Chinese Early Childhood Educators' Beliefs and Experiences around Using Touchscreens with Children under Three Years of Age

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Abstract

Young children under three years of age are increasingly reported to spend time on touchscreen technologies in their daily lives. In early childhood educational settings, educators play a key role in influencing young children's access to and use of touchscreen devices. Research shows that educators' technology beliefs and experiences strongly shape their technology adoption and utilization in educational practices. This mixed-method study investigated very young children's educators' touchscreen use and their beliefs and experiences in China. Rich quantitative findings (N=1276) revealed the availability of touchscreen devices mainly computers and laptops in early childhood educational settings and this technology provision aligns with Chinese traditional teacher-centred educational practices. Despite their highly reported digital skills, educators' overall use of touchscreen technologies with very young children was low and there was a lack of confidence in using

them with children. They were also concerned about the negative impact of technology on young children. It appears that confidence is more influential for Chinese educators in deciding to use technology with very young children than their digital skills. Implications for educational policies and designing effective professional learning and development for early childhood educators to enhance their digital competence are discussed.

Keywords: early childhood, young children, educators, touchscreens, professional training, and development

Globally, many children have access to a wide range of digital technologies and the time spent on touchscreen devices (e.g., mobile tablets and smartphones) has been steadily growing in recent years. According to the China National Children's Centre (2021), school-aged children spent an average of 96.27 minutes per day on digital devices, watching audio and video, cartoons, and playing games on weekends. For younger children, Niu and others (2018) found that a significantly high number of children under three had used iPads (96.5%) and smartphones (87.7%) at least once per day at home. During the COVID lockdown, most young children (3-6) in China used screen devices and experienced online learning (Cao et al., 2021; Luo et al., 2022). While inequalities continue to exist in the diversity and quality of access by young children, there is a general trend that an increasing number of children at an ever-younger age have access to touchscreen technologies and their free time becomes screen time (Kumpulainen et al., 2020; OECD, 2018)

Young children's use of screen technologies has been a controversial topic for early childhood education (ECE) stakeholders. Health authorities, such as the World Health Organization (2019) published new guidelines on young children's health, which recommend no

screen time for children under one-year-old. The American Academy of Child and Adolescent Psychiatry (2020) also offered suggestions about the optimum daily time of screen use for children of all ages. For instance, children younger than 18 months should avoid the use of screen media other than video chatting, and one hour of screen use maximum for children 2 to 5. These health organizations have emphasized the amount of time but not the quality of screen engagement. On the other hand, early childhood education researchers have demonstrated evidence that the intuitive touchscreen user interface on internet-enabled mobile devices is interactive and portable, and could enhance children's early learning (e.g., emergent literacy) and development (e.g. physical experiences) (Christakis, 2014; Neumann, 2016; Plumb et al., 2013; Samuelsson et al., 2022; Xie et al., 2018). The lack of empirical educational research with children under three years of age, unjustified media panic, and conflicting perspectives on screen technologies have shaped a blurry landscape and left many ECE stakeholders in a dilemma regarding screen technology use by very young children (Straker et al., 2018).

For young children who attend ECE settings, their educators play a critical role in deciding the provision of technologies for educational practices and influencing children's access and use of screen devices. Research on both pre-service and in-service early childhood (EC) educators shows that their beliefs about technologies strongly shape their technology adoption and utilization in educational practices (Dong & Mertala, 2021; Fotakopoulou et al., 2020; Hatzigianni & Kalaitzidis, 2018). Further, their own educational philosophy, technology experiences (e.g., training, skills, knowledge) and culture mediate their confidence in using technologies with young children (Ertmer & Ottenbreit-Leftwich, 2010; Nikolopoulou & Gialamas, 2015). Overall, research on technology use in ECE has mainly focused on educators of older children, with limited research on those who work with very young children (under 3)

