UNIVERSITY OF IOANNINA
SCHOOL OF EDUCATION
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The Use of ICT in Preschool Education: A Comparative Study between Greece and China

Xia Liu

This thesis is presented for the degree of
Doctor of Philosophy

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Τριμελής Συμβουλευτική Επιτροπή

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Abstract

The advent of an information society has brought the digitization of young children's childhood lives and the acknowledgment of education policies and academic research for the introduction and use of Information and Communication Technologies (ICTs) in preschool teaching and learning. These changes in the social, policy and academic research contexts have brought not only new opportunities but also new requirements and challenges for preschool teaching and learning practices. As the key practitioners of teaching activities in the preschool setting, it is of great significance for preschool teachers to be well prepared to adapt to new requirements, embrace new opportunities and cope with new challenges.

Although a large number of studies have been carried out to examine the preparedness and adaptation of primary and secondary school teachers for ICT use in teaching and learning, a scarcity in relevant studies exists for preschool teachers, particularly in terms of systematic and international comparative studies. Therefore, in order to fill in these research gaps, this study aimed to make a systematic comparison between Greek and Chinese preschool teachers in the preparedness and adaptation status for the use of ICTs in teaching and learning practices. More specifically, this study reported on the similarities and differences between Greek and Chinese preschool teachers in five dimensions, including ICT access, ICT use practices, attitudes toward ICT use, ICT competences and barriers to ICT use in daily teaching and learning activities.

The case study methodology which selected one city with similar geographic, political and economic conditions was adopted in this study. Moreover, this study was also a mixed study, in which both quantitative (survey) and qualitative methods (interview) were included. As a consequence, 108 Greek teachers and 155 Chinese teachers who taught children aged 4-6 years old in urban public preschools took part in the survey study. There were also 15 Greek teachers in 13 preschools and 19 Chinese teachers in

11 preschools who were further interviewed.

It was concluded that the preparedness and adaptation status of the Greek and Chinese preschool teachers for the use of ICTs in teaching and learning was at a primary stage, although the level of each dimension of preparedness and adaptation was uneven for the two groups of teachers.

More specifically, the Greek teachers expressed a high level in the attitude dimension, while the level of their access and competence dimension was low. They used limited ICT hardware and software with a relatively low frequency, but aimed to support a child-centered teaching and learning paradigm. They met with a range of first-order barriers, but had overcome several crucial second-order barriers, including teachers' attitudes toward ICT use in teaching and learning, and teachers' teaching and learning beliefs and practices.

Similarly, the Chinese teachers expressed a high level in the attitude dimension and a low level in the competence dimension, but their level of the access dimension was high. Even though they had a relatively high frequency in using various ICT hardware and software, they stayed with the "generic use" and teacher-centered teaching and learning paradigm, which indicated a low level in the use dimension. Moreover, they encountered both first-order and second-order barriers, particularly in terms of the transformation of traditional teaching and learning beliefs and practices, even though their attitude-barrier had been overcome.

According to the findings of this study, a series of recommendations were offered for educational authorities, preschool leaders and training programs in Greece and China, including: 1) offering preschools and classrooms with adequate and easy-to-access hardware; 2) developing and offering professional educational software and resources; 3) providing systematic support to teachers; 4) organizing quality and continuous ICT training to teachers; 5) emphasizing teachers' successful ICT experiences in practice;

and 6) transforming teachers' traditional teaching and learning paradigm.

Keywords

Preschool Teachers; ICT use; Comparative Study; Mixed Study; Greece; China

ΠΕΡΙΛΗΨΗ

Η κοινωνία της πληροφορίας έχει επιφέρει την ψηφιοποίηση στη ζωή των μικρών παιδιών και ως αποτέλεσμα η εκπαιδευτική πολιτική και η εκπαιδευτική έρευνα υποστηρίζουν την εισαγωγή και την χρήση των Τεχνολογιών Πληροφορικής και Επικοινωνιών (ΤΠΕ) στην προσχολική διδασκαλία και μάθηση. Αυτές οι αλλαγές στο κοινωνικό πλαίσιο, στην πολιτική και στο πλαίσιο της ακαδημαϊκής έρευνας έχουν προκαλέσει όχι μόνο νέες ευκαιρίες αλλά και νέες απαιτήσεις και προκλήσεις για τις πρακτικές διδασκαλίας και μάθησης στην προσχολική ηλικία. Όσο για τους πρωταγωνιστές των διδακτικών δραστηριοτήτων σε περιβάλλοντα προσχολικής εκπαίδευσης, είναι πρωταρχικής σημασίας οι εκπαιδευτικοί προσχολικής ηλικίας να είναι καλά προετοιμασμένοι ώστε να προσαρμόζονται στις νέες απαιτήσεις, να εκμεταλλεύονται νέες ευκαιρίες και να αντιμετωπίζουν τις νέες προκλήσεις.

