Mobile device use among preschool-aged children in Greece

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Abstract

In the last decade, interactive touchscreen devices have become ubiquitous in young children, and toddlers first experience touchscreen technology before two. Although parents have a vital role in developing the home environment as a stimulus for development, they also have conflicting views on the appropriateness of using apps to deliver educational content for assorted reasons. The purpose of the study was to reveal various aspects of children's smart mobile use at home, such as the frequency of mobile device usage, preferred app types, and parent beliefs and strategies. Three hundred twenty-five parents of kindergarten children took part in this study. The present study revealed that parents seek to support their children's learning at home via mobile devices. Furthermore, parents lack knowledge about app developmentally appropriateness and need further guidance. We expect the findings to serve as a reference for researchers to better information for parents and create apps with real educational value for children.

Keywords Preschool children · Parents · Smart mobile devices · Apps

1 Introduction

Internationally, scientists voiced possible adverse outcomes from frequent technology use by young children in the previous years (Radesky et al., 2016). Nevertheless, in the last decade, interactive touchscreen devices are part of young children's lives (Burns & Gottschalk, 2019), and toddlers have first experience with touchscreen technology before the age of two (Dardanou et al., 2020; Rizk & Hillier, 2020).

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Although some aspects of technology, such as audio-visual media exposure, had been linked to adverse effects on cognitive development and academic achievement, research is linking children's cognitive development with touchscreen devices and well-designed mobile applications (apps) (Portugal et al., 2021; Sheehan et al., 2019). In addition, research suggests that interactive touchscreen media offer a new, dynamic, and interactive way for children to increase early literacy and math skills by experiencing the basics of letters, shapes, sounds, and numbers (Radesky et al., 2015). As a result, self-proclaimed education apps are among the most accessed or purchased application categories in digital app stores (Gözüm & Kandır, 2021).

Parents have a vital role in developing the home environment as a stimulus for development, and children's use of technology does not occur in a vacuum but within the context of family norms (Griffith & Arnold, 2019). However, parents have conflicting views on the appropriateness of using apps to deliver educational content for assorted reasons, such as not having enough information about their children's development needs or controlling the content delivered via the apps (Palaigeorgiou et al., 2017). Other factors include parenting style and socioeconomic status (Lev & Elias, 2020; Radesky et al., 2015). Furthermore, studies often highlight the difference between the parents' ideal use and the children's actual screen use about app content, time limitation, and parental control (Kaya, 2020).

Earlier research mainly focused on older children using interactive touchscreen technology, and thus there is not enough research focusing on young children. However, this gap is narrowing as researchers and policy experts address it (OECD, 2019). This research aims to fill this knowledge gap in Greece about mobile device usage among preschool-aged children at home. The research aims to reveal various aspects such as the frequency of mobile device usage, preferred app types, and parent beliefs and strategies about their children's device usage. The findings of this study will inform research aimed at understanding how the home learning environment influences children's learning in Greece and other countries undergoing similar technological reforms (Levinthal et al., 2021).

2 Literature review

Smart mobile device usage is increasing rapidly among young children due to the novel characteristics of these devices and the rapid development of mobile applications (apps) targeting these age groups (Hosokawa & Katsura, 2018). Earlier research has pointed out mobile devices as the preferred technological tool for young children (Brito & Dias, 2016) due to the advantages of this technology relative to other older technologies. These include a user-friendly touchable interface, convenient portability, suitable size, and interactive multimedia displays that stimulate multiple sensory systems and provide instant responses to input (Cooper, 2005). Unlike 'traditional' technological tools such as computers that demand fine motor skills to work correctly, which often prove difficult for young children, tablets' intuitive touch-based interface makes it appropriate for those ages 2 to 4 years old (Marsh et al., 2015). Livingstone et al. (2014) found that children aged between 0 and 5 found that these age groups were competent tablet users in the United Kingdom.

Children could navigate through the apps and made fair use of multimodal device features (Livingstone et al., 2014).

Researchers constantly worried that households might be positioned along a digital divide regarding the use of technology, a growing chasm 'between media-rich and media-poor homes' (Livingstone, 2007, p. 926). The 'digital divide' refers to the gap between those who do and those who do not have access to technology, usually falling across low-income racial and ethnic minorities (Gutnick et al., 2010). Rideout (2017) notes that the previous years' gap discussed in various reports does not exist due to the proliferation of smartphones and tablets. Smart mobile device usage among young children is widening fast, even for disadvantaged backgrounds (Radesky et al., 2016), providing significant opportunities for children from low-income families (Rizk & Hillier, 2020). Almost 100% of children in the United States under eight years living in a home with a tablet or smartphone (Wartella et al., 2019). Rideout and Katz (2016a, 2016b) states that in the United States, most low and moderate-income households are more likely today than in the past to use and learn about technology. Similarly, researchers claim that educational apps can help low-income students in the US develop their early skills and stay connected to school (Griffith et al., 2019; Rizk & Hillier, 2020).

Research has revealed that parents felt deep concerns about exposing their children to anything harmful during their engagement with technology. Yadav and Chakraborty's (2021) metanalysis has mentioned that the overuse of smartphones may cause physiological implications, like sleep disorders and obesity, and psychological implications, like addiction and anxiety, in children. Parent's role is essential in their children's technology-mediated activities (Govind et al., 2020; Sheehan et al., 2019) as they control their children's interactive media experiences (Chaudron et al., 2018a, b). At the same time, parents' beliefs about their role in supporting children's learning with digital technology are related to the frequency of children's engagement in educational activities with touchscreen technology at home (Sonnenschein et al., 2020). Given the potential that young children nowadays can have their digital experiences at an ever-earlier age, parents' attitudes and beliefs enable or constrain this opportunity. These perceptions may vary according to the social, cultural, and economic diversity in which that behavior occurs (Dardanou et al., 2020; Kaya, 2020). A study with the parents of 0–8 aged children in the United States showed that their screen use habits strongly influence their children's screen use. This study further stated that the children's screen use habits are highly affected by the parent-child interaction and the parents' attitude towards screen use (Lauricella et al., 2015). Nikken and Schols (2015) have reported that children's access to digital content is strongly linked to parental attitudes rather than age. Parents have divergent views on the appropriateness of using tablets to deliver educational content, often assuming an almost restrictive mediation role (Palaigeorgiou et al., 2017). The research has also reported how parents struggle to manage their children tablet usage (Holloway et al., 2014) while they believe that the increased use of these type devices may have had an unintended consequence: a decrease in at-home routine literacy-related activities such as reading paper-based books (Neumann & Neumann, 2017).

Regarding children's use of digital technology, earlier studies have revealed several reasons behind the contradictory parents' views, such as the lack of enough information on this subject or being unable to control the multitude of parameters of device usage. Furthermore, other studies reveal that there seems to emerge a 'digital generation gap.' Even young age children use digital tools in ways that extend far beyond their parents' comfort level (Connell et al., 2015).