(Hatzigianni & Kalaitzidis, 2018). Similarly, popular technology frameworks such as the Technology, Pedagogy and Content Knowledge (TPACK) (Mishra & Koehler, 2007) and the substitution, augmentation, modification and redefinition (SAMR) model developed by Puentendura (2014), can only be used by educators of older children (K-12) who have specific content areas and subjects to teach (see for example suggestions by Hamilton, et al., 2016). Recently, the Organization for Economic Cooperation and Development (OECD) (Dardanou et al., 2023) has published an extensive review on the early childhood education workforce and digital competencies, underlining the need for more research and professional development initiatives in the sector. The review offers useful insights into different early childhood systems around the world and their adoption of digital technologies but also helpful suggestions on how early childhood educators' diverse training needs can be satisfied to ensure the increase in their digital competence, knowledge and understanding (see for example the INSPIRE model in the report). However, to date, no specific, international framework on how to integrate digital technologies in the early years could be located (similar to TPACK or SAMR) and the reason behind this might be the openness and diversity of early childhood systems around the world. As also noted previously, basic guidelines exist from different health and education organisations around the proper use of digital technologies with young children for both parents and educators. For example, statements such as the Early Childhood Australia statement on digital technology (Early Childhood Australia, 2018) or the statement from the National Association for the Education of Young Children (NAEYC, 2012a, b) provide advice about the use of digital technologies. Significant changes have also been implemented in EC National Curricula around the world incorporating digital technologies and this is a positive step towards improvement in EC educators' digital competence (see for example work from Undheim, 2022; Undheim &

Ploog, 2023). However, more work is vital as EC educators do not have a model they can adopt that is easy to implement, flexible and adjustable to young children helping them plan their everyday digital educational practices.

The present study examined Chinese very young children's educators' beliefs and experiences around the use of touchscreen technologies. This study contributes to research on EC technology research in four ways. First, it examines the availability and use of touchscreens in ECE in China to reflect the fast change in the digital landscape of young children's educational settings. Second, exploring factors influencing EC educators' technology use and confidence will shed light on their professional learning and development. Third, focusing on EC educators of children under three is imperative as the first three years of young children are crucial for their development and their educator's role is key in enabling holistic development. Finally, recruiting Chinese educators as participants expands the scope of international early childhood technology research, which is dominated by Western research.

Literature review

Although there is increasing penetration of digital technologies in early childhood educational settings, effective technology integration into early learning and development has not been widely established in many countries and areas (Blackwell et al., 2014; Dong & Newman, 2018; Mertala, 2019a). Factors influencing technology integration can be manifold and complex, but considerable research has shown that educators' beliefs about the use of digital technologies can strongly impact their technology practices and affect technology integration into teaching and learning. If educators believe that technology is useful then they are likely to adopt and utilize it in their educational practices (Dong & Mertala, 2019; Ertmer & Ottenbreit-Leftwich,

2010; Fotakopoulou et al., 2020; Hatzigianni & Kalaitzidis, 2018). Unless educators perceive digital technology as valuable, they will be unwilling or unable to use them meaningfully.

International early childhood studies on both preservice and in-service educators found that they were positive about the role of digital technologies and believed that technologies can support their early childhood practices when their pedagogical philosophy was also progressive and child-focused (Hatzigianni & Kalaitzidis, 2018; Ihmeideh & Alkhawaldeh, 2017; Mertala, 2019b). In the Chinese context, Dong and others identified (2018, 2019) that many Chinese EC educators, including preservice educators, held a widespread view that technologies have made their teaching more 'effective' than traditional methods (e.g., drawing on blackboards) and enhanced children's learning by broadening their knowledge (Dong & Mertala, 2019; Dong & Newman, 2018;). It is worth noting that research into the experiences of educators who work with children (under 3) in China is scarce.

Existing literature also shows that EC educators experienced various barriers which prevented them from utilizing technologies in their everyday work, despite their positive attitudes and beliefs towards technology use. One of the top barriers for ECE educators to integrate technology into their educational practices is the lack of sufficient knowledge during their initial teacher education studies (Brown et al., 2016; Hu & Yelland, 2017; Luo et al., 2021; Tondeur et al., 2017), but also the absence of effective, continuous and targeted professional development (Falloon, 2020; Fernández-Batanero et al., 2022; Galindo-Domínguez & Bezanilla, 2021). A plethora of research around the world has strongly recommended the need for more strategic, dynamic, authentic, personalized, in-site, flexible, collaborative, and systematic professional development for early childhood educators (Dardanou et al., 2023; Fotakopoulou et al., 2020; Gudmundsdottir & Haltvik, 2018; Luo et al., 2021)

