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What do Teachers say about Young Children's ICT Skills? An Investigation of Three Kindergartens in China

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Abstract

Information and communication technology (ICT) has become a ubiquitous component of many people's daily lives. While some kindergartens have begun to pay attention to young children's ICT skills, little is known about how teachers perceive this shift and in what ways they are emphasising these skills in kindergartens. Such research is particularly uncommon in China. This study explored how teachers perceive the significance of children's ICT skills and how they taught these skills in kindergartens in China. By interviewing fifteen teachers in three kindergartens in Nanjing, this study found that participants generally considered ICT skills to be an important capability for children although they had various interpretations of their definition. Additionally, it was found that participants had different perceptions of how children could learn ICT skills in kindergartens. The analysis suggested that a clearer and shared definition of ICT skills should be provided by policymakers.

Keywords

ICT skills; Kindergarten education; Teachers' perceptions and practices; Early childhood

Introduction

Information and communication technology (ICT) has become a pervasive component in many people's lives (Yelland, 2005). Despite the debate about the role that ICT should play in early childhood education (ECE), some kindergarten teachers have begun to implement ICT in teaching and learning in some countries (e.g. Australia, UK) to facilitate children's learning and development, to equip them for education and employment, and to implement good pedagogies (Dong, 2014; Yelland, 2005). According to Wren et al. (2018), ECE teachers saw benefits beyond ICT-supported pedagogies as they believed children's learning of ICT skills was itself important. Similarly, Yelland (2015) argued that the use of ICT in the ECE context was not only to enable better pedagogies but also for children's development of a specific skill in this new era – digital literacy.

Digital literacy is an evolving concept without a universal definition, because "different technologies give rise to different sets of skills and competences" (Marsh, 2016, p. 5). Through reviewing literature on the ECE context, it was found that digital literacy is often considered as the skills and knowledge that children can gain from using digital devices, including ICT-operating skills and the abilities for accessing and making use of information purposefully (Sefton-Green et al., 2016). This definition was used for the study reported here. It was evident

that researchers in the ECE context used different terms to refer to digital literacy, including digital skills (Marsh, 2016), information skills, and ICT skills (Kerckaert et al., 2015). As the research was conducted in China and there is no accurate translation for *digital literacy* in Chinese, the term *ICT skills* is used throughout the article.

In China, both teachers' and students' ICT skills have received much attention in recent years (Wu, 2014). The Ministry of Education of China (MoE) issued documents and policies on integrating ICT into a wide range of educational settings, including the ECE context. The *National Development Plan for ICT in Education (2011-2020)* (MoE, 2012), the most significant document in this context, emphasises the importance of teaching students ICT skills to support their active and collaborative learning, and to facilitate students' problem-solving and information-searching skills in the information age. However, little is known about how teachers perceive kindergarten children's ICT skills and in what ways teachers have taught these children ICT skills in China. Furthermore, as the national plan does not provide a clear definition of ICT skills, this may have resulted in teachers making various interpretations and causing further confusion. Based on the research problem, this study investigated how ICT skills are perceived by kindergarten teachers in China.

Young children's ICT skills

Young children's ICT skills are fairly widely believed to be important for their future learning and development. For example, in a study investigating parents' perceptions of children's ICT use, Collins (2013) found almost all participating parents reported that their children had gained ICT skills that enabled them to navigate different ICT devices. The parents advocated for children's learning of ICT skills because they believed this could benefit their school readiness. Similarly, a survey of 1,365 ECE teachers in the US by Blackwell (2015), reported the majority of the participants appreciated the value of ICT for preparing children for future study and work.

Evidence that ICT skills are considered an essential part of school readiness, has gained attention in some ECE settings. Children's ICT skills have been emphasised by some ECE teachers in recent decades, and become an important part of teachers' rationale for using ICT in teaching and learning activities in ECE settings (Wren et al., 2018; Yelland, 2015). ECE teachers' attention to children's learning of ICT skills had been reported by Edwards (2005) as early as 2005. By interviewing 12 teachers about their rationales for using computers in ECE settings in Australia, Edwards found participants saw children's acquisition of computer skills as an important reason for using computers in ECE settings. However, Edwards' research could only tell a partial story of how teachers perceived children's ICT skills as she specifically focused on the use of computers in ECE settings.

