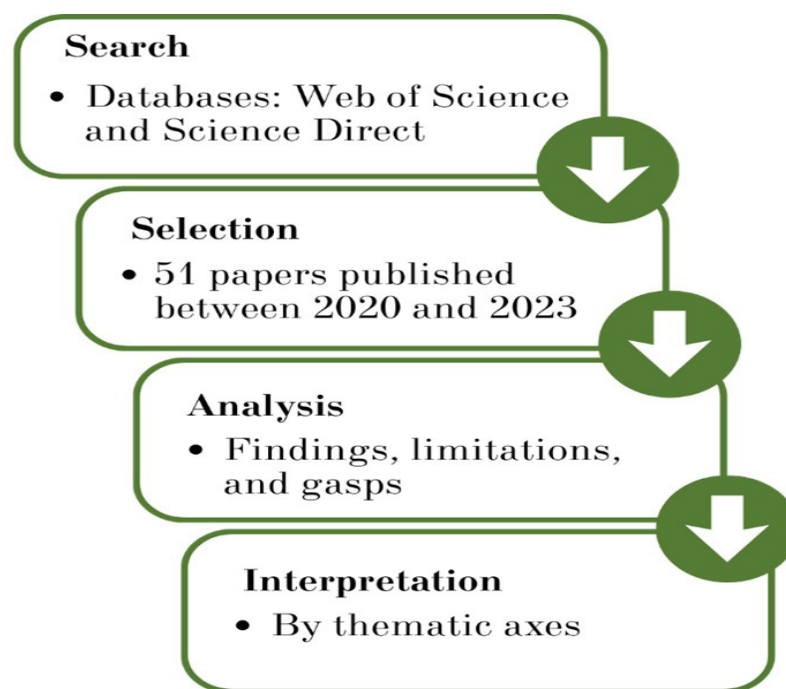


Figure 1. *Phases of this review.*

Note. Adapted from the flowchart by Alayza Degola, 2020 et al. (2020).

Search phase

The search phase was conducted in January 2024 using the advanced tools of the Web of Science and Science Direct databases. The central categories of this study—ICT exposure and oral language development in early childhood—were used as primary descriptors. These were refined using the UNESCO Thesaurus to ensure terminological precision. The search equation incorporated main terms such as language development, communication technology, early childhood, and pandemic, as well as secondary terms including ICT, screens, children, COVID-19, and confinement. To increase specificity, exclusion terms such as pediatrics, obesity, hospital, and medical were added. The Boolean logic applied is detailed in Table 1.

Table 1.

Search equation using Boolean operators, adapted to the syntax of Web of Science.

WoS's Search equation
<p>(((((((((((((TS=(Language development OR Speech-language development OR Communication)) AND TS=(Information and communications technology)) OR TS=(communications technology)) OR TS=(ICT)) OR TS=(Screens)) AND TS=(early childhood)) OR TS=(childs)) OR TS=(childrens)) OR TS=(infancy)) AND TS=(Pandemic)) OR TS=(covid 19)) OR TS=(lockdown)) NOT TS=(pediatry)) NOT TS=(obesity)) NOT TS=(hospital)) NOT TS=(medical)</p>

Selection phase

The selection of sources followed clearly defined inclusion and exclusion criteria. Papers were included if they (a) were published between 2020 and 2023, corresponding to the period of the COVID-19 lockdown and its aftermath; (b) addressed the categories of ICT exposure and oral language development in early childhood; and (c) were open access papers published in peer-reviewed journals indexed in the selected databases.

Exclusion criteria were applied to papers that (a) focused on medical contexts, such as pediatrics, obesity, or hospitalization, (b) addressed general aspects of child development without reference to language, or (c) examined ICT use strictly within educational or civic empowerment frameworks (e.g., Technologies for Learning and Knowledge or Empowerment and Participation Technologies).

The screening process involved an initial review of titles, abstracts, and keywords. To ensure methodological rigor, a double-blind procedure was implemented during the screening phase: two researchers independently evaluated the studies based on the inclusion and exclusion criteria. In cases of disagreement, a third researcher conducted a full-text reading of the conflicting studies and made the final determination. Papers meeting the agreed-upon criteria were subsequently assessed in full text to confirm their relevance to the research categories and the overall scope of this review.

Analytical phase

The analysis phase focused on the review and comparison of the selected papers through a structured documentary matrix. This instrument enabled the identification of findings, limitations, and gaps across the corpus, based on the categories defined in the preliminary phase. The matrix included variables such as methodological focus, population characteristics, and conceptual contributions related to ICT exposure and oral language development in early childhood.

This phase served as the analytical foundation for the subsequent interpretation process, in which thematic axes were developed based on the patterns identified in the reviewed literature.

