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The interplay between digital media, shared book reading and sleeping problems in early language development

La interacción entre medios digitales, lectura compartida y problemas para dormir en el desarrollo lingüístico temprano

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ABSTRACT

The main goal of this study was to explore the impact of digital media (screen exposure and video calls) on children's early language development by exploring its interrelationships with shared book reading and children's sleeping problems. The cross-sectional data of 362 families with children aged 30 to 41 months old were collected and a structural equation analysis was used as a multivariate analysis technique to explore the complexity of the relationships among variables of interest. Screen exposure was significantly and negatively related to book reading and marginally and positively related to sleeping problems. The results indicated that screen exposure and video calls were not associated to children's linguistic development; rather book reading was the main predictor. Maternal education was also a key factor on these interrelationships, as children from families in which the mother had a higher education degree spent less time with screens and were more exposed to shared book reading. The findings of this study provide additional insights on the relationship between digital media use and language development in the early years and highlight the importance of raising awareness among parents of the relevance of practices out of screens, such as book reading.

Keywords: language development, screen exposure, shared book reading, sleep quality, video calls

RESUMEN

El objetivo de este estudio fue conocer el impacto de los medios digitales (exposición a pantallas y videollamadas) en el desarrollo lingüístico temprano de los niños explorando sus interrelaciones con la lectura compartida de libros y los problemas para dormir. Para estudiar la complejidad de estas relaciones se analizaron datos transversales recopilados de 362 familias con niños de entre 30 y 41 meses de edad, usando ecuaciones estructurales. Los resultados revelaron que la exposición a pantallas se relacionaba significativamente de forma negativa con la lectura de libros y marginalmente de forma positiva con los problemas para dormir. Sin embargo, ni la exposición a pantallas ni las videollamadas se asociaron con el desarrollo lingüístico de los niños, siendo la lectura de libros el predictor principal. La educación materna también fue un factor clave en estas interrelaciones, ya que los niños de familias en las que la madre tenía un título superior pasaban menos tiempo frente a las pantallas y estaban más expuestos a la lectura compartida de libros. Los hallazgos de este estudio proporcionan información adicional sobre la relación entre el uso de medios digitales y el desarrollo del lenguaje en los primeros años, y resaltan la importancia de concienciar a las familias sobre la relevancia de prácticas fuera de las pantallas, como la lectura de libros.

Palabras clave: desarrollo del lenguaje, exposición a pantallas, lectura compartida de libros, calidad del sueño, videollamadas

INTRODUCTION

The relationship between digital media use in childhood and learning outcomes is likely complex, as there seem to be conflicting results. On the one hand, some research suggests some positive effects of digital skills acquired in early childhood in future school achievement (Hurwitz & Schmitt, 2020). On the other hand, other studies suggest that the time of screen exposure has no effects (Adelantado-Renau et al., 2019; Kumar & Shirley, 2020) or has a moderate negative effect on children's academic performance (Tremblay et al., 2011). This negative effect has been explained by a number of reasons, including a reduction in the time available for academic-related activities such as reading or homework (Nolan et al., 2022; Shin, 2004), and a reduction in cognitive processing abilities, including a decrease in brain connectivity (Horowitz-Kraus & Hutton, 2018) and attention skills (Jourdren et al., 2023; Meri et al., 2023; Santos et al., 2022).

Some research has specifically focused on the relationship between digital media use and language development. The results of a systematic review published in 2017, including studies with children under 14 years old, indicate that television exposure is associated with poor linguistic outcomes (Kostyrka-Allchorne et al., 2017). Another systematic review with meta-analysis that included studies whose participants were aged 4 to 18 years old also showed that the time of television viewing was negatively associated with language, both in children and adolescents (Adelantado-Renau et al., 2019). An even more recent systematic review with meta-analysis, covering studies with children under 12 years old, also provided strong evidence that the quantity of screen time (whether TV or other devices) was negatively related to children's language development, whereas later age at screen use onset was associated to better linguistic skills (Madigan et al., 2020).

