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Young Children's Digital Literacy Practices with Caregivers in the Home Environment: Voices of Chinese Parents and Grandparents

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Abstract: The development of children's digital literacy is essential in the 21st century. Digital technologies have been adopted by both parents and grandparents to enhance children's quality of education, in accordance with the Sustainable Development Goals (e.g., SDGs 4 and 17). Many children have been provided with all types of digital tools and e-devices from birth, which puts their caregivers in a challenging position. In that context, investigating the attitudes, beliefs, communication, and practices of caregivers when interacting with young children while utilizing digital technologies is crucial for comprehending the disparity in digital literacy between parents and grandparents. In this study, we adopted a mixed research design to examine Chinese intergenerational caregiving during the COVID-19 pandemic and different types of caregivers' beliefs, practices, and communication with children through various digital tools in the home environment. A caregiver-reported survey was conducted to investigate the primary caregivers' beliefs, practices, and communication using digital media tools with children at home. Intergenerational interviews with 18 families further identified the different methods of caregiving between parents and grandparents. Mixed attitudes were found concerning popular technologies commonly used at home and children's digital literacy practices, and we heard intergenerational concerns about children's use of digital technologies. This study shows that Chinese fathers are generally more supportive of digital practices at home, while mothers are more restrictive of their children's use of digital technology tools. Grandparenting may be overwhelming for Chinese seniors in the 21st century.

Keywords: Sustainable Development Goals; ecological system theory; digital literacy; caregivers; home environment

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1. Background

With the development of digital technology, young children have begun to be born with various kinds of digital technologies available (i.e., apps, smartphones, iPads). At the same time, in recent years, scholars have paid more attention to how we can develop young children's digital literacy in the home environment [1–4]. Although research studies have been carried out in different social contexts, and the children's literacy skills under study have been different, researchers have generally reported that young children can develop an understanding of digital literacy through their engagement in early literacy practices in the family context from birth. Also, in the home context, parents' involvement in digital literacy practices with their children has been demonstrated to be a key factor influencing young children's understanding of abstract concepts, collaborative learning, reasoning, and problem-solving [5–7]. More specifically, in the post-COVID-19 era, parents working from home has gradually become normal in many households, and they might spend more time dealing with their work than engaging their children in home digital literacy practices. In tandem, the main caring responsibility might have come to be shifted from parents to

grandparents. Importantly, little is known about grandparents' perceptions of their grandchildren's development of digital literacy in the grandparenting process [8]. In this regard, it is necessary to examine caregivers' involvement with children regarding their digital literacy practices in the home environment, particularly in the Chinese context.

In addition, Sustainable Development Goals (SDGs) 4 and 17 highlight that the development of quality education and reduction of educational inequalities are essential in the strategic plan for the 2030 Agenda. Sustainable development is regarded as an approach to meet everyone's needs now without sacrificing the needs of future generations (United Nations Division for Sustainable Development, 1992). Using digital technologies in a more collaborative and inclusive way is emphasized in Goal 17 of the SDGs (United Nations General Assembly, 2015). The SDGs not only propose international cooperation but also the enhancement of knowledge sharing. Compared to the wide adoption of digital technologies at preschool and at home in the West, the potential adoption of digital technologies in Chinese homes has been underexamined. To fill this gap, this study attempts to explore young children's digital literacy practices with Chinese caregivers in the home environment.

2. Digital Literacy Practices in the Home Environment

Digital literacy is an important competence that young children need to develop in the 21st century. Although it is complicated to define digital literacy, scholars widely use the definition coined by Martin [9]. Digital literacy is regarded as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, to enable constructive social action; and to reflect upon this process" [9] (pp. 135–136). Based on this definition, it can be concluded that children need to have various literacy skills, such as ICT skills, text creation, information transmission, social interaction, and critical thoughts. Some researchers claim that children's digital literacy refers to "the diversity of children's literacy practice across media" [10] (p. 15). In the process of engaging in social practices with various digital technologies, children may acquire digital literacy competence, and this process can be enhanced by adults [10]. In this regard, it is necessary for young children to interact with adults and to engage in events and social practices involving the use of digital technologies, which could support children in meaning making, text creating, and information sharing in their early years.

There has been an increasing number of studies investigating children's digital literacy development in the home environment. The development of children's early literacy is commonly associated with their primary caregivers at home [11]. It is necessary for young children to develop meaning making through multimodalities, such as printed texts, symbols, sound, and visual images. Flewitt et al. [12] propose that the early development of young children's literacy is embedded in everyday practices. Compared to a formal learning environment, young children have more daily interactions and diverse digital technologies in the home environment, through both of which they communicate with siblings and parents [13]. Recently, Dong and her colleagues [14] found that family characteristics and diverse digital resources could significantly predict young children's digital literacy and their multimodal practices at home. Also, they argued that if children do not have equal access to digital resources, the "digital divide" phenomenon could become a social issue in less developed regions in China (referring to small cities/towns with a relatively low GDP compared to big international cities and provincial cities in mainland China).

Parents normally take a primary role in rearing their children, and an increasing number of research studies are focusing on exploring parents' engagement with their children in digital literacy practices. Ozturk and Ohi [3] investigated family digital practices in Turkey, and they found that parents' attitudes and views of digital technologies influenced their children's use in the home environment. Most of the parents were actively involved in family digital practices with their children, such as watching TV programs, watching

videos online, and having video conversations. Similar results were gained in an Australian study [1], which found that parents' views determined their children's digital play content and time. Apart from the traditional digital technologies that parents and children use, more recent studies have found that smartphones, iPads, and touch-based immersive tools are being adopted in home environments to enhance communication and remove constraints on the development of literacy skills between parents and young children [15–17]. Parents' digital skills, self-beliefs, and previous learning experiences were also examined as important factors that influence their young children's digital literacy at home [18].

Unlike parents, grandparents pay more attention to establishing and strengthening intergenerational relationships with their grandchildren through home digital literacy practices [19,20]. One study found that grandparents believed that engaging in digital practices offers a good opportunity to interact with their grandchildren while communicating with younger generations [20]. Also, engagement with their grandchildren can help young children in the learning process while cultivating intergenerational bonds [20,21]. Similar results were found in a qualitative study, which showed a more significant sense of "love and security" in this type of intergenerational relationship in the process of informal learning and literacy development among grandparents and grandchildren [22] (p. 42).