Interpretation phase

The final phase of this review consisted of a thematic interpretation based on the results of the documentary analysis. The identified findings, limitations, and gaps were synthesized using the thematic analysis approach proposed by [Clarke & Braun \(2014\)](#).

This allowed for a critical organization of the literature into three emergent thematic axes: (a) the role of parental mediation in ICT exposure; (b) the influence of ICT on children’s communicative and cognitive development; and (c) the interaction between technological environments and communicative diversity in early childhood.

These thematic axes provide a framework for discussing how ICT exposure—outside educational settings—relates to the development of oral language in early childhood and reveal the current limitations of the field in addressing this relationship from a comprehensive and inclusive perspective.

Ethical Considerations

As this study involved no human subjects or personal data, ethical approval was not required. The review was conducted exclusively with open-access scientific literature, following academic integrity and citation standards.

RESULTS

This section presents the analytical findings derived from the selected corpus, composed of 51 peer-reviewed papers published between 2020 and 2023 in Web of Science and Science Direct. These studies, written in English (48), Spanish (2), and Portuguese (1), employ diverse methodological approaches, including qualitative, quantitative, and mixed-method designs, with considerable variation in research focus, populations, and assessment tools. The heterogeneity of the corpus reflects the exploratory character of the field but also imposes challenges for synthesis. Therefore, the results are organized in two subsections: first, a critical account of the methodological and epistemological limitations that constrain the generalizability and interpretability of the reviewed literature; second, a descriptive synthesis of the main findings, which outlines thematic patterns regarding how ICT exposure and oral language development in early childhood are approached and problematized in recent research.

Table 2.

Documentary corpus

#	Identificator	Approach / Design	Language	Publication
1	Aditya et al. (2022)	Qualitative	English	<i>Procedia Computer Science</i>
2	Babvey et al. (2021)	Quantitative	English	<i>Child Abuse & Neglect</i>
3	Barbosa & Nogueira (2021)	Qualitative / Essay	Portuguese	<i>Periferia</i>
4	Berard et al. (2022)	Quantitative	English	<i>Frontiers In Psychology</i>
5	Bruni et al. (2021)	Quantitative	English	<i>Brain Sciences</i>
6	Cortés-Albornoz et al. (2023)	Qualitative / Literature Review	English	<i>International Journal Of Educational Development</i>
7	Crescenzi-Lanna (2022)	Quantitative / Sequential	English	<i>International Journal Of Child-Computer Interaction</i>
8	Delgado Martín & Larrú Ramos (2022)	Quantitative	English	<i>Social Sciences & Humanities Open</i>
9	Dong et al. (2023)	Quantitative	English	<i>Translational Pediatrics</i>

LANGUAGE DEVELOPMENT AND EXPOSURE TO ICT IN EARLY CHILDHOOD: A SCOPING REVIEW OF POST-COVID-19 RESEARCH

10	Du et al. (2021)	Qualitative / Review	Historic	English	<i>Multimodal Technologies And Interaction</i>
11	Dunn et al., (2023)	Quantitative		English	<i>Reading And Writing</i>
12	Egan et al. (2021)	Quantitative		English	<i>Early Childhood Education Journal</i>
13	Eichengreen et al. (2023)	Quantitative		English	<i>Journal Of Applied Developmental Psychology</i>
14	Fiske et al. (2022)	Quantitative		English	<i>Infant And Child Development</i>
15	Fitzpatrick, Almeida et al. (2022)	Quantitative / sectional study	Cross-	English	<i>Bmc Pediatrics</i>
16	Fitzpatrick, Harvey et al. (2022)	Quantitative		English	<i>Frontiers In Psychology</i>
17	Forne (2021)	Qualitative autoethnographic		Spanish	<i>Páginas De Educación</i>
18	Fung et al., (2023)	Quantitative		English	<i>Journal Of Experimental Child Psychology</i>
19	Gath et al., (2023)	Quantitative		English	<i>Current Research in Behavioral Sciences</i>
20	Gerosa & Gui, (2023)	Quantitative		English	<i>Social Science Research</i>
21	Heffler et al. (2022)	Qualitative		English	<i>Psychiatry Research Case Reports</i>
22	Hendry et al. (2023)	Quantitative		English	<i>Infancy</i>
23	Hood et al. (2021)	Qualitative		English	<i>International Journal Of Environmental Research And Public Health</i>
24	Kalantari et al. (2023)	Qualitative		English	<i>International Journal Of Child-Computer Interaction</i>
25	Koran et al. (2022)	Quantitative Descriptive		English	<i>Education And Information Technologies</i>
26	Kracht et al. (2021)	Quantitative / Regression Analysis	Linear	English	<i>Bmc Public Health</i>
27	Kucirkova et al. (2020)	Qualitative / Case Study	Multiple	English	<i>International Journal of Child-Computer Interaction</i>
28	Lampis et al. (2023)	Quantitative		English	<i>Children-Basel O Children</i>
29	Larranga et al. (2022)	Qualitative		Spanish	<i>Palabra Clave</i>
30	Lewis et al. (2023)	Mixt / Explanatory	Sequential-	English	<i>Journal Of Early Childhood Research</i>
31	Lin et al. (2023)	Quantitative Longitudinal		English	<i>Journal Of Early Childhood Research</i>
32	Linnavalli & Kalland (2021)	Quantitative		English	<i>Education Sciences</i>
33	Lopes et al. (2023)	Quantitative Longitudinal		English	<i>Frontiers In Psychology</i>
34	Mesce et al. (2022)	Qualitative / Review	Narrative	English	<i>Heliyon</i>
35	Mifsud et al. (2021)	Qualitative / Case Study	Multiple	English	<i>International Journal Of Educational Research</i>
36	Moavero et al. (2023)	Quantitative		English	<i>Sleep Medicine</i>
37	Morrone et al. (2023)	Quantitative / sectional study	Cross-	English	<i>Early Human Development</i>