There are some hypotheses to the reasons for this negative impact of the digital media on children's linguistic development. During their first years of life, infants and toddlers develop their linguistic skills through interaction with others, mainly their caregivers. Screen time (even when a device, such as TV, is in the background and children are not directly watching it) seems to reduce not only parent-child interactions, but also children's play, which is key for the development of symbolic operations (Anderson & Subrahmanyam, 2017; Madigan et al., 2020). Additionally, there is evidence that infants and toddlers under 3 years have difficulties in learning and translating to their experience the information that is communicated to them via symbolic media, as studies show that screen exposure only has a positive effect on linguistic development when parents interact with their children, "translating" the content provided by screens and providing them opportunities for conversational turn-taking (Alroqi et al., 2023; Deloache et al., 2010). In fact, the results of the

meta-analysis by Madigan et al. (2020) indicate that screen co-viewing is associated with children's better linguistic skills.

Furthermore, there is evidence that screen exposure under three years of age has negative effects on cognitive abilities that have a key role on linguistic development, such as working memory (Zimmerman & Christakis, 2005). For these reasons, several organizations, such as the World Health Organization (WHO) and the American Academy of Pediatrics (AAP), have suggested that screen exposure is not recommended for children under 2 years, and should not exceed 1 hour per day in children aged between 2 and 5 years (AAP, 2016; WHO, 2019), being considered excessive when surpassing 2 hours per day (Bhutani et al., 2024). However, studies in different countries show that the reality is too far from these numbers. For example, a recent study in Saudi Arabia (Alroqi et al., 2023) showed that 95% of the children aged under 2 years and 91% of the children aged between 2 and 3 years exceeded these screen time recommendations, each age group being exposed to screens, on average, 2 and 3 hours a day, respectively. A recent study in Portugal with children aged between 18 and 57 months also showed that children were exposed to screens, on average, 2 hours a day (Rocha et al., 2023). Another study in the United States found similar results, indicating that children under 3 years watched television on average 2.2 hours per day (Zimmerman & Christakis, 2005). A study in Finland (Mustonen et al., 2022), focusing children aged between 2 and 4 years of age, found a daily average of 79 minutes of screen exposure, which, although is lower than the time found in other studies, is still above the recommended time. Nonetheless, research also shows that families of higher socioeconomic status and with more educational qualifications tend to adhere more to the recommended time of screen exposure, and therefore their children are less exposed to screens than children from families coming from lower socioeconomic strata (Fung et al., 2023; Lan et al., 2020; Rocha et al., 2023).

Thus, research has supported the existence of a negative effect of digital media use on children's linguistic development, but the existing research focuses mainly on passive screen exposure, such as watching television. When considering children under three years, in fact, passive screen exposure, such as watching cartoons, movies or videos on TV or in other devices, accounts for the majority of digital media use (Bhutani et al., 2024; Sundqvist et al., 2021). However, the COVID-19 pandemic brought several societal changes, including a more recurring use of digital media to communicate. Previous research with children around 2 to 2;6 years old has suggested that children can learn new words through the use of digital media, but only in situations in which there are live interactions and video chat with an adult (Roseberry et al., 2014).

Research has also shown a negative association between screen exposure and other two variables that have a positive effect in language development: sleep

quality and quantity (Knowland et al., 2022; Turnbull et al., 2022) and shared book reading (Karrass & Braungart-Rieker, 2005; Mol et al., 2008; Noble et al., 2019). On the one hand, previous studies have consistently shown that screen exposure is related to children's reduced sleeping time (Lan et al., 2020; Mallawaarachchi et al., 2022; Marinelli et al., 2014) and to sleep disturbances, such as nightmares and night awakenings (Brockmann et al., 2016; Cavalli et al., 2021; Ricci et al., 2021). This association between screen exposure and a reduction in sleep quantity and quality has been explained mainly by both the decrease in melatonin due to the screens' blue light and the arousal caused by the media contents (Garrison et al., 2011; Green et al., 2017). Some research has also found that more shared book reading was associated with less screen exposure (and vice-versa) not only in the case of school-aged children (Nolan et al., 2022), but also in the case of children under three years (Osika et al., 2023). However, this result has not been found universally. For example, a study by Taylor et al. (2018) conducted in the United Kingdom found no inverse relationship between screen exposure and shared book reading with children aged between 6 and 36 months. However, the sample of this study was highly educated, with 81.7% of the parents having a higher education degree. Therefore, the educational level of the families may also play a role in this relationship.