To summarize, the focus on children's digital literacy has shifted from schools to the home environment [23], where children and parents might feel more relaxed, natural, and informal in their daily practices [24]. Although rich evidence has shown that the home environment is essential for literacy development and that parents' attitudes might be decisive for young children's adoption of digital technologies [1,3], few researchers have focused on examining the different roles of caregivers and the subsequent consequences that may occur in terms of young children's digital literacy practices at home, particularly in the Chinese context. In this regard, we believe that it is essential for us to have a better understanding of these issues from the perspective of Chinese caregivers.

3. Framework and Context of This Study

This study is based on Bronfenbrenner's [25] ecological system theory, which explains how individual children, their family, and their environment interact with one another to influence children's development. This theory suggests that studying children's development in multiple environments is essential. When participating in home and social activities, children are not passive receivers who only receive external reinforcement. Instead, they are active players responding to the influence of the surrounding environment [26]. The ecological system theory emphasizes a bi-directional influence between adults and children. For example, when young children are engaged with caregivers in digital literacy activities, both of them need to interact, communicate, and share in a co-creating learning process. This reciprocity is important for supporting young children and shaping their early experiences and development [13].

Chinese families have experienced fast digital development in the last several decades, with the generations born after the millennium coined "digital children". Recent studies have focused on the disparities in family social status, educational backgrounds of caregivers, and family residency locations that might predict children's digital literacy [14,18,27]. During the COVID-19 pandemic, many Chinese parents had to stay with their children at home. In this time, Chinese parents took on a dominant parenting role and spent their free time with their children at home. However, in the post-pandemic era, many parents have to work extensive hours outside of the home, so the dominant roles of caregiving might be different. Therefore, in the unique context of China, caregivers who usually engage children in digital literacy activities may be divided in terms of their attitudes, perceptions, and home practices.

With the continuous changes in demographics and family structures (e.g., an increasing divorce rate, non-marital fertility, and two-working-parent families), caregiving responsibilities for young children are gradually shifting from parents to grandparents [28]. For example, grandparent-led child-rearing has reached 40% in urban China and 90% in rural areas [29]. Researchers have reached a consensus that grandparents play an important role

in childcare, although the associated cultural values and family norms might vary from one society to another [30]. Compared to the independent assistance of grandparents in the West, Chinese grandparents are more likely to have a co-resident style of input, where they provide full-time support for their grandchildren [30]. Xu [30] proposed that this multigenerational co-residence illustrates "filial piety" in Chinese traditional culture. In recent years, grandparenting has become popular in mainland China due to young couples' intense work schedules. Previous research has found that the stress this places on seniors' psychological and physical well-being increases their burden [31]. Chinese scholars have also noted that some grandparents have emotional and behavioral problems that stem from a lack of relationship with their grandchildren or lack of care from their parents in skipped-generation families [32]. Hung et al. [32] proposed that it is essential to examine grandparents who are the primary caregivers for their grandchildren in the Chinese context.

The concept of "*Tiger Mums*" and "*Panda Dads*" is another unique Chinese social–cultural phenomenon [33]. "Tiger mum" is a common term used to describe strict and demanding Chinese mothers with high expectations for their children. "Panda dad", or xiong mao ba (熊猫爸), is a term to describe fathers who more easily meet their children's needs and support the autonomy of their children compared to tiger mums [34]. Furthermore, Chinese scholars have found that mothers and fathers have different parenting styles in developed and international cities in mainland China [33]. In terms of digital literacy practices at home, which model do parents in China adopt today? This question requires empirical verification. Accordingly, this study addresses the following questions:

1. What are primary caregivers' views of home digital practices in China?
2. What are the different roles of caregivers in engaging in digital practices with young children at home?
3. What support do primary caregivers need to guide young children's digital literacy in the home environment?

3.1. Methods

Mixed research methods were used in this study [35]. We employed a sequential exploratory mixed research design to gain primary caregivers' views of using various digital technologies with young children at home and the support needed to guide these children. This study began with a quantitative phase, which was followed by semi-structured interviews to further explore the participants' perceptions of the research questions in a unique social–cultural context. Based on previous studies, a survey that has been used in both Western countries and China was adapted [3,14]. We believe that adopting mixed research methods allows researchers to obtain a broad picture during data collection and analysis [36], as in this case.

3.2. Participants in the Quantitative Phase

This study was conducted on families who had children aged 3–6 years old in Eastern and Central China, as families in these regions have diverse backgrounds, ranging from low to high social–economic statuses. Thus, these families are likely to be representative of digital home practices in China. After obtaining ethical approval, we sent an information package to six preschools, and finally, three preschool managers agreed to take part in the study. In total, 350 surveys with electronic consent forms were sent out by the preschool managers to parents' online accounts, and 264 surveys and consent forms were completed, with a return rate of 75.4%.

3.3. Instruments for the Quantitative Phase

At the quantitative stage, the participants were invited to complete the survey, which examined primary caregivers' perceptions of digital literacy practices. The survey was adapted from previous studies, which were completed widely in the West and China [3,18]. It is composed of three parts: (1) the participants' demographic background (e.g., gender, family income, family location, primary caregivers at home); (2) the participants' attitudes

toward using technological tools with children; and (3) the frequency of the participants' engagement with their children's digital literacy activities in the home environment. The items of part 2 and part 3 were ranked on a 5-point Likert scale, ranging from 1 (representing "totally disagree") to 5 (indicating "totally agree") [37].

3.4. Data Analysis in the Quantitative Phase

At the quantitative stage, we used SPSS version 27 to analyze the frequency of the primary caregivers' involvement and engagement with their young children, the caregivers' attitudes, and the different behavioral roles of the caregivers. Descriptive statistics were calculated for each item to provide information on the caregivers' perceptions of adopting digital technologies at home and their digital practices at home. Then, Kruskal–Wallis tests and Dunn's post hoc tests were conducted to test for differences among the groups.

3.5. Participants in the Qualitative Phase

The participants in the qualitative stage were 18 primary caregivers (10 females and 8 males) who voluntarily joined this study. These participants were invited according to their contact method provided in the last open question in the survey: "Please identify the primary caregiver in the family, and leave the contact method if you would like to attend the interviews". The primary caregivers were mainly from Eastern China, though four were from Northwestern China. Their roles were identified as follows: grandparents (n = 10), mothers (n = 6), and fathers (n = 2).

