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Weekend screen use of parents and children associates with child language skills

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Introduction: The study examined the relationship between screen time and types of screen activities engaged in by children, mothers, and fathers on weekends, and its association with mother-reported vocabulary and grammatical skills of children aged 2;5 to 4;0.

Methods: Mothers reported the language skills of 421 children (M age = 38.18 months; $SD = 5.73$) by the Estonian CDI-III, and the screen use of children, mothers, and fathers by the Screen Time Inventory. We applied Latent Class Analysis (LCA) to analyze the screen time of children, mothers, and fathers, aiming to identify common family screen use profiles.

Results: The results showed that higher total screen time of children was linked to poorer vocabulary and grammatical skills. None of the screen-based activities that children, mothers, and fathers engaged in, including co-viewing of screens and socializing time, were found to positively relate to language skills. Playing video games was negatively associated with children's language skills, regardless of whether it was the child, mother, or father gaming. LCA identified 3 distinct family screen use profiles (low, moderate, and high users) which differed by parental education, screen-based activities, and children's language skills.

Discussion: The findings underscore the significance of family-based interventions when addressing screen time within the context of child language development.

KEYWORDS

screen time, expressive vocabulary, grammatical skills, language development, CDI, screen-based activities, preschoolers, latent class analysis

1 Introduction

Advances in touchscreen technology and the ease of access to various electronic devices at home have significantly heightened screen exposure among young children. Despite the World Health Organization's (WHO, 2019) guideline that screen time for children aged 2–5 should not exceed 1 h per day, most 2–3-year-olds surpass this recommended limit (Madigan et al., 2020a).

There is a substantial body of research linking children's screen time to various aspects of cognitive development, learning, and wellbeing (Xie et al., 2018; McArthur et al., 2021; Zhang et al., 2022). The focal point of the current study is the relationship between screen exposure and language skills, a critical area given that early language development is the best predictor of later development, wellbeing, and academic success in children (Golinkoff et al., 2019). Nonetheless, findings on the association between screen time and language development are mixed. Numerous studies show that excessive screen time is associated with reduced language skills (Duch et al., 2013; Lin et al., 2015; Madigan et al., 2020b; Axelsson et al., 2022). For example, Sundqvist et al. (2023) found that higher child and parental exposure to electronic media was associated with smaller expressive vocabulary at age 2, and that children's screen time

at age 2 negatively predicted children's vocabulary at age 5. In contrast, other studies have suggested a positive effect of greater screen time on vocabulary size (e.g., [Jing et al., 2023](#)). Other studies state that preschoolers' total screen time is unrelated to their expressive vocabulary ([Alloway et al., 2014](#); [Taylor et al., 2018](#); [Zhang et al., 2022](#)). These divergent findings reported in literature could stem from variations in the tools used to measure child screen time and language skills, differences in screen usage (solitary vs. co-viewing), screen content features (interactive or not; program; intended audience: child- vs. adult-directed), media type, child age, and differences in the availability of apps at particular ages of children ([Xie et al., 2018](#); [Axelsson et al., 2022](#)).

In many cultures, children learn language largely through adult-child verbal interactions. They need opportunities for language-rich experiences and interactive talk—back-and-forth interactions with adults ([Golinkoff et al., 2019](#); [Rowe and Snow, 2020](#)). Screen interactions can reduce or even substitute time otherwise dedicated to dyadic face-to-face verbal interaction with adults, which has been considered essential for child language acquisition and development ([Anderson and Hanson, 2017](#)). Studies have shown that background TV exposure significantly diminishes the quantity and quality of verbal interactions between mothers and children ([Kirkorian et al., 2009](#); [Lavigne et al., 2015](#)). Despite the shift toward more interactive media forms like computers, tablets, and mobile touchscreen devices that complement TV viewing, most research findings on child language acquisition continue to focus on the effects of traditional media rather attending to new, more interactive media ([Lauricella et al., 2015](#)). Recent studies highlight that children learn new words more effectively from live interactions and real-life events than from video content alone ([Roseberry et al., 2009](#)) or from chat interactions such as via Skype ([Roseberry et al., 2014](#)). [Radesky et al. \(2015\)](#) found that parents' excessive use of mobile devices reduces their interactions with children. Parental technoreference—regular disruption of face-to-face interactions between parents and children due to the use of a screen device—has an impact on child mental health, family relationships, and children's cognitive development ([Mackay et al., 2022](#)). Although not yet experimentally validated, parental technoreference may have a great impact on child language development.

