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Using ICT in Early Childhood: What Teachers, Principals, and Parents Say

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Abstract: Many countries around the world have recognized the importance of early childhood education. As facilitators of learning, preschool teachers are expected to plan and provide for their children's learning by using a variety of resources, including information communication technology (ICT). The term IT refers to digital media or tools, including computers, tablets, multi-touch screens, Internet, digital cameras, audio recorders, and e-book readers. The key purpose of this study is to identify the key ICT competencies that are expected of pre-school teachers. In addition, this study examines the benefits of using ICT with preschool children as perceived by teachers, principals, and parents. This study also identifies the concerns or limitations of using ICT with preschool children.

Keywords: Early childhood education, information communication technology, preschool, ICT

1. Introduction

Today's children are surrounded by a wide variety of digital media and tools at their homes and schools. This has led to a growing interest among researchers to develop baseline data on computer habits and behaviors among young children. While there is research on the use of ICT by pre-school children, far less is known about how ICT is used by pre-school teachers in early childhood programs (Wartella, Schomburg, Lauricella, Robb, & Flynn, 2010). In many early childhood programs and schools, IT will be a part of the learning landscape of the future (Wardle, 2008).

We are aware that there are concerns about whether children should have access to ICT, due to potential health or social risks such as eye strain, poor sitting postures, and poor ability to interact with peers. However, many of these concerns seem to stem mainly from *unsupervised* use of ICT by children. For example, Teng (2013), who reported a study led by Nirmala Karuppiah, wrote that few parents monitored how their children used devices such as smartphones and tablets at home. Only 18 of 60 parents enforced rules on how much screen time their children were allowed, while the remaining 70% gave their children the freedom to use devices of any kind (Teng, 2013). However, 85% of parents believed that their children had benefited from using the technology (Teng, 2013).

What about the use of ICT in pre-school classrooms? Do we completely eliminate it in pre-school settings? Do we, for example, want to shut the door on a teacher being able to read children a new picture book that is available only *online* (Guernsey, 2010)? Some educators, researchers, and parents stress that pre-school children already spend too much time in front of television and computer screens (Plowman, McPake, & Stephen 2010), so why add more technology use during the school day (Shifflet et al., 2012)? In the following section, we describe some of the rationale for using ICT in early childhood. We also describe some of the ICT competencies, hardware, and software that have been used in preschools of many countries during the recent decade (2005-2014).

2. Literature Review

The use of ICT may not be appropriate for very young children such as infants and toddlers. Organizations such as the American Academy of Pediatrics (2009, 2010, 2011) and the White House Task Force on Childhood Obesity (2010), for example, recommend that no screen time (including television, videos, and digital media) be given for children under 2 years old, and between one to two hours of total screen time per day for those older than 2. However, for older children (e.g., ages three and above), the potential benefits of technology for children's learning and development have been documented.

Technologies can be particularly useful tools for expanding or enhancing children's social, language, and cognitive skills (Seng, 1998). According to Wardle (2008), children over the age of three are developmentally within Piaget's preoperational stage, which means that they are concrete learners who are very interested in using newly learned symbolic representation – speaking, writing, drawing, and numbers. Clearly, many of these developmental needs match well with appropriate use of technology, especially exploration, manipulation of symbolic representation, and learning modalities that individual children can control and pace to meet their personal individual needs (Wardle, 2008).

Barron and colleagues (2011), for example, reported that children progressed in spatial understanding when they manipulated objects in digital space. The researchers wrote (p. 17): "When a child clicks on a computer icon to rotate a shape on the screen, they are not performing an unconscious or intuitive manipulation as they might when physically putting together a puzzle or building with blocks; use of the icon tends to make the student more aware of rotation and thus 'mathematizes' the experience."

Another example of extending children's experiences through technology is the project created by the Elliot Pearson Children's School at Tufts University. Kindergartners designed a storyboard and made their own movie about the parts of the Boston Marathon that they found the most interesting (Barron et al., 2011). The children assigned roles including camera crew, directors, writers, and editors, shot the video and considered the sequence of scenes. Carrying out the project enabled the children to become active and thoughtful participants (Mardell, 2009).