Additionally, previous research has classified barriers into two categories: first-order extrinsic barriers and second-order intrinsic barriers, according to Ertmer's theory (1999) for the lack and ineffective use of technology in educational contexts. First-order barriers are those obstacles that are extrinsic to educators and described in terms of the types of resources (e.g., access to devices, time, training, and support). Second-order barriers are deeply rooted in teachers' underlying beliefs about teaching and learning (perceptions of technology value, educational philosophy), which are often believed to cause more challenges than first-order barriers. Due to these barriers, EC educators were reported to have a lack of confidence and competence in adopting technologies into their daily practices (Aubrey & Dahl, 2014; Gudmundsdottir & Haltvik, 2018). Despite the opportunities to integrate technology into meaningful and child-centred practices, they were using it in a more traditional and didactic way (Blackwell et al., 2014, Dong & Mertala, 2020).

In summary, the lack of research and effective professional development is evident in early childhood education and this lack is even greater when focusing on the youngest children (birth to three). This study contributes to diminishing this gap and offers useful insights from an alternative, diverse educational context in the Eastern part of the world, China.

Early Childhood Technology Education in China

At the beginning of the 21st century, China has consistently given priority to education, adapting to the international trend of educational reforms and the application of new technologies in education. In early childhood education, as early as 2002, Shanghai, one of the largest coastal cities, started to emphasize the integration of technologies and media into educational practices to support early learning and development. For instance, the *Shanghai*

Early Childhood Education Curriculum Guidelines (Shanghai Education Commission, 2002, p. 2) first mentioned that EC teachers should effectively integrate technologies and media into the curriculum and "young children should experience the impacts of scientific and technological achievements on life." Four years later, the Shanghai Education Commission (2006a) explicitly stated that the availability and use of digital technologies should meet the needs of teaching and promote communication between childcare centres, parents and communities. For instance, children's rooms should be equipped with a TV, a tape recorder, a video recorder, and an electronic player used with headphones (Shanghai Education Commission, 2006). The multimedia classrooms in each centre should have internet connection, computers, electronic projectors, and a stereo system for different activities (Dong, 2014). In its latest version (Shanghai Education Commission 2020), this policy specifies the provision of audiovisual toys and digital players, point-to-pens and interactive books, and digital audio equipment, as well as media devices that support interaction in children's reading areas. For teachers, they need to be provided with access to a range of digital devices, such as computers (desktop or laptop), printers, and internet connections in teachers' offices. This policy partially recognized technology potential for teaching and enhancing relationships with stakeholders, such as parents and teachers, but the value of digital technologies for early learning and development is not explicitly stated.

In the next few years, Shanghai issued a series of '*Three-Year Plan'* (e.g. 2011-2013, 2019-2021) for early childhood education, emphasizing the effective use of digital resources to enhance the quality of ECE services (Shanghai Municipal Government, 2010; 2019). While these plans require EC teachers to use digital technologies to innovate curriculum content and pedagogy and support children's learning and creativity, it does not refer to EC teachers'

professional learning and development in relation to technology use. In recent years, the use of

digital technologies has been given significant attention by local policymakers. These efforts

have set a leading model for introducing technologies into ECE for other regions across the

nation (Dong, 2014). However, there is an assumption behind the efforts to incorporate digital

technologies into ECE. That is, when teachers have adequate technologies in their educational

settings, they would then adopt them and innovate their educational practices (Ertmer, 1999).

The underlying assumption that digital technologies can improve education is prevalent and

governments have invested in it for fear of being left behind (Nordkvelle & Olson, 2005;

Stephen & Edwards, 2018). However, anticipated changes in educational practices regarding the

use of digital technologies have yet to be realized in China (Dong, 2014), with questions relating

to EC educators' confidence and competence in using technologies remaining unaddressed.

Methodology

The design of this study is determined by the nature of the research problems and the questions

being asked in the study (Patomäki, 2021). The main purpose of this study is to explore Chinese

early childhood educators' beliefs and experiences around touchscreen use. According to

Creswell (2008), the combination of quantitative and qualitative methods can help identify the

trends and general characteristics, as well as provide in-depth knowledge of participants'

perspectives and experiences. Thus, this study utilizes both quantitative and qualitative data to

address the following research questions:

1)   What are Chinese EC educators' beliefs about and experiences (e.g., access, skills and

confidence) with the use of touchscreen technologies by children under three years of age?