It is well known that open-ended digital activities that support exploration and experimentation while offering cooperative and collaborative interaction opportunities contribute to children's learning (Eagle, 2012). Furthermore, a substantial body of research shows that children's participation in learning activities at home during their early years reflects an educational development in the later years (Elliott & Bachman, 2018). Prior research on tablet apps in preschools has proved that severe educational apps can boost preschool children's various skills. These include literacy development, geography, art, science, technology, engineering, math, computational thinking, and cognitive and social control (Liu et al., 2021). Although the 'app gap' discussed in the previous years had decreased (Rideout, 2017), a quality app selection gap still exists. For instance, there is a strong link between low-income parents and their belief in marketing claims about the educational value of commercially available apps that could be downloaded from the Internet (Radesky et al., 2016). On the contrary, several studies have proven that most apps in the educational category for Android and iOS operating system devices (Apple App Store and Google Play) have no educational value based on rote learning and memorization. Furthermore, most self-proclaimed educational apps lack clear evidence of efficacy and are not scientifically established, having received no feedback from developmental specialists during their development.

It has been reported that, in the United Kingdom, young children mostly experience entertainment apps (Neumann & Neumann, 2017). On the contrary to their addictive design features, these apps do not offer any learning benefits (Neumann & Neumann, 2017). Further research has also shown that children play dozens of the most popular apps in games and do not use apps to get extra help on their reading, writing, and math skills (Livingstone et al., 2014). Further concerns about parents' choice of apps involve the commercialization embedded in almost all of the freely available apps with many popups and inappropriate ads for children, disrupting their learning (Neumann & Neumann, 2017). The companies make money on these free apps through advertisements, in-app purchases, or advertising paid apps on free ones.

For the reasons mentioned above, the research raises awareness about the potential benefits of young children's apps usage, suggesting that it plays an essential role in setting up a technology-mediated environment in which children can grow mentally (Govind et al., 2020; Sheehan et al., 2019). Parents must select appropriate apps to increase children's learning and enjoy reading, writing, and mathematics despite the abundance of low-quality educational apps. Taking this into account and considering the ubiquitous use of smart technology by children younger than six years, further research is needed to investigate

whether parent app choices affect preschool-aged children's learning at home (Bers, 2018; Rideout, 2017; Sheehan et al., 2019).

3 Methods

3.1 Study setting and participants

The study implemented the design of a method utilizing quantitative data. Parents with preschool-aged children, all enrolled in early childhood education classrooms, took part in the research. A stratified random sampling frame was implemented to ensure that the demographic composition (parents across the region of Crete in Greece) is representative of national patterns. Kindergarten educators actively engaged in the process to increase participants' responses to the questionnaire. Parents who did not fully complete questionnaires were excluded from the sample. A total of 325 participating parents completed paper copies of the survey, a participation rate of 91%.

The paper-based questionnaire took 15 to 30 min to complete, focused on parents' perceptions and children's screen media use. Packets, including the questionnaire and informed consent information, were distributed among the kindergartens and sent home in children's backpacks in autumn 2020. Parents were asked to focus their survey answers on the child who attended the kindergarten and not all the children in their household to capture the targeted age group. Parents had to return the questionnaire within a week.

The present study was approved by the University of Crete Institutional Review Board to comply with ethical considerations. Furthermore, the participants were recruited ethically, without respect to their socioeconomic background. Confidentiality was maintained throughout the study (Petousi & Sifaki, 2020). Raw data were entered into SPSS to ensure the anonymity of participants.

3.2 Aims, objectives, and research questions

The study aimed to examine parents' perceptions and knowledge of apps, ownership of mobile devices, app purchasing habits; children's use of apps; and app usage contexts by parents and their children. The study also tried to identify how parents determine the appropriate apps for their children, their concerns about their children's use of apps, the types of apps they and their children access and are interested in, and personal policies for buying and using an app.

The objectives were:

- To collect information about Greek preschool children's access to and use of apps at home.
- To identify the most popular types of apps that preschool children use at home.

- To identify the factors that currently inform parents' app choices for this age group.
- To increase dialogue and promote knowledge exchange between scientists, stakeholders, children's software industry, parents/caregivers, and early-year educators to encourage creative use of apps from preschoolers.

The research questions that guided this study were as follows:

- What kind of access do Greek preschool children currently have at apps at home, and how are they used?
- How do demographic variables such as age, gender, ethnicity, and education impact media access and use?
- What are the most popular app categories that Greek parents select for their preschool children?
- What factors influence parents' decisions when it comes to choosing which apps to use?
- What support do parents need to make these mobile tools more beneficial for child development?
- Parents' attitudes and perceptions toward technology and mobile media use as an educational resource for children?

3.3 Study instrument

When designing this study questionnaire, we started with the research questions mentioned above that motivated the study and continued with existing reports and literature that have focused on children's media use (e.g., Chiong & Shuler, 2010; Marsh et al., 2015; McCloskey et al., 2018; Nikolopoulou, 2020; Rideout et al., 2011; Takeuchi, 2011). In addition, some of the questions were updated to reflect changes in technology and research on the content or context of early screen time (Barr et al., 2020).

Our main objectives in referencing these different sources were to understand similar ground covered by researchers concerned with young children and media technology to complement and build upon initial findings. In the present study questionnaire development, we utilized an iterative process involving the research team for the item's creation, experts from the University of Crete for the items, and the research team for the revised item's creation. The questionnaire went through several rounds of iteration during the adaptation process to develop a tool that followed best practices, pinpointed the questions we were most interested in answering, and was relevant to the present study sample. The research team expected that many parents would be unfamiliar with most questionnaire items while representing various socioeconomic backgrounds and age groups.

The questionnaire consisted of 28 questions, including dichotomous choice (yes/no), multiple-choice, and open-ended questions. Questions addressed frequency, content, and context of children's smart media use, parent beliefs and comfort with

smart mobile devices, and demographics. A group of experts reviewed the questionnaire in a validation meeting to establish content validity.

The questionnaire included three parts. The first part focused on demographic information, including age, gender, number of children, educational status, and family income characteristics. The second part focused on the availability of technology to children at home (e.g., smartphone, tablet, etc.) and apps' frequency of use. The third part focused on parents' thoughts and concerns about their children's use of technology. Besides, parents were asked if they had received any guidance or advice (professional or otherwise) on young children's use of touchscreens. Finally, we collected evidence of factors influencing how parents view their children's engagement with smart screen technology with the more detailed data analysis.

3.4 Threats to validity

There are four potential threats to validity in a research study: external validity, internal validity, construct validity, and statistical conclusion validity (Campbell & Stanley, 1963). Potential threats to external validity from self-selection bias underline the need to take care when generalizing the results beyond the context of the study (Campbell & Stanley, 1963). There was no interaction bias based on participant selection. Moreover, parents could fill out the questionnaire without spatial and time restrictions, so there were no cases of reactive arrangement. A small number of participants means that the external validity *is* limited, and thus the study results may not be generalizable to the overall population. To detect an effect size of Cohen's $d = .43$ with 80% power ($alpha = .05$, two-tailed), G*Power suggests we would need 86 participants per group ($N = 172$) in an independent sample t-test. Accordingly, to detect an effect of partial eta squared $= .04$ with 80% power in a one-way within-subjects ANOVA (three groups, $alpha = .05$, non-sphericity correction $= 1$), G*Power suggests we would need 119 participants (Faul et al., 2007). A larger sample size recommended by the G*Power software was used to recruit participants for the present study to reduce the possibility of Type II error (Faul et al., 2009). Considering the total number of 325 participants, we can assume that the sample represents a larger population (Bartlett, 2019). Of course, we should consider that a larger sample can lower the type II error. However, it does not guarantee sample representativeness (for Crete, for Greece). A future study would weigh the results so that the sample sociodemographic composition fits the whole region/country population.