Pre-school teachers' personal use of ICT and their competence in using ICT also affect the way how they use ICT in their practice; perhaps they varied in the confidence and competence in using ICT for teaching and learning (Xinyin, 2015). In this study, 'technology skills' refers to the knowledge and abilities expected of a preschool educator to use technological tools such as computers, tablets, touch screens, digital cameras, audio recorders, internet, and e-books to extend children's learning in ways that are not possible otherwise. If the goal of a lesson is to learn the habitat of different zoo animals, then technology can augment that through the use of specific CDROMS and various zoo websites (Wardle, 2008). Similarly, studying extinct creatures such as dinosaurs can become more real through the use of specific software and websites (Wardle, 2008). Drawing on a touch screen can add to children's graphic representational experiences (NAEYC and the Fred Rogers Center for Early Learning and Children's Media, 2011). The use of a touch screen should not completely replace paper and pencil or other graphic art materials but provide additional options for children's self-expression.

3. Purpose of the Study and Research Questions

Although research studies in education show that use of technology can help student achievement, its use is generally affected by the key competencies of kindergarten teachers. Very little of the literature covers the expected ICT competencies of preschool teachers as compared to teachers in primary or secondary school settings. In Hong Kong, three strategic plans for ICT policy in schools have been launched since 1998. However, till date there are no guidelines or specific policy documents regarding the use of ICT at the preschool level in Hong Kong. Probably the closest related document is the *Guide to the Pre-Primary Curriculum 2006*. This document considers ICT to be a type of

product or resource that relates to children's daily lives, but gives no specific guidance concerning the desired or expected preschool teachers' technology skills.

The key purpose of this study is to fill this knowledge gap by identifying the key ICT competencies that are expected of preschool teachers in Hong Kong. This study also examines some of the key benefits and concerns of using ICT with preschool children as perceived by teachers, principals, and parents. The identification of key ICT competencies, as well as concerns of using ICT would be useful for policy makers to formulate a possible ICT education curriculum to teach preschool teachers. This ensures that preschool teachers have the necessary ICT competencies, and appropriate strategies to extend their children's learning needs and address the concerns. Specifically, this study was underpinned by four questions based on practitioners and parent perspectives:

1. What basic technology skills should a preschool teacher have?
2. What technologies regarding software and hardware are children using practically at school?
3. What are some benefits of using ICT with preschool children, as perceived by teachers, principals, and parents?
4. What are some concerns or limitations of using ICT with preschool children, as perceived by teachers, principals, and parents?

4. **Method**

The research design is based on case study approach. The case study approach has chosen because the key purpose of the study is to gain a deeper understanding of a phenomenon or situation (Merriam, 1998). To address the research questions, the study has adopted both quantitative and qualitative methods to collect data. Data collection approaches include questionnaire and semi-structured interviews.

4.1 Participants and procedure

The study sample consisted of the kindergarten principals, teachers, and parents from two international Kindergartens located in Hong Kong. Survey and interview participants were recruited through face to face discussions and e-mail. E-mails and survey links were sent out to principals, teachers, and parents to solicit their participation.

The teachers' questionnaire comprised a range of scenarios relating to the use of technology, such as software tools including software for teachers to use, software for students to learn, hardware devices that teachers will use in the classroom, important technological skills that a competent teacher should possess, technological skills of particular teachers, frequency and duration of integrated technology in teaching, school support to integrate technology in terms of hardware and software acquisitions, and technical support from the schools involved in the research project. Recent professional development opportunities and future improvement plans were also discussed. Copies of the teachers' questionnaires were emailed to all the educators from these two schools as well as pre-school teachers from other international Kindergartens (n=56). 39 questionnaires were returned using email, resulting in a return rate of 69%.

The questionnaire issued to parents was designed to collect parents' views on important software tools that they believed kindergartens should have, what hardware devices should be used, and what are the most important technology skills that a competent teacher should possess. The questionnaire also asked what software tools and hardware devices children were using at home, their frequency, and what the parents had done to improve their children's IT knowledge recently. The list of possible answers was provided in a fixed-response questionnaire. Copies of parental questionnaires (n=80) were presented in hard copies after parent session, with a return rate of 38 copies or 47.5%.