Παρόλο που έχει διεξαχθεί ένας μεγάλος αριθμός μελετών για να εξετάσουν την ετοιμότητα και την προσαρμογή των εκπαιδευτικών της πρωτοβάθμιας και της δευτεροβάθμιας εκπαίδευσης στη χρήση των ΤΠΕ στη διδασκαλία και στη μάθηση, υπάρχει έλλειψη ανάλογων μελετών για τους εκπαιδευτικούς προσχολικής ηλικίας, ιδιαίτερα όσον αφορά σε συστηματικές και διεθνείς συγκριτικές έρευνες. Γι' αυτό ακριβώς το λόγο, προκειμένου να καλυφθεί το ερευνητικό αυτό κενό, η συγκεκριμένη έρευνα αποσκοπεί στο να κάνει μία συστηματική συγκριτική μελέτη ανάμεσα σε Έλληνες και Κινέζους εκπαιδευτικούς προσχολικής ηλικίας όσον αφορά στην ετοιμότητα και στην προσαρμογή τους για τη χρήση των ΤΠΕ στις διδακτικές και μαθησιακές τους πρακτικές. Πιο συγκεκριμένα, η παρούσα μελέτη αναφέρεται στις ομοιότητες και στις διαφορές που παρατηρούνται ανάμεσα σε Έλληνες και Κινέζους εκπαιδευτικούς προσχολικής ηλικίας σε πέντε δείκτες, που περιλαμβάνουν πρόσβαση στις ΤΠΕ, χρήση των ΤΠΕ στην πράξη, στάσεις απέναντι στη χρήση των ΤΠΕ, δεξιότητες στη χρήση των ΤΠΕ και εμπόδια στη χρήση των ΤΠΕ στις καθημερινές διδακτικές και μαθησιακές δραστηριότητες.

Στην παρούσα διδακτορική διατριβή υιοθετήθηκε η μεθοδολογία της μελέτης

περίπτωσης και επιλέχτηκε μία πόλη με παρόμοιες γεωγραφικές, πολιτικές και οικονομικές συνθήκες. Πέραν αυτού, η παρούσα διδακτορική διατριβή ήταν και μια ανάμεικτη μελέτη, στην οποία συμπεριλήφθηκαν τόσο ποσοτικές (επισκόπηση) και ποιοτικές μέθοδοι (συνέντευξη). Ως συνέπεια, στη διδακτορική διατριβή πήραν μέρος 108 Έλληνες και 115 Κινέζοι εκπαιδευτικοί που δίδαξαν παιδιά ηλικίας 4-6 ετών. Επίσης, 15 Έλληνες εκπαιδευτικοί σε 13 νηπιαγωγεία και 19 Κινέζοι εκπαιδευτικοί σε 11 νηπιαγωγεία πήραν μέρος σε περαιτέρω συνεντεύξεις.

Το συμπέρασμα στο οποίο καταλήγει είναι ότι η ετοιμότητα και η προσαρμογή των Ελλήνων και Κινέζων νηπιαγωγών αναφορικά με τη χρήση των ΤΠΕ στη διαδικασία της διδασκαλίας και μάθησης βρίσκεται σε μια πρώιμη φάση, αν και το επίπεδο για κάθε δείκτη ετοιμότητας και προσαρμογής δεν ήταν ίδιο για τις δύο ομάδες.

Πιο συγκεκριμένα, οι Έλληνες εκπαιδευτικοί εξέφρασαν υψηλό επίπεδο στη στάση τους προς τις ΤΠΕ, την ίδια στιγμή που σε επίπεδο πρόσβασης και δεξιότητας το επίπεδο ήταν χαμηλό. Χρησιμοποίησαν περιορισμένο εξοπλισμό και λογισμικό ΤΠΕ, με σχετικά χαμηλή συχνότητα χρήσης, αν και σκόπευαν να υποστηρίζουν ένα παιδοκεντρικό κονστρουβιστικό παράδειγμα διδασκαλίας-μάθησης. Αντιμετώπισαν μια σειρά από εμπόδια εγκατάστασης ΤΠΕ, αλλά ξεπέρασαν πολλά κρίσιμα εμπόδια, συμπεριλαμβάνοντας τις στάσεις των εκπαιδευτικών απέναντι στη χρήση ΤΠΕ στη διδασκαλία και στη μάθηση, όσο και τις απόψεις και τις πρακτικές των εκπαιδευτικών.

Αντίστοιχα, οι Κινέζοι εκπαιδευτικοί εξέφρασαν υψηλό επίπεδο αποδοχής στην παράμετρο της στάσης και χαμηλό επίπεδο στην παράμετρο της δεξιότητας των ΤΠΕ, αν και το επίπεδο της πρόσβασης στις ΤΠΕ ήταν υψηλό. Αν και παρουσίαζαν σχετικά υψηλή συχνότητα στη χρήση εξοπλισμού και διαφόρων λογισμικών ΤΠΕ, παρέμειναν προσκολλημένοι στο δασκαλοκεντρικό παράδειγμα διδασκαλίας-μάθησης, κάτι που υποδήλωνε χαμηλό επίπεδο στο δείκτη της χρήσης τους. Επιπλέον, αντιμετώπισαν και εμπόδια, ιδιαίτερα σε σχέση με το μετασχηματισμό των παραδοσιακών αντιλήψεων και πρακτικών, αν και είχε παρακαμφθεί το πρόβλημα της στάσης των νηπιαγωγών απέναντι στις ΤΠΕ.