The WHO (2019) recommendations for children's screen use advocate for parental co-viewing and discussion with children about the content of what they see and do. There is some research evidence that children who co-view media with parents outperform those who use media independently ([Madigan et al., 2020a](#); [Griffith et al., 2021](#); [Mustonen et al., 2022](#)). Nonetheless, most studies on effects of screen use on children's language development focus on impacts of children's solitary device use rather than on co-viewing with a parent or both parents. Moreover, most prior studies have centered on English-speaking children and those of older ages ([Neuman et al., 2017](#); [Madigan et al., 2020a](#)).

Our study aims to describe the screen use patterns of Estonian families' and the overall home digital environment, addressing their connection to the language skills of children aged 2;5–4;0. The reason for focusing specifically on this age period is that children are often first introduced to screens at ages 2 and 3 years ([Nevski and Siibak, 2016](#)). Moreover, the instrument used for assessing

language skills of children is designed for children aged 2;5–4;0 years. This study examines media exposure and screen use across the entire family, recognizing that children's home environment is where long-term behavioral patterns, including healthy screen use, are initially formed ([Lauricella et al., 2015](#); [McArthur et al., 2021](#)). It has been observed that parents with higher screen time tend to have children with similarly high screen time ([Lauricella et al., 2015](#); [Nevski and Siibak, 2016](#); [Mustonen et al., 2022](#)).

Acknowledging that research evidence suggests that not all screen time is equally impactful, the effect of screen use on language development may vary based on the content and purpose of specific screen activities. When examining the link between screen use and children's language skills, it is essential to consider the time dedicated to specific screen-involving activities. The literature lacks a systematic study on how various digital activities relate to children's language skills. An additional objective was to explore the duration of different screen-based activities, and whether it relates to children's vocabulary and grammatical scores.

Variability in children's screen time has been attributed to several factors, including gender and SES. Children from lower-income families tend to spend more time on screens compared to their peers from higher-income families ([Cameron et al., 2015](#)). In families with higher educational attainment, children's engagement with screens does not detract from developmentally more-appropriate activities such as reading ([Vandewater et al., 2006](#); [Taylor et al., 2018](#)), and is not negatively related to children's language skills, possibly because parents with higher education may compensate for screen time by engaging in more conversation with their children and doing so in ways that support language development ([Taylor et al., 2018](#)). Regarding gender as a potential factor, girls are reported to spend more time with screen devices than boys ([Taylor et al., 2018](#)). Similarly, gender and SES are factors that also explain the wide variability in children's language development. Mothers with higher education have been found to speak in ways that better support children's language development: talking more with children, using a greater variety of words, and engaging children more in back-and-forth conversations ([Pace et al., 2017](#); [Rowe, 2018](#)). Girls tend to be ahead of boys in language development, although the degree of precociousness is rather small ([Fenson et al., 2007](#); [Eriksson et al., 2012](#)).

In summary, this study was guided by the following research questions:

RSQ1: How much time do Estonian children, along with their parents, spend on screen devices during a typical weekend day, including co-viewing screens with parents, and how does this screen time relate to children's language skills (expressive vocabulary and grammatical skills)?

RSQ2: When examining screen use patterns in Estonian families, can a small set of underlying subgroups be identified? Do these latent classes differ in terms of sociodemographic characteristics, screen time and types of activities engaged in by each family member, and children's language skills?

RSQ3: How does the time spent on different screen activities by the child, mother, and father relate to children's language skill outcomes?

2 Method

2.1 Participants

The sample included 421 children (38.2 ± 5.7 months of age and 52% were female). Mothers were 32.5 ± 5.1 and fathers 35.3 ± 6.2 yrs. of age. Parental education was categorized as at least a bachelor's degree (55.6% of mothers and 34.5% of fathers) or less than a bachelor's degree (25.5% of mothers and 45.6% of fathers), with 18.9% of mothers and 19.9% of fathers not reporting their educational level. The sample was reflective of the educational distribution among the Estonian population. According to the OECD adult education level indicator, 54.8% of 25- to 34-year-old Estonian women and 39.9% of 25- to 34-year-old men have acquired tertiary education (OECD, 2022).