Fourteen face to face interviews with principals / executives, teachers, and parents were conducted and their audio responses were recorded. The term, 'executives' includes supervisors, head teachers, and Special education needs (SEN) coordinators. Each interview took approximately 20 minutes to complete. Most of the questions were open-ended and would lead to the practical implementation of ICT. Supportive documents such as scaffolding notes, photos, pictures, diagrams,

and charts were collected. These taped interviews were transcribed and the salient points of content were sent back to the users for validation. Interview questions included: examples of teacher use of technology in class, along with software tools and hardware devices used for teaching purposes, how teachers integrate technology in instructions, the benefits and limitations of technology use, examples of successful and unsuccessful IT integrated lessons, ten important technology skills for preschool teachers, and IT support and training needs.

The majority of participant teachers were below 35 years old and the second largest age group of respondent teachers was 35 - 49 years old. The findings from demographic questions interpret that the majority of teachers may not be digital natives but digital immigrants. 92.3% of educators who took part were female, and 7.7% were male.

4.2 *Data Analysis*

4.2.1. *Quantitative Data Analysis*

The survey results were studied based on educators and parental votes (selection) for different categories. Data collected through the survey of educators and parents were analysed using Excel statistical software. Clustered charts were used to make relative comparisons within the categories.

4.2.2 *Qualitative Data Analysis*

The interview results were studied based on the three categories; principals/executives, teachers, and parents' perspective. Data quantification was used to determine the relationship between various factors. Average subscale scores were also generated from the total number of participants. Data triangulation was used on the data, collected through open-ended questions from surveys and interviews to analyse, reflect, and construct thematic categorization. To identify the key benefits and limitations of ICT use in preschools, collected data from the interviews and open-ended questions in the questionnaire were analysed. Statements were coded within each focus group transcript. All the transcripts were read and coded to identify and summarize the main themes or domains that emerged from the collected data to answer the specific research questions.

5. Results

5.1 Technology Skills that Pre-School Teachers should possess

To determine the eight most important technology skills for a pre-school teacher as revealed in the collected data, the clustered bar graph, shown in Figure1 is used. The results are based on a statistical comparison in this frequency cluster bar graph. The majority of respondents from both the surveys (Educators- 92.3%, Parents- 63.2%) said that pre-school teachers should know how to operate a computer and printer. The second skill reflected is the use of Internet browsers (E- 87.2%; P-50%).

The findings regarding the third skill are the use of word processor (E- 61.5; P- 55.3%), and the fourth is the ability to operate an interactive whiteboard (E-79.5%; P- 36.8%). Use of a computer management system is the fifth skill. The sixth and seventh clear findings are the use of new digital devices such as the iPad, iPod, and Tablet (E-71.8%; P- 36.8%) and use of web based application software for learning and teaching (E-61.5; P- 44.4%). Use of educational CDs and DVDs with their respective players and projectors is the eighth skill that the respondents perceived kindergarten teachers should possess.

Based on findings from the parental survey the other two important skills kindergarten teachers should possess are the ability to use simple statistical software programs to process students' data and to possess knowledge and skills on maintaining security and privacy. The results of the survey of educators demonstrated that 33.3% of teachers considered it to be important to use simple statistics. On the other hand, principal B. in her interview, stated, "Statistics is something teachers should know how to analyse and understand; as far as statistics are concerned, I think I

would not like my staff to use time on that; instead myself as a manager can do it for all the classes. However, I agree that teachers should understand the results of statistics to reflect on their practices and future improvements".