The present study

This study aims at contributing to the understanding of the impact of digital media on children's early language development by exploring the interplay between media exposure and other key determinants of linguistic development (book reading, maternal education and sleeping problems), given the scarcity of studies that have investigated conjointly all these variables and their complex interrelationships. Specifically, this research seeks to answer the following questions:

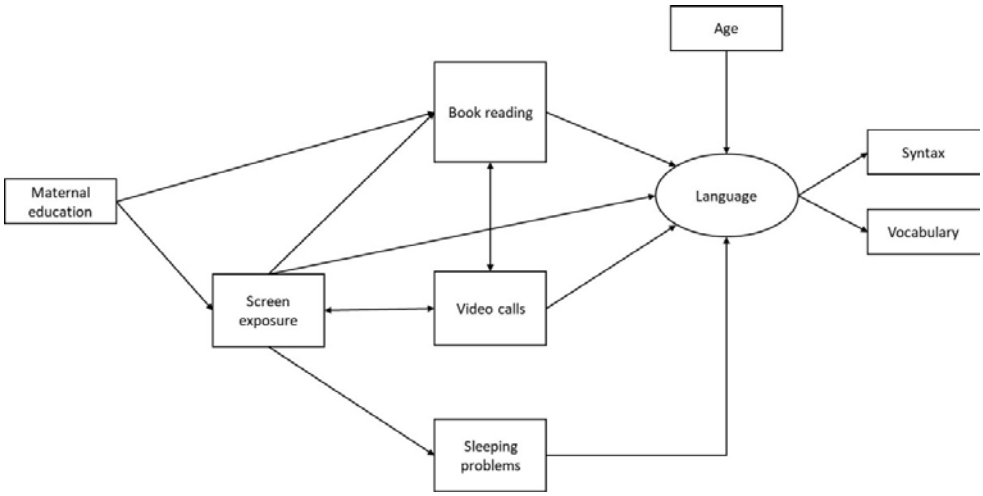
a) Does digital media use influence children's early language development? Does this effect vary depending on whether its use involves interaction (as in video calls) or is it limited to mere passive exposure to screens?
b) To what extent is the use of digital media related to other family practices that have been shown to have a positive effect on promoting early language, such as shared book reading?
c) Are these family practices modulated by the family socioeconomic status?
d) To what extent does the use of digital media affect other determinants of early development, such as sleep quality?

Given the results of the previous research mentioned above, we anticipated that the frequency of shared book reading and video calls would have a positive relationship with children's linguistic development. On the other hand, we expected

that the time of screen exposure would have a negative effect on children's linguistic development, which may be mediated by sleeping problems. Regarding socioeconomic status (SES), in this study, we considered maternal education as a proxy of SES. Following previous literature, we predicted that children from mothers with lower educational levels would be more exposed to screens and participated with less frequency in shared book reading practices, which in turn would be associated with lower levels of linguistic development. Figure 1 represents the conceptual model under study.

Figure 1

Hypothetical model for the expected relationships among digital media use, shared book reading, sleeping problems, children's linguistic skills and maternal education



METHOD

Participants

The data of this study came from a project that investigates the acquisition of European Portuguese as an L1 by children whose first years of life took place in the context of the COVID-19 pandemic (LCF/PR/FP22/62010012). Relevant information about children and their family environment was collected through their parents or main caregivers in March and April 2023. Families had to have at least one child aged between 30 and 42 months to be eligible. Children who met any of the following criteria were excluded: a) birth before 9 months of gestation with a weight of less than 1500 grams, b) previous diagnosis of a developmental disorder,

and/or c) parents who only spoke to them in a language other than Portuguese. A total of 402 respondents filled out the online survey created for this research. After discarding data from interviewees whose responses either indicated the presence of serious outliers in any of the variables studied or suggested that the child might have a neurodevelopmental disorder, the final sample of this study consisted of 362 children and their families. Table 1 summarizes the main sociodemographic information of the study sample. As shown in the table, the sample included a similar proportion of boys and girls, the average age of children was around 3 years and there were no significant age differences between boys and girls ($t_{(360)} = 0.031$, $p = .976$, $d = .00$). The sample was mainly composed of children whose mothers have a higher education level (around 63% of the mothers had a qualification equivalent to a university degree). The distribution of boys and girls ($\chi^2_{(1)} = 0.026$, $p = .873$) and children's age ($t_{(360)} = 0.793$, $p = .429$, $d = .09$) was similar in families with mothers with a higher education degree and families where the mother completed only the upper secondary level or below.