3.6. Instrument in the Qualitative Phase

Semi-structured interviews were conducted to determine the primary caregivers' attitudes, that is, their perspectives on the reasons and methods for using digital technologies with their children and concerns about the use of such technologies, to identify the potential factors that might influence their digital literacy practices and engagement at home [35,36]. All the interviews were conducted in Chinese and recorded. Later, they were transcribed by the principal investigator (PI). The transcriptions were translated into English by the PI, who has rich research experience in Chinese–English translation. The individual interviews lasted between 35 and 45 min.

3.7. Data Analysis at the Qualitative Stage

We used thematic analysis to analyze the qualitative data [38]. The first step in the thematic analysis was to read the transcriptions carefully, highlighting and bolding keywords and important concepts. The keywords and concepts were then compared and contrasted to generate distinct themes [38]. The third and the fourth authors independently coded 60% of the data, with an inter-coder reliability of Cohen's K = 0.93, showing a high inter-rater reliability [38]. Any disagreement in the coding was discussed among the first and third authors through discussion. The distinct themes were organized into a table, accompanied by representative quotes from each participant.

3.8. Findings

The results are presented separately for the quantitative and qualitative phases in the following sections.

3.9. Results at the Quantitative Stage

The sample consisted of 264 caregivers of children. Of these, 185 were mothers, 71 were grandparents, and 8 were fathers. In terms of the parents' educational backgrounds, 39.4% of the families reported that neither parent had a degree; 29.2% reported that one of the parents had a bachelor's degree; 27.7% reported that both parents had a bachelor's degree; 3.4% reported that one of the parents had a master's degree or above; and only 0.4% of the families reported that both parents had a master's degree or above. Regarding family income, 35.2% of the respondents reported an annual family income (RMB) of between

100,000 and 200,000, followed by 50,000–99,000 (22.3%), 200,000–400,000 (20.1%), <50,000 (15.9%), 400,000–600,000 (2.7%), and >600,000 (3.8%). The average annual expenditure on children's electronic products was RMB 2138.70, with a standard deviation of RMB 5881.421. The maximum expenditure reported was RMB 70,000, while the minimum reported was RMB 0, indicating significant variance in how much money each family spends on electronic products for their children. Nearly all of the participants came from second- and third-tier cities (92.4%), and only very small portions came from rural and remote areas (6.4%) and provincial capitals (1.1%).

3.10. Descriptive Statistics

Table 1 presents the descriptive statistics for all the items measuring the caregivers' involvement and attitudes toward early digital literacy practices at home by caregiver group, while Table 2 presents the frequency of each item.

Table 1. Descriptive statistics of survey items that measured caregivers' involvement and attitudes towards digital literacy practices at home by caregiver group.

	Mother			Father			Grandparents		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Caregiver Involvement									
My child uses computers, phones, and tablets to watch TV shows	2.830	3.000	1.215	4.250	4.500	0.886	2.930	3.000	1.269
My child uses computers, mobile phones, and tablets to play games	1.900	2.000	1.076	3.000	3.000	1.604	1.630	1.000	0.975
My child surfs the Internet	1.330	1.000	0.776	2.380	2.500	1.408	1.310	1.000	0.729
My child uses computers, mobile phones, and tablets to read	2.170	2.000	1.100	2.880	3.000	1.356	1.920	2.000	1.092
My child uses computers, mobile phones, and tablets to draw	1.710	2.000	0.859	2.380	2.000	1.302	1.440	1.000	0.788
My child uses computers, mobile phones, and tablets to listen to music	2.410	2.000	1.134	3.130	3.000	1.356	2.180	2.000	1.163
My child uses computers, mobile phones, and tablets to complete parent–child tasks	2.120	2.000	1.020	2.880	3.000	1.246	1.870	2.000	1.027
My child uses children's puzzle apps	2.680	2.000	1.161	3.250	3.000	1.389	2.390	2.000	1.315
I watch children's movies with my children	2.440	2.000	0.883	3.000	3.000	0.535	2.650	2.000	1.135
I surf the Internet with my children	1.420	1.000	0.718	2.500	3.000	0.756	1.480	1.000	0.772
I play games with my children on mobile phones, computers, and tablets	1.560	1.000	0.786	3.000	3.000	0.926	1.610	1.000	1.075
I use mobile phones, computers, and tablets to listen to music with my children	2.410	2.000	1.039	2.630	3.000	0.916	2.410	2.000	1.166
I watch TV programs with my children	2.400	2.000	0.886	3.500	3.500	1.195	2.550	2.000	1.106
My child and I use smart communication tools to chat (smart watch, WeChat, QQ, etc.)	1.850	2.000	0.961	2.130	2.000	1.126	2.070	2.000	1.302
I use webcams with my children	2.170	2.000	1.032	2.880	3.000	1.126	2.150	2.000	1.167
My child and I use computers, mobile phones, and tablets to complete parent–child tasks	2.160	2.000	0.898	2.380	2.500	1.061	1.920	2.000	1.092
My child and I use computers, mobile phones, and tablets to draw	1.790	2.000	0.873	2.130	2.000	0.835	1.460	1.000	0.825
My child and I use messages to communicate with each other	1.520	1.000	0.795	1.750	1.000	1.035	1.240	1.000	0.597
I use puzzle apps with my children	2.370	2.000	1.066	2.630	3.000	0.744	2.110	2.000	1.190
Caregiver Attitudes									
Children's use of electronic information tools is not good for their brains	2.890	3.000	1.120	2.630	2.000	0.916	2.830	3.000	1.108
Online activities (online games, movies) are detrimental to children's development	3.190	3.000	1.243	2.880	2.000	1.246	3.230	4.000	1.198
Children do not need to use electronic information tools for educational purposes	2.490	2.000	1.043	2.130	2.000	0.354	2.410	2.000	0.979
Traditional educational resources (e.g., printed books) are better for children's education than electronic information resources	3.100	3.000	1.175	2.750	3.000	0.707	3.070	3.000	1.223
Electronic information resources do not contribute to children's learning	2.240	2.000	0.925	2.130	2.000	0.354	2.250	2.000	0.921

Table 2. Frequency of items that measured caregivers' involvement and attitudes towards digital literacy practices at home by caregiver group.