38	Panchal et al. (2023)	Quantitative / Systematic Reviews and Meta-analysis	English	<i>European Child & Adolescent Psychiatry</i>
39	Pedersen et al. (2022)	Qualitative / Randomized Controlled Trial	English	<i>Preventive Medicine</i>
40	Picca et al. (2022)	Quantitative / Cross-sectional study	English	<i>Children-Basel O Children</i>
41	Pombo et al. (2021)	Quantitative / Linear Regression Analysis	English	<i>Children-Basel O Children</i>
42	Portugal et al. (2023)	Quantitative / Longitudinal	English	<i>Computers In Human Behavior</i>
43	Raney et al. (2022)	Quantitative	English	<i>Academic Pediatrics</i>
44	Sancili & Tugluk (2022)	Quantitative / Correlational	English	<i>Croatian Journal of Education-Hrvatski Casopis Za Odgoj I Obrazovanje</i>
45	Siskind et al. (2022)	Qualitative / Literature Review	English	<i>Journal Of Early Childhood Teacher Education</i>
46	Sriwaranun et al. (2023)	Quantitative	English	<i>Journal Of Attention Disorders</i>
47	Stienwandt et al. (2022)	Quantitative	English	<i>Child & Youth Care Forum</i>
48	Sun et al. (2023)	Quantitative	English	<i>Reading And Writing</i>
49	Susilowati et al. (2021)	Quantitative	English	<i>Global Pediatric Health</i>
50	Tan et al. (2023)	Quantitative	English	<i>Computers In Human Behavior Reports</i>
51	Tiitinen et al. (2023)	Qualitative	English	<i>Children And Youth Services Review</i>

Some limitations of the studies analyzed revealed that one (1) study employed a mixed-method, sequential-explanatory design. The corpus includes thirty-five (35) studies with a quantitative approach, encompassing diverse designs: three (3) longitudinal, three (3) cross-sectional, one (1) descriptive, one (1) sequential, one (1) systematic review, one (1) correlational, and two (2) linear regression analyses. Fifteen (15) studies follow a qualitative approach, including one (1) reflective, one (1) historical review, one (1) autoethnography, three (3) documentary reviews, two (2) multiple case studies, and one (1) randomized controlled trial. Some studies do not explicitly report the specific design, referring only to the general methodological approach.

Emerging Themes

Recent research indicates that Information and Communication Technologies (ICT), particularly educational applications and interactive digital devices, can support oral language development in early childhood under specific conditions. Several studies report that screen-based activities involving active user interaction and real-time feedback contribute to vocabulary acquisition and comprehension skills in preschool-aged children. These benefits, however, depend significantly on three key factors: the pedagogical quality of digital content, the presence of adult mediation, and the duration and frequency of screen exposure.

Conversely, a consistent body of evidence across the reviewed studies points to the adverse effects of excessive or unsupervised ICT use. When children are exposed to passive and non-interactive content—such as television programs or videos lacking educational intent—negative outcomes such as reduced attention spans, impaired socialization opportunities, and delayed verbal expression are more frequently observed. The studies also emphasize that screen time that displaces caregiver-child interaction tends to undermine language development, especially when screen use is not embedded in dialogical, shared activities such as storytelling or interactive reading.

The review also highlights how contextual variables, such as parental education levels, household routines, and socioeconomic conditions, mediate the impact of ICT on language development. In households with higher educational attainment and structured daily routines, ICTs are more often integrated into enriching learning environments, leading to more favorable language outcomes. In contrast, in homes characterized by disorganization or limited adult availability, screen exposure tends to replace interpersonal communication, thereby limiting linguistic stimulation.