Με βάση τα ευρήματα της παρούσας διδακτορικής διατριβής, διαμορφώθηκε μια σειρά από προτάσεις για τους υπεύθυνους/αρμόδιους της εκπαίδευσης, διευθυντές προσχολικής εκπαίδευσης και για δημιουργία προγράμματων κατάρτισης στην Ελλάδα και στην Κίνα, μεταξύ των οποίων: 1) αναβάθμιση εξοπλισμού των νηπιαγωγείων και των αιθουσών με επαρκή και εύκολα προσβάσιμο εξοπλισμό, 2) ανάπτυξη και διάθεση επαγγελματικού εκπαιδευτικού λογισμικού και άλλων πολυμέσων, 3) συστηματική υποστήριξη στους εκπαιδευτικούς στη χρήση ΤΠΕ, 4) οργάνωση ποιοτικής και συνεχούς κατάρτισης των εκπαιδευτικών στις ΤΠΕ, 5) προβολή επιτυχών εμπειριών χρήσης ΤΠΕ στην πράξη, και 6) μετασχηματισμός του παραδοσιακού σχολείου διδασκαλίας-μάθησης σε ενα σύγχρονο σχολείο, μαθητοκεντρικό, με χρήση ΤΠΕ.

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Abbreviation

CK: Content Knowledge

DATEC: Developmentally Appropriate Technology in Early Childhood

EU: European Union

ICTs: Information and Communication Technologies

NAEYC: National Association for the Education of Young Children

OECD: Organization for Economic Cooperation and Development

PCK: Pedagogical Content Knowledge

PK: Pedagogical Knowledge

TAM: Technology Acceptance Model

TCK: Technological Content Knowledge

TK: Technological Knowledge

TPACK: Technological Pedagogical Content Knowledge

TPK: Technological Pedagogical Knowledge

TTF: Task-Technology Fit Model

UNESCO: United Nations Educational, Scientific and Cultural Organization

WB: World Bank

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Chapter 1 Introduction

This chapter introduces the background to this study (1.1), which include the social, policy and research contexts. Current research gaps and problems are presented by the following section (1.2). The research aim and specific research questions of this study are further addressed (1.3). Finally the significance and contribution of this study (1.4) and the overall structure of this thesis are discussed (1.5).

1.1 Background of the Study

1.1.1 Social Context: Digital Childhood

Since the 1980s, the advent and development of an information society has brought a quite different living environment to young children. They have been surrounded by a broad range of Information and Communication Technologies (ICTs) not only in the home but also in the broader society. They also begin to utilize these technologies for their entertainment and learning, including the youngest infants and toddlers (Kekkeris & Paliokas, 2005; Pange & Kontozisis, 2001; Toki & Pange, 2014).

The home is the first setting for young children to have their initial encounter and experience with ICTs. It is at home that young children begin to be exposed to and use a number of ICTs. A recent report revealed that American children aged 8 and under spent an average of 1 hour and 55 minutes per day using ICTs in the home. The types of ICTs involved not only traditional ones, such as television, DVD players, video game players and computers, but also latest ones, such as smartphones and tablets. In particular, as mobile technologies are becoming increasingly ubiquitous and advanced, young children' access to and use of mobile devices at home would continue to rise (Common Sense Media, 2013).

Except for ICT devices, young children have also accessed the Internet world where the Internet is playing a significant role in young children's lives (Toki, Pange, & Mikropoulos, 2012; Παγγέ, 2007). Many recent studies have reported that a rising number of young children have gone online and have used the Internet for a variety of activities. The European Union (EU) carried out a study in its member countries and reported a substantial growth on the use of the Internet by children under 9. They used the Internet for a series of activities, including watching videos, playing games, searching for information, doing homework and socializing in the virtual world (Holloway, Green, & Livingstone, 2013). Besides, young children's exposure to and frequent use of the Internet was also found in several other countries, such as the U.S. (Gutnick, Robb, Takeuchi & Kotler, 2011), Australia (Australian Bureau of Statistics, 2012), and South Korea (Jie, 2012).

Another crucial driving force to immerse young children in the technology-rich world is the prosperity of the baby-targeted technological market (Craft, 2012; Vandewater et al., 2007). Young children, including the youngest infants and toddlers, are the main targets and consumers of this market. They are offered various technological products, which are accompanied with several educational promises (Wartella & Heintz, 2007). Thus, today's young children are considered as the most targeted generation by the technological market in history, whom have been greatly affected by the joint forces of a marketing-driven culture and digital culture (Linn, 2010; Zevenbergen, 2007).

In summary, due to the change of social and technological contexts in recent decades, the childhood life of today's children has become quite different from that of previous generations. They are born and grow up in a technology-saturated environment, which is not experienced by former generations (Kalaš, 2010). Because of the technological market, they begin to encounter, understand and utilize a wide range of technologies at home and in society at a young age, even from infancy. Technology has become an integral part of their childhood lives, both in their daily lives and in their learning and development (Kalaš, 2010; Pange, 2007; Zevenbergen, 2007).

1.1.2 Policy Context: Favorable ICT Policy Environment

Educational policy is of significance for the introduction and integration of ICTs into teaching and learning practices. A supportive and favorable policy environment is often related to active, systematic and sustainable practices to introduce and integrate ICTs into teaching and learning activities (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2011; Voogt & Knezek, 2008).