4 Results

The data were analyzed using IBM SPSS statistical package version 26 (Chicago, Illinois, USA). There were no missing values. All variables, both demographic and individual question responses, were either nominal or ordinal. The results were

Table 1 Demographics of Parent Respondents

Demographics		All participants (N=325)
Gender	Male	71 (21.8%)
	Female	254 (78.2%)
Age	22–30	18 (5.5%)
	31–40	218 (67.1%)
	41–50	87 (26.8%)
	51–60	2 (.6%)
Ethnicity	Greek	309 (95.1%)
	Albanian	13 (4.0%)
	Other	3 (.9%)
Education	Primary Education	3 (.9%)
	Lower Secondary Education	18 (5.5%)
	Upper Secondary Education	80 (24.6%)
	Tertiary Education - (Technological sector)	79 (24.3%)
	Tertiary Education – (University sector)	100 (30.8%)
	Master's degree	39 (12.0%)
	Doctoral degree	6 (1.8%)
Type of studies	Pedagogical studies	79 (24.3%)
	Non-pedagogical studies	246 (75.7%)
Income	< 10,326€	75 (23.1%)
	10,327€ - 16,147€	119 (36.1%)
	> 16,148€	131 (40.3%)
Child gender	Male	168 (51.7%)
	Female	157 (48.3%)
Existence of other family members	Yes	254 (78.2%) Average age: 6.44 Min age: 2 months Max age: 19 years
	No	71 (21.8%)

determined to be statistically significant at the 5% level ($p < .05$). An assessment of data normality is a prerequisite as normal data is an underlying assumption in parametric testing. Data were checked for normality both graphically and by assessing skewness and kurtosis. Parametric assumptions for all independent variables were examined, and they were not met. Furthermore, this study design meets the necessary three assumptions to use a rank-based nonparametric test to correctly analyses the data: (a) a continuous or ordinal dependent variable; (b) the independent variable is categorical with two groups; and (c) independence of observations (Hollander & Wolfe, 1999).[1]

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[1] The same assumptions apply to the other variables examined using the Mann-Whitney U test in the present study.

4.1 Demographics

The researchers calculated descriptive statistics for demographics (see Table 1). The majority of respondents consisted of mothers; almost all identified as Greeks, with a small percentage identified as Albanians. Regarding parents' studies categorization, the present study used the description provided by the European Centre for the Development of Vocational Training (CEDEFOP, https://www.cedefop.europa.eu/files/5135_en.pdf). Most parents reported being well educated, having at least a tertiary education diploma (in terms of university or technological sector), and belonging to the 31–40 age group or the 41–50 age group. A quarter of them had attended pedagogical studies (e.g., schoolteachers). Most parents reported that there were other family members, younger or older, with an equal number of boys and girls.

Regarding the available family income, according to the most recent data (2019 Survey on Income and Living Conditions) given by the Hellenic Statistical Authority (ELSTAT) (Hellenic Statistical Authority, 2020), the poverty threshold amounted to 10,326 euros for households with two adults and two dependent children under 14 years old. Based on ELSTAT data, the mean annual disposable income of the country's households was estimated at 16,147 Euros, and the country's population at risk of poverty or social exclusion is 34.8%. In the present study, the risk of poverty or social exclusion was estimated at 23.1%. The percentage was below the national average. The region of Crete belongs to the five regions in Greece that the risk of poverty rates are recorded lower than those of the whole country.

Furthermore, the Region of Crete is at an intermediate level of development in the European Union (EU). GDP per capita was 85% of the EU-27 average in 2009, occupying 170th place among the EU's regions (http://www.pepkritis.gr/uploaded/espa/CRETE_2014-2020.pdf). Nevertheless, the choice of this region is representative of the Greek population, and it can also supply data comparable across populations between European countries (see Table 1).

All children had access to at least an electronic device at home. Furthermore, many children had access to two or more diverse types of devices. Most of the children had access to a smart device some days during the week or even daily. Children played with a smart mobile device in the presence of an adult or even alone, with a few children playing with smart mobile devices alone. In the majority, children shared the mobile device with another family member. Very few children had their mobile devices. Almost all parents declared that they use a restriction policy on their child's time with the mobile device (see Table 2).

Most parents answered that children play educational games (apps with a game-like format and an educational goal) on the smart mobile device daily or some days during the week. Children play with math apps, read/writing apps, and coloring recognition apps. Surprisingly enough, the parents answered that children also play with apps that promote spatial reasoning skills. There were also few children playing with coding and STEM and language learning apps (English) (see Table 3).

Participants answered that they download mainly free educational apps/games for their children. Significantly few parents declared that they use both free and paid apps. None of the participants answered that they use only paid apps. Only a few parents download apps for their children weekly. On the contrary, parents rarely

Table 2 Frequencies of children and smart mobile devices ownership and use at home

Items	Frequencies						
Children access on mobile devices		iPad	Android tablet	Laptop computer	Desktop computer	Smartphone	Portable gaming console
		34	66	115	65	232	23
Children smart mobile device usage		Never	Less than one time per week	Some days during a week	Most days during a week	Everyday	
		0	95	144	53	33	
Children smart device usage		With an adult	Alone	Sometimes alone – sometimes with an adult			
		183	21				
Children smart device ownership		Have their own	Share the device with another family member				
		37	288				

Table 3 Frequencies of children engagement with apps

Items	Frequencies					
The child plays with educational games (apps)	Yes 303	No 22				
Frequency of play with educational games (apps)	The child does not play educational games 22	Less than one time per week 130	Some days during the week 50	Most of the days during a week 112	Every day 11	
Types of educational games	Mathematics 153	Spatial reasoning skills 224	Colors 168	Read Writing 153	STEM 43	Other 325

Table 4 Parents' general strategies on app selection, download, and use

Items	Frequencies					
Parents apps download	Yes — 297	No — 28				
Parents apps payment policy	Only free apps — 294	Free and paid apps — 31	Paid apps — 0			
Parents apps download frequency	Never — 21	Daily — 0	Two-three times per week — 19	One time per week — 9	2–3 times per month — 64	One time per month — 50
	One time per two or three months — 64	One time per 6 months — 62	Seldom — 36			
Parental incentives for apps download	As a reward for achievement or child good behavior — 124	To support the child's learning — 116	To satisfy the child's desire — 118	To encourage the child's play and creativity — 82	As a gift — 36	Just the child asks a new app — 26
Parents apps download strategies	The child asks for the app — 139	Informed from other family members — 60	Informed from child teachers — 74	Personal search in app stores — 82	Via social media — 136	From ads — 49
Parents apps download criteria	Recommendations from friends, relatives — 166	Comments, reviews on app stores — 151	Comments, reviews on social media — 67	Comments, reviews on specialized sites, blogs — 89	App stars in app stores — 18	App downloads in app stores — 92

download apps, once per one-three months, or even seldom. Some parents declared that they do not download apps following their previous answers regarding the number of children playing apps without an adult supervisor. Thus, we can also suppose that children choose and download apps independently in these families even at this young age.