Another emerging line of evidence concerns neurodiverse children, particularly those diagnosed with Autism Spectrum Disorder (ASD) or Attention Deficit Hyperactivity Disorder (ADHD). In these cases, ICTs have the potential to serve as tailored learning tools that support specific communicative or cognitive needs. However, the benefits in such contexts are closely tied to content adaptation, adult involvement, and the intentional use of digital technologies. The studies suggest that while digital media can facilitate engagement for children with atypical developmental trajectories, unregulated or excessive recreational use may exacerbate challenges in attention, interaction, and language processing.

Despite these insights, the reviewed literature remains limited by methodological heterogeneity. Most studies are cross-sectional, rely heavily on parental self-reports, and use non-standardized instruments to assess language development and ICT exposure. As a result, comparative analysis is difficult, and the findings lack the robustness required to establish causality. Furthermore, there is insufficient consensus on how various types, frequencies, and contexts of ICT use distinctly influence language development in early childhood. Research gaps also include the underrepresentation of rural populations and developing countries, which hinders the understanding of how digital inequalities and contextual diversity shape the ICT–language development relationship.

Beyond the specific findings and methodological patterns, the reviewed literature reveals a set of emerging thematic concerns that recur across diverse studies and hint at broader analytical trajectories. Three interrelated themes stand out: (1) parenting as a mediating dimension in children’s exposure to and use of ICT, particularly regarding adult supervision and dialogic interaction; (2) cognitive diversity, especially the differentiated impacts of digital content on neurodiverse children; and (3) the development of communication skills as both outcome and mediating process in early childhood language development. These themes not only organize much of the existing evidence but also serve as conceptual axes for the subsequent discussion.

DISCUSSION

This review analyzes recent scientific findings regarding the impact of ICT exposure on oral language development in early childhood, particularly in the context of the COVID-19 pandemic and post-pandemic periods. The analysis is structured around the three thematic axes: 1) parenting; 2) cognitive diversities; and 3) communication (Figure 2), which allow for a nuanced interpretation of how these findings contribute to the broader understanding of childhood development in digital environments. Within each thematic cluster, the review identifies convergences, gaps, and opportunities to advance scientific knowledge on childhood, language and ICT.

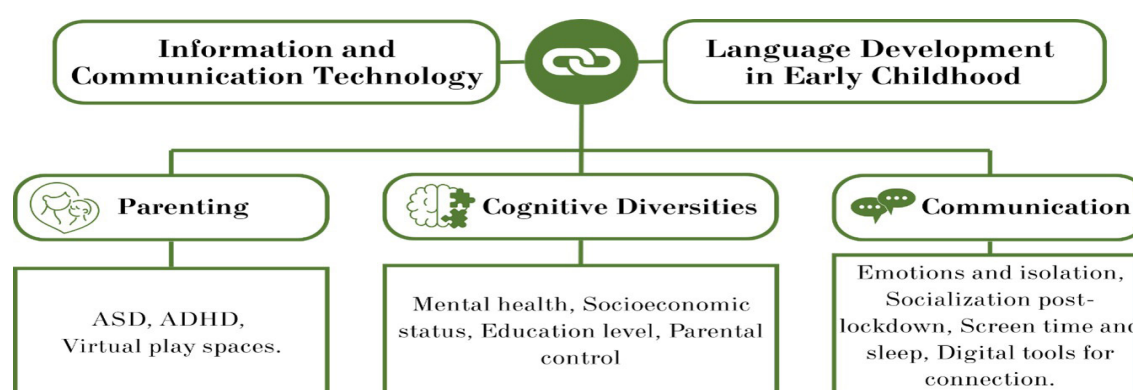


Figure 2. Thematic axes between ICT and Language Development in Early Childhood

The aforementioned thematic axes are discussed below

Parenting

In lockdown by covid-19, children made greater use of ICTs without supervision. They spent more time in front of the screen, and not only in educational activities (Raney et al., 2022). In the corpus, different research explains how language development and ICT use are discussed in relation to various complex factors, like parenting or family care. At least four of them are analyzed here: Mental and Emotional Health, Socioeconomic level, Parents' Educational Level and Parental control.

Mental and Emotional Health. The first factor identified is the mental and emotional health of parents or caregivers. The most significant finding highlights the need to support families' mental and emotional well-being to guide the use of technology in childhood as a means of fostering high-quality interactions between parents and children. This involves activities that promote emotional regulation, understanding, and creativity. Parent-Child Interaction Therapy and the Triple P-Positive Parenting Program are recommended for fostering high-quality interactions, as they have shown positive effects in reducing parenting-related stress, managing challenging child behaviors, and enhancing positive parenting strategies (Stienwandt et al., 2022).

From a research perspective, there is a gap regarding how to develop family support strategies that address parental stress and children's use of ICTs. This issue requires urgent attention in the fields of childhood development and education. Evidence confirms

that parental stress is associated with children's symptoms of inattention (Lopes et al., 2023). Additionally, another study finds that parents' mental health, particularly mothers, influences various aspects of children's cognitive and psychosocial development (Hendry et al., 2023).