2.2 Procedure

Data were collected using an online questionnaire from November 2018 to July 2019, i.e., before the onset of COVID-19. In Estonia, families are well-equipped with digital devices: 93.2% have an Internet connection (Statistics Estonia, 2023), 39.4% of Estonian children up to 3 years old use smartphones, and 25.5% use tablets daily (Nevski and Siibak, 2016). Families participating in the study were recruited through Facebook groups for parents with children aged 2;5–4 years, and through kindergartens from different regions in Estonia. The current study is part of a larger research project about the associations between children's language development and their language and digital environment at home. The current study uses data regarding the use of digital media devices by children, mothers, and fathers measured by the Screen Time Questionnaire, and children's language skills measured by the Estonian Communicative Development Inventory-III (ECDI-III, Tulviste and Schults, 2020). Although it was not specified which parent would be expected to complete the web-based questionnaires, it was mostly the mothers who provided the reports (except for two fathers). The criteria for inclusion in this study was that children are from families where the dominant language is Estonian, children have no serious health and language problems, and data regarding children's language skills and all family members' (i.e., children's, mothers', and fathers') screen use were available. In Estonia, 82.8% of children aged 0–5 live together with their mother and father (OECD Family Database, 2018). We have no information about whether the parents resided together permanently or had a different arrangement. At the end of the data collection, written feedback on the child's language results was sent to the parents.

2.2.1 The screen time inventory

The instrument was designed by us for a previous project and consisted of four parts. First, parents were asked to indicate all screen devices (e.g., television, smart phone, tablet, laptop, game console, other) the child, mother and father used during last 2 weeks. Second, in alignment with the diversity of screen media and exposure to various media already at a young age, we asked parents to estimate how many hours and minutes children, as well

as their mothers and fathers spend with various screen devices (including traditional media such as TV as well as new media such as computers, laptops, tablets, cell phones, game consoles etc.) on a typical weekend day for various screen-based activities: entertainment, gaming, shopping, learning, and socializing. For example, parents were asked, "Please mark how many hours and minutes the child, mother and father used the screen devices for the playing video games on video, computers, or mobile devices on a typical weekend day". The parent wrote hours in one box and minutes in another about each activity for every family member. Third, we asked about co-viewing of the screens, "How much time (in hours and minutes) did your child use digital devices with a parent during a typical weekend day?" The fourth part of the inventory measured parents' attitudes toward children's screen use. Parents were asked to rate the usefulness or harmfulness of spending time with screens on 11 different aspects of child development (i.e., math skills, physical activity, behavior, creativity, reading skills, attention span, speaking, communication skills, knowledge acquisition, understanding others, and sleep) on a five-point scale, from very harmful (5) to very beneficial (1).

In the current study, the second and third parts of the inventory, i.e., the amount of time of different screen-based activities of each family member and co-viewing with parents, were analyzed. Total screen time for the mother and father was calculated by summing up the time spent on all individual screen activities. For children, time spent on entertainment, gaming, and socializing activities was collected and summed up to derive total screen time. Children's total screen time on a typical weekend day was categorized as meeting the recommended limits (low screen use, ≤ 1 h/day) vs. exceeding the recommended limit by spending either 1–2 h/day (moderate screen use) or more than 2 h/day (high screen use) with screens. Total screen time of mothers and fathers was broken down into three groups: low screen user (≤ 2 h/day), moderate screen user (2–4 h/day), and high screen user (> 4 h/day).

2.2.2 ECD-III

Children's language skills were assessed by the ECDI-III (Tulviste and Schults, 2020). This is an Estonian adaptation of the Swedish version of the CDI-III developed by Eriksson (2017), exhibiting sufficient internal consistency (Cronbach's $\alpha = 0.97$ for the Vocabulary section and $\alpha = 0.92$ for the Grammar section) and concurrent and predictive validity (Tulviste and Schults, 2020, 2023). The Vocabulary and Grammar sections were included in this study. In the Vocabulary section mothers marked the words their children produce using a 100-item vocabulary list that included food words ($n = 16$), body words ($n = 26$), mental words ($n = 30$), and emotion words ($n = 28$). In the Grammar section, parents reported on their child's Grammatical constructions and Sentence complexity. The Grammatical construction section consists of seven items, including the plural, comparisons, past tense, and conjunctions. The parents were asked to mark for each item if their child has never used a particular example of grammar (scored 0), has used it several times (scored 1), or uses it daily (scored 2). The Sentence complexity section includes 10 pairs of sentences that consist of a short sentence with simple

grammar and a complex, more elaborated sentence. For each pair, the parents had to indicate whether their child currently uses the simpler one (scored 0), alternates between simple and complex sentences (scored 1), or currently uses the more complex one (scored 2). The maximum score for grammatical skills is 34.