When parents asked what motivates them to download apps for their children, they gave various answers (see Table 4). The most popular answers were 'as a reward for an achievement or a good behavior,' 'to support the child's learning,' and 'satisfy the child's desire.' A question that arises is how a child knows about a specific app? In the specific question, parents answered that the child asks for a particular app. We suppose they meant that the parent and the child are looking for apps, and the parent downloads apps that the child finds attractive. Almost half of the parents answered that they download apps after a personal search in app stores. A small group of parents answered that they download apps recommended by the older member of the family or their husband or partner, their child educators, friends, and colleagues. Some parents got recommendations through social networks posts and advertisements. These two answers must problematize the researchers as studies have found that user comments are primarily subjective and do not correlate with the actual educational value, while ads promote specific apps (Papadakis, 2021). An interesting point arises. Parents are informed by their colleagues or friends and not by their children's teachers. However, in Greece, this can be explained by the low degree of penetration of mobile technology in schools and the lack of familiarity and knowledge of teachers about this new educational reality.

Parents follow the same strategy on the criteria they use to download an app. Instead of following recommendations on specialized sites or blogs, they prefer to base their decision on friends' or relatives' recommendations, comments, reviews on app stores or social media, and the number of app downloads. Surprisingly, in contrast to other studies' findings (Papadakis et al., 2018), they do not base their strategies on app stars or price. Their low-interest in-app price may be explained since they mostly download free apps. Few parents answered that they base their criteria on specific tools such as rubrics and checklists (Papadakis, 2021). There is a logical explanation for this. There are no specific websites and blogs in Greece providing tools for app reviews, such as the Commonsense Media in the United States.

4.2 Parents' perceptions of educational apps' advantages (PPEAG) at home

Parents answered 11 different questions on a 5 Likert scale (Strongly disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Strongly agree) to learn their perceptions regarding the educational app's usefulness (see Table 5). Although parents believe that educational apps help their children learn basic skills, they cannot help their children express themselves creatively. The low quality of self-proclaimed educational apps in Greece can explain parents' responses. Most of them have content with closed-type questions that promote rote learning (Papadakis et al., 2018).

Table 5 Parents' perceptions of educational apps' benefits for the child

Items	Min	Max	Mean	Std. Deviation
The use of educational apps by the children can make learning more fun	1	5	3.90	.709
The use of educational apps by the children can teach basic technological skills	1	5	3.94	.674
The use of educational apps by the children can promote curiosity and creativity	1	5	3.60	.835
The use of educational apps by the children allows them to express themselves	1	5	2.78	.888
The use of educational apps by the children can teach problem-solving	1	5	3.26	.924
The use of educational apps by the children allows them to relax	1	5	3.25	.942
The use of educational apps by the children can teach reading and writing	1	5	3.26	.981
The use of educational apps by the children can teach mathematical concepts	1	5	3.54	.840
The use of educational apps by the children can teach concepts from the field of Natural Sciences	1	5	3.49	.819
The use of educational apps by the children can teach foreign languages	1	5	3.71	.783
The use of educational apps by the children can teach Computational Thinking, coding	1	5	3.47	.811

To better understand parents' perceptions of educational apps' advantages (PPEAG), we created a construct called 'PPEAG' consisting of 11 questions. The scale had a high level of internal consistency, as determined by Cronbach's alpha of .88 (Bland & Altman, 1997). An initial data check revealed that the data were not normally distributed, so we used a rank-based nonparametric test to determine differences between two groups on a continuous or ordinal dependent variable. Thus, the Mann-Whitney U test (also called the Wilcoxon-Mann-Whitney test) was run to determine differences in parents' views of educational apps' advantages (PPEAG) between males and females. Distributions of the scores for males and females were similar, as assessed by visual inspection. Scores was not statistically significantly different between males ($Mdn = 40.00$) and females ($Mdn = 39.00$), $U = 7803.5$, $z = -1.737$, $p = .082$, using an exact sampling distribution for U (Agresti, 2013; Dineen & Blakesley, 1973). The same test was used to determine whether there were differences in parents' scores (PPEAG) regarding their studies domain (pedagogical studies or not). Distributions of the scores for pedagogical and non-pedagogical studies were similar, as assessed by visual inspection. Scores for pedagogical studies ($Mdn = 40.00$) and non-pedagogical studies ($Mdn = 39.00$) were not statistically significantly different, $U = 9122.00$, $z = -.82$, $p = .412$.

A Kruskal-Wallis H test or 'one-way ANOVA on ranks' was run to determine differences in score between four groups of participants with different age groups. This rank-based nonparametric test was used as there were non-normally distributed data, and the independent variable consisted of two or more categorical, independent groups. Furthermore, observations were independent, meaning there is no relationship between the observations in each independent variable or between the groups themselves. Additionally, the distributions of scores were not similar for all groups, as assessed by visual inspection of a boxplot[2] (Vargha & Delaney, 1998). PPEAG scores were statistically significantly different between the separate groups, $X^2(3) = 8.50$, $p = .037$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Statistical significance was accepted at the $p < .01$ level. This post hoc analysis did not reveal statistically significant differences in PPEAG scores between any group combination.

A Kruskal-Wallis H test was also run to determine differences in PPEAG score between three groups of participants with different nationalities. Median PPEAG scores were not statistically significantly different between groups, $X^2(2) = 5.738$, $p = .057$. The same test was run to determine differences in PPEAG scores between participants with different educational levels. The mean rank of PPEAG scores was not statistically significantly different between groups, $X^2(6) = 11.182$, $p = .083$. Median PPEAG scores were statistically significantly different between participants with different finance outcomes, $X^2(2) = 4.519$, $p = .001$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Statistical significance was accepted at the $p < .01$

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[2] The same assumptions apply to the other variables examined using the Kruskal-Wallis H test in the present study.

level. This post hoc analysis reveals statistically significant differences in PPEAG scores between any group combination. PPEAG scores increased from the poorer to the wealthiest parents.

A Mann-Whitney U test was run to determine differences in parents' scores based on their children's gender. Median engagement score for boys ($Mdn = 39.00$) and girls ($Mdn = 39.00$) was not statistically significantly different, $U = 13,177.45$, $z = -.012$, $p = .990$, using an exact sampling distribution. The same results gave the Mann-Whitney U test on the score differences on other children's existence in the family, $U = 9048.50$, $z = -.045$, $p = .964$. Median PPEAG scores based on a Kruskal-Wallis H test were not statistically significantly different between participants with different smart mobile activity levels groups, $X^2(3) = 5.803$, $p = .122$.

PPEAG score was statistically significantly higher in those parents who have bought/given a smart mobile device for their children ($Mdn = 42.00$) than in those who do not ($Mdn = 39.00$), $U = 3842.50$, $z = -2.766$, $p < .05$. On the contrary median engagement score was not statistically significantly different between the existence of parents' policy or not, $U = 3047.00$, $z = 1.572$, $p = .116$ and the frequency a child plays an educational app at home, $U = 2775.50$, $z = -1.313$, $p = .189$. PPEAG score was statistically significantly higher in those parents who download educational apps for their children ($Mdn = 39.00$) than in those who don't download ($Mdn = 36.50$), $U = 2946$, $z = -2.555$, $p < .05$. Similarly, median PPEAG scores were statistically significantly different between parents about their strategy of apps acquisition, $X^2(1) = 10.985$, $p = .001$. PPEAG scores increased from those who do not buy apps ($Mdn = 39.00$) to those who use free and paid apps ($Mdn = 42.00$). Finally, median PPEAG scores were not statistically significantly different between groups of parents regarding apps download frequency, $X^2(7) = 2.048$, $p = .957$. The analysis results are shown in Table 9.