Table 1
Sociodemographic information of the sample

Variables	*M* (SD) [Minimum–Maximum]	*N* (%)
Child's age (in months)	35.42 (3.56) [30-41]	
Child's sex		
Female		187 (51.7)
Male		175 (48.3)
Mother's educational level		
Upper secondary or below (<12 years)		135 (37.3)
Post-secondary or above (>12 years)		227 (62.7)

Measures and instruments

Language development

The MacArthur-Bates Communicative Development Inventory III, Portuguese version (CDI-III-PT; Cadime et al., 2021) was used to measure children's linguistic development. This is a parental report inventory that includes two subscales: vocabulary and syntactic complexity. The first one includes a checklist of 166 words divided into four lexical categories: (1) body parts and related words (34 words); (2)

food and related words (37 words); (3) mental terms (45 words); and (4) emotions and related words (50 words). The syntactic complexity subscale consists of a 26-item checklist that presents different types of syntactic structures that children are expected to produce at this level. For each item, parents must indicate whether the child produces the word or the target structure. In the validation study for the Portuguese population (Cadime et al., 2021), high internal consistency values were obtained (KR-20 = .981 and KR-20 = .911, for each subscale respectively). Reliability for the current sample was also high (KR-20 = .986 for vocabulary and KR-20 = .939 for syntactic complexity).

Shared book reading

Shared book reading was assessed through one question asking parents how frequently they read to their children during the last 30 days, using a six-point Likert scale: (1) never; (2) 1-3 times a week; (3) 4-6 times a week; (4) 7-9 times a week; (5) 10-12 times a week, and (6) more than 12 times a week. Similar measures are frequently used in research on shared reading (see e.g., Farrant & Zubrick, 2013; Hayes & Berthelsen, 2019).

Screen exposure

Children's screen exposure was assessed by four items, where parents had to estimate how much time children were exposed to television, computer, tablet or mobile phone screens, on a usual day (considering the last 30 days), regardless of being alone or not. Parents were asked to report the time spent in hours with each device, with the option to specify periods in half-hour increments (0.5 hours) or indicate no time spent (0 hours). The time of exposure to each device was then summed to obtain a total number of hours of screen exposure. The development of this measure took into account the findings of a systematic review on screen time measurement in children aged 0 to 6 years old (Byrne et al., 2021), which indicated that most measures consisted of one to three items that assessed duration of screen time on a usual day.

Frequency of video calls

Frequency of video calls was assessed by one question where parents had to estimate, on a usual day (considering the last 30 days), how often their child

participated in video calls, using a 5-point Likert scale: (1) never; (2) 1-2 times per day; (3) 3-4 times per day; (4) 5-6 times per day; (5) more than 6 times per day.

Sleeping problems

Children's sleeping problems were assessed by one question where the parents had to indicate whether their child has had sleeping problems during the last 30 days, such as restless sleep, trouble falling asleep, nightmares or waking up frequently during the night, using the following 4-point Likert scale: (1) no sleeping problems; (2) mild sleeping problems; (3) moderate sleeping problems, and (4) severe sleeping problems. Previous studies investigating children's sleeping problems have used similar single-item measures (see e.g., Covington et al., 2018). It has been suggested that single-item measures can be an appropriate procedure for measuring constructs which are not ambiguous and have a limited scope, especially when conducting surveys that collect a significant amount of data (Allen et al., 2022).

Procedure

The study obtained approval from the Institutional Ethics Committee at University of Minho (reference CEICSH 042/2023) and is part of a larger study whose main goal was to explore the effects of the COVID-19 pandemic on children's linguistic development (LCF/PR/FP22/62010012). Data collection for these measures was carried out during March and April 2023 by the company GfK metrics through an online survey that participating parents completed after providing voluntary and informed consent for their involvement in the study.

Statistical analyses

Firstly, data from continuous variables were verified to be normally distributed using skewness and kurtosis values within a range of ±2 as criterion of normality (George & Mallery, 2016). Next, a descriptive analysis was performed on all the data. Nominal and ordinal variables were described in terms of frequencies and percentages. Normally distributed continuous variables were expressed as means (*M*), standard deviations (*SD*), and maximum and minimum values.