	Never			Occasional (1–2 Times a Week)			Sometimes (3 Times a Week)			Often (4 Times a Week or More)			Frequent (Daily)		
	Mother	**Father**	**Grandparents**	**Mother**	**Father**	**Grandparents**	**Mother**	**Father**	**Grandparents**	**Mother**	**Father**	**Grandparents**	**Mother**	**Father**	**Grandparents**
Caregiver Involvement															
My child uses computers, phones, and tablets to watch TV shows	11.40%	0.00%	9.90%	35.70%	0.00%	38.00%	24.90%	25.00%	16.90%	14.60%	25.00%	19.70%	13.50%	50.00%	15.50%
My child uses computers, mobile phones, and tablets to play games	45.40%	25.00%	59.20%	33.50%	12.50%	28.20%	10.80%	25.00%	5.60%	6.50%	12.50%	4.20%	3.80%	25.00%	2.80%
My child surfs the Internet	78.90%	37.50%	78.90%	14.60%	12.50%	15.50%	2.70%	37.50%	2.80%	2.20%	0.00%	1.40%	1.60%	12.50%	1.40%
My child uses computers, mobile phones, and tablets to read	32.40%	25.00%	43.70%	34.10%	0.00%	36.60%	21.60%	50.00%	8.50%	7.60%	12.50%	7.00%	4.30%	12.50%	4.20%
My child uses computers, mobile phones, and tablets to draw	49.70%	25.00%	69.00%	33.50%	37.50%	23.90%	13.50%	25.00%	1.40%	2.20%	0.00%	5.60%	1.10%	12.50%	0.00%
My child uses computers, mobile phones, and tablets to listen to music	21.10%	12.50%	33.80%	41.60%	12.50%	35.20%	19.50%	50.00%	14.10%	11.40%	0.00%	12.70%	6.50%	25.00%	4.20%
My child uses computers, mobile phones, and tablets to complete parent–child tasks	29.20%	12.50%	45.10%	42.70%	25.00%	35.20%	19.50%	37.50%	8.50%	4.30%	12.50%	9.90%	4.30%	12.50%	1.40%
My child uses children's puzzle apps	14.60%	12.50%	31.00%	35.70%	12.50%	31.00%	25.40%	37.50%	15.50%	15.70%	12.50%	12.70%	8.60%	25.00%	9.90%
I watch children's movies with my children	5.90%	0.00%	8.50%	61.60%	12.50%	52.10%	18.40%	75.00%	15.50%	10.80%	12.50%	14.10%	3.20%	0.00%	9.90%
I surf the Internet with my children	68.60%	12.50%	64.80%	23.80%	25.00%	26.80%	5.40%	62.50%	4.20%	1.60%	0.00%	4.20%	0.50%	0.00%	0.00%
I play games with my children on mobile phones, computers, and tablets	58.40%	0.00%	66.20%	31.40%	25.00%	21.10%	7.00%	62.50%	2.80%	2.70%	0.00%	5.60%	0.50%	12.50%	4.20%
I use mobile phones, computers, and tablets to listen to music with my children	16.20%	12.50%	23.90%	46.50%	25.00%	38.00%	22.70%	50.00%	15.50%	9.20%	12.50%	18.30%	5.40%	0.00%	4.20%
I watch TV programs with my children	9.20%	0.00%	14.10%	56.80%	25.00%	43.70%	21.60%	25.00%	22.50%	9.70%	25.00%	12.70%	2.70%	25.00%	7.00%
My child and I use smart communication tools to chat (smart watch, WeChat, QQ, etc.)	44.90%	37.50%	45.10%	33.50%	25.00%	28.20%	15.10%	25.00%	11.30%	4.90%	12.50%	5.60%	1.60%	0.00%	9.90%
I use webcams with my children	27.60%	12.50%	35.20%	42.70%	12.50%	33.80%	18.90%	62.50%	16.90%	7.00%	0.00%	8.50%	3.80%	12.50%	5.60%
My child and I use computers, mobile phones, and tablets to complete parent–child tasks	19.50%	25.00%	46.50%	56.20%	25.00%	29.60%	16.80%	37.50%	12.70%	4.30%	12.50%	8.50%	3.20%	0.00%	2.80%
My child and I use computers, mobile phones, and tablets to draw	42.70%	25.00%	69.00%	41.60%	37.50%	19.70%	10.30%	37.50%	8.50%	4.30%	0.00%	1.40%	1.10%	0.00%	1.40%
My child and I use messages to communicate with each other	62.20%	62.50%	83.10%	27.60%	0.00%	11.30%	7.60%	37.50%	4.20%	1.60%	0.00%	1.40%	1.10%	0.00%	0.00%
I use puzzle apps with my children	17.80%	12.50%	38.00%	48.10%	12.50%	33.80%	18.90%	75.00%	12.70%	9.20%	0.00%	9.90%	5.90%	0.00%	5.60%
Caregiver Attitude															
Children's use of electronic information tools is not good for their brains	6.50%	0.00%	8.50%	39.50%	62.50%	38.00%	22.70%	12.50%	22.50%	21.60%	25.00%	23.90%	9.70%	0.00%	7.00%
Online activities (online games, movies) are detrimental to children's development	5.90%	0.00%	5.60%	34.60%	62.50%	31.00%	10.80%	0.00%	12.70%	31.90%	25.00%	36.60%	16.80%	12.50%	14.10%
Children do not need to use electronic information tools for educational purposes	8.60%	0.00%	9.90%	60.50%	87.50%	60.60%	10.80%	12.50%	12.70%	13.50%	0.00%	12.70%	6.50%	0.00%	4.20%
Traditional educational resources (e.g., printed books) are better for children's education than electronic information resources	4.30%	0.00%	4.20%	36.80%	37.50%	42.30%	18.40%	50.00%	11.30%	25.90%	12.50%	26.80%	14.60%	0.00%	15.50%
Electronic information resources do not contribute to children's learning	13.50%	0.00%	14.10%	64.90%	87.50%	60.60%	10.30%	12.50%	15.50%	7.00%	0.00%	5.60%	4.30%	0.00%	4.20%

3.11. Children's Involvement in Digital Literacy Practices at Home

The results of the Kruskal–Wallis tests with Dunn's post hoc test indicated that there were statistically significant differences in several aspects of children's involvement in digital literacy practices at home among the different groups of primary caregivers. Overall, children's involvement in digital literacy practices at home was more frequent when fathers were the primary caregivers compared to situations where grandparents or mothers were the primary caregivers (see Table 3).

Table 3. Kruskal–Wallis test of children's involvement in digital literacy practices at home across primary caregiver groups.