2)   What factors have influenced Chinese EC educators' beliefs and experiences (e.g. skills, confidence and use) around the use of touchscreen technologies?

Research Methods and Ethics

The study gained ethical approval from the Human Research Ethics Committee at the first author's university. The targeted participants in this research were EC educators who work with younger children (under three) in ECE settings in Shanghai. All EC educators of children under three in Shanghai were invited via email to answer the questionnaire through the local early childhood education organization. Information letters and consent forms about the study were provided. Anonymity and confidentiality were ensured, and participants were given the right to withdraw their participation at any time. Throughout the paper, pseudonyms are used to refer to the participants.

The study involved an online questionnaire, adopted from Hatzigianni and Kalaitzidis (2018). The online survey was created with Qualtrics including both closed and open-ended questions. In the open-ended questions, participants were asked to provide further specifications for their responses. This paper reports on:

a) Part 1:

1)   demographic background (e.g., age, qualifications and experiences).

2)   skills in using digital technologies. There were 35 statements (e.g., "I feel confident in using tablets;" I know how to connect to wifi;").

3)   confidence in the general use of digital devices, confidence in integrating technology with children under three, and the reasons for their confidence ratings.

b) Part 2 included questions about teachers' use, access and knowledge. More specifically, it had questions around:

1)   their personal and professional technology use (hours of technology use weekly and reasons).

2)   the technological devices and hours of use with children under three.

3)   their knowledge about children's home technology use and communication with families.

Data Analysis

The quantitative data collected from the questionnaire were analyzed using SPSS Statistics 28. Descriptive statistical analyses were first conducted in order to explore EC educators' experiences with the use of touchscreen technologies. The relationship between educators' training, skills, confidence and use of technology was explored with correlational analysis. Simple linear regression analyses were performed to explore how different factors predicted the overall use of technology by educators with young children.

Qualitative data reported in this paper were generated from open-ended questions in the questionnaire. Content analysis is the classical method of analysing responses to open-ended questions, which are usually short and limited by the context of the question (Züll, 2016). The analysis process consists of the following steps: Firstly, the written responses were organized in a Word document with an appropriate identifier for each respondent, then imported to NVivo. Secondly, initial coding was derived directly from the textual data. For instance, the participants were asked to provide comments about their training and professional development. All the written comments from the participants about their training and professional development were first coded into the same category: training and professional development. Within this category, participants' responses were their descriptions of their training content and needs. Thus, a new

sub-category 'Training content and needs' was created. Lastly, refined codes and themes were discussed among researcher number one and her research assistant, as well as the author team to ensure consistency.

Participants

The total sample comprised 1276 EC educators working with children under the age of three. More specifically, 98% (1250) of the participants recruited were female educators and 2% (25) were male. Participants were distributed approximately equally to three age groups: 31.3% of the participants were under 30, 37.6% were between 30-40 years old and 31% were above 40 years of age. The vast majority of the participants held a university degree (82.8%), a considerable number (13.1%) had obtained a College degree, a smaller number had completed post-graduate studies (1.4%) and a limited number (1.0%) reported a vocational qualification. Regarding their experience working with 0-3 years, 58.95% of the EC educators had worked for 0-5 years. Table 1 provides all the details around participants' work experience with very young children.

Table 1: Years of experience with children 0-3 years old

Years of experience	Frequency	Percent
0-5	752	58.9
6-10	269	21.1

11-15	131	10.3
16-20	48	3.8
More than 20	76	6.0
Total	1276	100.0

Findings

In this section, quantitative findings will be presented first focusing on educators' beliefs and experiences with touchscreen technologies (first research question). The examination of factors associated with touchscreen use will follow (second research question). The findings of the qualitative analysis will be also reported.