Parental stress is a significant barrier to positive interactions between caregivers and children, which are crucial for fostering language development. High levels of stress can reduce responsiveness and engagement, limiting the quality of communication essential for language growth. Addressing parental stress not only helps manage challenging child behaviors but also enhances the caregiver's ability to support children's cognitive and psychosocial development, underscoring the need for family support strategies that specifically target these stressors.

Socioeconomic level. The second factor is the socioeconomic level of the parents. This is a crucial determinant of children's screen time and their participation in non-screen communication activities (Berard et al., 2022). In summary, this factor shows that the organization of home education during covid-19 confinement, which was framed by the use of ICTs, was directly conditioned by household income and financial difficulties (Berard et al., 2022; Cortés-Albornoz et al., 2023; Fung et al., 2023; Raney et al., 2022; Sancili & Tugluk, 2022; Sun et al., 2023; Tiitinen et al., 2023).

This adult mediation in the use of ICTs is frequently associated with aspects of children's language development, according to the studies reviewed. Consistent with the above, the reviewed studies highlight how vocabulary development during the pandemic was differentially reported according to socioeconomic status. Children with a good economic status showed greater progress compared to those who lacked this status (Fung et al., 2023; Sun et al., 2023). There is not enough information to assert that these problems only affect parents or caregivers with low socioeconomic status. This must be studied from a broader and more critical perspective, as the differences in progress may be attributable to various other factors related to systemic and structural issues of social inequality. These issues often persist, ultimately undermining the rights of all individuals, including those of children.

In contrast, during the pandemic, marginalized communities faced greater challenges, including food insecurity and higher rates of COVID-19 morbidity and mortality. These communities also experienced intense and mandatory exposure to digital technologies, which led to a reduction in home activities without ICT mediation. Consequently, unsupervised screen exposure and problematic behaviors among children were exacerbated in environments with declining incomes and difficulties in accessing food (Sancili & Tugluk, 2022). All of these elements contributed to a negative impact on the academic performance of boys and girls across various areas of knowledge (Cortés-Albornoz et al., 2023). In this context, digital inequality must be taken into account (Tiitinen et al., 2023). While it is true that marginalized communities have less material access to digital technology due to its costs, this does not necessarily mean that its impact is less significant. Digital inequality encompasses not only the need for material resources in digital technology but also the availability of adequate study spaces. Therefore, even in sectors lacking digital technology, there was still a high use of ICTs among children without adult mediation. This occurred because there were

no intentional spaces for their use, nor were there regulated activities in the home dedicated to study or parent-child interaction.

This socioeconomic factor is closely related to what has been described as ‘domestic chaos,’ as there was a significant increase in children’s screen time following the COVID-19 outbreak, particularly in households characterized by greater levels of ‘domestic chaos (Hood et al., 2021; Kracht et al., 2021). This suggests that children spent more time in front of screens in households lacking clear routines. When mothers exercised less executive control over their children, there was a risk of increased screen time. ‘Domestic chaos’ intensified due to shifts in maternal priorities, influenced by factors such as working from home and similar dynamics that became more prevalent during confinement. Consequently, while cohabitation occurred, there was a lack of interaction between parents and children that fostered language development.

Parents’ Educational Level. The third factor is the parents’ level of education, which has also been observed to influence language development. Mothers with higher educational levels tend to engage more verbally with their children, asking questions and providing comments, aligning their interactions with teaching strategies rather than giving direct orders. This approach fosters a space for bidirectional language learning. Similarly, it was found that the higher the educational level of parents, the greater their involvement in their children’s learning activities, such as reading books or participating in music and art classes (Fitzpatrick, Harvey et al., 2022; Morrone et al., 2023). Another study suggested that lower levels of education among mothers and fathers may be an indicator of greater use of digital media and screens for children’s entertainment.

This is concerning, as has been discussed in the literature in connection with reduced levels of effort control. This refers to reduced attentional and cognitive skills needed to regulate emotions and feelings effectively, which can impair children’s ability to benefit from informal learning situations at home and in their surroundings (Fitzpatrick, Harvey et al., 2022). This states that digital technology should not be used as a substitute for interaction with parents. Digital technology cannot replace meaningful interpersonal exchanges, but it could enhance or facilitate these types of interactions.

The results related to this third factor emphasize that some studies suggest that excessive screen time may displace key interactions that support language development. Parents or caregivers play a crucial role in the storytelling process, providing recognition and support that foster cognitive flexibility and enhance language skills in children (Kalantari et al., 2023). Therefore, when there is closeness between parents and children during screen exposure, language development processes are strengthened, such as using screens during shared reading routines.