Child's Involvement at Home	Kruskal–Wallis H	df	Asymp. Sig.
My child uses computers, mobile phones, and tablets to watch TV shows	9.501	2	0.009
My child uses computers, mobile phones, and tablets to play games	9.36	2	0.009
My child surfs the Internet	9.822	2	0.007
My child uses computers, mobile phones, and tablets to read	7.116	2	0.028
My child uses computers, mobile phones, and tablets to draw	11.659	2	0.003
My child uses computers, mobile phones, and tablets to listen to music	5.872	2	0.053
My child uses computers, mobile phones, and tablets to complete parent–child interactions	8.781	2	0.012
My child uses children's puzzle apps	6.052	2	0.049

Compared to grandparents, when fathers are the primary caregivers, children are more likely to use computers, cellphones, and tablets to watch TV shows at home ($p = 0.005$), use these digital devices to play games at home ($p = 0.006$), surf the Internet ($p = 0.002$), use computers, cell phones, and tablets to read ($p = 0.024$), use digital devices to draw ($p = 0.008$), and use these digital devices to engage in parent–child interactions ($p = 0.010$).

Similarly, compared to grandparents, mothers seem to allow their children to use computers, cell phones, and tablets more frequently for both entertainment purposes (playing games: $p = 0.043$, surfing the Internet: $p = 0.031$) and for developmental/educational purposes (reading: $p = 0.049$, drawing: $p = 0.005$, engaging in parent–child interactions: $p = 0.035$). It seems that, overall, when parents are the primary caregivers, their children are more likely to use digital devices for both entertainment and educational purposes than when grandparents are the primary caregivers.

However, there are still some moderate differences between mothers and fathers. Compared to mothers, when fathers are the primary caregivers, their children are also more likely to use computers, cellphones, and tablets to watch TV shows at home ($p = 0.002$), use these digital devices to play games at home ($p = 0.039$), and surf the Internet ($p = 0.002$). These results indicate that mothers are less likely to support their children's use of digital devices for entertainment purposes than fathers; however, mothers are not significantly different from fathers when it comes to supporting their children's educational use of digital devices.

3.12. Caregivers' Interactions with Children's Digital Literacy Practices at Home

When it comes to using digital devices together with their children, fathers also engage in such practices more often than mothers and grandparents. As shown in Table 4 below, first, compared to mothers, fathers more frequently watch children's movies with their children ($p = 0.016$), more frequently surf the Internet with their children ($p < 0.001$), more frequently play games on computers, mobile phones, and tablets with their children ($p < 0.001$), and more often watch TV programs with their children ($p = 0.007$). In addition, compared to grandparents, fathers more frequently surf the Internet with the children ($p < 0.001$), more frequently play games on computers, mobile phones, and tablets with their children ($p < 0.001$), more often watch TV programs with their children ($p = 0.021$), and more frequently draw with their children using digital devices ($p = 0.013$).

Table 4. Kruskal–Wallis test of caregiver–child interactions involving digital literacy practices at home across primary caregiver groups.

Caregiver's Involvement	Kruskal–Wallis H	df	Asymp. Sig.
I watch children's movies with my children	6.553	2	0.038
I surf the internet with my children	15.153	2	0.001
I play games with my children on mobile phones, computers, and tablets	18.346	2	0.001
I listen to music together with my children using mobile phones, computers, and tablets	0.859	2	0.651
I watch TV programs with my children	7.624	2	0.022
My children and I use smart communication tools to chat (smart watch, WeChat, QQ, etc.)	0.821	2	0.663
I use webcams with my children	4.189	2	0.123
My children and I use computers, mobile phones, and tablets to complete parent–child tasks	7.839	2	0.020
My children and I use computers, mobile phones, and tablets to draw	13.92	2	0.001
My children and I use messages to communicate with each other	10.034	2	0.007
I use puzzle apps with my children	7.022	2	0.030

Differences between mothers and grandparents were found in three aspects: (1) mothers more frequently use computers, mobile phones, and tablets to engage in parent–child tasks with their children ($p = 0.009$); (2) mothers more often use these digital devices to draw with their children ($p < 0.001$); and (3) mothers more frequently use digital messages to communicate ($p = 0.002$). Again, it can be seen that, overall, fathers are more likely to engage in digital practices together with their children at home than both mothers and grandparents, while mothers are also more likely to engage in such practices than grandparents.

3.13. Caregivers' Attitudes toward Their Children's Involvement in Digital Literacy Practices

As shown in Table 2, primary caregivers hold mixed attitudes toward their children's involvement in home digital literacy practices. In terms of the impact of home digital literacy practices on children's brain development, in each of the three groups of primary caregivers, higher percentages disagree or strongly disagree that the use of electronic information tools is not good for children's brains. However, a higher percentage of mothers and grandparents also believe that online activities are detrimental to children's development. With regard to the benefit of digital literacy practices for learning, higher percentages of the primary caregivers in each of the three groups believe that electronic resources contribute to children's learning. However, mothers and grandparents are less sure about whether traditional resources are better than electronic sources, as evidenced by the small difference in percentage between those who chose disagree/strongly disagree and those who chose agree/strongly agree.

Overall, as shown in Table 2, fathers tend to show a generally more positive attitude toward home digital literacy practices than mothers and grandparents, as evidenced by the fact that a higher percentage of fathers chose "disagree" or "strongly disagree" on all five items that measured attitude. However, the results of the Kruskal–Wallis test (Table 5) showed that there were no statistically significant differences in the different primary caregivers' attitudes toward home digital literacy practices.

Table 5. Kruskal–Wallis test of caregiver attitude towards children's involvement in home digital literacy practices across primary caregiver groups.

Caregiver's Attitude	Kruskal–Wallis H	df	Asymp. Sig.
Children's use of electronic information tools is not good for their brains	0.481	2	0.786
Online activities (online games, movies) are detrimental to children's development	0.606	2	0.739
Children do not need to use electronic information tools for educational purposes	0.644	2	0.725
Traditional educational resources (e.g., printed books) are better for children's education than electronic information resources	0.526	2	0.769
Electronic information resources do not contribute to children's learning	0.095	2	0.954

3.14. Results of the Qualitative Phase

We read the transcribed responses carefully, categorized them into units, compared the units, and grouped them into three main themes:

- Mixed attitudes of primary caregivers;
- Family support for children's digital literacy;
- Grandparents' burden.

3.15. Mixed Attitudes of Primary Caregivers

The first theme is about the attitudes of the family primary caregivers toward adopting digital technologies with their children in a home environment. Within this theme, three sub-themes were identified: (1) home digital practice merits; (2) home digital practice concerns; and (3) home digital practice confusion.