1) *Educators' access and use of touchscreens*

Table 2 (please see Appendix) summarises the usage of technology by EC educators in the early years settings. Less than half (39.4%) of the educators reported that they had access to the internet across the centre, compared to a higher percentage of 53.6% having secured access to the internet for staff in the office. A significant percentage of the educators (67%) reported the existence of computers/laptops in each room with 41% responding that they were provided with computers/laptops for their personal use. A relatively lower percentage (25.2%) responded that they were supplied with tablets in each room with 29% being supplied with tablets for themselves.

Interactive whiteboards were less popular (15%) than tablets in each room and for educators (15.8%). Robotics were scarce (4.2%) in the early years' settings.

Educators reported on the hours they shared with the 0-3 aged children on the different devices in their settings. The most preferable devices were mobiles/smartphones followed by computers and laptops, and educators reported one to two hours of usage per day. The majority had mainly used mobiles/smartphones (83.1%) with half of them having spent more than three hours. Desk computers or laptops (79.3%) and tablets (52.0%) were also frequently used outside their workplace. However, their time spent on these devices was generally less than two hours per day. Educators spent significantly less time on robotics and interactive whiteboards, as shown in Table 3 below.

Table 3: *Hours educators spent on different types of technology with 0-3 aged children*

Time spent	Hours on different types of technology (Frequency/Percentage)			
	Hours on Mobile/smartphone	Hours on Computers/laptops	Hours on Interactive Whiteboards	Hours on Robotics
0 hours = no use	149 (11.7)	48 (3.8)	521 (40.8)	615 (48.2)
1-2	773 (60.6)	627 (49.1)	219 (17.2)	53 (4.2)

3-5	184 (14.4)	376 (29.5)	18 (1.4)	7 (.5)
more than 5	82 (6.4)	177 (13.9)	14 (1.1)	3 (.2)
Total	1188	1228	772	678

2) *Technology Training and Needs*

Chinese EC educators were asked about the number of hours of technology training they have received over the last five years, training content and their satisfaction with their training. A significant number of the EC educators (38.2%) responded that they had completed less than 20 hours of training with 33.2% reporting that they had received between 20 to 60 hours of training. Only 21.5% had completed 60 hours and above and 6.6% responded that they had not received training at all (see Table 4).

Table 4: *Hours of technology training of EC educators in the last 5 years*

Hours of training	Frequency	Percent
None	84	6.6
Less than 20 hours	488	38.2
20-60 hours	423	33.2

60-100 hours	144	11.3
More than 100 hours	130	10.2
Total	1269	99.5

The training they received in the last five years was mostly on how to integrate software and applications in their teaching (28.4%), how to use certain hardware, software and applications (14.6%) and on both technical and pedagogical aspects (52.7%). The majority of the Chinese EC educators (74.6%) responded that they were overall satisfied with the technology training they have received, with 12.9% reporting that this was very true of them and 8.9% admitting that this was not very true of them (Please see Table 5 in the Appendix).

3)   *Competence and Confidence*

The digital skills statements were answered on a five-point Likert scale ("not at all true of me" to "very true of me"). A total score was calculated ranging from 35 to 175. Overall, educators rated themselves quite highly for their digital skills, with the majority having a total score of 105 (mean 141.77 and *SD* 25.93), as shown in Table 6 (Please see the Appendix).

Interestingly, despite the high score in digital competence and confidence for personal use, educators' confidence in using touchscreen technologies with very young children was lower. When they were asked to report their confidence level on a scale from 0 to 10 (10 was the highest score), a total of 43% had rated themselves over 7 with a mean of 6.95 in terms of personal

technology use. In contrast, fewer educators (35%) had a self-rating over 7 with a mean of 6.59 for their professional use with very young children. Their confidence in using technology was affected by a variety of factors, such as a shortage of tools or resources and support, as shown in Table 7 (Please see Appendix). Specifically, a total of nearly a third of the participants reported that the lack of training was the most important reason for not having high confidence as Table 7 reports.

Further, Table 8 (please see Appendix) demonstrates a range of intrinsic factors affecting educators' confidence in using technology with children under three. According to their reports, 'using technology with very young children was against their teaching philosophy', being mostly true (25.1%) or very true of them (23.8%). Following this, about one out of four educators indicated that 'managers do not support the use of technology with very young children'. Also, a small percentage of educators indicated that the 'workplace does not allow technology for under three years old children' was mostly (12.6%), and very true of them (8.9%).