This is particularly relevant in contexts where teachers have fewer opportunities to interact with students due to the pandemic (Dunn et al., 2023; Gath et al., 2023). In this regard, the finding that digital books can be a valuable addition to reading is important, particularly due to their thematic content and their use in activities such as shared reading with parents at home (Dunn et al., 2023; Gath et al., 2023; Kalantari et al., 2023; Mifsud et al., 2021). This could also extend to viewing audiovisual content,

such as series and movies, serving as a pretext for sharing comments, conversations, and discussions with children.

It is important to remember that most children believe technology supports their learning, making it easier and more enjoyable, which underscores the significance of ICT in their daily lives (Delgado Martín & Larrú Ramos, 2022). Therefore, it is not feasible to eliminate the use of digital technologies for children over three years of age. ICT also facilitates effective communication during online learning. The quality of education, educational excellence, and the academic progress of children can benefit from strong communication between teachers and parents (Aditya et al., 2022; Delgado Martín & Larrú Ramos, 2022; Kucirkova et al., 2020). Moreover, outside the educational context, ICTs have a strong capacity to capture the attention of children. Therefore, parents or caregivers could leverage ICTs to foster interaction and communication with them.

Parental control. The fourth factor is parental control, which is particularly relevant. One study indicates that most families reported that children do not have their own mobile technology devices, but rather use those belonging to relatives or siblings. However, the majority of children were exposed to mobile technology devices before the age of 36 months, becoming familiar with these devices, in some cases, from birth (Koran et al., 2022, p. 337). During the confinement, many parents reported relaxing their rules on the use of digital devices. As a result, they encountered multiple challenges in controlling screen time, particularly given its essential role in home learning (Lewis et al., 2023; Susilowati et al., 2021).

In the same vein, parents stated in another study (Crescenzi-Lanna, 2022) their concern for the quality and accuracy of digital content available to their children; as they are often misclassified or distorted according to the country of evaluation. This places children at a possible risk of witnessing content that may be harmful or violent (Crescenzi-Lanna, 2022). In many cases, it is not so crucial for governments to adopt (Babvey et al., 2021; Bruni et al., 2021; Fitzpatrick, Almeida et al., 2022; Pombo et al., 2021). Ultimately, parents are responsible for knowing how their children use ICTs in order to reduce possible negative effects (Mesce et al., 2022).

Families can begin by teaching screen time management skills from an early age and providing children with their own electronic devices only when they demonstrate the ability to use them in a balanced way (Gerosa & Gui, 2023; Mesce et al., 2022; Pedersen et al., 2022; Tan et al., 2023). Parents are also encouraged to limit their children's online time to model positive digital technology use and promote alternative activities, such as listening to music, reading together, or playing board games (Crescenzi-Lanna, 2022; Lewis et al., 2023; Panchal et al., 2023; Susilowati et al., 2021). Not because screens are inherently harmful, but because longer exposure makes it more challenging to regulate intentional use.

It is also important to consider that the amount of time parents spend in front of screens influences their children's behavior, particularly on weekends (Tan et al., 2023). For this reason, it is emphasized that educational institutions and families should teach children the necessary skills and competencies to avoid the distracting effects of screens. Additionally, young people should only be provided with a smartphone when they have

demonstrated the ability to manage their time effectively with other screen-based media (Gerosa & Gui, 2023; Mesce et al., 2022; Pedersen et al., 2022; Tan et al., 2023).

It is important to keep in mind that the pandemic led to a lack of social interactions and a reduction in normal physical and academic activities, which impaired sleep and, in turn, negatively affected language development in children (Bruni et al., 2021). Also, it is necessary to consider factors such as screen time, dietary habits, and motor development. (Pombo et al., 2021). Furthermore, in a study (Fitzpatrick, Almeida et al., 2022) it was found that children who were better able to regulate their emotions, attention, and movement were less likely to be exposed to media before bedtime, thanks to parents who adopted a restrictive approach.

In contrast, parents who co-viewed or used instructional methods with their children were more likely to expose them to media before bedtime and even use media themselves at bedtime, which resulted in lower temperamental control or reduced self-management of emotions. Interestingly, parents with more children reported less media use at bedtime, likely because they needed to organize their routines more effectively (Fitzpatrick, Almeida et al., 2022).

Conversely, the use of electronic screens by siblings appears to have a greater impact, as it directly affects children's screen time. Observing their older siblings spending more time on devices due to homeschooling, younger children often request more screen time themselves, citing a need for 'equal conditions' during confinement (Dong et al., 2023). Despite the above, it was observed that the interaction between time spent watching television or playing video games and the presence of siblings may positively impact long-term emotional profiles. This is because screen time with siblings is shared time, allowing for sensitive interaction and verbalization, with an active engagement with the content on the screen (Dong et al., 2023; Lampis et al., 2023).