3.16. Home Digital Practice Merits

Most of the participants believe that digital technologies have become popular tools for engaging their children in home literacy practices. Children enjoy watching TV and movies and playing games with their parents. Also, sharing information among family members has become much easier with iPhones, iPads, and smartphones. By adopting various communication channels, sharing messages and pictures and downloading books have become widely popular home literacy activities. Moreover, using various digital tools is a popular method to improve children's early literacy development. A mother explained her experience as follows:

> I used to read stories with my children before the bedtime. My twins loved the time with me. However, the simple stories were repeated several times, which made me bored and sleepy, but the children were still excited and had no plan to sleep. Later, preschool teachers suggested that I use apps, which could provide more vivid pictures and beautiful sounds, to enhance their creativity and interest. In this way, my children and I could click on the story they liked and I could walk them through the storyline by showing them pictures. If I was sick, they could use the sound channel to listen to the story by themselves. At present, my children have acquired more words than their peers, so I think that I will continue using apps.
>
> (Participant 10)

In addition to the improvement in children's language and literacy development, caregivers' active involvement in their children's home digital literacy practices could increase the interactions between parents and children. As a positive consequence, parent–child relationships and the family climate could be enhanced. This point was highlighted by the male participants. A father who has taken on the primary parenting role shared the following:

> I was extremely busy with my work and missed lots of opportunities to communicate with my son. After my busy day, he was usually asleep and I left in the early morning. Once, his words touched my bottom of heart. He asked me if I could have one-day leave and take him to the zoo. My son told me that his mother always told him that his father was busy and did not have any time to

> be with him. On hearing it, I felt very guilty and did not know how to respond. While he was still in his time before preschool, I did not want to miss more opportunities in my son's early years' life. At that time, I made the decision to resign from my former workplace and became a freelancer. From that point, I spent more time with him, and I have found that he has become closer to me and now started to share his secrets from preschool, and I believe that he might be off to a very good start there.
>
> (Participant 5)

Among the various activities, fathers and mothers have different perceptions about the best ways in which to support their children in digital literacy practices. In general, fathers hold a more positive attitude toward playing with their children by using digital technologies and provided positive feedback (instead of only being engaged in the activities). In contrast, mothers tend to allow their children to choose their favorite ways to be engaged in digital literacy practices, such as listening to songs, watching TV programs, and reading via apps, but they do not give co-created feedback to their children on how they can improve.

3.17. Concerns about Young Children Using Digital Technologies

Although the results of the questionnaire showed that a large number of parents appreciate the opportunities afforded by digital technologies, Chinese parents still have concerns about the negative effects of adopting digital tools at home. Parents feel challenged in creating a clear boundary for the adoption of digital tools and balancing the time spent on learning and playing. The participants were also concerned about media censorship and health-related issues.

Most of our participants understand and agree that their children should have access to digital technologies in daily life. They guide their children to finish a range of tasks using digital technologies. However, these caregivers are worried about their knowledge base regarding digital literacy and child-rearing. Many of our participants feel that they lack the knowledge and skills to choose the most appropriate educational applications for their children. During the interviews, one mother mentioned that the only channel through which to obtain information in terms of how to support children in their use of digital technologies is parents' meetings. She continued to point out that "*parents share information with preschool teachers, and those teachers and other guest speakers then help me to identify which applications could be most suitable for my kids*". Other participants also raised concerns about lacking knowledge on controlling screen time and reported worries that their children were spending too much time on iPads and smartphones. A father said, "*I have to use passwords to prevent my child from being engaged in using digital technologies for a long time*". He was eager to learn from experts regarding the appropriate amount of time to spend on using digital technologies for learning and entertainment. Some parents mentioned that even though they restricted the time to 30 min per weekday, their children did not strictly follow the rules.

Both parents and grandparents also had concerns regarding young children's use of technology to surf the Internet for entertainment purposes. In the interviews, participants identified risks associated with their child's use of digital technologies. Most parents noted that they have to regulate their children's use of digital devices due to concerns about media content and their children's health. A participant described her son's excessive use of games and remarked that he does not have a good sleep if he spends too much time playing games after dinner. During the interviews, the participants made clear that they are strongly against exposing their children to violent or sexual content, such as in some advertisements on TV. One parent commented that he is afraid of his younger son using smartphones for over 20 min because it is very difficult to implement media censorship for young children. This parent continued sharing his opinion as follows: "*Apart from the media censorship, it is not healthy for children to be involved in a digital world. Children easily become nearsighted when using devices too much*".

3.18. Home Digital Practice Confusion

The primary caregivers' confusion about the uses of various digital technologies appeared in two main regards: (1) their proficiency in using digital technology tools, and (2) the purposes of various apps. Both the grandparents and parents who participated in the interviews expressed that they lacked digital literacy skills. One mother confided that she was not clear about what that term exactly meant and did not know what it included. The researcher communicated with her and introduced different definitions from academic works. However, it is very difficult to give a definite concept of digital literacy. Nonetheless, in the interviews, we found that grandparents may face more challenges than parents when engaging in home literacy practices. One example is as follows:

> I was asked to look after my grandson in the afternoons as my son and daughter-in-law were extremely busy. My grandson was usually picked up from preschool at around 3:30 p.m. and I would try my best to play with him. The most common way was to ask him to read stories from a smartphone. You know, most kids don't like reading books now. But, if you ask me about the difference between the traditional way of reading books and reading via using digital technologies, I find it difficult to tell them apart. For me, both of the ways could allow me to be engaged with my grandson.
>
> (Participant 2)

Generally, the grandparents believe that young parents might be more proficient than them in using digital technologies to engage in digital home practices. This might be due to the young parents' frequent access to digital technologies at their workplaces and training courses they attended at school.

In addition, both the parents and grandparents reflected that they are not very clear about the exact functions of individual apps. Most of the participants expressed that they obtain information and a brief introduction to each app online or from preschool teachers, but they lack any detailed information. One grandmother said, "I was told that Tong Tong, my granddaughter, should use it to improve her literacy skills. But I have not gotten any detailed information about the app and do not know how effective it will be". Similar perceptions were offered from other grandparents in the interviews. In addition to uncertainties about the functions of the apps, most grandparent participants do not know about the effectiveness of using them to improve young children's literacy in the home environment. They worry that young children might use them for entertainment purposes rather than learning because they are difficult to monitor.