4.3 Parents' perceptions of technology on children (PPAT)

To further investigate parents' belief in digital technology, they answered nine different questions on the same 5 Likert scale. From their answers, we can conclude that parents are confused as they cannot decide whether digital technology is beneficial or harmful for their children (see Table 6). For instance, they are unsure whether digital technology harms children's development. Similarly, they are not sure whether traditional educational materials are better than digital ones. On the contrary, they agree that children need to know how to use digital technologies for their education and that digital educational materials support children's learning slightly. In the majority, they are afraid that their child may be exposed to inappropriate content using digital technology or that digital technology distracts children from other essential developmental experiences or leads to minimized social experiences. Finally, they are unsure whether digital technology can make their child overweight.

We created a construct called 'PPAT' based on responses to nine questions that assessed parents' perceptions of the advantages of technology for their children. The questions were negatively worded. The scale had a high level of internal consistency, as determined by Cronbach's alpha of .84 (Bland & Altman, 1997). The

Table 6 Parents perceptions on the impact of digital technology

Items	Min	Max	Mean	Std. Deviation
The use of digital technology harms the children brain	1	5	2.99	.951
The use of digital technology is harmful to children's development	1	5	2.93	.922
Children do not need to know how to use digital technologies for their education	1	5	2.29	.828
Traditional educational materials are better than digital educational materials for children	1	5	2.94	.970
Digital educational materials do not support children's learning	1	5	2.39	.807
Children may be exposed to inappropriate content using digital technology	1	5	3.60	.946
The use of digital technology distracts children from other experiences that are important for their develop-ment	1	5	3.64	.927
The use of digital technology leads children to less social contact with other children	1	5	3.62	.964
The use of digital technology can make children overweight	1	5	2.98	1.048

analysis results are shown in Table 9. Similar analyses with the previous construct were done. A Mann-Whitney U test was run in the following variables, parent gender, studies categorization, child gender, the existence of other children in the family, parents' policy, child engagement with mobile apps, child device ownership, and parents' apps download policy. There were no statistically significantly different between groups regarding the parents gender $U = 10,311.00$, $z = 1.852$, $p = .064$, the parents studies categorization $U = 10,414.00$, $z = .961$, $p = .337$, the child gender $U = 14,019.00$, $z = .983$, $p = .325$, the parents policy $U = 2428.00$, $z = -.120$, $p = .904$, the child engagement with mobile apps $U = 4026.50$, $z = 1.632$, $p = .103$, parents studies categorization $U = 1414.00$, $z = .961$, $p = .337$. Scores for those parents whose children have their own smart device ($Mdn = 27.00$) were statistically significantly higher than for those who have not ($Mdn = 25.00$), $U = 6164.50$, $z = 1.557$, $p = .005$. Similarly, scores for those parents who have other children in the family ($Mdn = 25.00$) were statistically significantly lower than for those who have not ($Mdn = 27.00$), $U = 7057.5$, $z = -2.804$, $p = .005$. Finally, scores for those parents who download apps for their children ($Mdn = 27.00$) were statistically significantly lower than for those who do not download apps ($Mdn = 30.00$), $U = 5475.5$, $z = 2.777$, $p = .005$.

A Kruskal-Wallis H test was conducted in the following variables: age group, educational levels, financial outcomes, nationality, frequency of smart mobile usage, apps acquisition policy (paid/free apps), apps frequency download. Median PPAT scores were not statistically significantly different between age groups, $X^2(3) = 5.720$, $p = .126$. The median PPAT scores were not statistically significantly different on educational levels, $X^2(6) = 6.133$, $p = .408$. On the contrary, the median PPAT scores were statistically significantly different on parents' financial outcomes, $X^2(2) = 10.634$, $p = .005$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons with statistical significance accepted at the $p < .0016$ level. This post hoc analysis did not reveal statistically significant differences in PPEAG scores between any group combination. The parents' scores were inversely proportional to their financial level, i.e., the poorer had more negative attitudes about using digital technology by children ($Mdn = 29.00$) than the other financial groups with the same median score ($Mdn = 26.00$). Median PPAT scores were not statistically significantly different between parents' nationality, $X^2(2) = .174$, $p = .917$.

Distributions of PPAT scores were not similar for all groups on the frequency of smart mobile usage within the child's family, as assessed by visual inspection of a boxplot. PPAT scores' distributions were statistically significantly different between groups, $X^2(3) = 9.448$, $p = .024$. Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Statistical significance was accepted at the $p < .0083$ level. This post hoc analysis did not reveal statistically significant differences in PPAT scores between any group combination. Parents who let their children play with mobile devices more frequently have the most positive views regarding the use of digital technology than those who do not let their children play so frequently or seldom.

Distributions of PPAT scores were not similar for all groups regarding the parents' app acquisition policy, as assessed by visual inspection of a boxplot. PPAT

scores' distributions were statistically significantly different between groups, $X^2(1) = 10.071$, $p = .002$. Parents who prefer to buy and use free apps have more positive views about digital technology ($Mdn = 23$) than parents who download only free apps ($Mdn = 27$). Apps that are not free to download follow a business model that is not based on annoying advertisements and popups compared to most free apps and may also have better features and more comprehensive content than free apps. For these reasons, parents who buy apps realize the value of digital technology for children's learning.

Similarly, PPAT scores' distributions were statistically significantly different between groups of parents who download apps for their children, $X^2(7) = 15.816$, $p < .05$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Statistical significance was accepted at the $p < .0071$ level. This post hoc analysis did not reveal statistically significant differences in PPAT scores between any group combination. A median comparison revealed that those parents who prefer to download apps more frequently have more positive thoughts than the parents who download apps less frequently.

4.4 Parents' perceptions of the advantages of mobile educational technology (PPMET) at school

The parent's perceptions on educational material usage are positive (see Table 7). This is quite interesting, especially when compared with their perceptions of the usefulness of digital technology in general. Parents had to answer six questions on the same 5 Likert scale. They believed that digital educational materials could help children learn critical mathematical skills and reading-writing skills. They also considered digital applications as just as necessary as other learning resources and essential for children's success at school and future career choices. They also believed that the everyday use of digital technology and the traditional educational model offers more stimuli and eases learning.