Teachers' advocacy for supporting children to gain ICT skills is not unique to the Australian ECE context. After surveying 232 teachers about their use of ICT in ECE settings in Flanders, Kerckaert et al. (2015) also found almost all teacher participants considered ICT as a separate subject and argued that this was largely an outcome of the perception held by teachers that they need to use ICT to "support young children's ICT basic skills" (p. 2) in order to ensure their educational future. However, it seemed that researchers simply considered those skills as the ability to operate ICT devices, and they did not report on how the teachers taught children ICT basic skills in practice. More importantly, those studies were conducted in contexts which have different educational approaches and social and cultural norms; therefore, those findings might have limited value in understanding teachers' perceptions in China.

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In the global context, effort has been made to explore the ways children's learning of ICT skills could be supported (Fau & Moreau, 2018; Marsh, 2016). A UNESCO report (Fau & Moreau, 2018) showed technological infrastructure (telecommunications networks and physical infrastructure) play an important role in supporting children's development of ICT skill. However, the report also suggested that the level of children's skill is influenced more by usage than by access. The report indicated that the number of devices and wider access to ICT would not automatically result in increased ICT skills. Other researchers have emphasised that teachers have a significant role to play in children's ICT use (Liu & Pange, 2015), because in kindergartens the teachers are the ones who design and support ICT-related pedagogical activities. In the same vein, how teachers perceive children's ICT skills and how they support children's learning of them might influence their development.

In the UK, after investigating children's ICT skills in using tablets by surveying 2,000 parents and observing six children's ICT use in the home, Marsh (2016) argued that, although children are able to navigate technological worlds with confidence and competence relative to their age, they would not develop ICT skills in a seamless manner. Marsh concluded that ECE teachers should not make assumptions about children's ICT skill. However, this suggestion provided by Marsh was at a theoretical level, as she did not investigate teachers' practices; empirical evidence regarding how teachers perceive children's ICT skills and in what ways they support children's learning of ICT skills is of significance for this research topic.

Previous studies have shown that both teachers and parents believe that ICT skills are important for children's future learning and development. To address the research gaps noted earlier, the study reported in this article aimed to investigate how kindergarten teachers perceive the significance of ICT skills and how they articulate their practices related to children's learning of ICT skills. In China, researchers found that kindergarten teachers' perceptions of, and practices in, ICT are shaped by the traditional Chinese culture (Dong, 2014; Liu & Pange, 2015), therefore an introduction to the Chinese traditions in ECE is of significance for this study. ECE in this study was defined contextually. In China, ECE refers to educational institutions that provide teaching and caring services for children from three to six years of age (National Education Committee, 1996).

ECE in China

Chinese ECE programmes, profoundly influenced by Confucianism, emphasise virtue and relationships and specifically focus on desirable child behaviour (Yang & Li, 2019). Confucianism suggests that a "good" child should be obedient to parents, self-disciplined, respect teachers, and have high academic achievements (Li & Chen, 2016). Communist ideas and collective values are also reflected in Chinese ECE, because China's government began to implement the curriculum model of the Soviet Union after the Communist Party came into power (Zhu, 2015). This curriculum model adopts a teacher-centred pedagogy and focuses on planning and promoting routines, so that children's daily activities follow rigid schedules planned by teachers (Li & Chen, 2016). Since collectivism respects unity, China's kindergarten teachers tend to conduct teaching activities and games in big groups (Rao et al., 2017).

In recent decades, the educational principles adopted in China's kindergartens have been gradually modified due to the introduction of educational theories from other countries, such as cognitive constructionism by Piaget and social constructionism by Vygotsky (Li & Chen, 2016). These principles have evolved from emphasising teacher-led strategies to advocating child-led

strategies, and from encouraging collectivism to respecting individual difference (Rao et al., 2017). These ideas, however, are not generally reflected in teachers' practices as they encountered some cultural incompatibility when introduced to China's kindergartens (Zhu, 2015). Similarly, as a new topic in the Chinese ECE context, children's ICT skills may also encounter some challenges. For example, would the teachers teach children ICT skills in a big group because of the collectivism? Little is known about ECE teachers' current perceptions and practices, so empirical evidence is needed, in order to offer future support and guidance.