3.19. Family Support for Children's Digital Literacy

The second theme found in the interview transcripts concerns the role of parents and family members in supporting their children's use of digital technologies. Within this theme, we identified two sub-themes: (1) one is related to the improvement of children's hard skills, and (2) the other to the improvement of children's soft skills.

3.19.1. Hard Skills

Hard skills are usually teachable competencies, acquired through "self-study, work experience, education or training" [39] (p. 242). Generally, it is believed that people with hard skills can function in a rapidly changing and dynamic world. People can use these hard skills to accomplish goals quickly. In one study, most parents reported that they were supportive of their children exploring a variety of digital technologies if the tools were beneficial for their children's emergent digital literacy [40]. For example, it is common for parents to subscribe to educational website memberships and digital storybook applications because they think that using these apps could improve their children's language, literacy, and numeracy development. A mother who is a manager in an international enterprise stated the following:

> All children in the preschool had access to digital devices at their homes. While speaking with other parents, I found that they allowed their kids to use tablets because they had paid for access to educational websites. I am engaging in international trade so that I can obtain more information from overseas. Also, I have asked many foreign friends to check which apps could be beneficial for young children to use at home. Then, I have compared the functions and usability of the foreign and Chinese educational apps. Finally, I have decided to purchase the Marcopolo World School app, which can be used in various aspects. As the membership is costly, I expect that my children will improve their skills in STEM.
>
> (Participant 9)

Another participant shared with us a very similar idea. He commented that his daughter likes role-playing games, so has he purchased an annual membership for an online program in which she can communicate with AI in order to carry out a range of tasks. This enables his daughter to learn English words at home. Most parents commented that they also bought media-related books, games, and toys based on their children's favorite TV shows. Their children tended to be more engaged in reading and writing with digital technologies when using content related to their favorite TV programs.

Chinese families usually invest in the best resources to improve their children's academic skills, which can be useful for primary schools. Evidence of this came from a mother who expressed the following:

> I was born in a rural family and so I have decided to give the best resources to my child if I can. I often receive messages from application providers asking me to buy updated apps for my children. Usually, I have firstly been provided with a range of skills that a child needs to develop, such as communication, cognition, interaction, etc. Accordingly, I asked the app representative to introduce me to the functions, and if they are only related to improving my children's soft skills, I will refuse to buy it.
>
> (Participant 1)

When this participant was invited to further comment on the reasons why she refused to pay for the apps, she let out a long sigh and continued:

> I totally understand that it is essential to improve my children's soft skills and they might be beneficial for their life-long learning. But children can interact and communicate with adults and peers to improve their language and literacy skills as well as learning though devices. And a middle-income family can only afford to develop children's core skills that they need at school, such as mathematics, reading, and writing. It is highly competitive in these kinds of examinations for children here.
>
> (Participant 1)

3.19.2. Soft Skills

Soft skills are seen as a "dynamic combination of cognitive and meta-cognitive skills, interpersonal, intellectual and practical skills. Soft skills help people to adapt and behave positively so that they can deal effectively with the challenges of their professional and everyday life" [41] (p. 67). Compared to hard skills, soft skills might not be learned quickly and cannot be directly applied to industry innovation. In this study, most participants were not keen on purchasing annual memberships for any websites or educational applications if they believed that they would only help develop their children's soft skills. However, a few parents indicated that they believe it is worthwhile and necessary to develop their children's soft skills when they are young. A participant who is a teacher reflected as follows:

> I totally understand how important it is to cultivate young children's interest and motivation to explore and learn while interacting and playing with others. Learning new words is not just asking kids to sit and read. My son likes sharing

> his story screen with me while his grandparents take photos with us. I intentionally asked him to point out different family members in the photo, and then he became so talkative wanting to tell me their characteristics. When he was talking, I used voice apps to record him and send clips to others via a group chat. This is an interesting way to share stories, and my son can quickly learn words by using his story screen.
>
> (Participant 11)

Some parents commented that their children developed their interaction skills with siblings under family guidance. For example, a participant said that his "two kids learned how to buy birthday gifts and send warm messages to each other with my guidance of how to use the Internet. I helped them search online and choose their favorite birthday gifts—something of interest to them". In this way and others like it, we found that some children regularly interacted with and received digital support and guidance from their siblings, parents, and grandparents.

3.19.3. Grandparents' Burden

Although the third theme had the smallest number of references, it offers interesting and essential information about textual data. Most of the grandparents noted that they are not happy to be the primary caregivers of their grandchildren, but they have had to step up. One grandmother gave the following reasons:

> I planned to travel with my friends after my retirement in 2019. Unfortunately, the COVID-19 pandemic brought up lots of uncertainties so I had to postpone it. At the beginning of 2023, I thought that I could replan the trip and discussed it with my daughter. However, my daughter told me that her second baby would be maturing and I had to look after the elder grandson in the daytime. I felt disappointed but I have had to support her. In terms of digital literacy practices, I was not sure what they used. I only followed what I was told by my daughter.
>
> (Participant 16)

When the grandmother was asked to explain how she engaged her grandson in digital literacy practices at home, she could not describe the process in detail. She mentioned that she accompanied her grandson in watching his favorite cartoons, but she did not use smartphones or an iPad at home. She expressed that she was not comfortable using them, let alone guiding her grandson to use them.

Some grandparent participants believed that they were pushed to look after their grandchildren because of the costly expense of nannies and home-based babysitters. These two kinds of caregivers who can look after young children may take up a large portion of a couple's income. Also, considering their child's health, safety, and attachment, most young couples still prefer their own parents to look after their young children at home. However, the grandparent participants reflected that they did not receive enough education when they were young so they might have poorer child-rearing skills than young parents do. One of the grandparent participants said, "*I use smartphones for entertainment purposes, sending messages, and talking with my friends. I have found that the tech boom has pushed me to learn lots of new stuff but I have learnt it slowly. Hence, I can pick my granddaughter up from the preschool but I cannot help much more*".