ICT Policy in Entire Education

ICT is a powerful tool not only to improve and transform the educational system, but also to promote economic growth and social progress (Mikropoulos & Natsis, 2011). Consequently, the issue of ICT use in education has been addressed by educational policy makers both nationally and internationally (Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011; UNESCO, 2011; Voogt & Knezek, 2008).

On the national level, almost every country in the world has designed or will design national policies on the introduction and use of ICTs in the education field (Voogt & Knezek, 2008). From an international perspective, several international organizations have been encouraging and supporting their member countries to develop and implement their own national ICT policies in the education field, such as UNESCO, the Organization for Economic Cooperation and Development (OECD), the World Bank (WB), and EU (UNESCO, 2011; Voogt & Knezek, 2008).

ICT Policy in Preschool Education

Thanks to the characteristics of teaching and learning activities in preschool education, it is also necessary for educational policy makers to develop a special ICT policy for preschool education. Even though a lack of ICT policies exists in preschool education,

some relevant ICT policies or guidelines are also found. They are published by either international organizations or individual governments.

From an international perspective, the most influential guiding documents on the use of ICTs in preschool education come from a program entitled “Developmentally Appropriate Technology in Early Childhood ” (hereinafter referred to as “DATEC”) in Europe and the National Association for the Education of Young Children (hereinafter referred to as “NAEYC”) in the U.S. Both of them have affirmed the potential of ICTs in teaching and learning, and have stated that if ICTs are used in a developmentally appropriate way, they will bring positive effects to teaching and learning. Moreover, they have also provided a series of guiding principles to help teachers understand and implement developmentally appropriate teaching and learning practices with ICTs (NAEYC, 2012; Siraj-Blatchford & Siraj-Blatchford, 2003).

From a national perspective, there are also several governments who have developed and issued national ICT policies in preschool education. These policies are mainly integrated in the national preschool curriculum, such as in Ireland (National Council for Curriculum and Assessment, Ireland, 2009), Qatar (Education Institute of the Supreme Education Council, Qatar, 2009), Australia (Australian Government Department of Education, Employment and Workforce, 2009), Sweden (Ministry of Education and Science, Sweden, 2010), Iceland (Ministry of Education, Science and Culture, Iceland, 2011), Singapore (Ministry of Education, Singapore, 2012) and England (Department for Education, England, 2014). However, there are also cases that ICT policies appear in a separate policy document, such as in Scotland (Scottish Executive, 2003) and New Zealand (Ministry of Education, New Zealand, 2009). Regardless of what format, all of these ICT policies recognize the role and effect of ICT as a teaching and learning tool in the preschool. They also encourage teachers to introduce and use ICTs in classroom teaching and learning.

In summary, educational policy makers have realized the potential and role of ICT use in education, not only for the educational system in particular, but also for economic and social development in general. Therefore, nearly all countries have published their national ICT policies for their entire education system. Moreover, many governments are beginning to develop a specific ICT policy for preschool education. Meanwhile, many international organizations are also making efforts to facilitate the introduction and use of ICTs in the entire educational system, including preschool education. The existence of ICT policies forms a strong political driving force to support, promote and guide the process of the introduction and use of ICTs in preschool education.

1.1.3 Research Context: from "if" to "how"

At the beginning, especially in the 1980s, the effect of ICT as an innovation was paid more attention to by researchers. This was truer when young children were mentioned, because they are often seen as innocent and vulnerable. The main questions of earlier effect research focused on "is it appropriate for children to be exposed to and use ICTs?", "what kinds of effects do ICTs have on children?", "are these effects negative or positive?" etc. These research questions were necessary and valuable, particularly when ICTs were initially introduced into young children's lives. They constituted a significant foundation for further research.

Nevertheless, there are also some drawbacks of earlier effect research. One of them is that children were considered as passive receivers and users of ICTs. It was thought that they were not mature enough to select what they liked, judge what was good, and make right decisions. Another shortcoming is that these studies neglected the presence and role of human factors. In a more specific way, the human factor refers to a series of significant others who are around children, especially their parents and teachers. The views they hold, competences they have and practices they implement are crucial mediators to determine the nature and level of the effects which ICTs bring to children (Plowman & Stephen, 2003).

Since the 1990s, with the development and ubiquity of ICTs in young children's lives, educational researchers have realized that the exposure to and use of ICTs by young children has become an unavoidable reality. It has been inopportune to simply call for opposition and prohibition. The alternative has been to actively accept the existence of ICTs in young children's lives, and utilize them in an appropriate and effective way so as to optimize their benefits while avoid their risks. Accordingly, the main research questions have shifted from "if" ICTs should be used to "how" ICTs could be used appropriately and effectively (Clements & Sarama, 2003; Cook, 2003; Mioduser, Tur-Kaspa, & Leitner, 2000; Mouza, 2005; Shah & Godiyal, 2004; Verenikina, Harris, & Lysaght, 2003). This change of research focus is consistent with the research trend on general innovations: "it begins with concerns, then these concerns are proven to be unfounded, finally leading to looking for the specific ways to use the innovation. So a range of more specific questions arise, such as how, when, where, and why to use" (Clements & Nastasi, 1993).