There have been some studies related to kindergarten teacher's perceptions and practices of ICT implementation undertaken in China in the past decade (Dong, 2014; Guo et al., 2006; Liu et al., 2016), but they generally focused on how teachers use ICT to enhance teaching and facilitate children's learning. It seems that no Chinese research has investigated how teachers perceive the importance of children's ICT skills and how they support children's learning of these skills. In terms of using ICT for general pedagogical purposes, although kindergarten teachers were generally found to hold neutral to positive attitudes toward ICT, their practices around its use varied from study to study. For example, in a survey study in Qingdao City (Liu et al., 2016), 62 kindergarten teachers' use of PowerPoint was investigated, and the results showed that participants frequently used PowerPoint in teaching activities. Most teachers had positive attitudes toward PowerPoint, believing it can attract children's attention and facilitate teacher-child interactions. In contrast, after surveying 316 teachers in 20 kindergartens in Shanghai, Dong (2018a) found that participants infrequently used ICT, despite their positive attitudes toward the role of ICT in education. The two studies focused on using ICT for general teaching purposes rather than specific ICT skills.

To fill the research gap, this study adopted a qualitative research approach to gain an in-depth understanding of kindergarten teachers' perceptions and practices in teaching kindergarten children ICT skills in one technology enabled city in China.

Research design

The research was based on interpretivism, in which each individual constructs meanings and his/her experience through social interaction (Guba & Lincoln, 1994). A qualitative methodology was selected to investigate and understand teachers' perceptions and experiences. Individual interviews were used to explore teachers' perceptions and experiences related to children's ICT skills. A semi-structured format ensured the researcher was able to raise spontaneous questions to further investigate the respondent's answers (Borg & Gall, 1983). The interview questions were generally about the use of ICT in participating kindergartens. Some questions aimed to investigate participants' thinking around children's ICT skills, including but not limited to:

- How do you think about children's ICT skills? Why (or why not) are they necessary?
- In what ways have you supported children's learning of ICT skills?

Data were collected in three kindergartens in Nanjing, China. Before conducting the interviews, the leading researcher invited some friends who had worked in kindergartens in China to give feedback on the interview questions. The aim of the pilot was to identify whether these questions were useful for gaining the necessary data, and whether they could be interpreted in a straightforward manner. In the main study in China, each interview was conducted in an empty room in the kindergarten, during children's nap-time or after the children left the kindergarten.

All interviews were conducted in Mandarin, audio-recorded and later transcribed and translated by the researcher for analysis.

The sample included fifteen kindergarten teachers; demographic information for participating teachers is presented in Table 1. The participants were selected based on two criteria: a minimum of one year using a range of ICT in teaching, and to represent a range of educational backgrounds, teaching experiences, and qualifications, so the researcher could gain diverse perspectives around the research topic. Ethical approval for the study was granted by the University of Auckland Human Participants Ethics Committee. Informed consent was gained from participants before the commencement of research; in this article, pseudonyms were used for kindergartens and teachers. The kindergarten principals also gave their assurance that the participation or non-participation in the project by teachers would not influence their relationship with the kindergarten.

Table 1.   Demographic information for participating teachers

Kindergarten	Teacher	Profile		
		Degree	Years of teaching	Age (in years)
River Kindergarten (government-funded)	Xuan	Bachelor	4	27
	Yan	Bachelor	2	26
	Xing	Bachelor	4	26
	Jing	*Vocational college	11	33
	Wan	Bachelor	12	32
	Lun	Vocational college	16	36
Lake Kindergarten (university-affiliated)	Xie	Bachelor	1	24
	Tong	Bachelor	6	30
	Jia	Vocational college	3	23
	Chen	Bachelor	1	26
	Yong	Bachelor	5	27
	Qiong	Bachelor	1	24
Stream Kindergarten (self-funded)	Dang	Bachelor	17	35
	Bai	Bachelor	5	28
	Fan	Vocational college	18	37

Note. Vocational colleges generally provide five years of training.