As a final aspect of parental control, it is important to note that many studies in the corpus assume that the role of supervision is exclusively the mother's. These studies focus on the factors, habits, and behaviors of the mother without considering the findings from a gender perspective. This approach is problematic and leads to biased discussions, as the role of the mother is examined as if she were solely responsible for the development and upbringing of children in the home.

Cognitive diversities

Cognitive divergences emerge as a key point of interest in the discussion on ICT and language development, particularly concerning autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD). Studies suggest that children with ASD tend to spend more time in front of screens, even before the COVID-19 confinement, and are more likely to prefer stereotyped content over learning activities. Furthermore, due to challenges in social relationships and interactions, children with ASD face a higher risk of sedentary behavior and reduced opportunities for socialization (Dong et al., 2023). Neurotypical children, in contrast, are more likely to use their screen time for academic activities and tend to engage more readily in activities away from screens.

Thus, improvements in ASD symptoms have been reported by reducing screen exposure and encouraging more social interaction. These cases highlight the importance

of considering screen exposure as a factor that can influence autism-like symptoms (Dong et al., 2023; Heffler et al., 2022; Siskind et al., 2022; Sriwaranun et al., 2023).

About children with ADHD, it was observed that the decrease in screen time was mainly related to time spent in study activities. In seeking a reduction in screen time, the time spent on academic time is often reduced, but not the time spent on recreational time. This is a mistake. The corpus notes that this does not positively impact the ADHD scales. When the time that is reduced is recreational, there is an improvement in these scales and the severity of symptoms decreases.

That supports the idea that only excessive screen time without intent or purpose affects cognitive development, which in this case translates into the severity of ADHD symptoms. Therefore, it is recommended that in situations requiring confinement and online education, recreational screen time be appropriately monitored and limited, especially in children with ADHD (Sriwaranun et al., 2023).

Therefore, in children with ASD and ADHD, recreational screen exposure has been associated with adverse outcomes in symptom management and developmental processes, including aspects of language acquisition. This is consistent with the study of Du et al. (2021), which points out how those children who often learn in special education classrooms have difficulty socializing through traditional face-to-face interactions.

In these cases, the strategy of virtual playgrounds can be an interesting option to give meaning to the use of ICT and have positive effects. In these games you can learn the rules and norms of the community, through recreational time. That same study points to the value of neurodiverse children using the resource of online communities to foster communication. For these spaces encourage play with other neurodiverse peers outside of traditional settings, such as classrooms (Du et al., 2021). So, even in this line about neurodivergences, a conscious, intentional and, when possible, shared use of screens is also recommended. Otherwise, excessive and unsupervised recreational use of digital devices can lead to negative linguistic, social and cognitive outcomes among young children (Siskind et al., 2022).

Communication

In the previous discussion, the positive effects of neurodiverse children using ICTs during confinement for communicative purposes and social interaction were highlighted. This applies to all children. It is especially important to consider that there were many limitations to communication both during and after confinement. These limitations in social interaction and communication, combined with the use of ICTs, impacted language development.

This situation led parents to express concern about their children's language development and present and future socioemotional well-being. Anxiety, isolation, and low mood due to confinement were common issues reported by parents (Egan et al., 2021). Consequently, it was observed that children whose relationships with their parents had deteriorated under these conditions were more likely to exhibit negative behaviors (Linnavalli & Kalland, 2021). Additionally, increased irritability and anger were noted among children, likely due to uncertainty about regular school attendance

and the loss of peer interactions during the COVID-19 pandemic in 2020 (Picca et al., 2022).

These challenges may also be linked to other factors affecting behavior, such as poor sleep hygiene during the pandemic. Low sleep quality can impact psychosocial health, learning efficiency, academic performance, and ultimately, language development in children and adolescents. Therefore, it is recommended to adjust schedules, promote healthy sleep routines, and reduce screen use before bedtime (Moavero et al., 2023).

Although evidence shows an increase in negative behaviors, such as irritability, no substantial impact of the pandemic on typical temperament development during infancy and early childhood was found. Despite the increased use of ICTs and limited social interaction, resilience in normative temperament development was observed during these critical periods of childhood growth (Fiske et al., 2022). This suggests that an association between ICT use and negative behaviors should not be generalized.

Thus, parents are encouraged to make informed and thoughtful decisions regarding ICT use, considering the unique circumstances of each case. This approach will help them better discern the actions and regulations necessary to support their children's language development. For this reason, findings from research on COVID-19 pandemic confinement remain relevant.