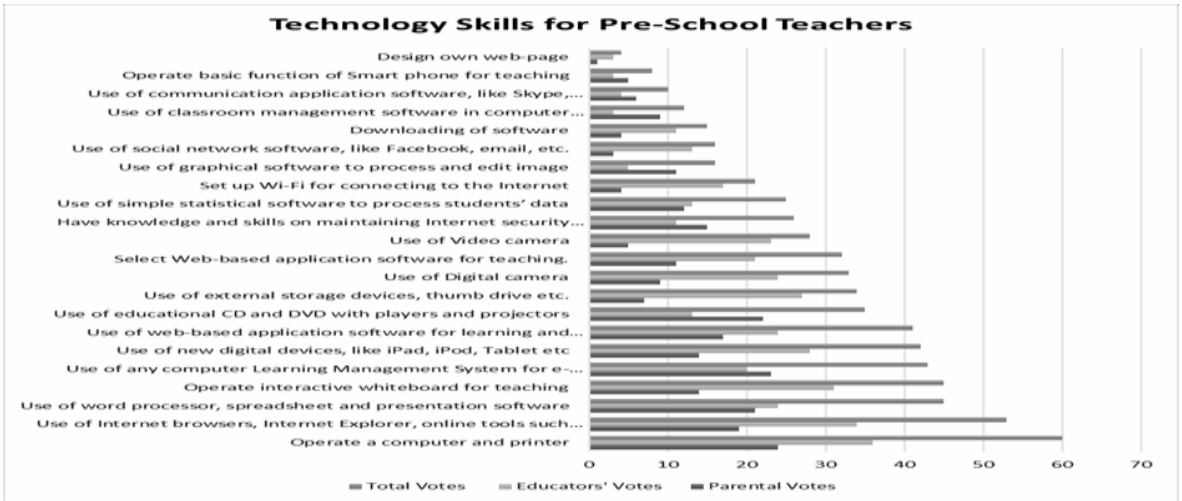

Figure 1. Technology Skills for Pre-School Teachers

The other finding from the parental survey was that teachers should possess knowledge and skills in maintaining security and privacy. A large proportion of respondents commented on this during their interviews and agreed that the use of social media platforms such as Twitter and Facebook should be restricted.

During her interview a parent described her concerns, "It's like you are posting pictures of my child in public and we will not be able to take them out anytime; once they are out on the Internet we may not be able to delete them anytime, so I don't want my child's pictures to be displayed on the website or school's Facebook page or Twitter. I am OK if they password protected the school portfolio, which only I can access." This suggests that parental perspective is that teachers should be skilled to maintain the security and privacy of their children.

5.2 *Hardware Devices for Use in pre-schools*

The clustered bar chart in Figure 2 shows that the majority of respondents from both the surveys considered that use of Interactive whiteboard, digital cameras, iPads, laptops and desktops, digital touch screens, and digital audio recorders are the hardware devices that should be used in preschool settings for teaching and learning purposes.

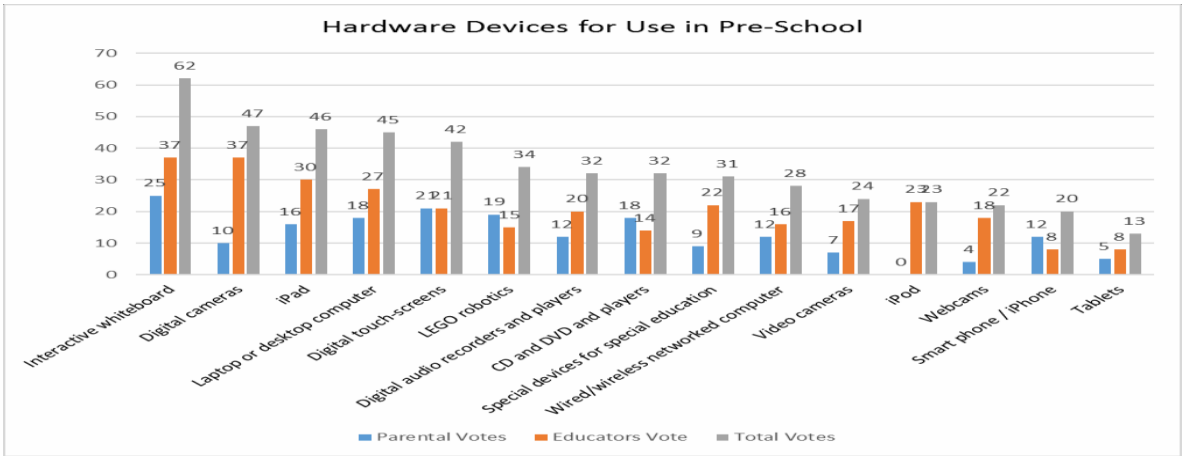

Figure 2. Hardware Devices for Use in Pre-School

The study tells us that many parents are not interested in providing hardware devices to preschool children. One of the parents said "Lesser is better; Laptops, phone, iPads are just for adults not for children" while other mentioned, "Actually nothing much, I don't think they need to be exposed to ICT this early." Findings from the open-ended questions answered by parents reflect on some parents being positive about the use of ICT at this age. "Kids are great learners, whether we want or not, kids love using iPad and iPhone. These technologies help kids' development, well if parents and teachers watch them when they use."