To analyse the data, thematic analysis was used as this can reflect the meaning behind the data by searching for patterns and themes that appear in collected information (Patton, 1990). This approach focuses on describing the underlying ideas and meanings that participants ascribed to their experiences; therefore it is appropriate for the current study which explores participants' subjective perspectives. Analysis of the data was conducted based on the approach suggested by Braun and Clarke (2006) with the support of Nvivo software programme, which includes following phases:

- Familiarisation with data: transcribing and translating interview recordings, re-reading transcriptions, keeping an analytical memo to record questions that need further investigation;

- Generating initial codes: searching for recurring elements in the raw data, using several words to reflect the ideas and meanings (for example, "ICT skills is taught in primary schools" and "ICT skills is required by future job market");

- Searching for themes: grouping similar codes (and coded data) into different categories and combining codes to form an overarching theme (for example, the two codes above were developed for the theme "ICT skills are significant for future"); and

- Reviewing themes, defining and naming themes: refining current themes and re-naming the themes when necessary (for example, the theme above was re-named as "ICT skills are significant for future learning and work" to reflect the meaning participants attributed to this topic).

Based on this approach, four main themes emerged and are discussed one by one in the following sections.

Findings and discussion

Four themes were identified during data analysis and are used here to present and discuss the findings of the study: ICT skills are significant for future learning and work; young children are already proficient with ICT; there had been a computer lab for children; and letting children explore ICT by themselves.

ICT skills are significant for future learning and work

All participating teachers believed that ICT skills could play a significant role in children's future learning and work. For example, one participant emphasised that this is an information age, and children should not be left behind:

> I think it [teaching ICT skills] is good because it means keeping pace with the times. It is difficult to survive if you know nothing about ICT in this generation; you must know it. Therefore, I think compared to children learning ICT covertly, it is better to teach them directly…about how to use ICT correctly and appropriately. (Xuan)

The participants believed one of their responsibilities was preparing children for future study and work. To explain how children's ICT skills were related to their future study, Jing raised an example that her son, a primary school student, had to make PowerPoint slides to give presentations in his class. Jing also explained that children were supposed to have computer lessons in primary school and suggested:

> … the earlier they learn ICT skills, the better level of skills they will develop in primary school. (Jing)

It seemed Jing regarded ICT skills as the ability to use both hardware and software to complete tasks. Apart from acknowledging the significance of children's learning of ICT skills, three teachers also mentioned another aspect – the awareness of using ICT to solve problems. Fan gave an explanation of the relationship between ICT and problem-solving skills:

> I think for children at this age, it is important to know that ICT can be used to solve problems…This is a topic [this awareness] that can be taught in kindergartens. (Fan)

Here, Fan seemed to consider tablets and computers as tools which could enable children to gain problem-solving skills. In this case, those ICT devices had been positioned as an aid to solving problems (i.e., using ICT to search for information online, or in order to find answers to questions), rather than the specific capability to operate ICT devices.

Based on participants' explanations, it appeared that participants conceptualised children's ICT skills in different ways. Some considered it as the operating ability and echoed Kerckaert et al.'s (2015) findings about teachers' perceptions of children's ICT skills. Other participants related ICT skills to the awareness of and ability for using ICT to solve problems, which aligned with national policies about ICT skills (MoE, 2012). The analysis showed that however participants interpreted children's ICT skills, they all believed they would benefit children's future study and work. Additionally, the findings indicated that some teachers' advocacy of children's ICT skills was influenced by the social development, which reflected Yelland's (2015) argument that children's ICT skills were prioritised by adults in the current digital era.

Young children are already proficient with ICT

Although ICT skills were generally considered an important capability, some participants pointed out that there was no necessity to teach it in kindergartens because children might already have mastered the basic skills. For example, Lun argued:

> In terms of the basic skills, I think the children already know how to use computers and tablets, they know how to turn on and turn off [the devices]… It has no meaning if we teach them something that they have already known. (Lun)

From the teachers' perspectives, children had already gained the skills needed in operating ICT devices such as computers and tablets. Jia offered an example of how the children in her class operated the computer when she used it in class:

> … when I displayed the PowerPoint slides for them, some of the children would say they want to use the mouse. Sometimes I would give them opportunities to operate it for others. In addition, when I played cartoons for them, they knew how to play the next episode. I think they are smarter than the previous generation. (Jia)

While Jia attributed children's ICT skills to their smartness, Dang gave a further explanation that children's ICT operating skills might be a result of their observations of adults' modelling the use of ICT:

> They all know ICT well, as they often observe how their family members use ICT in daily life. They can learn it by imitating them, teachers do not need to teach them on purpose. (Dang)

It appeared that participants believed children's learning resulted from the way they observe family members' ICT use, which echoed what Dong (2018b) found in Shanghai. A report in China (XinHua Net, 2016) indicated that many children are exposed to an environment which is filled with ICT, and teachers in the current study believed children are likely to observe how their

parents and teachers use different forms of ICT devices in daily life. Those models provide examples of behaviour for children to observe and imitate; in this way, participants believed children could construct the knowledge and skills related to ICT.