We also created a construct called 'PPMET' consisting of six questions to represent parents' perceptions of mobile educational technology's advantages for their children. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.75. The analysis results are shown in Table 9. A Mann-Whitney U test was run in the same variables as the earlier analyses. The distributions of the scores for males and females were similar, as assessed by visual inspection. Score was statistically significantly higher in males ($Mdn = 23.00$) than in females ($Mdn = 22.00$), $U = 6534.50$, $z = -3.575$, $p = .000$. Similarly, the score was statistically significantly higher in those parents who answered that their children have their device ($Mdn = 23.00$) than in those who do not ($Mdn = 22.00$), $U = 4275.50$, $z = -1.972$, $p = .049$. There were no statistically significantly different between groups regarding the parents studies categorization $U = 9133.00$, $z = -.810$, $p = .418$, the child gender $U = 12,232.00$, $z = -1.138$, $p = .255$, the parents policy regarding mobile devices usage $U = 3148.50$, $z = 1.861$, $p = .063$, the child engagement

Table 7 Parents perceptions on the impact of digital educational material

Items	Min	Max	Mean	Std. Deviation
Digital educational materials can help children learn critical mathematical skills	1	5	3.78	.643
The digital educational materials can help children learn essential reading and writing skills	1	5	3.48	.800
When children learn math, reading, and writing, digital applications are just as crucial as other learning resources.	1	5	3.28	.919
I believe that technology, in general, is essential for children success at school	1	5	3.19	.843
I believe that technology, in general, is essential for children future career choices	2	5	3.57	.773
The joint use of technology and the traditional educational model offers more stimuli and eases the learning	1	6	4.00	.760

with mobile apps $U = 3434.00$, $z = .239$, $p = .811$, the existence of other children in the family, $U = 9768.5$, $z = 1.082$, $p = .279$. The score was statistically significantly higher in parents who answered that they download apps for their children ($Mdn = 24.00$) than those who did not ($Mdn = 22.00$), $U = 3638.00$, $z = -1.103$, $p = .035$.

Similarly, a Kruskal-Wallis H test was run in the same variables as the earlier analyses. Median PPMET scores were not statistically significantly different between age groups, $X^2(3) = 5.082$, $p = .166$, educational levels, $X^2(6) = 8.250$, $p = .220$, parents' nationality, $X^2(2) = .2898$, $p = .235$, the frequency of smart mobile usage within the child's family $X^2(3) = 4.301$, $p = .231$ and the frequency of app download by the parents $X^2(7) = 6.047$, $p = .534$. On the contrary, the median PPMET scores on parents' financial outcomes were statistically significantly different, $X^2(2) = 9.724$, $p = .008$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons with statistical significance accepted at the $p < .0016$ level. This post hoc analysis did not reveal statistically significant differences in PPMET scores between any group combination. The parents' scores were inversely proportional to their financial level, i.e., the poorer had more negative attitudes about using digital technology by children ($Mdn = 21.00$) than the other financial groups with the same median score ($Mdn = 22.00$). Distributions of PPMET scores were not similar for all groups regarding the parents' app acquisition policy, as assessed by visual inspection of a boxplot. PPMET scores' distributions were statistically significantly different between groups, $X^2(1) = 9.713$, $p = .001$. Parents who prefer to buy and use free apps have more positive views on digital technology ($Mdn = 23$) than parents who download only free apps ($Mdn = 22$).

4.5 Parents need about apps usage (PPAP)

From the parents' answers (see Table 8), we can conclude that parents are positive about using mobile technology for their children's education in formal and informal settings, although they feel unsure about their knowledge about this technology's utilization. They express their need for information from experts on finding apps with educational value to help their children learn, balancing the time between apps usage and other activities for their children, and the correct age to introduce mobile technology to their children.

Similar analyses were done to understand better parents' needs on the correct usage of mobile apps for their children. We created a construct called 'PPAP' consisting of 3 questions to represent based on responses to three questions that assessed parents' needs. The analysis results are shown in Table 9. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of .85. Similar analyses were done as the earlier sections. There were no statistically significantly different between groups regarding the parents gender $U = 7764.50$, $z = -1.874$, $p = .061$, studies categorization $U = 10,053.00$, $z = .484$, $p = .628$, the child gender $U = 10,526.00$, $z = -1.230$, $p = .219$, the parents policy regarding mobile devices usage $U = 2041.50$, $z = 1.861$, $p = .063$, the child engagement with mobile apps $U = 3499.00$, $z = .409$, $p = .683$, the existence of other family members, $U = 9657.00$,

Table 8 Parents interest in mobile educational technology

Items	Min	Max	Mean	Std. Deviation
Want more information from experts on finding educational applications for mobile devices that can support children's learning.	1	5	3.86	.832
Want more information about the length of time to use apps to be beneficial for children's development.	1	5	3.81	.819
Want more information on the age at which children should be allowed to use mobile devices.	1	5	3.85	.822
Want mobile devices to be introduced in schools and used in children's education.	1	5	3.55	.917

Table 9 Results of constructs analysis

Constructs	PPEAG	PPAT	PPMET	PPAP
Parent gender	−[1]	−	+[2]	−
Studies categorization	−	−	−	−
Age group	+	−	−	−
Educational levels	−	−	−	−
Financial outcomes	+	+	+	−
Nationality	−	−	−	−
Child gender	−	−	−	−
Other children in the family	−	+	−	−
Smart mobile frequency usage	−	+	−	−
Parent's restriction policy	−	−	−	−
Child device ownership	+	+	+	−
Child engagement with educational apps	−	−	−	−
Download apps for the child	+	+	+	−
Parents apps acquisition policy	+	+	+	−
Parents apps download frequency	−	+	−	−

[1]Non statistically significant result

[2]Statistically significant result

$z = .958$, $p = .338$, child device ownership $U = 4709.50$, $z = -1.204$, $p = .229$, the parents who download apps $U = 4296.50$, $z = .305$, $p = .760$.

Median PPAP scores were not statistically significantly different between age groups, $X^2(3) = 1.315$, $p = .726$, educational levels, $X^2(6) = 3.871$, $p = .694$, family's financial levels, $X^2(2) =, 774$, $p = .679$, smart mobile and apps usage frequency by the child $X^2(4) = 5.996$, $p = .199$, parents apps acquisition policy $X^2(1) = .016$, $p = .899$, parents nationality $X^2(4) = 1.479$, $p = .477$, and parents apps download frequency $X^2(7) = 4.221$, $p = .754$. On the contrary, the median PPMET scores were statistically significantly different regarding parents' financial outcomes, $X^2(2) = 9.724$, $p = .008$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons with statistical significance accepted at the $p < .0016$ level. This post hoc analysis did not reveal statistically significant differences in PPMET scores between any group combination. The parents' scores were inversely proportional to their financial level, i.e., the richer had more needs regarding apps usage ($Mdn = 22.00$) than the 'poorer' parents ($Mdn = 21.00$). Median PPMET scores were not statistically significantly different between parents' nationality, $X^2(2) = .2898$, $p = .235$, the frequency of smart mobile usage within the child's family $X^2(3) = 4.301$, $p = .231$ and the frequency of app download by the parents $X^2(7) = 6.047$, $p = .534$.

5 Discussion

From Table 9 and the earlier analyses, we can conclude that parents do not follow a particular pattern that could determine the effects of various variables on their perceptions and strategies on children's smart mobile use at home. Often mentioned factors like age, gender, and educational levels do not seem prognostic value. On the contrary, factors such as financial outcomes influence their answers. Although the gap in which children of lower-income homeowners had less access to smartphones, tablets, or educational apps described in older studies (Rideout, 2013), does not exist, the parents' scores were inversely proportional to their financial level, i.e., the poorer had more negative attitudes about using digital technology by children than the wealthier financial groups. We can also recognize another pattern. Parents who have positive views of digital technology do not only download apps for their children more often than other parents, but they also try to buy apps instead of using only free apps. Of course, these parents try to equip their children with at least one type of smart mobile device. In the following subsections, we discuss the answers to the research questions.