5.3 Software Tools to Use in Pre-School Settings

The survey findings, as seen in Figure 3, show that the first eight preferences of software tools to use with pre-school children are the same for educators and parents. These preferences are: word processing, presentation software for teachers to use, and multimedia storybooks, reading software tools, writing software tools, web based software, and musical software for children to explore and learn. One respondent stated, "At this age teacher should use Word and PowerPoint for parent sessions and portfolios but for teaching they may not have needed those. Musical software and software for gifted or special needs children will be good to use in class." Another parent said, "I would prefer my child to use phonics, reading, and writing software."

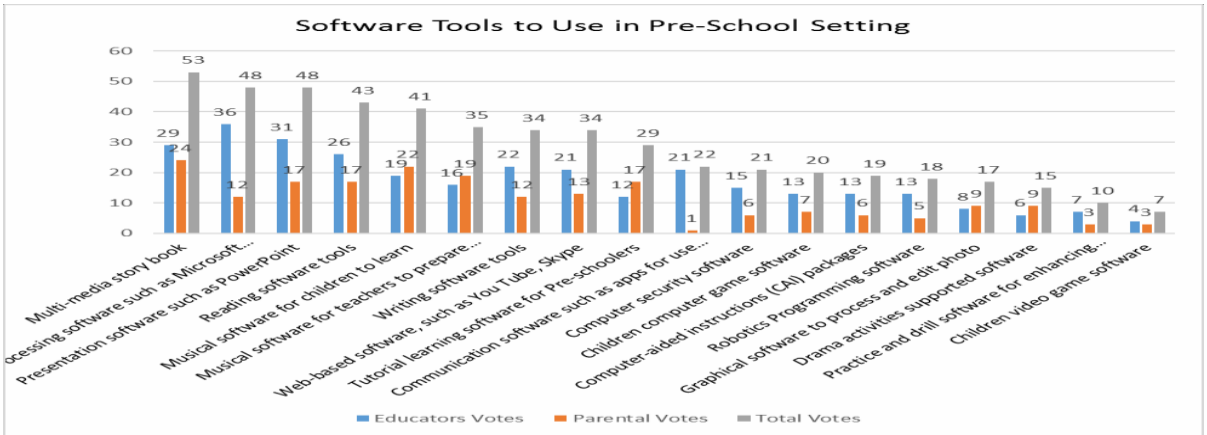

Figure 3. Software Tools to Use in Pre-School Setting

The qualitative data collected from the interviews were thematically analyzed and organized into two main categories using the grounded approach (Corbin & Strauss, 2008), namely the benefits of using ICT in preschool, and the concerns or limitations of ICT use in preschool. Table 1 and Table 2 contains the most frequently mentioned factors. In coming section, first we will discuss the benefits of ICT use and concerns will be discussed in the following section.

5.4 Benefits of Using ICT in Pre-School Based on Educators and Parents' Perspectives

The five main benefits of using ICT are: enhancing traditional learning outcomes, enhancing pupil motivation, ICT to enhance delivery of content, and enhancing collaborative and reflective practice. Enhancing traditional learning outcomes refers to the increase in understanding of student achievement of success criteria. Enhancing pupil motivation refers to the pupils' participation in learning being voluntary. ICT to enhance delivery of content is defined as using ICT to improve the efficiency and the effectiveness of content delivery. Enhancing collaborative and reflective practice is collaborative planning and shared resources and reflections to keep informed for the next implementation, as well as building upon experience. In the parent interviews this is also defined as the collaboration between parents and teachers.

Table 1: Benefits of Using ICT in the Pre-school Setting.

	Teachers n=6	Principals / Executives n=4	Parents n=4
Improving the quality of teaching	4	4	4
Enhancing traditional learning outcomes	6	3	2
Enhancing Pupil Motivation	5	3	3
ICT to Enhance delivery of content	6	4	3
Enhancing Collaborative and reflective practice	4	4	2

After coding 14 transcripts from the interviews, we found that all sets of respondents agreed that use of ICT in preschool education improves the overall quality of teaching. The results also indicated that at least half of all respondents' type believed that ICT benefits children's preschool learning experiences. Table1 shows the frequencies across the respondent groups and the benefits from ICT integrating learning opportunities emerged from the data. The views of some of the respondents regarding benefits were:

> "I think. In the modern era, you can't teach without computers because that would be teaching very much in isolation from what's going on in the outside world. Just that kids are used to working with all of these things you may as well use them to the best of your ability." -Principal

> "Yes, I do believe that it will make them learn faster. At home, we use rhymes so they can see video and copy the actions, so it gets easier to understand." – Parent