In conclusion, the advent of an information society has changed children's childhood lives, educational policies and academic research. These social, policy and research factors provide not only new opportunities but also new requirements and challenges for today's preschool teachers, namely, introducing and using new ICTs in classroom teaching and learning. It is quite crucial for them to be well prepared to adapt to new requirements, embrace new opportunities and cope with new challenges. Thus, it is of great significance for educational researchers to closely and systematically investigate and analyze the preparedness and adaptation of preschool teachers for the introduction and use of ICTs in teaching and learning practices.

1.2 Statement of Research Gaps

The preparedness and adaptation of preschool teachers for the introduction and use of ICTs in teaching and learning are multidimensional. They refer to not only sufficient

ICT access and appropriate ICT use, but also favorable ICT attitudes, qualified ICT competences and relatively few ICT barriers. Therefore, in order to better understand the preparedness and adaptation of preschool teachers, systematic and comprehensive research which covers all these dimensions is needed.

However, compared with related studies on the use of ICTs by primary and secondary school teachers, there are limited studies that have been carried out on the use of ICTs by preschool teachers. Moreover, relevant studies regarding preschool teachers have paid more attention to each individual dimension, while systematic studies that cover multiple dimensions are lacking.

Furthermore, different national conditions and cultures can result in different levels of preparedness and adaptation of preschool teachers for the use of ICTs. Thus, it is also necessary for educational researchers to carry out international comparative studies in order to find out common trends and different features among countries. However, a very few studies have been conducted regarding the comparison of preschool teachers among countries by educational researchers.

1.3 Research Aim and Questions

This study aimed to systematically compare Greek and Chinese preschool teachers in terms of the preparedness and adaptation status for the use of ICTs in teaching and learning practices. Specifically, five research questions were answered:

1) What are the similarities and differences between Greek and Chinese preschool teachers in terms of ICT access in teaching and learning?
2) What are the similarities and differences between Greek and Chinese preschool teachers in terms of ICT use in teaching and learning?
3) What are the similarities and differences between Greek and Chinese preschool teachers in terms of attitudes toward ICT use in teaching and learning?

4) What are the similarities and differences between Greek and Chinese preschool teachers in terms of ICT competences?
5) What are the similarities and differences between Greek and Chinese preschool teachers in terms of barriers to ICT use in teaching and learning?

1.4 Significance of the Study

This study is of great importance in three respects:

1) Comparative study. This study is the first comparative study between Greece and China on preschool teachers' ICT use in teaching and learning practices. It is also one of the limited international comparative studies on ICT use of preschool teachers in teaching and learning practices. It compares the similarities and differences between Greek and Chinese preschool teachers in terms of the preparedness and adaptation for the use of ICTs in teaching and learning. It not only offers information for preschool education in Greece and China, but also offers implications for international preschool education.

2) Systematic study. This study makes up for the limited systematic studies related to teachers' ICT use in teaching and learning in both general and preschool education. It systematically analyzes five dimensions of ICT use of Greek and Chinese preschool teachers in teaching and learning practices. These dimensions are access, use practices, attitudes, competences and barriers. Therefore, it provides comprehensive information to understand the status of preschool teachers in terms of the use of ICTs in teaching and learning in both the Greek and Chinese context.

3) Mixed study. This study is both quantitative and qualitative. The quantitative part looks at the general landscape of a certain research question, while more detailed and in-depth information is further presented by the qualitative part.

1.5 Structure of the Thesis

This thesis consists of six chapters, which specifically includes Introduction (Chapter 1), Theoretical Background (Chapter 2), Methodology (Chapter 3), Results of the Quantitative Study (Chapter 4), Results of the Qualitative study (Chapter 5), as well as Discussion and Conclusion (Chapter 6).

Chapter 1 is the introductory part of this thesis. It describes the social, policy and research contexts of the study (1.1). It then presents the gaps of existing research (1.2) and the significance and contribution of the study (1.4). Moreover, the research aim and specific research questions (1.3), and the structure of the thesis (1.5) are also presented in this chapter.

Chapter 2 reviews previous literature on preschool education in Greece and China as well as existing studies on teachers' ICT use in teaching and learning in both general and preschool education. It is divided into seven parts, which include an overview of preschool education in Greece and China (2.1); young children and ICTs: an ongoing debate (2.2); teachers' ICT access in teaching and learning (2.3); teachers' ICT use practices in teaching and learning (2.4); teachers' attitudes toward ICT use in teaching and learning (2.5); teachers' ICT competences (2.6); and teachers' barriers to ICT use in teaching and learning (2.7).

Chapter 3 describes the methodology of this study. It outlines the general research design which involves the comparative study and case study (3.1). It is followed by a detailed description in the sampling methods (3.2), the measurement instruments (3.3), the data collection methods (3.4), the data analysis methods (3.5), and the reliability and validity of both the quantitative and qualitative study (3.6).

Chapter 4 presents the results of the quantitative study. The demographic information of the participating teachers is firstly presented (4.1). The results on participants' ICT

access (4.2), ICT use practices (4.3), attitudes toward ICT use (4.4), ICT competences (4.5) and barriers (4.6) are then separately analyzed.