The study was approved by the Research Ethics Committee of the University of Tartu, Estonia.

2.2.3 Statistical analysis

To estimate the screen time of Estonian children, mothers, and fathers on a typical weekend day, and to evaluate whether total screen time of each family member relates to children's language skills, descriptive and correlational analysis of each study variable was performed using IBM SPSS 29.0. One-way ANOVAs were used to compare means, and Pearson's chi-squared tests were used to compare proportions. Pearson correlational analyses were performed to address the links between screen use and language skills.

To explore the typologies of screen use in families, screen use patterns of individual family members (child, mother, and father) were subjected to Latent Class Analysis (LCA) on our sample ($n = 421$). LCA was conducted based on individual total screen time values for the child, mother, and father. Mothers provided the screen time estimates for all family members. LCA will generate probabilities for membership in all identified classes in the model, allowing to evaluate, for example, the membership of low screen time mothers or high screen time children in each identified class (Sinha et al., 2021). The optimal class solution was determined by comparing 2- through 5-class models based on key statistical indicators including Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), entropy, as well as the class sizes and overall utility of the model in explaining qualitative differences between the classes (Raftery, 1995; Berlin et al., 2014). Finally, a 3-class model was selected to best describe the latent screen use typologies in families in Estonia.

3 Results

3.1 Data description

Findings suggest that 6.7% of children were non-users of digital devices. Most children (69.5%) were high users of screen devices, i.e., their screen time exceeded 1 h per day. Descriptive statistics for expressive vocabulary, grammar, total screen time and screen-based activities for the child, mother, and father in the whole sample, and for the three identified family class profiles are presented in Table 1. Children as well as their mothers and fathers were active screen users, although large individual differences were evident regarding all study variables (see Table 1). Children were mainly engaged with entertainment, whereas mothers and fathers were mainly engaged with entertainment and socializing.

3.2 Family screen use profiles

LCA identified three distinct family screen use profiles, which we named with the aim of reflecting the predominant screen use behavior or the three family members: (1) low screen use family (32.5%); (2) moderate screen use family (32.3%); (3) high screen use family (35.2%) (see Figure 1). The classes were named with the aim to reflect the predominant screen use patterns of the child, mother, and father within each class.

Table 1 presents descriptive statistics on study variables across the three detected classes. As seen in Table 1, there were significant differences among three profiles in parents' age and educational level, time of co-viewing screens with a parent, children's, mothers', and fathers' total screen time, as well as in times engaged with different screen-based activities, except the time fathers spent for learning, and children for learning and socializing. Children from the low screen use family class had significantly higher vocabulary scores than those from the high screen use profile, $F_{(2,411)} = 4.22$, $p = 0.015$, $\eta^2 = 0.020$. They also reflected significantly higher grammatical scores than peers belonging to the moderate or high screen use profiles, $F_{(2,407)} = 4.48$, $p = 0.012$, $\eta^2 = 0.022$.

3.3 Correlation among study variables

Correlational analysis showed that children's and fathers' screen use were not related to children's age in months, but there was a significant negative correlation between mothers' total screen use and children's age ($r = -0.107$, $p = 0.028$). Children's vocabulary scores were strongly related to their age ($r = 0.404$, $p < 0.001$), as well as their grammatical scores ($r = 0.237$, $p < 0.001$). Accordingly, we proceeded to control for the age of children when exploring associations between children's language skills and total screen time, as well as individual screen-based activities of the child, mother, and father. Table 2 presents the results of correlational analyses. As seen in Table 2, child total screen time was significantly related to mothers' and fathers' screen time and negatively associated with children's vocabulary and grammatical scores. Co-using screens with parents wasn't related to children's language skills.

A correlational analysis correcting the age of children found that vocabulary and grammatical scores of children were negatively associated with their total screen time and the time spent with entertainment and gaming. Children's vocabulary scores were negatively related to mothers' entertainment and mothers' and fathers' gaming, and children's grammatical scores were negatively related to mothers' gaming and fathers' total screentime and gaming (see Table 2).

4 Discussion

This study aimed to investigate the relationships between families' screen time use and mother-reported language skills in Estonian children aged 2;5–4;0 years. The first research question explored how much time Estonian children, mothers, and fathers spend on a typical weekend day with screens and whether the total screen time of each family member is related to children's

TABLE 1 Child and parent demographics, screen use, and children's language scores by the ECDI-III, in the total sample and in different family profiles according to the 3-class model generated by Latent Class Analysis.