5.1 Q1: What kind of access do Greek preschool children currently have at apps at home, and how are they used?

The present study results suggest that all children at home have access to at least an electronic device, while many children have access to two or more diverse types of devices. Smartphones are the most popular device for children. Regarding the access and usage of Greek preschool children of mobile devices and apps at home, we can recognize the same trends as a similar study in Greece (Papadakis et al., 2019). Although still not widely available in kindergartens, smart mobile device adoption is increasing fast, and children at a younger age begin to use them early in Greek homes. Other studies have revealed that television had been the "go-to" device for parents of young children but noted that touchscreen and multi-use devices are gaining popularity (Kostyrka-Allchorne et al., 2017; Parsons & Adhikar, 2016).

Furthermore, these results are confirmed in other international studies, such as Dardanou et al. (2020). In their study, Dardanou et al. (2020) analyzed 0- to 3-year-olds children's use of touchscreen devices at home in three different countries, Japan, Norway, and Portugal. The study results revealed that touchscreen technologies dominate in these three different countries. Based on our study, we can conclude that most children in western countries, including Greece, live in homes that are "digitally fluent" environments (Dias & Brito, 2021). Especially European children grow up in technology-rich homes (Chaudron et al., 2015), and printed books and educational television programs rapidly give way to digital content, shifting the learning environment at home for very young children (Furenes et al., 2021). In general, smartphones followed by tablets are popular in this age group due to their simplicity, portability, size of the screen, and ease of use (Chaudron et al., 2018a,

b), illustrating how deeply this technology has integrated into the daily parenting routines (Lev & Elias, 2020).

In Greece, young children use touchscreen devices (smartphones or tablets) daily or a few days per week, following Palaiologou's (2016) study. In her study, Palaiologou (2016) investigated the digital technologies children under five use at home in four European countries: England, Greece, Malta, and Luxemburg. She found that many 3- to 5-year-olds use digital technologies (computer-based, internet-based) more than 30 min during the week and longer during the weekend. Based on the participants' responses, our results are in contradiction with previous studies. It seems that children in Greece use mobile devices less compared to other children around the globe. Marsh et al. (2015) reported that 0–5-year-olds had access to a tablet at home on an average of 79 min per day. In Japan, almost half the two-year-old children watched videos or played games through their parents' smart screen devices for 60–80 min per day on average (Dardanou et al., 2020). Similarly, in the United States, children as young as four years of age spend an average of an hour per day on an interactive screen device (Rideout, 2017).

5.2 Q2: How do demographic variables such as age, gender, ethnicity, and education impact media access and use?

Regarding the impact of socioeconomic status, age, gender, and ethnicity on digital technology access and use, the previous year's studies found that families' socioeconomic background can influence how families incorporate digital media (Livingstone, 2007). Socioeconomic status (SES) is a multidimensional vector that refers to a cluster of variables, such as lack of material resources, low parental education, or family financial pressures (Tonizzi et al., 2020). The present study found that even lower-income parents provide their children with versions of Apple and Android devices. These results followed other international study results. For instance, in a study in Canada with families from different socioeconomic backgrounds, social class did not seem to be a key indicator of technology practice or use (Rizk & Hillier, 2020). In general, we can consider that in Greece, there is no digital divide in lower-income and ethnic minority children due to the overall increase in mobile device availability. While earlier studies have shown that children from low-income families have limited access to educational opportunities in digital content (Ramani & Siegler, 2011), in this study, children from both low and high SES have equal access to mobile content within the family environment. Several studies have also highlighted the parents' crucial role in guiding young children to use touchscreen mobile devices to gain educational benefits in informal educational settings (Liu & Hwang, 2020). Knowledge of this is considered necessary, as mobile game-based learning in developmentally appropriate apps with educational value can help young children quickly develop their math, language, coding, and STEM skills (Lehrl et al., 2021). We also found that there is also no difference in apps usage and digital device access between boys and girls. This is vital as the mobile ecosystem can create a supportive environment that can help children create positive attitudes and set clear learning goals (Office of Educational Technology, 2021). Furthermore, gender equality in

device and apps access can help females overcome technology phobias which can, in theory, impact the acquisition of CT skills and compromise their academic and professional future (Relkin & Bers, 2021). Thus, the gap in which children of lower-income homeowners had substantially less access to smartphones, tablets, or educational apps described in older studies (Rideout, 2013), does not exist.

Earlier studies such as the 'The EU Kids Online survey' found that families' socioeconomic differences affect the amount of active mediation that children received on internet use and safety (Livingstone et al., 2011). Other study results showed that higher-income parents were more likely to engage in active mediation frequently (Livingstone et al., 2015). However, measuring parental mediation is not straightforward as it might be considered to be. The reason is that many parents may overestimate their engagement in regulating their children's digital experiences (Livingstone et al., 2015). Like other studies (Dias & Brito, 2021), the present study found that parents have adopted the reduction of screen time, an average of some minutes per day, as the most common restrictive policy. Also, this study's results coincide with those of other authors (Gözüm & Kandır, 2021) that found that only a tiny percentage of parents (below 10%) provide conscious guidance to their children in digital edutainment. According to the same study, conscious guidance is directly related to parental education levels. Parents with a high level of education are involved more in co-playing mediation strategies (Gözüm & Kandır, 2021). In the present study, more highly educated parents tended to be more confident in their digital skills combined with active mediation. These results are similar to the study of Livingstone et al. (2015). Furthermore, the literature has determined various demographic factors influential in mediation strategies, including family relationships, siblings, parental employment, family income, school attendance, and cultural background (Toran et al., 2021). This study found that the number of siblings also plays an important, influential role in parents' mediation strategies.

5.3 Q3: What are the most popular app categories that Greek parents select for their preschool children?

Research suggests that children can learn educational concepts from well-designed multimedia resources such as mobile applications (apps) (Sheehan et al., 2019). An abundance of apps designated as educational (without evidence for this claim) are available in digital stores (Radesky et al., 2015), and parents play an essential role in supporting their children in their learning with educational media (Yu et al., 2021) by choosing developmentally appropriate apps. However, reports indicate that children entertain themselves at home mostly with tablets (Livingstone et al., 2014). In this study, we also found that children mostly use apps for entertainment purposes. Studies have also found that young children widely use three types of educational apps (Neumann & Neumann, 2015): interactive gaming apps that have goals that progressively increase in difficulty, thereby piquing children's interest; applications that have tools for drawing or building to encourage children to join a constructive

activity with may possible outputs; and electronic books with colorful, animated, and interactive features (Liu et al., 2021).

Nevertheless, in this study, children follow the same trend as principally engaged with interactive gaming apps, applications with tools for drawing but less on electronic books. Like the study of Rideout (2017), most parents have downloaded apps for them in this study. Although the same researcher (Rideout, 2017) discussed an "app gap" that mentioned the difference in the percent of parents who have downloaded apps for their children to use in this study, we can speak of an "app quality gap." In other words, the app's visual design, sound effects, and interface can distract children from the actual educational content. A balance between these characteristics is necessary to ease children's learning (Radesky et al., 2015).