Chapter 5 reports the results of the qualitative study. Similarly, both the demographic characteristics of the participants (5.1) and relevant findings on their ICT access (5.2), ICT use practices (5.3), attitudes towards ICT use (5.4), ICT competences (5.5) and barriers (5.6) are equally presented.

Chapter 6 is the conclusion of this study. It first discusses and concludes the findings of the study (5.1). It then focuses on the implications of the findings (5.2), states the limitations of the study (5.3), and makes recommendations for future research (5.4).

Chapter 2 Theoretical Background

This chapter constructs the theoretical context of this study. At the beginning, it makes a brief introduction to the history and current situation of preschool education in both Greece and China (2.1). It then presents the continuous debate and a new perspective regarding the use of ICTs in young children's lives (2.2). The following five sections review the relevant literature related to teachers' ICT access in teaching and learning (2.3), teachers' ICT use in teaching and learning (2.4), teachers' attitudes towards ICT use in teaching and learning (2.5), teachers' ICT competences (2.6), and teachers' barriers to ICT use in teaching and learning (2.7) respectively.

2.1 Overview of Preschool Education in Greece and China

2.1.1 Preschool Education in Greece

A Brief History of Preschool Education

The history of modern preschool education in Greece can date back to the 1830s. Its birth can be attributed to the contribution of several foreign missionaries. In 1831, the German missionary August Frederik Hildler established the first modern preschool educational institution. It was in Syros of Cycladic islands and provided educational services for children aged 2 to 6 years old. Another similar educational institution was opened in Athens in the same year by an American missionary couple - Mr. and Mrs. Hill. Afterwards, particularly in the 1870s, the similar institutions popped up across the country. In 1897, the Greek educationalist Aikaterini Laskaridou (1842-1916) founded the first kindergarten, which was based on the educational philosophies and theories of German educationalist Friedrich Frobel (1782-1852) (Doliopoulou, 2006; Μπάκας, 2010).

At the end of the 19th century and the early of the 20th century, the official recognition and institutionalization for preschool educational institutions in Greece was achieved. In 1895, the government issued a law mentioning that educational services could be offered by independent educational institutions for children aged 3 to 6 years old. In

1929, another law was issued which regulated that preschool education was integrated into primary education with a two-year period and was administrated by the Ministry of Education (Doliopoulou, 2006; Μπάκας, 2010).

Types of Preschool Educational Institutions

According to the age of young children, preschool care and educational institutions in Greece can be roughly divided into two paralleled but distinct categories: infant/child centers or child centers (βρεφονηπιακοί σταθμοί or παιδικοί σταθμοί) and preschools (νηπιαγωγεία) (Petrogiannis, 2013; Sakellariou & Rentzou, 2012).

Specifically, infant/child centers or child centers are run by both public and private sectors. They mainly provide custodial care services for children aged 2 months to 5 years old (the age for compulsory education). Infant/child centers offer services for children aged 2 months to 5 years old, while child centers are for children between 2.5 and 5 years old. Infant/child centers or child centers are usually grouped into different classes based on the age of children: 1) class for children under 1.5 years old; 2) class for children aged 1.5 to 2.5 years old; 3) class for children aged 2.5 to 3.5 years old; 4) class for children aged 3.5 to 5 years old. Infant classes are staffed by two teachers, an assistant for 12 infants, and children classes can hold up to 25 children with a teacher and an assistant (Association for Childhood Education International, 2014; EU, 2015a, 2015c, 2015d; Petrogiannis, 2006, 2013).

Preschools offer services for children aged 4 to 5 years old, which pay more attention to the educational function than the care function. Preschool education is an integral part of primary education and the first stage of formal education. It is compulsory for children aged 5 years old. Most of preschools are public and free of charge. There are also private ones, but with a limited number. Half-day and all-day preschools all exist. The class with 7 to 25 children is staffed by one teacher. Two teachers should be provided if there are 25 to 50 children. Children in the same classroom have mixed ages (Association for Childhood Education International, 2014; EU, 2015c, 2016c; Petrogiannis, 2006, 2013; Sakellariou & Rentzou, 2012; Sofou & Tsafos, 2010; Spodek & Saracho, 2005; Μπάκας, 2010).

This study focuses on the teachers in preschools. Therefore, the following sections are going to present relevant information on the system of preschools. The same case will also appear in the Chinese context.

Administrative System

The administrative system of Greek preschools is highly centralized and hierarchical (EU, 2015b; Sofou & Tsafos, 2010). Nationwide affairs of preschools are under the auspice of the Ministry of Education and Religious Affairs (EU, 2015c; Sakellariou & Rentzou, 2012). Specifically, it is responsible for the design and issue of educational policies, the implementation and monitoring of educational policies, and the administration of educational affairs (EU, 2015f).

At the regional level, the Regional Directorates of Education exercises management, guidance and supervision for regional affairs of preschools. Besides, the Directorates of Primary Education is the governing body of preschools at the municipality level (EU, 2016b).

Funding System

All levels and types of public education in Greece are free of charge, including the educational service provided by public preschools (EU, 2015c). The government is the main funding source for public education. Students enrolled in public schools are entitled to free tuition fees, textbooks and other extra materials (EU, 2015g). However, private preschools are not subsidized by the government. The costs are shared by the parents of enrolled children and the preschool (EU, 2015g).