A chi-square test (χ^2) was performed on child's sex and mother's educational level to confirm that the group of families including mothers with higher education was matched with the group of families including mothers with upper secondary

or lower education with respect to the former variable. Student's *t*-tests for independent samples and Mann-Whitney *U*-tests were used to explore differences associated with sociodemographic variables. For independent *t*-tests, effect size was reported in terms of Cohen's *d* value, while rank biserial correlation coefficient (r_{rb}) was used to determine the strength and direction of the relationship between a dichotomous nominal variable and an ordinal variable. Cohen's *d* and r_{rb} values were interpreted as very small ($d < 0.20$; $r_{rb} < 0.10$), small ($0.20 \leq d < 0.50$; $0.10 \leq r_{rb} < 0.29$), moderate ($0.50 \leq d < 0.79$; $0.30 \leq r_{rb} < 0.49$), and large ($d \geq 0.80$; $r_{rb} \geq 0.50$), according to the benchmarks proposed by Cohen (1988). Spearman's correlations coefficients (ρ) were computed to describe bivariate associations between continuous and ordinal variables. For the interpretation of ρ values, the same cut-off points were considered as for r_{rb}. All univariate and bivariate statistical analyses were performed using IBM SPSS 27 for Windows and a *p*-value lower .05 was considered statistically significant in all the tests.

Structural equation modelling (SEM) was used as a multivariate analysis technique to examine patterns of interrelationships among variables of study. All variables were included in the model as observed variables except for language development construct, which was modeled as a latent variable measured by two indicators: vocabulary and syntax. A combination of indices was used to assess the overall fit of the model under consideration including a chi-square to degrees of freedom ratio (χ^2/df) lower than 2, a Comparative Fit Index (CFI) higher than .95, as well as a Root Mean Square Error of Approximation (RMSEA) below .05 (Hu & Bentler, 1999; Marsh et al., 2004). SEM was carried out using Mplus 7, applying a full information maximum likelihood estimator.

RESULTS

Descriptive and bivariate statistics

Descriptive statistics for the measures used in this study are presented in Table 2. Children's language development did not differ according to mothers' educational level: no significant differences associated with maternal education were observed in either vocabulary ($t_{(360)} = 1.103$, $p = .271$, $d = .12$) or syntax ($t_{(360)} = -1.565$, $p = .115$, $d = .17$).

Table 2
Descriptive statistics for variables of the study

Variables	*M* (*SD*) [Minimum–Maximum]	N (%)
Child's expressive language skills		
Vocabulary	51.73 (40.41) [0-166]	
Syntax	17.95 (7.33) [0-26]	
Screen exposure		
Time (hours a day)	3.23 (2.33) [0-12]	
Shared book reading		
Never		32 (8.8)
1 to 3 times a week		138 (38.1)
4 to 6 times a week		102 (28.2)
7 to 9 times a week		50 (13.8)
10 to 12 times a week		15 (4.1)
More than 12 times a week		25 (6.9)
Video calls		
Never		120 (33.1)
1 or 2 times a day		208 (57.5)
3 or 4 times a day		21 (5.8)
5 or 6 times a day		6 (1.7)
More than 6 times a day		7 (1.9)
Sleeping problems		
No sleeping problems		248 (68.5)
Mild sleeping problems		97 (26.8)
Moderate sleeping problems		12 (3.3)
Severe sleeping problems		5 (1.4)

In relation to the practices implemented by parents at home, more than 50% of participating families reported a frequency of shared reading activities greater than 3 times per week, and around 67% of parents claimed their child participated in video calls at least once a day, with no more than two daily video calls, in most cases (see Table 2). Children in the study spent an average of 3.23 hours a day watching or using screens, although the parents' report of daily time their child spent in front of media devices was highly variable across participating families. Maternal education was associated with this variability: families whose mothers did not have a higher education degree reported significantly more screen time (M = 4.07, SD = 2.49) than those with more educated mothers