Children may be more inclined to use touch-screen technologies as a form of support, especially those with difficulties in working memory and cognitive flexibility, as these technologies offer a more structured environment and clearer perceptual representations of stimulus-response (Portugal et al., 2023). During confinement, children's preferred activities on digital devices were centered around entertainment and social relationships, underscoring the digital space's importance as a site where social norms and values are constructed (Larranga et al., 2022). Consequently, a shift in children's social network cohesion was observed, likely due to increased engagement in social play, which often involves established rules or objectives that promote participant's interactions (Eichengreen et al., 2023). Schools are even encouraged to use social networks to foster greater connectedness and well-being among all children following reopening (Eichengreen et al., 2023).

While parents reported a lack of interaction among their children, this was primarily because the children missed relationships with friends and peers from early childhood or school. However, due to the use of ICT during distance education, an increase in playground interactions was observed after reopening, including the integration of more peers in play (Egan et al., 2021). This increased interaction may be attributed to a renewed desire to socialize after a long period of confinement (Eichengreen et al., 2023). Technology plays a crucial role in children's socialization and relationships today (Barbosa & Nogueira, 2021).

Furthermore, although physical contact and closeness are essential for children, particularly for positive relational experiences, digital technology provided a necessary adaptation to the reality of social interaction during confinement (Forne, 2021). This was especially evident in children's social interactions with their families, where the use of technological tools at home contributed to their cognitive development (Lin et al., 2023). These findings underscore that communication, understood as a social and

emotional process, constitutes an independent yet interconnected domain of analysis in understanding the impact of ICT on early childhood language development

CONCLUSION

This review analyzed the scientific literature published after the COVID-19 lockdown about the influence of ICT exposure on oral language development in early childhood. The analysis was organized around three thematic axes: parenting, cognitive diversities and communication. These dimensions allowed for the identification, interpretation and synthesis of key findings related to how digital environments shape early linguistic experiences.

The evidence shows that prolonged and unsupervised screen exposure tends to negatively affect language development, especially when it replaces adult-child interaction. This effect is influenced by the mental health of caregivers, the socioeconomic conditions of the household and the educational levels of parents. In the case of neurodiverse children, some studies report that intentional and guided use of digital tools can support specific communicative needs, although unregulated recreational use tends to intensify developmental challenges.

Most studies present methodological limitations such as cross-sectional designs, self-reported data and lack of standardization in the assessment of ICT use and language outcomes. A particularly relevant gap is the limited number of studies focused on Latin American contexts. There is a lack of investigations that consider how inequality, domestic routines and structural conditions in this region shape children's experiences with digital technologies and language development.

It is important to consider that the evidence was produced in a period of social confinement, which may have affected the focus, urgency and publication dynamics of the studies. Therefore, these findings cannot be generalized to contexts without pandemic restrictions. Future research should incorporate longitudinal designs and include populations from underrepresented regions to better understand how ICT exposure affects oral language development in diverse childhood contexts.

Limitations

The reviewed literature exhibits several methodological and epistemological limitations that restrict the generalizability and analytical depth of its contributions. A predominant limitation is the reliance on cross-sectional designs, which hinders the ability to trace developmental trajectories or evaluate the sustained impact of ICT exposure on oral language development. The absence of longitudinal or mixed-method studies limits the understanding of causal mechanisms and the long-term consequences of early digital exposure.

Another major concern is the widespread reliance on self-reported data from parents or caregivers to estimate screen time and digital device use. This introduces potential recall bias, inconsistent reporting, and divergent categorizations of digital activity. Furthermore, the assessment of language development lacks standardization across

studies, with considerable variability in instruments, age ranges, and evaluation criteria—factors that challenge comparative synthesis.

Significant heterogeneity also characterizes the samples, research settings, and types of digital content analyzed. Many studies fail to clearly distinguish between educational and recreational content, or between interactive and passive use, nor do they systematically evaluate the presence or quality of adult mediation—factors widely recognized as essential mediators of language outcomes. This lack of specificity limits the ability to determine under which conditions digital technologies may support or hinder language development.

Moreover, sociocultural and contextual diversity is notably underrepresented. Most studies are situated in urban, high-income contexts in the Global North, with limited attention to how factors such as socioeconomic inequality, domestic infrastructure, and caregiver availability shape ICT use in early childhood. Consequently, the external validity of these findings for rural or Global South settings remains limited.

Finally, although a subset of studies addresses children with neurodevelopmental conditions such as ASD or ADHD, the findings are often insufficiently contextualized. There is a marked lack of systematic inquiry into how different cognitive profiles interact with ICT use, or how digital interventions might be tailored to foster inclusive language development pathways.

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STATEMENT OF CONFLICTS OF INTEREST

The authors report that there are no competing interests to declare.

AUTHOR'S CONTRIBUTION

Leidy-Laura Salcedo-Ortiz: conceptualization, investigation, data curation, formal analysis and writing.

Miguel-Ángel Afanador-Restrepo: conceptualization, investigation, data curation, formal analysis, methodology, visualization, project administration and writing.

Angélica López-Rodríguez: validation, supervision, project administration and writing.

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