Curriculum and Daily Routine

According to the National Curriculum (Ministerial Decision 21072β/Γ2/28-2-2003)[1],

[1]**See website**:
http://www.et.gr/idocs-nph/search/pdfViewerForm.html?args=5C7QrtC22wFalhF2BrTT7HdtvSoClrL8aHyK_kVuaY55MXD0LzQTLf7MGgcO23N88knBzLCmTXKaO6fpVZ6Lx3UnKl3nP8NxdnJ5r9cmWyJWelDvWS_18kAEhATUkJb0x1LIdQ163nV9K--td6SIuYZjQtN2HijNtrrCjSWI0xgLmQS2oZjfRQhZ4xKnkghY

teaching and learning activities in Greek preschools are composed by five learning areas: Language, Mathematics, Environmental Study, Creation and Expression, and Information Technology. These learning areas are not separated but closely interrelate. Thus, teachers are suggested to apply an interdisciplinary and theme-based approach to design and organize teaching and learning activities (EU, 2016d; Sakellariou & Rentzou, 2012)

A detailed daily schedule is also provided by the government (Ministerial Decision 130272/D1/5-8-2016)[1]. It mainly involves: 1) arrival, departure, meals, break, rest and sleeping; 2) free-flow play and corner learning activities; 3) designed learning activities based on the Cross Thematic Curriculum Framework; 4) contemplation, feedback and following-day planning (EU, 2016c, 2016d; Sakellariou & Rentzou, 2012).

Teachers and Training

Permanent preschool teachers in Greece are civil servants. The minimum academic qualification for them is a Bachelor Degree. The Department of Preschool Education in the university is the main pre-service training institution for preschool teachers. The duration of training lasts four years (EU, 2015c, 2015e, 2016a; Sakellariou & Rentzou, 2012; Μπάκας, 2010).

Except for the required academic qualification, the graduates from the university also have to take part in the examination of Supreme Council for Civil Personnel Selection, which is another prerequisite to become a preschool teacher. Only the candidates who have passed the examination are eligible to be written on the ranking list, waiting for the appointment and employment for teachers in the preschool (EU, 2015c, 2016a).

[1]**See website**:
http://www.et.gr/idocs-nph/search/pdfViewerForm.html?args=5C7QrtC22wFHp_31M9ESQXdtvSoClrL8zBUObvzOFsjNZ8op6Z_wSuJInJ48_97uHrMts-zFzeyCiBSQOpYnTy36MacmUFCx2ppFvBej56Mmc8Qdb8ZfRJqZnsIAdk8Lv_e6czmhEembNmZCMxLMtT9jIanDwZpeZYJGUIrRiAaFghq9U46NQLucksXiyAWi

2.1.2 Preschool Education in China

A Brief History of Preschool Education

The first public preschool educational institution in modern China is Hubei Preschool (湖北幼儿园). It was founded by the governor Fang Duan in 1903 in Hubei which was a province located in South China. It hired three Japanese teachers and adopted Japanese educational theories and practices, which were learned from the German educationalist Friedrich Frobel (1782-1852). The establishment of Hubei Preschool started the history of modern public preschool education in China. Later, in 1904, the government of the day issued the Official School Regulations where the educational institution for young children was named as Meng Yang Yuan (蒙养院) (Huo, 2015).

From the first modern public preschool until now, the history of preschool education in modern China has gone through more than 100 years. Overall, this history can be roughly divided into five stages (Huo, 2015).

The first stage: Learning from the Japanese model (1903-1919). Due to China's defeat in the Sino-Japan war in 1894-1895 and the modernization of Japan, "learning from Japan" became the main strategy of the government of the day for social reform. The reform in preschool education was no exception. The introduction of Japanese teachers, the use of Japanese educational theories and practices, and the establishment of Meng Yang Yuan system were the main reflections of this trend.

The second stage: Learning from the American model (1919-1949). As the advent of the May 4th Movement in 1919, "learning from America" became a new trend in entire education. A number of Chinese students went to America and studied modern education there. When they returned China, they began to introduce and experiment with the American educational model and became the pioneers of the modernization of education. The most influential preschool educationists Xingzhi Tao (1891-1946) and Heqin Chen (1892-1982) were among them.

The third stage: Learning from the Soviet Union model (1949-1978). In 1949, New China was founded by the Communist Party. Because of the blockage of western countries and the lack of experience in constructing socialism, learning and adopting the Soviet Union model was adopted in almost all aspects of social development. It was also the case in preschool education. The educational system, theory and practice of the Soviet Union were totally accepted by Chinese preschool education, including collectivist instruction, subject instruction and direct instruction.

The fourth stage: Learning from the Western model (1978-2006). In 1978, the Chinese government issued the reform and opening up policy. Under the promotion of this new policy, preschool education in China began a new round of reform by means of learning from the West, which included America and capitalist countries in Europe. A series of educational theories and patterns deeply affected the reform and practice of preschool education in China, such as Montessori Method, Reggio Approach and Multiple Intelligences.