	Whole sample	Class 1: low screen use family	Class 2: moderate screen use family	Class 3: high screen use family	P-value
	(n = 421)	(n = 137)	(n = 136)	(n = 148)	
Demographics					
Child's age (months)	38.18 (5.73) ¹	39.39 (6.42) ^b	37.66 (5.81) ^a	37.53 (4.74) ^a	0.010
Child sex (% female)	48.0	48.2 ^a	57.4 ^a	49.3 ^a	0.291
Mother's age (years)	32.55 (5.10)	33.32 (5.26) ^a	32.67 (4.91) ^a	31.72 (5.04) ^b	0.029
Mothers with higher education (%)	68.5	77.9 ^a	74.1 ^a	53.5 ^b	<0.001
Father's age (years)	35.31 (6.23)	36.58 (6.82)	35.15 (5.92)	34.29 (5.75)	0.008
Fathers with higher education (%)	43.1	51.4 ^a	48.3 ^a	29.5 ^b	0.002
ECDI-III					
Vocabulary score	56.68 (22.37)	61.07 (20.65) ^a	55.63 (24.80) ^{a,b}	53.57 (21.02) ^b	0.015
Grammatical score	18.54 (8.75)	20.26 (7.83) ^a	18.33 (9.38) ^{a,b}	17.17 (8.76) ^b	0.012
SCREEN TIME (h)					
Mother					
Screen use total	3.95 (3.07)	1.79 (1.48) ^a	2.97 (0.80) ^b	6.84 (3.26) ^c	<0.001
Entertainment	2.11 (1.72)	0.83 (0.77) ^a	1.70 (0.87) ^b	3.66 (1.77) ^c	<0.001
Gaming	0.15 (0.51)	0.05 (0.17) ^a	0.12 (0.37) ^a	0.28 (0.76) ^b	<0.001
Shopping	0.21 (0.44)	0.09 (0.21) ^a	0.18 (0.34) ^a	0.35 (0.62) ^b	<0.001
Learning	0.27 (0.82)	0.15 (0.52) ^a	0.08 (0.29) ^a	0.58 (1.21) ^b	<0.001
Socializing	1.23 (1.51)	0.71 (0.87) ^a	0.89 (0.63) ^a	2.01 (2.12) ^b	<0.001
Father					
Screen use total	4.25 (3.47)	1.77 (1.44) ^a	4.01 (3.02) ^b	6.76 (3.46) ^c	<0.001
Entertainment	2.43 (2.07)	1.02 (0.96) ^a	2.34 (1.84) ^b	3.82 (2.11) ^c	<0.001
Gaming	0.57 (1.21)	0.16 (0.46) ^a	0.53 (1.14) ^b	1.00 (1.58) ^c	<0.001
Shopping	0.07 (0.26)	0.03 (0.10) ^a	0.05 (0.17) ^a	0.14 (0.38) ^b	<0.001
Learning	0.17 (0.70)	0.08 (0.46)	0.30 (1.01)	0.14 (0.49)	0.027
Socializing	1.02 (1.52)	0.50 (0.79) ^a	0.80 (0.96) ^a	1.71 (2.11) ^b	<0.001
Child					
Screen use total	1.76 (1.70)	0.70 (0.62) ^a	1.57 (0.74) ^b	2.90 (2.24) ^c	<0.001
Entertainment	1.51 (1.28)	0.61 (0.57) ^a	1.45 (0.74) ^b	2.38 (1.53) ^c	<0.001
Gaming	0.16 (0.59)	0.06 (0.21) ^a	0.06 (0.20) ^a	0.33 (0.94) ^b	<0.001
Learning	0.07 (0.76)	0.02 (0.10)	0.03 (0.12)	0.16 (1.28)	0.206
Socializing	0.03 (0.18)	0.02 (0.08)	0.03 (0.11)	0.04 (0.27)	0.504
Co-viewing	1.05 (1.17)	0.55 (0.71) ^a	0.86 (0.71) ^a	1.66 (1.53) ^b	<0.001

^{a,b,c} Within a row, means without a common superscript differ ($P = <0.05$).