International statistics highlight ongoing concerns about the science education achievement gap that exists between kindergarten students. Girls worldwide are at higher risk for their STEM skill development than boys. The present study found that parents do not download apps for their children's STEM skill development. On the contrary, studies highlight that early STEM engagement is crucial for young children of both genders to prepare for future STEM challenges (Stephenson et al., 2021).

It is not expected that children can choose digital devices and apps with appropriate educational content. Research recognizes that parents play a critical role in children's technology introductory activities. Furthermore, the joint parent and child engagement with technology can improve children learning outcomes (Archer et al., 2021; Gözüm & Kandır, 2021). Nevertheless, most parents worldwide do not know where to find appropriate tools and high-quality educational apps. For instance, it has been found that children play games instead of educational apps (Gözüm & Kandır, 2021). In the light of the research findings from the study in Turkey, the same researchers found that all the digital games were in the 'negative category,' characterized by inadequate design and the education content (Gözüm & Kandır, 2021).

5.4 Q4: What factors influence parents' decisions when it comes to choosing which apps to use?

In this study, similar to other studies (Chaudron et al., 2018a, b), parents select and download apps and games that they consider educational and appropriate for their children. Nevertheless, parents often perceive what is being taught as educational value, similar to early childhood curricula (quizzes, puzzles, and games), dismissing other aspects of context and skills (Dias & Brito, 2021). Furthermore, in this study, the inadequate and often misleading information that parents receive from the media and other unofficial sources such as peers about digital content appears to be a significant factor in their decisions on children's touchscreen use (Dardanou et al., 2020). In this study, parents mainly download and use free apps. Researchers have proven that the quality of an app may be

reduced by features such as ads and popups that can divert children's attention away from the educational content (Northrop & Killeen, 2013).

Furthermore, these distracting features increase the cognitive burden, especially younger children (Krcmar & Cingel, 2014). Additionally, researchers state that several free early literacy apps targeted at younger children imitate worksheets or flashcards promoting rote learning (Neumann & Neumann, 2017). Fortunately, early childhood organizations (e.g., Resources for Early Learning or Zero to Three) provide parents with ideas and strategies for developmentally appropriate activities with smart screen technologies (Radesky et al., 2015). Unfortunately, there are no similar resources in Greece, although this lack has been already mentioned in the earlier studies (Papadakis et al., 2018).

5.5 Q5: What support do parents need to make these mobile tools more beneficial for child development?

Like other studies in the present study, most parents, despite their willingness, mentioned a lack of scientific literacy to find educational apps in the digital stores (Gözüm & Kandır, 2020; Lupton & Williamson, 2017). In addition, they are also being unaware of classifying young children learning needs and how they can use apps to scaffold children learning, such as encouraging engagement in meaningful activities (Hirsh-Pasek et al., 2015) or higher-order skills such as problem-solving (Dias & Brito, 2021). Although digital learning can be used in diverse ways to enhance learning, parents still voiced uncertainty about whether to adopt and how best to implement these digital resources (Livingstone et al., 2015). In the present study, participants have mixed views about the potential of screen media for their children's development.

5.6 Q6: What are parents' attitudes and perceptions toward technology and mobile media use as an educational resource for children?

Although the studies are not similar, the present study results align with McCloskey et al.'s (2018) study. The researchers determined that parents are worried about the negative consequences of excessive use of digital technology, limiting the media usage time (Chaudron et al., 2018a, b). Like other studies, in the present study, most parents simultaneously recognize the potential benefits of using touchscreen technologies for their children, but they also expressed concern about potential risks, such as exposure to inappropriate content (Dardanou et al., 2020; Rideout, 2017). Participants are most worried about inappropriate content, motivating violence, or social destruction (Dias & Brito, 2021). Although the participants in this study, in their responses did not mention the unfamiliarity and the high cost of monitoring software and parental control functions (Marais, 2012), almost all of them express their concerns regarding their lack of knowledge on selecting appropriate mobile educational content in the form of apps. However, regarding their concerns, in contrast to the study results of Dias and Brito (2021), parents do not get informed from

scientific sources like doctors, educational reports, or experts. On the contrary, the participants answered that they mostly get recommendations from family and friends.

6 Conclusion

According to the United Nations Committee on the Rights of the Child (2021), state parties should pay more attention to the effects of digital technology in the first years of life. Considering that brain plasticity is maximal in the child, social relations, particularly with parents, are essential to stimulate children's cognitive, emotional, and social development. Mobile technology is becoming increasingly important in young children's lives. Due to their cost-effectiveness, portability, and easy-to-use feature, smart mobile devices that introduce media at ever-younger ages deserve serious attention and thought (Radesky et al., 2015; Radesky & Christakis, 2016). Children's media research should not be given high importance on "screen time." Instead, they should focus on specific guidelines for parents on promoting appropriate media experiences for young children (Huber et al., 2016; Radesky & Christakis, 2016).

Parents are the primary mediators of children's home digital media, deciding the digital presence, content, and activities for children (Archer et al., 2021; Dias & Brito, 2021; Levinthal et al., 2021), especially in crises such as COVID-19 lockdown (United Nations Committee on the Rights of the Child, 2021). Nevertheless, now, parents are perceived as valuable partners in a learning process supporting the schools' goals (Archer et al., 2021; Levinthal et al., 2021). In this aspect, researchers, software developers, and educational stakeholders need to reshape that mobile content for young children is designed with the needs of children in mind (Neumann & Neumann, 2017).

Providing parents with support services and strategies for coping with mobile media usage challenges can enhance learning and both learner and parent satisfaction with mobile technology. Educational organizations, stakeholders, and researchers should recommend or even better provide age-appropriate and developmentally appropriate content in apps. For instance, parents should be encouraged to try an app first, play the app with the child, and then ask the child about it, focusing on what the child learns (Radesky et al., 2015). Unfortunately, there are no digital resources such as PBS Kids in Greece and other countries in the parents' native language. Early childhood organizations must provide parents with advice for mobile developmentally appropriate activities to pursue their children's education.

7 Limitations of the study

On limitations, firstly, given that this study was a survey design, the causal direction between the dependent and the independent factors could not be ascertained. Although significant associations were detected, the study was limited in explaining parental supervision of mobile media usage within the family. Furthermore, due to the correlational approach, extraneous variables such as individual differences (parents' personality, cultural values) might also influence the study outcomes. A longitudinal study is required to separate the various factors that influence parents' mobile media strategies and determine the factors influencing the intention to use and actual children's mobile media usage.

In addition, the data on this study were reported by parents. Thus, there might be a discrepancy between mobile media use reported by parents and the child's actual usage. Past research has suggested that parents cannot correctly determine the number of times children spend with the screens (Gentile et al., 2012). The participants' familiarity with the technology could be a crucial factor affecting their children's media usage beliefs. Therefore, future studies should collect various variables to explain further the differences in mobile usage strategies and adoption among parents and preschool children to minimize attribution bias.

Data availability statement The raw data supporting the conclusions of this article will be made available by the authors upon request.

Declarations

Conflict of interest The authors have not stated any conflicts of interest.

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