Further, the responses from the participants generated a main theme of the need for training and professional development. Under this theme, three subcategories regarding specific needs for training and professional development were further created. The percentages of their responses were calculated in relation to the total sample of the study. They are (1) professional development for early childhood professional knowledge (34.3%); (2) the need for developing technological knowledge, skills and understanding (69.7%), (3) training to develop skills for communication with families, and administration management (32.1%). It appears that more than two-thirds of participants wished for more training opportunities to develop their knowledge and skills in using technologies and gain a better understanding of technology integration. For instance, one educator wrote that she would like to learn "*how technologies can be best used in teaching practices.*" A few mentioned the need for training to develop their

technology skills in using devices, such as interactive whiteboards and robotics, or designing PowerPoints and animations for teaching

4) Relationships between Educators' Training, Skills, Confidence and Overall Use

A Pearson correlation coefficient was computed to assess the linear relationship between age, current position, years of experience with 0–3-year-olds and years of training. Table 9 (please see the Appendix) displays the following correlations: A positive correlation was found between age and current position, r (1273) = .22, p = <.001. A positive correlation was also found between age and years of experience r (1274) = .50, p = <.001. A negative correlation was found between age and digital skills r (916) = -.28, p = <.001. A positive correlation was also recorded for the years of experience with 0-3s and digital skills r (911) = .205, p = <.001. Finally, as is demonstrated in Table 9, a positive correlation was found between hours of technology training and digital skills of educators r (911) = -.21, p = <.001.

A simple linear regression analysis was performed to explore if the educators' confidence in using technology significantly predicted the overall use of technology with young children. The overall regression was statistically significant ($R2$ = .005, $F(1, 948)$ = 4.552, p = .033. It was found that confidence significantly predicted overall use (β = .493, p =.033). Further, another simple linear regression analysis was performed to explore if the educators' digital skills with using technology significantly predicted the overall use of technology with young children. The overall regression was not statistically significant ($R2$ = .001, $F(1, 755)$ = .000, p = .990. It was found that digital skills did not significantly predict overall use (β = .000, p =.990).

Discussion

This study explored a large sample of Chinese EC educators and their beliefs and experiences around the use of touchscreen technologies with very young children. As explained in the introduction and the literature review of this paper, a very limited research exists in this field. Given the ongoing increase in accessing and using digital devices from a very young age and, also the significance of this age for building healthy foundations of personality and strong academic abilities (REF), exploring the role digital technologies play is extremely important.

Educators reported that they had good access to digital technologies. Desk computers and laptops were the most frequently used devices by Chinese educators. This finding is consistent with previous research (Dong, 2016a; Liu & Pange, 2015; Weng & Li, 2018). However, new technologies (e.g. robotics. Interactive whiteboards) or a variety of devices was not reported. The provision of these devices appears strongly related to educators' pedagogical preferences for digital use in their practices. Earlier interviews and observational studies consistently found that Chinese EC educators had mainly used these devices as a display to replace traditional blackboards to conduct group teaching (Dong, 2016b; Liu & Pange, 2015; Luo et al., 2021). Previous research argued that Chinese EC educators preferred to use desk computers/laptops to show PowerPoints to young children or display content on the interactive whiteboard. Other studies have explained such a traditional, didactic approach to technology use. Chinese EC educators believed these screen technologies to be beneficial for their teaching as they could instruct and deliver knowledge to children in a large group, which aligns with their traditional teacher-centered practices (Dong & Mertala, 2020; Li, 2015). Luo and her colleagues (2021) further noted that EC educators' choice of technological pedagogies tended to focus on passive implementation rather than approaches that support conservative instructional practices. For instance, they found that Chinese EC educators

most frequently used a computer to play videos or engage children in listening to music. Notably, such a low level of technology use supporting traditional and teacher-directed practices was also reported in Western studies (Blackwell et al., 2014; Ertmer & Ottenbreit-Leftwich, 2010).