(M = 2.73, DT = 2.09; $t_{(243.826)}$ = 5.248, p < .001, d = .60). Inversely, shared book reading was a practice significantly more frequent in families whose mothers had at least an undergraduate degree (63% of these families claimed to carry out this activity more than three times a week) than in those whose mothers had an educational level equal to upper secondary or lower (where only 36.3% engaged in these activities more than three times a week; Z = -4.964, p < .001, r_{rb} = .30). No association was found between the mother's educational level and the number of daily video calls (Z = -0.403, p = .687, r_{rb} = -.02). Regarding sleep quality, it should also be noted that around a third of the families interviewed reported that their child had sleeping problems, with the majority being of mild severity (see Table 2). Children's sleeping problems were not associated with mother's educational level (Z = -0.457, p = .648, r_{rb} = -.02).

Table 3 shows bivariate correlations among study variables. As expected, vocabulary and syntax correlated positively and significantly. Likewise, significantly positive relationships were also found between children's age and their expressive linguistic skills, which reflects an increase associated with age in the productive vocabulary, as well as in the syntactic complexity of the sentences generated by children. However, no significant association was found between children's age and household practices studied here, i.e., daily exposure to screens, number of video calls per day, and frequency of shared reading activities per week. Children's age also did not correlate with parent-reported children's sleeping problems.

Table 3

Spearman's correlations between ordinal and continuous variables of the study

		1	2	3	4	5	6	7
1	Age		.134*	.252***	-.005	.024	-.069	-.073
2	Vocabulary			.273***	.225***	-.127*	-.004	-.014
3	Syntax				.094†	-.039	-.007	-.109*
4	Shared book reading					-.191***	.031	.080
5	Screen exposure						.141**	.068
6	Video calls							.105*
7	Sleeping problems							

Note. † $p \leq .10$; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

Growth of vocabulary significantly correlated with both the frequency of shared reading activities and the time spent on screens, although in different ways. Specifically, the higher the frequency of shared reading activities reported by the family, the higher also the vocabulary score; but the longer the exposure time to screens, the lower the parent-reported proficiency level for this linguistic skill. In the case of syntax, a marginally significant positive association was observed only between the weekly frequency of shared book reading activities and the syntactic complexity of sentences produced by children.

No significant associations were found between the frequency of video calls and the children's expressive linguistic skills. In relation to the other family practices, the number of daily video calls correlated positively and significantly with the daily exposure time to screens, but it did not with the weekly frequency of shared reading activities. However, the daily screen time did relate significantly, although negatively, to shared reading practice; so, the longer the exposure time to screens per day, the lower the frequency of shared reading activities per week reported by the parents. Additionally, a higher frequency of video calls per day was also associated with more severe sleeping problems, which in turn were significantly related to lower performance in syntax.

Structural equation modelling

A structural equation model was tested, based on the literature review (Figure 1) and the results of bivariate statistics (Table 3). In this model, maternal education was tested as a predictor of both book reading and screen exposure. Besides age, sleeping problems, shared book reading, screen exposure and video calls were tested as predictors of children's linguistic skills. To test whether more screen exposure led to less time devoted to book reading, this relationship was considered in the model as well. As video calls also imply screen exposure, the covariance of these variables was also inserted in the model. Regarding the relationship between media use and sleeping problems, although in the bivariate statistics sleeping problems were correlated with a higher frequency of video calls, when considering the multivariate relationships, there was no significant relationship between these two variables. Rather, the study of the patterns of interrelations suggested an effect of screen exposure on sleeping problems, and thus this effect was introduced in the model instead of the effect of video calls on sleeping problems.