¹ Numbers in each cell are: means, SDs in parentheses.

vocabulary and grammatical skills. According to our data, all family members were on average active screen users, with children spending 1.8 h, mothers 4 h, and fathers 4.3 h daily with screen devices. At the same time, there were wide individual differences in total screen time as well as in the time spent with different screen-based activities. Among 421 children, 128 (30.5%) did not exceed the recommended screentime limit of up to 1 h/day. During

the investigated age period, there were no age-related differences in the time children spent with screens, matching the findings of a longitudinal study by Sundqvist et al. (2023), while the total screen time of mothers (but not fathers) decreased significantly as children's age increased. This may be partly because parents have been found to talk more when children become older and as children's language skills improve (Tulviste and Tamm, 2021;

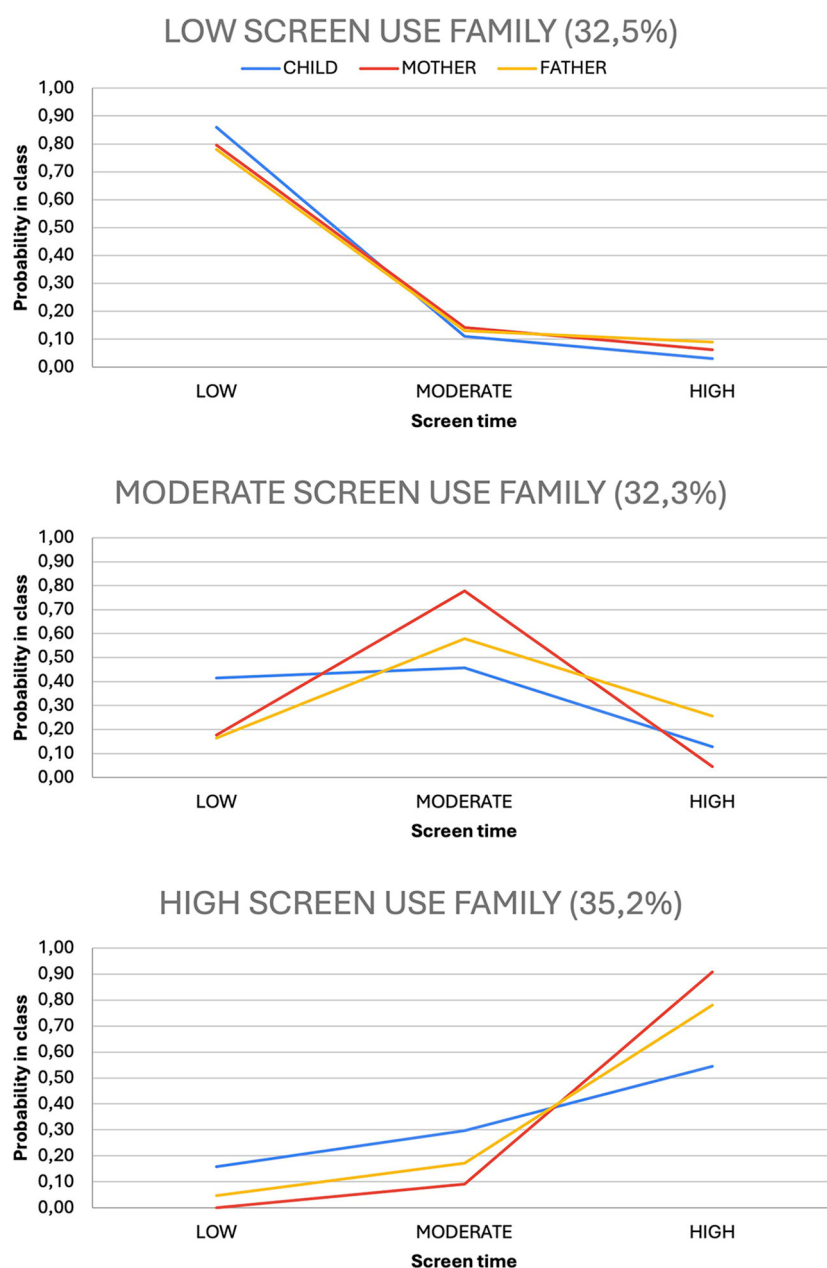


FIGURE 1
 The 3-class model of Estonian families according to the screen use patterns of family members—the child, mother, and father—generated by Latent Class Analysis. The model identified 3 distinct classes (class size in parenthesis): (1) low screen use family (32.5%); (2) moderate screen use family (32.3%); (3) high screen use family (35.2%). For children, screen time was defined as low (≤ 1 h/day), moderate (1–2 h/day) or high (> 2 h/day), and for the mother and father as low (≤ 2 h/day), moderate (2–4 h/day) or high (> 4 h/day).