Compared with access to computers/laptops, touchscreen and interactive technologies (e.g., iPads) that can enable young children's active use and interaction were scarce in children's rooms. This might be because the key early childhood educational policies (e.g., curriculum guidelines) had not specified the provision of digital technologies for children's play and learning (Shanghai Education Commission, 2002; 2020). Another possible explanation is that educators were concerned about the harms of screen devices on young children's health, as evidenced in the comments from the participants saying watching screens is harmful to children. Indeed, several recent Chinese studies show that ECE stakeholders including educators and parents were strongly concerned about possible threats to children's health, in particular eye vision (Cao et al., 2021; Dong & Mertala, 2021). However, these concerns do not seem to apply when children are passive viewers of TV or IWB content. Future studies on educators could focus on exploring their teaching beliefs around differences between passive and active engagement with digital technologies and the impact on children's health and development. Despite the required provision of the Internet for Shanghai EC centers by the local government (Shanghai Education Commission, 2020), only slightly more than half participants in the study had reported their access to the Internet in the office indicating a gap between the policy goals and its implementation. Internet access in children's rooms was even lower. This could be a barrier for educators accessing online resources.

Overall, touchscreen technologies owned by these Shanghai kindergartens were limited, compared with those owned at children's homes (Niu et al., 2018). This might mean that young children growing up in rich home digital environments with more sophisticated resources may

experience a 'disconnection' when they come to using digital devices for play and learning in educational settings. It might also mean that children with no or very limited access to the internet or digital devices at home also have inadequate opportunities in their early childhood setting, which potentially could contribute to widening the digital divide. This area needs further examination as it has consequences for equity and children's development.

Lack of technology tools/resources was reported by the educators as one of the main factors influencing their confidence in using technologies with young children. This finding is important as it was found that educators' confidence in using technology significantly predicted the overall use of technology with young children. Educators' confidence was more significant in predicting their technology use than their high digital skills score. This finding aligns with prior studies that confidence is one of the greatest predictors of teachers' technology use (Nikolopoulou & Gialamas, 2015; Wozney et al., 2006). These findings support the hypothesis (Blackwell et al., 2014) that first-order extrinsic barriers (e.g., access, support) can directly influence technology use and have indirect effects on use through the second-order barriers of confidence. This suggests that time and effort should be devoted to providing sufficient technological infrastructure and increasing teachers' confidence in using technology.

In addition to inadequate access to technologies, a lack of sufficient training was identified by most educators as the key factor influencing their confidence in using technologies with very young children. This result aligns with the early childhood technology literature (Dardanou et al., 2023; Hatzigianni & Kalaitzidis, 2018; Nikolopoulou & Gialamas, 2015). However, it should also be noted that the majority of Chinese educators in this study (87,5) reported overall higher satisfaction with their training than their colleagues in Western studies (e.g., Hatzigianni & Kalaitzidis, 2018). Nevertheless, a large number of Chinese EC educators reported the need for

further professional development. This is not difficult to understand as technology devices and digital resources are fast changing and advancing, EC educators need ongoing professional support to help them acquire complex knowledge and skills to use new and emerging technologies in diverse, digitally-mediated environments (Falloon, 2020; Fernández-Batanero et al., 2022; Galindo-Domínguez & Bezanilla, 2021). Indeed, professional learning and development was a crucial factor for enhancing the educators' competence in using technologies, as evident in the relationship of the significant statistics between technology training and digital skills.

Furthermore, both technology training and skills did not predict educators' overall technology use with young children. This may suggest that their received training might be problematic or ineffective as it had not 'activated' fundamental changes in these educators for technology integration. Luo and others (2021) studied Chinese pre-service teachers' technology integration and revealed that their technology training was mostly technocratic, focused on how educators can operate devices and deliver content with technology. There was little evidence in their study that the training programs demonstrated how to create participatory learning environments that used the technology in open and exploratory ways or fostered critical reflections on the pedagogic possibilities of fostering children's engagement through creation, collaboration, experimentation, or social interactions mediated by digital tools. Their findings suggest that Chinese initial teacher education programs have not prepared EC educators for incorporating technologies into educational practices. As suggested by other studies (Dardanou et al., 2023; Hatzigianni and Kalaitzidis,2018), future training and professional programs for both preservice and in-service educators in China should be ongoing and tailored to address their everyday needs and interactions with very young children.