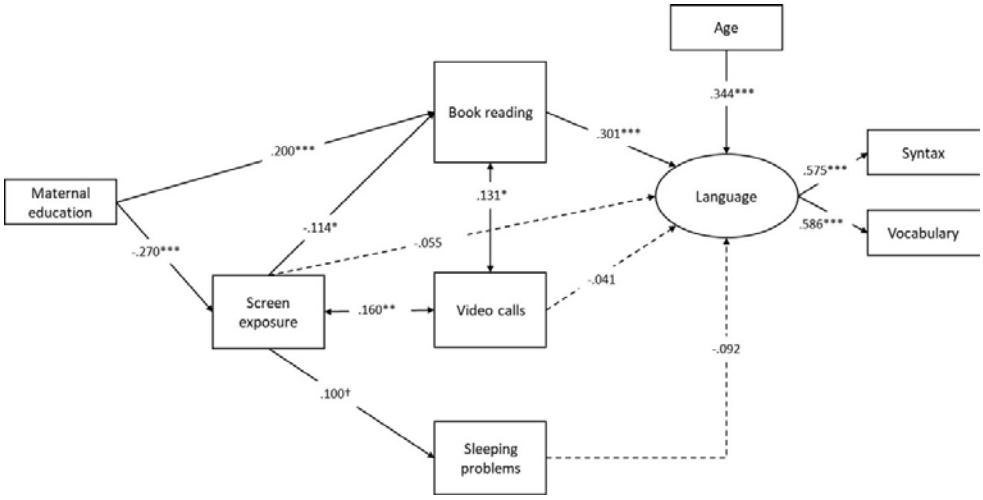
The fit of this model was good: $\chi^2_{(14)} = 21.237$, $p = .096$, CFI = .953, TLI = .916, RMSEA = .038 [.000, .068], SRMR = .037. As depicted in Figure 2, a higher level of maternal education was significantly associated with more shared book reading and less children's screen exposure. More screen exposure was, in turn, significantly associated with less shared book reading and marginally associated with more

sleeping problems (p = .055). Video calls were positively associated both with book reading and screen exposure. Besides age, the main predictor of children's linguistic skills was shared book reading. Screen exposure and video calls were not significantly related to children's language development.

Table 4 presents the indirect effects in the model. Maternal education indirectly predicted children's linguistic development via shared book reading, but not via screen exposure. A marginally significant indirect effect of maternal education on children's linguistic development via both screen exposure and book reading was also found. The remaining indirect effects were also not significant.

Figure 2

Model for the relationships among digital media use, shared book reading, sleeping problems, children's linguistic skills and maternal education



Note. † $p \leq .10$; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

Table 4
Indirect effects (standardized estimates) linking maternal education and children's language development

Indirect effects	Estimate	SE	*p*
Maternal education → book reading → language	0.060	0.021	.005
Maternal education → screen exposure → language	0.015	0.020	.452
Maternal education → screen exposure → book reading → language	0.009	0.005	.070
Maternal education → screen exposure → sleeping problems → language	0.002	0.002	.294

DISCUSSION

The first research question was whether digital media use influenced children's early language development and whether the possible effect varied depending on whether its use involved an interaction or a passive exposure. The results indicate that children spent on average around three hours per day with screens, which is a much higher duration than recommended by WHO (2019) and AAP (2016). However, contrarily to previous research (Adelantado-Renau et al., 2019; Kostyrka-Allchorne et al., 2017; Madigan et al., 2020), the results of this study showed no significant direct effect of the passive screen exposure, nor of the frequency of video calls on children's linguistic skills.

Regarding passive exposure to screens, this finding might be related to the measure selected to collect the data: parents were simply asked to indicate how much time per day their children are exposed to a set of screens, including TV or other devices. This type of measure is commonly used in studies that resort to reported measures to obtain information about children's screen time (see e.g., Khan et al., 2017; Mustonen et al., 2022). However, considering more qualitative information in future studies, such as whether the child was exposed to screens alone or whether there was interaction with adults during the screen use could provide additional information to broaden understanding of its effect in early infancy. As previously indicated, screen co-viewing seems to be associated to children's better linguistic skills (Alroqi et al., 2023; Madigan et al., 2020), as parents of children under three years old can help them make sense of symbolic sources, thus compensating the possible negative effects of screens. Therefore, interaction with others might be a key factor when studying the relationship between screen exposure and children's linguistic development. Due to this reason, it was expected that the frequency of

video calls could have a positive effect on children's language skills, as video calls allow for contingent social interactions. However, such an effect was not observed in our study.