Dailey and Bergelson, 2023). It could also reflect that mothers of younger children can spend more time with screen devices because their children request less attention from them (e.g., sleep for longer periods) than when they become older.

The study found that when controlling for the age of children, those with higher total language scores used digital devices less than their peers with lower language skills. Thus, the results confirm previous research indicating a negative correlation between children’s greater screen time and early language skills (Duch et al., 2013; Lin et al., 2015; Madigan et al., 2020a).

In line with earlier studies (Lauricella et al., 2015; Mustonen et al., 2022), we also observed that the greater screen use of mothers and fathers is associated with increased screen time in children. The study contributes new insights by showing that fathers’ (not mothers’) longer screen time was negatively associated with grammatical skills of children. Accordingly, it is probable that more time on screens reduces opportunities for face-to-face verbal family interaction and other language-rich experiences essential for language development (Anderson and Hanson, 2017).

TABLE 2 Correlations between screen use by children and parents, and children's language skills, controlling for children's age in months.

	Child							
	Vocabulary	Grammar	Screen use total	Entertainment	Gaming	Learning	Socializing	Co-viewing
ECDI-III								
Vocabulary score	1.00	0.73*	-0.12*	-0.13*	-0.15*	0.07	0.00	-0.03
Grammar score	0.73*	1.00	-0.11*	-0.11*	-0.18*	0.06	0.00	-0.02
Mother screen use total	-0.06	-0.05	0.48*	0.48*	0.27*	0.07	0.05	0.41*
Entertainment	-0.11*	-0.05	0.51*	0.55*	0.17*	0.08	-0.01	0.36*
Gaming	-0.16*	-0.20*	0.40*	0.26*	0.58*	-0.01	0.06	0.11*
Shopping	0.07	0.08	0.03	-0.01	-0.01	0.10	0.03	0.29*
Learning	0.01	-0.01	0.16*	0.15*	0.13*	-0.01	0.07	0.22*
Socializing	0.03	0.00	0.19*	0.19*	0.09	0.03	0.03	0.20*
Father screen use total	-0.09	-0.11*	0.38*	0.39*	0.21*	0.02	0.10	0.34*
Entertainment	-0.07	-0.05	0.38*	0.43*	0.14*	0.03	0.05	0.29*
Gaming	-0.15*	-0.21*	0.24*	0.23*	0.23*	-0.03	0.02	0.16*
Shopping	0.00	0.00	0.21*	0.09	0.01	0.19*	0.47	0.19*
Learning	0.04	0.04	-0.04	-0.03	-0.04	-0.02	0.02	-0.02
Socializing	0.01	-0.02	0.12*	0.11*	0.11*	0.00	0.04	0.22*
Child screen use total	-0.12*	-0.11*	1.00	0.81*	0.56*	0.42*	0.10	0.43*
Entertainment	-0.13*	-0.11*	0.81*	1.00	0.28*	-0.05	-0.02	0.54*
Gaming	-0.15*	-0.18*	0.56*	0.28*	1.00	0.01	0.02	0.09
Learning	0.07	0.06	0.42*	-0.05	0.01	1.00	0.00	-0.03
Socializing	0.00	0.00	0.10	-0.02	0.02	0.00	1.00	0.10
Co-viewing	-0.03	-0.02	0.43*	0.54*	0.09	-0.03	0.10	1.00

* $p < 0.05$.

Previous studies have emphasized that co-viewing media with parents is crucial for minimizing adverse effects of screen devices on child language development (Griffith et al., 2021; Mustonen et al., 2022). Our study did not find evidence that co-viewing of digital devices is related to better language skills in children. Research indicates that less verbal interaction occurs when the TV is turned on (Kirkorian et al., 2009; Lavigne et al., 2015), and more time is spent in silence when playing with electronic devices than when playing with toys (Griffith and Arnold, 2019). Moreover, Estonian mothers have been found to talk less and expect less verbalization from children than mothers of other cultural backgrounds (Tulviste et al., 2003). It might be that families engage in silent co-viewing of movies on TV or computer or that they co-play games without discussing and elaborating the content, which may result in limiting rich language learning opportunities for young children. Greater emphasis should be placed on informing parents that limiting use of digital devices or promoting verbal interaction with children when co-using digital devices may enhance children's language skills (Griffith et al., 2021).