> "Yes, because the children get more stimulated or motivated. It's a different kind of exposure. It's a breakaway from a normal teaching. So they get eager to learn. For example, when we were doing a unit on animals, we showed them some short videos of animals in natural habitat. This helps the children to gain information in context. They even learn the vocabulary."-Teacher

> "I think social media can be a very valuable tool for giving you ideas and things because that is a way for teachers all around the world to share information, share ideas, and also ask questions. If you've been in different situations, maybe something that you haven't experienced before, somebody else might be able to support you. There is a lot to learn from others' experience too." -Teacher

5.5 Concerns and Limitations of ICT Use in Pre-School

The second dimension is made up of five factors that fall under concerns and limitations of the use of ICT, where the effective application of technology integration is discussed first and other sub limitations are then described under it: developmental appropriateness, health and safety issues, timed integration, and supervised play with the use of technology. Effective application of technology integration refers to use of technology, keeping content and pedagogy in mind. Developmental appropriateness is defined as technology that children can use and understand to achieve learning objectives. Health and safety are described as the direct or indirect impact of technology on their health, as well as issues related to safety in the use of technology. Timed use of technology is important to balance learning through play. Supervised play with the use of technology is defined as using technology under the supervision of teachers to improve the efficiency and the effectiveness of its use. The views of some of the respondents regarding concerns and limitations are:

> "I think that's a really complicated question because it's really easy to assume that teacher is using technology and leaving the children alone with these technological devices, I think I wouldn't want it, though 20 minutes per day will be my preferred duration for supervised play." Parent

The results from our qualitative coding scheme indicated that at least half of all respondents believe that there is a need for effective application of technology integration in children's preschool learning

experiences. Table 2 shows the frequencies across the respondent groups and the benefits from ICT integrating learning opportunities that emerged from the data.

Table 2: Limitations of ICT use in Preschool Setting.

	Teachers n=6	Principals / Executives n=4	Parents n=4
Effective Application of Technology Integration	6	4	4
Developmental Appropriateness	4	4	2
Health and Safety Issues	5	4	4
Timed Integration	3	3	2
Supervised Play with Use of Technology	3	2	4
Training Needs and On-site Support	6	4	1

As can be seen from Figure 4, 41% of teachers used technology more than 5 times a week and only 2.6% answered that they had not used technology for over a week. This indicates that pre-school teachers are using technology at least 2-4 times a week, on average. Whereas the majority of parents supported the use of technology 1-2 times a week, 18.4% of parents answered that they supported its use 3-4 times a week. As indicated in Figure 5 below, the findings reflect that only 2.9% of parents supported the use of technology more than 5 times a week but the majority 10.5% thought that technology should not be used at all.

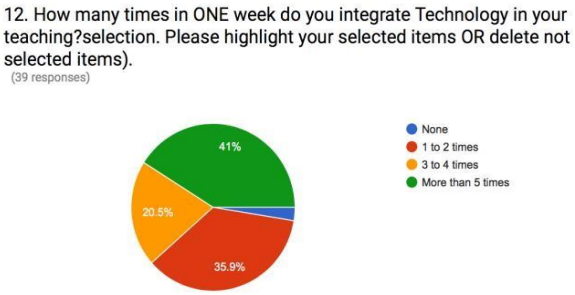

Figure 4. Teachers' perspective regarding weekly IT integrated lessons

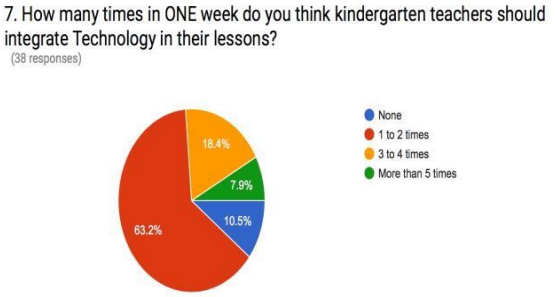

Figure 5. Parental perspective regarding weekly IT integrated lessons

"If though, it is best practice which I presume would be something like an interactive whiteboard that the children access as a group, in a group activity. I think it's fun and interactive. Not just with the technology but with other children. I would be happy with 2/3 hours a day, if it is used well technology can be really great." Parent

"I believe it can be a very useful tool. However, I think if the teacher uses it more as a babysitting device or maybe they're not familiar enough with it, I think it cannot be as beneficial as it could be" Executive.