Although video calls have aspects that can positively contribute to children's linguistic development (e.g., contingent responses from adults, the possibility of turn-taking, among others), in contrast to passive screen exposure, they also have some limitations that can hinder this effect. These limitations are summarized in a review by Glick and Saiyed (2022): (a) there may be technical difficulties that lead to a low quality of video and sound; (b) the camera (instead of eye location) determines what is visible and participants tend to look at their on-screen partner (not the camera), making eye gaze different from on-site communication; and (c) shared physical contact and joint manipulation of objects are not possible. All these limitations can make video calls less effective in promoting children's communicative and linguistic development than in-person interactions. Moreover, in our study we only measured video calls frequency per day. About half of the participants reported that their children were involved in video calls once or twice a day, but no data about the duration, type of interactions and quality of the input received by children during these calls was collected. There is robust evidence that the quality of input has a stronger effect on children's linguistic development than the quantity (Anderson et al., 2021), which can be part of the reason why we found no effects. We also did not collect information about the physical presence of co-viewers and their behavior during the video calls, as the behavior of these co-viewers can minimize some of the previously referred limitations, by correcting technical issues or providing contingent responses in the talk with the conversation partner, therefore helping children to better understand what they see and hear during the video-calls (Glick & Saiyed, 2022; Myers et al., 2018). All these aspects should be considered in future research investigating the role of video calls in early linguistic development.

The second research question was to what extent the use of digital media was related to other family practices that have been shown to have a positive effect on promoting language, namely shared book reading. The results indicate a negative relationship between screen exposure and book reading, similarly to what has been found in other studies (Nolan et al., 2022; Osika et al., 2023). This finding seems to support the idea that screen time reduces the time available for other activities, such as book reading. However, the results also suggest that the frequency of these activities is modulated by the socioeconomic status of the family, as indicated by maternal education – a result allowing to answer our third research question. In families with mothers with a higher education degree, children spent less time with screens and had read books to them more frequently. In turn, book reading was the main predictor of children's language development. Shared book reading has

some features which are particularly important for fostering children's language development, and which are probably less prominent in other practices such as the ones that involve media use. First, written language exposes children to more complex input than everyday informal oral language use; this higher complexity in the written use of language may be defined in terms of higher lexical diversity, higher diversity of complex syntactic structures and, more generally, higher mean length of utterance (MLU) and speech rate (Hoff-Ginsberg, 1991). Moreover, there is evidence that parents engage in explicit vocabulary teaching during shared book reading (Hindman et al., 2014; Olszewski & Hood, 2023), which may not occur or be so frequent during media use. Future studies should explore this hypothesis.

The last research question regarded the relationship between digital media and sleep quality. Similarly to previous research (Brockmann et al., 2016; Cavalli et al., 2021; Ricci et al., 2021), the results of the SEM tested in this study suggested that the higher the time of screen exposure, the more sleeping problems identified in children. Although we did not collect data on whether screen exposure happened during the day or at night, our finding reinforces the negative link between excessive screen exposure and sleep quality in children. Even though the effect of sleeping problems on children's linguistic development did not reach significance, it is possible that prolonged sleeping problems can lead to learning difficulties in the future (Cardoso & Capellini, 2018). Therefore, programs aiming to raise awareness among parents concerning the relevance of reducing children's screen time are needed.

The main limitation of this study is data collection through parental reports. Although previous research has shown that parental reports are reliable, particularly in the case of language assessment (Cadime et al., 2021; Jarůšková et al., 2023), some social desirability can be present in some of the responses, particularly in the ones related to the household practices conducted with and by children. Moreover, data was collected online, which can have limited the participation of parents with lower digital skills. Thus, future studies should apply more inclusive data collection methodologies. Another interesting aspect to consider in futures studies is the influence of content to which children are exposed during screen time -as noted by Kostyrka-Allchorne et al. (2017), "*what* children watch may be more important than *how much* they watch" (p.53).

Conclusion

This study allowed to collect information on family practices with children between 30 and 41 months and to contribute to the discussion concerning the complex relations between these practices, the family socioeconomic status and early linguistic development. As for media use, and even though we confirmed

a higher screen exposure time than what is recommended for children under 5 years, there was no direct effect of screen exposure on language development – as measured by the CDI-III-PT. Nevertheless, our results also allow to confirm a negative effect of digital media use on other family practices with a positive effect on linguistic development, namely, shared book reading. In addition, the frequency of these family practices is modulated by socioeconomic status, measured in terms of maternal education. Finally, a negative effect of digital media use on the quality of sleep was identified. These results not only highlight the complexity of the relations between linguistic development and a set of diverse variables that may directly or indirectly determine children's linguistic environment, but they also justify particular attention to excessive screen exposure in the early years.

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