These findings showed participants did not perceive the necessity to teach ICT skills in kindergartens. This conflicted with the work of Kerckaert et al. (2015) in which they found most teacher participants considered ICT as a separate subject to be taught in kindergartens. One possible reason for this conflict could arise from participants' concern about children's long-time exposure to ICT. While all participants acknowledged the importance of children's ICT skills, two considered children's exposure to ICT at home as a "dangerous" thing, suggesting that teachers should not teach children ICT skills, thus to reduce their screen-time. It is noticeable that a common topic raised by the participants was concern about children's eyesight, which mirrored Dong's (2014) findings that teachers should limit children's access to ICT in order to reduce their screen time. Although those participants acknowledged they do not have evidence about the effects of ICT on children's eyesight, they chose to limit screen time and supposed the children could learn enough ICT skills at home.

There had been a computer lab for children

When the teachers were asked in what way they had supported children's learning of ICT skills, participants from River Kindergarten indicated that their site had established a computer lab several years ago. Participants explained the computer lab was established to help children have more access to computers. Lun gave a brief introduction on how the activities in the computer lab were conducted:

> …at that time, our main teaching strategy was group teaching… That was like a computer lesson, each child had one computer to use. (Lun)

Although each child got one computer to use, they had to follow teachers' instructions and practice computer-operating skills, such as the capability to turn on and turn off computers, the ability to double click the mouse, in a big group. However, those activities seemed to be task-oriented and the teachers seemed to be at the centre of the big-group activities. This finding could be interpreted using the argument of Guo et al. (2006) that teachers' practices around ICT use were profoundly influenced by Chinese traditional culture.

It was reported that the computer lab did not run for long because, at that time, more families began to purchase computers and the children could learn relevant skills by observing parents' operation (as discussed above). Wan mentioned another reason for this change:

> The technology is developing very fast and more and more ICT devices can be used for learning and work. For example, tablets emerged and quickly attracted children's attention. They are easy for children to use, as they only have to touch the screen rather than holding the mouse. (Wan)

Teachers from the other two kindergartens noted they had not conducted computer lessons in class, but some of them commented that computer labs they visited in other kindergartens led them to doubt the value of teaching children ICT skills in a big-group setting. Fan explained:

> …you should have a clear goal for the computer lesson. You should not always teach them [children] how to turn on and turn off the computers for a whole semester. Some children may have already gained ICT skills and the individual differences should be taken into considerations. (Fan)

Compared to the big-group ICT-skills teaching, Fan emphasised that children should use ICT to solve real problems. She also shared her thoughts about ways children should learn ICT skills:

> If conditions permit, I hope the children can bring their tablets to the kindergarten and we can discuss the problems they found in the games, or, I hope I can lead them to do some online searching. I think they can become familiar with ICT in the process of solving problems… ICT should not be regarded as an isolated teaching activity, it should be implemented in daily activities. (Fan)

Here, Fan connected ICT-operating skill with problem-solving ability. She also argued that ICT skills should not be taught as specific knowledge, emphasising the importance of children's active learning experience in solving real problems. This analysis perhaps revealed that, as Marsh (2016) argued, ICT skills could be interpreted in various ways and different interpretations would result in adults having different perceptions of how to support children's learning of ICT skills. Additionally, based on the analysis, this study argues that teachers' perception of, and practices around, children's learning of ICT skills could be influenced by time.