The study did not identify any positive associations between screen use and language skills in this age group, even when children co-viewed screens with parents or engaged in socializing via digital devices. It has been shown that verbal interactions with children through digital tools become more common as children grow older, beyond our study's participant age range (Rudi et al., 2015). Since family screen time is a modifiable behavior, recommendations to reduce screen time for all family members may lead to improved language skills in children, provided that verbal interactions within the family increase.

Significant variability in screen time among family members prompted our second research question: are there distinct common profiles reflecting family's screen use? Using latent class analysis on total screen time for the child, mother, and father, three distinct family classes were identified: low screen user child with low screen user parents (the low screen use family), moderate screen user child with a moderate screen user mother and moderate to high screen user father (moderate screen use family), and finally a high screen user child with high screen user parents (high screen use family). This suggests that within each class, family members share similar average screen times. Comparing the three profiles revealed that families of high screen users had fewer mothers and fathers with a high education level compared to other two profiles. This aligns with previous findings that low-SES families tend to use screens more than higher-SES families (Taylor et al., 2018). Significant differences were also noted among the three classes in time spent on all different online activities, except for children's learning and socializing and fathers' learning. Children in the low-users' classes had higher reported vocabulary and grammatical scores compared to children from high-users' classes.

The third research question concerned different screen-based activities of children, mothers and fathers, and the association of each screen activity with children's language skills. We found that children were primarily engaged in entertainment, while their mothers and fathers practiced entertainment and socializing. Children who allocated more time for entertainment also had mothers with greater entertainment time use, and those who spent more time with gaming had both parents who engage

in longer gaming sessions. The study demonstrates that for children, entertainment and playing video and computer games were negatively associated with their reported vocabulary and grammatical skills. It is important to point out that the negative impact of gaming could be partly attributed to a relative lack of developmentally appropriate computer games for this age group of Estonian children. Games in the English language with limited interactivity or visual-only content likely do not offer rich opportunities for learning oral language and communication skills, unlike personalized back-and-forth social interactions in the native Estonian language (Tatar and Gerde, 2023).

A limitation of the study is its cross-sectional design. Results raise questions about whether the family profiles remain stable when children grow older. Only a longitudinal study design can address this question and clarify the direction of causality between screen use and language skills. Another limitation is that the data were collected before the COVID-19 pandemic. It is possible that pandemic restrictions have altered families' screen use habits as well as children's language skills. The third limitation is that all data, including the child's and the fathers' screen use data, are reported by the mother. Furthermore, only families where children live with both of their parents participated.

Most prior research on the associations between children's screen time and language skills has focused solely on children's total screen time without explicitly considering the screen time of other family members or the specific screen activities in which children and parents engage. The strength of our study is that it examined weekend screen use across the entire family and identified family screen use profiles as a possible factor influencing child language skills. Another strength is our detailed examination of screen time activities for both children and parents, revealing the specific uses of screens. As a result, we found that more gaming time is a negative predictor of children's language skills, regardless of the participant (child, mother, or father) engaged in gaming. The study underscores the negative association between screen time and language development, suggesting that at the age of 2;5–4;0, children's language skills do not benefit from spending weekend days in front of screens. The greatest risk for language skills occurs when children themselves, their mothers, and fathers play video/computer games on screen devices. The results contribute to our understanding of the sources of individual differences in early language development, while also offering practical insights for educational and clinical interventions aimed at reducing screen time to enhance children's health and developmental outcomes. Family profiles aim in identifying children most in need of intervention due to their own and their parents' excessive screen use. Specifically, recognizing the three classes within the typology of family screen use over weekends (low vs. moderate vs. high users) highlights the necessity of family-based interventions for families with heavy screen use to support children's language development by limiting their screen time. The results reinforce the importance of whole-family interventions when seeking to reduce children's excessive digital devices usage, since family members screen use profiles tend to match. Furthermore, the study results suggest that considering families' screen time profiles and which types of screen activities they engage in, is crucial for evaluating the child's language development environment at home.

5 Conclusion

Our study suggests that the time children dedicate to digital devices is associated with lower scores on mother reported language skills. The findings demonstrate that children's screen use patterns compare to those of their parents. Furthermore, activities with screens at weekends should be accounted for when mapping the child language development environment at home, since children who themselves and whose mothers and fathers spend weekends playing video/computer games may face a greater risk of slower language development.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Research Ethics Committee of the University of Tartu, Estonia. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

TT: Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Funding

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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