"I would like to continue building on my IT skills as I believe in this day and age teachers need to have strong technology skills to keep up with children. Often children spend lots of time at home using technology, and as they get older, they are getting more and more experienced in using and creating technology. The landscape of learning has also changed, and technology plays a much bigger role in society than before, including the way people communicate with each other. I think teachers have a responsibility to keep up to speed with developments and have a go at understanding what our children can already do. I plan to continue learning how to build websites and develop my understanding of coding. I'd also like to develop my apps for the iPad for use within my school setting." Head Teacher

"The other support I need from the school is for them actually to provide me with the technology tools that I need. And then to provide me with training to best use this technology. A teacher needs to be able to use a PC, and they don't do that properly. As we know,

somethings can happen at times. I think word saving is safer than desktop saving. The teacher should learn to use spreadsheets more. DVDs and CDs are on the way out. Use of computer learning platforms is essential. Not so much with the little ones but knowledge construction is big. Classroom management software, Statistics and graphical software yes and I think each of this software teacher should be able to do it." Principal

6. Discussion and Conclusion

The aim of the study was to identify the key competencies of preschool teachers in the use of information technology. The sample size of this research does not allow for broad generalizations. However, the findings are useful for early childhood teachers, researchers, and policy makers as the study includes parental perspective.

Concerning the first research question, results from our survey supported that there are some skills needed for preschool teachers. These skills are the basic operation of a computer or printer, use of internet browsers, word processing, web application based software, and use of digital devices such as iPod, iPad, and video and digital cameras. These are the technologies that people are using these days for personal use too. Although this makes the skillset needed quite generalised, the important skill is to use these technologies appropriately to enhance teaching and learning using developmentally appropriate practices. It's equally important for preschool teachers to be able to maintain the security and privacy of students. The integration of technology into teaching and learning is influenced by the teachers' technical skills and beliefs (Hew and Bush 2007). Thus, it might be concluded that the teachers' technical skills are linked to the children's learning and development through developmentally appropriate technology integration.

"Regarding technology integration, my point is, how it is used to serve the purpose of the teacher's professional capacity or improving student learning. So, for instance, there is no point doing robotics if it's just for the sake of doing it, what children are going to learn from it and children are going to learn better, so it has to be intentional and well planned." Principal

How to integrate technology into the preschool curriculum and teachers' skills to integrate technology into play are some of the challenges that preschool teachers are facing. Teachers should integrate technology into children's' play, to make the learning through technology more authentic. To accomplish this, the learning of certain software related skills is a pre-requisite for educators, either through self-development or through formal training. We found that the majority of educator participants in our study believed that technology integration benefits preschool children and that integrating technology in an appropriate way will definitely improve the quality of teaching and learning. ICT provides motivation to learn. ICTs such as videos, television, and multimedia computer software combining text, sound, and colorful moving images can be used to provide challenging and authentic content that will engage the student in the learning process.

From these research findings, we can conclude that interactive whiteboard, digital cameras, iPad, laptops, desktops, and digital touch screens are the major pieces of hardware used in the preschool setting. Some specific technological devices are Beebots, projectors, remote controlled cars, talking machines, and zoom microscopes have been observed in pre-school settings. We found a great variation in parental perspective, as some parents expressed the view that pre-school children are too young to benefit from the use of technology, as opposed to the use of traditional play, while others indicated that their children are already using the most recent hardware devices, such as iPads, tablets at home. Furthermore, ICT may serve as a tool for curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of each pupil and by providing tailored feedback (Mooij, 1999; Smeets & Mooij, 2001).

"For children with special education needs, technology sometimes makes a huge difference. I have had a few cases where technology helped ADHD children to focus. Nowadays there are many apps specially designed for children with special needs and they are quite successful." -SEN Coordinator

An alternative explanation, however, is that few parent participants in our study believe that technology is not the right tool for pre-school learners because they learn through play. The meaningful technology integration in play is difficult. They also suggest that use of technology may have a negative effect on the health and safety of their children. However, based on the responses from our participants, we have an idea of the important technology skills pre-school teachers need for teaching pre-school children. The limitations of this study include the rather small size of the sample. Further research employing a larger sample would add to the body of knowledge by offering many more perspectives and insights into educators' and parental perspectives.

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