Previous studies have identified the same issue regarding the lack of training and professional development for both pre-service and in-service EC educators in China (Dong, 2016a; Liu & Pange, 2015; Luo et al., 2021) and other parts of the world (Falloon, 2020; Fernández-Batanero et al., 2022; Galindo-Domínguez & Bezanilla, 2021). Results from this study suggest this remains to be a large barrier to developing educators' competence in integrating technology. This barrier requires proper attention to be resolved soon. The Chinese *Early Childhood Teachers Professional Standards* (Ministry of Education, 2012) only briefly mentions that "EC educators should know new technologies (section two)", without mentioning the competence of using them in educational practices. Due to the lack of explicit reference to the development of educators' digital competence in these Professional Standards, the current Chinese ECE system may not guarantee sufficient and equal opportunities for technology professional development for all EC educators. Chinese educational authorities and policymakers could refer to international documents, such as reviewing the effectiveness of the European framework for digital competencies introduced back in 2017 (Redecker, 2017) for all educators and adapting relevant elements to improve existing principles and practices.

Although training and professional development are vital issues for ECE, this study also revealed that just training or good digital skills do not guarantee EC educators' successful technology integration. Results showed most educators rated themselves quite highly for digital skills, but their confidence in using technology with very young children was lower. As explained by Ertmer (2012), educators may believe that technology helps them accomplish professional and/or personal tasks more efficiently, but they are reluctant to incorporate the same tools into the classroom for a variety of reasons. Second-order intrinsic barriers such as beliefs or teaching philosophy can be more important to educators' use of technology than first-order barriers (Ertmer

et a. 2012). Blackwell and others (2012) pointed out that EC educators' beliefs on technology use may be more pertinent because of the historical debate over the role of technology in young children's life. Nearly half of the educators in this study reported that using technologies with 0-3 aged children was against their teaching philosophy and some of them were worried about harming children's eyesight/development, a consistent finding with prior studies (Dong & Mertala, 2021; Fotakopoulou et al., 2020; Mackay et al., 2022). Besides, about one out of six educators believed that very young children should not use technology. As noted by other researchers (Lindahl & Folkesson, 2012; Tondeur et al., 2017), educators' confidence or anxiety about technology is correlated with their actual use. Educators with negative beliefs or concerns were less willing to use technology in their practices while working with very young children. Similarly, recently Romero-Tena et al. (2020) postulated that "… rather than blaming pedagogy, the knowledge, and skills that early childhood teachers have, one should point to those psychological factors such as their self-perceptions of use. This fact will directly influence their integration in the classroom." (p. 2). The findings of this study clearly showed that confidence is more influential for Chinese educators in deciding to use technology with very young children than their digital skills. This finding underlines the importance of a new line of research around educators' perceptions, self-efficacy and other personal attributes which might be vital in making decisions around the integration of technologies in their everyday practice.

Limitations

A limitation of this study was the employment of convenience sampling which limits the possibility of generalising our results to the Chinese population. Additionally, our sample comprises about half of the participants with less than five years of experience in working with very young children. These educators do not represent the diverse early childhood workforce. A

second limitation the focus of this article was on the quantitative data and it didn't allow the space to present the interview data that will be presented in a future publication Finally, the use of cross-sectional design allowed us to analyse the data from a sample of the Chinese EC educators at a single point in time, but didn't enable us to follow the educators over time and explore their e development and change. The cross-sectional design cannot reveal the causality and voluntary participation could be prone to selection bias (Taris et al., 2021).

Conclusions

This study offers very useful insights into Chinese EC educators' beliefs and experiences around the use of touchscreen technologies. Focusing on Chinese educators adds to the diversity of findings in this line of research, making it more inclusive but also highlights similarities (e.g., high digital skills; confidence as the key factor in technology integration) and differences (e.g., higher satisfaction with training). Additionally, the findings of this study significantly contribute to our knowledge of the use of digital technologies with our youngest children, under the age of three, who are the first users of technology. Broadening our understanding of how digital technologies are introduced and experienced by very young children and their first educators is vital to be able to maximise the positive impact of technology on children's development while mitigating potential risks and challenges.

Given the significance of this research and the lack of evidence for this age, the need for developing specific educational policies that can support ongoing and systematic professional development for early childhood educators is imperative. Empowering educators to navigate the unique challenges and opportunities associated with introducing technology to very young children will ensure a brighter future for all.

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