4. Discussion

This study has explored the different roles of caregivers' involvement and their attitudes toward home digital literacy practices. Both the quantitative and qualitative results show that the primary caregivers are still mothers, who spend the most time with their children engaging in digital literacy practices. The results indicate that the participants hold mixed attitudes toward home digital literacy practices. The primary caregivers believe that these are necessary to enhance children's language and literacy skills in their early years. Also, the participants confirmed that digital technologies are used by their

children in daily learning and communication. These results are in line with those of previous studies [1,3]. It is interesting to note that although the primary caregivers identified the importance of using digital technologies with their children, they lack digital literacy skills. There are two possible reasons for these results. First, most families who have children who are 3–6 years old are couples who were born in the 1980s and 1990s. So, when the couples were young, they might not have had access to digital technologies at their schools. Although the generation from the 1990s is the one that grew up with digital technologies, they might not have formally received any training when they were at school. The grandparents who are the primary caregivers were mostly born in the 1950s and early 1960s, so they did not have access to any digital technologies in mainland China. In this regard, the primary caregivers' digital literacy skills depend on their own social networks, such as friends, colleagues, and family members. Thus, it is no surprise that they chose traditional TV programs and TV shows as the main ways for their children to develop digital literacy. On the other hand, with the boom of learning technologies, caregivers face challenges in selecting appropriate learning technologies and apps for their young children. Rather than taking risks, they would rather continue to use more traditional digital resources and digital literacy practices, such as listening to stories and music instead of surfing the Internet.

Moreover, the results indicate that an intergenerational gap exists between parents and grandparents in home digital literacy practices when they have the primary caregiving role. We found that children more frequently use digital devices for entertainment purposes when fathers are the primary caregivers. When grandparents are the primary caregivers, children are the least likely to use computers, cellphones, and tablets for both entertainment and educational purposes compared to when their fathers or mothers are the primary caregivers. These results echo those of the previous studies carried out by Xie [33] and Chua [34], who claimed that mothers paid more attention to their children's learning process via using digital technologies, but fathers were more likely to provide constructive support in digital practices. In addition to cultural factors, this can also be explained by the fact that fathers who often have business trips have fewer opportunities to stay with their children, so they are more likely to use "compensation strategies" with young children to maintain family harmony [17]. For grandparents, this study's results are not in an agreement with those of the previous studies, which showed that grandparents love to learn with their grandchildren using digital technologies [20,21]. There are two possible reasons for this. First, the previous studies showed that Chinese grandparents who love to learn and strengthen their bond with their grandchildren are mostly those settled in the USA or recent immigrant families. Their previous learning and working experiences could be significantly different from those who have never received education in the West. Second, compared to the traditional culture, Chinese seniors have begun to pay more attention to their wellbeing after retirement [30]. Their life satisfaction depends not on co-living with younger generations but on their leisure satisfaction, family capital, and community capital [42].

Family support and caregivers' perceptions of the adoption of digital technologies can influence the ways in which children use digital learning technologies. Consistent with previous studies [43], some parents hold a positive attitude and support their children's use of digital tools, while others do not value them as much. Chinese caregivers are worried that their children spend too much time exposed to screens and they are anxious about how to manage their children's use of technologies. This has also been evidenced by other studies conducted in China [17]. A challenge faced by Chinese caregivers is how to maintain a balance between digital and non-digital activities for their children [1]. Also, Chinese families are highly likely to invest in digital devices that can help improve children's academic skills. This result has not been found in other similar studies carried out in the West [3]. However, this is not uncommon in migrant families in the West, particularly Chinese immigrant families [2,44]. Chinese parents have high expectations for their children's school performance and academic skills, so they utilize informal digital practices for their chil-

dren to enhance their academic skills. This social–cultural perspective is deeply rooted in Chinese parents' beliefs [45].

This study makes contributions to our efforts to achieve the UN's sustainability goals in the following ways, which offer lessons with international relevance (SDG 4 and SDG 10). In line with SDG 4, understanding how parents and grandparents use devices to enhance children's learning and development can contribute to improving the quality of family-based education in the digital age. Furthermore, in line with SDG 10, by examining different generations' use of and attitude towards digital tools in childrearing at home, this study sheds light on inequalities. For instance, if grandparents are less likely to use technology or have a more negative attitude towards technology, children primarily cared for by grandparents may face a disadvantage in their development of digital literacy. This alerts us to a need to think about strategies to bridge this gap. It also reflects SDG 17, which emphasizes that collaboration between parents, grandparents, and other caregivers is essential for effective childrearing. Understanding their digital practices can inform strategies for fostering stronger family partnerships and achieving common goals related to child development. In addition, the findings of this study not only provide us with information on how child caregivers use digital devices with their children in family education but also a more in-depth understanding of the motivations, concerns, and challenges behind child caregivers' use of digital devices at home with their children.

Although this study has yielded interesting results, it has three main limitations. First of all, we only surveyed one caregiver in each family, which limited our opportunity to compare the attitudes and practices of different caregivers in the same family. In addition, grandfathers and grandmothers were treated as a sole group in our study, which prevented us from understanding the potential differences between grandmothers and grandfathers. Further studies should analyze such intra-family differences. Furthermore, in light of the burgeoning divorce rates observed in contemporary China, future research should incorporate an analysis of single-parent families, who, due to limited time and dual responsibilities, may rely more on digital devices for childrearing. Such investigations may contribute to a more inclusive approach to research on family digital practices, addressing the diverse needs and realities of modern family structures. Finally, given the rural–urban digital divide, future studies should contextualize the investigation of generational disparities in attitudes and digital practices in childrearing within the framework of a comprehensive rural–urban comparative analysis, to shed light on the divergent digital experiences and perceptions and provide a better understanding of the complex socio-technological landscape and its multifaceted implications for digital engagement in childrearing across diverse geographical settings.

5. Conclusions

This study has used mixed research methods to investigate Chinese caregivers' attitudes, digital engagement, and concerns about their children's digital practices in the home environment. The results show that most participants' children's digital practices are ubiquitous in daily life. Also, most participants hold mixed attitudes toward using digital devices to support their children's development due to their own lack of digital literacy skills. It is interesting to note that the majority of the parents are keen to use digital technology tools to enhance their children's academic skills in the context of traditional Chinese cultural norms [45]. Meanwhile, this study did not find that grandparenting is positive or efficient. Furthermore, we have found that, generally, both parents and grandparents are concerned about young children's mental and physical health if they spend too much time on digital devices each day.

As the caregivers in our study revealed that they lack the appropriate knowledge to help them choose suitable digital learning technologies and apps for their young children, we believe that family education programs should be designed and created for Chinese caregivers. An interdisciplinary team should be built to design family education programs based on Bronfenbrenner's ecological model [25]. This can be achieved by building positive partnerships

among early childhood educators, community workers, and families in order to enhance Chinese caregivers' knowledge and abilities, thus empowering them to make sound decisions about their children's use of digital learning technologies in their daily lives.

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