Letting children explore ICT by themselves

When queried about teachers' practices in supporting children's learning of ICT skills, many participants indicated that children could learn through individually interacting with ICT devices. As both River and Lake Kindergartens were equipped with tablets in their classrooms, teachers from these two kindergartens believed that children could learn relevant skills through interacting with tablets. A further explanation was given by Tong:

> I often step back when young children are using tablets. You know, the tablet is easy for children to use as they only need to touch the screen. Some children may not be familiar with the tablets at first, but they are happy to explore the devices by themselves. Their initial operation is quite like doing experiments; the more methods they try, the higher the level of ICT skills is. (Tong)

The excerpt showed Tong believed children's ICT skills should result from active learning: when provided with a tablet, children become active learners and become willing to try different methods of operation. In this way, Tong believed children could construct knowledge of ICT through the active learning experience. The emphasis on children's active learning experience in the real-life context is emphasised in China's national ECE guideline (Rao et al., 2017).

When asked what role she plays during the children's tablet session, Jia responded that she only provided assistance when she perceived there was a need:

> I do not want to intervene in children's ICT use. When they do not know how to use it, they can turn to me for help… Before the implementation of tablets, I needed to make decisions about which app to download, with consideration of their development level. (Jia)

It seemed that Jia played a role as an assistant when children were using tablets. The point she made about "deciding on which app to download for children" reflected teachers' role in supporting children's learning by considering their current needs and the learning goals (Liu & Pange, 2015). Based on those considerations, Jia made careful decisions about which apps to download to support children's learning at a higher level.

Although participants in Stream Kindergarten did not have tablets in classes, two of them shared their beliefs about children's "free" interactions with ICT. Although thirteen participants acknowledged the value of children's active exploration of ICT devices, nine emphasised the significance of setting rules for children's ICT use. Xie raised examples of the rules surrounding children's use of ICT:

> … you need to have many requirements for children, such as how they should use it appropriately, how to control the time spent on it… have their operating habits and the rules for use, which includes details such as the place ICT should be put after use, all of these are important. When these rules have been made, children could use the tablets effectively. (Xie)

According to Xie, obeying rules allowed the tablet sessions run smoothly. It appeared that although teachers in the study considered children's free interaction with ICT a valuable way to support their learning, participants tended to interpret the "free interaction" as a relative concept which was limited by the rules set by the teachers. It appeared participants believed children should gain ICT skills from their active but regulated interaction with ICT devices.

Benefits, limitations and conclusion

By discussing the themes above, this study has reported on an analysis of participating teachers' perceptions and their self-reported practices around the development of young children's ICT skills. Although teachers involved in the study had different interpretations of ICT skills, they all considered these skills important for the children's future. They also had different perceptions on the necessity of teaching children ICT skills in kindergartens, and therefore, they made various pedagogical decisions and mentioned different instructional practices to help children gain ICT skills. It seemed that the teacher-centred teaching approach had been the main method used to teach children ICT skills (i.e., teaching a big group of children to use computers). However, perhaps because of the current education reform in China, this approach was less favoured as participants began to value children's active exploration of ICT devices (Li & Chen, 2016; Zhu, 2015).

The analysis found participants' perceptions related to children's learning of ICT skills were shaped by the current context of ECE in China. As explained above, previous researchers had suggested that ECE in China represented a hybrid of traditional Chinese, Communist, and Western cultures (Rao et al., 2017). In this study, teachers' positive attitudes towards children's active role in constructing ICT skills reflected educational theories introduced from other countries. However, the emphasis on setting rules to guide children's ICT use perhaps revealed the authority of teachers, which has long been a feature of Chinese traditional culture (Li & Chen, 2016).

The findings in this study have implications for both ECE teachers and policymakers. Teachers in the study tended to anticipate children's ICT skills and planned activities based on their

perceived needs. Attention should be drawn to this issue to avoid the digital divide among children in kindergartens in China. Additionally, participants had different interpretations of ICT skills; most of them simply considered ICT skills as the ability to operate digital devices, which may not align with the national policy. Therefore, a clearer and shared definition of ICT skills should be provided by policymakers.

As a qualitative study conducted in three kindergartens, the research may lack generality and transferability. The findings may be only valid in the participating kindergartens in Nanjing, China, and can not necessarily be applied to other contexts. As ICT skills are an evolving notion, the validity of the findings is also limited by time. Additionally, interpretation of the findings may be influenced by the researcher's subjective perspective. As the research was conducted in Chinese and the findings are presented in English, translation issues may occur because not all concepts are universal and translatable. However, the value of the study in identifying pertinent issues to be addressed by ICT policy and teaching in kindergartens in China at a pivotal point time cannot be underplayed.

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