The fifth stage: Pursuing for the "Chinese model" (2006-). As the rapid advance of the economy and society and being more experienced in the socialism road, China began to shift from passive imitation to active innovation. In 2006, Chairman Jintao Hu put forward the concept of "Innovative Country", which should be achieved by 2020. This nationwide strategy was applied to all fields of economic and social reform. Preschool education in China has begun to look for and explore its unique Chinese pattern which is based on its own conditions and problems.

Types of Preschool Educational Institutions

Preschool education, in China, is considered as an integral part of basic education and a fundamental stage of schooling and lifelong education (State Council, the People's Republic of China, 2001). But it is not included into compulsory education. Generally, there are three types of institutions which can offer preschool educational services.

The most popular preschool educational institution is called You Er Yuan (幼儿园). It provides care and educational services to children aged 3 to 6 years old. However, as

the increasing awareness to the care and education of infants and toddlers, and the trend of the integration of early childhood care and education in recent years, the service offered by You Er Yuan has also been extended to children under 3 years old (Liu, 2007). You Er Yuan generally have all-day programs, while part-day programs are quite rare (Li, 2006; Liu, 2007). Children in You Er Yuan are usually grouped into classes based on their ages: 1) toddler class (around 1.5 to 3 years old); 2) junior class (3 to 4 years old); 3) middle class (4 to 5 years old); 4) senior class (5 to 6 years old). Both public and private You Er Yuan exist. According to the Preschool Staff Equipping Standard (Provisional), all-day preschools need to be equipped with two or three full-time teachers and a teaching assistant in each classroom. The ideal ratio of the teacher and the teaching assistant to the child is 1:7 to 1:9 (Ministry of Education, the People's Republic of China, 2013a). However, due to limited education resources and large number of classroom children, the real ratio is often beyond the ideal one (Li, 2006).

Another type of preschool educational institution is Tuo Er Suo (托儿所). It provides full-day care and educational services to children who are under 3 years old. Children in Tuo Er Suo are also separated into different classes based on their ages: 1) junior class (under 1 year old); 2) middle class (1 to 2 years old); 3) senior class (2 to 3 years old). The number of Tuo Er Suo is sharply declining because of the recent emergence and development of the toddler class in You Er Yuan.

A new type of preschool educational institution, which has emerged in recent years, is Zao Jiao Zhong Xin (早教中心). Its main function is to offer educational services for children under 3 years old. It not only organizes activities for infants and toddlers, but also conducts parent-child activities. Educational services in Zao Jiao Zhong Xin are usually paid hourly. Some of Zao Jiao Zhong Xin are public, while others are private. They either are independently built, or are affiliated to You Er Yuan (Liu, 2007).

Furthermore, the imbalance of economic and social development and the diversity of geographic conditions also lead to the emergence of some special preschool education institutions. For instance, in rural areas, the preschool class which provides one-year educational services for children who are going to go to primary school was popular

(Pang & Richey, 2007). Even though the government has paid much attention to rural preschool education in the past five years and the number of the preschool class has been decreasing, it is still a main form of preschool education in some rural areas (Ai, 2013)

Administrative System

The administrative system in the whole educational field in China is highly-centered and hierarchical. The Ministry of Education leads and administers all educational affairs of all forms and levels of education. Under the leadership of the Ministry of Education, the local educational authority is responsible for educational affairs in its own area. More specifically, the local educational authority can be divided into four levels: 1) province level; 2) municipality level; 3) county level; 4) town level (Central People's Government of the People's Republic of China, 2004).

Financial System

Before the 1990s when the planned economy was the main economic form in China, three types of preschools existed: 1) preschools established by government agencies; 2) preschools established by state-owned enterprises; and 3) preschools established by communities in urban and rural areas. The workplace or the community where parents were working or living was the main financial source for their children's educational services (Huo, 2015; Zeng & Fan, 2009). Parents needed to pay only about 40% of the cost (Liu, 2007).

Since the 1990s, China has begun to reform its economic system from a planned economy to a socialist market economy, in which stated-owned enterprises and communities were transformed. Accordingly, the preschools which were attached to state-owned enterprises and communities were separated from previous organizations (Huo, 2015). Some of them were even sold to private organizations or individuals and became private preschools (Liu, 2007). The preschools which were separated were not financially supported by their previous organizations, neither by the government. The government constrained public fund to support the preschools which were established and run by governmental agencies (Zeng & Fan, 2009).

In order to meet the huge demand for preschool education, the Chinese government has been encouraging the social power to open preschools (Huo, 2015). As a result, the number of private preschools has been increasing at a rapid speed. In 2004, the number of private preschools exceeded that of public preschools and became the main body for preschool educational services (National Institute of Education Sciences, 2012). However, private preschools are out of the scope of government's financial support. They are totally left to be afforded by preschools and parents. The proportion of the cost that parents have to pay is quite high, with over 70% (Ma, 2011).

Curriculum and Daily Routine

The current official preschool curriculum is stipulated by the Guidelines for Preschool Education which was issued in 2001 (State Council, the People's Republic of China, 2001). It divides the preschool curriculum into five learning areas: Heath, Language, Society, Science and Art.

The usual daily routine in the Chinese full-day preschool covers a variety of activities, including: 1) morning opening activities (e.g. welcoming children, heath check and free activities); 2) morning physical exercises; 3) large-group educational activities; 4) small-group educational activities; 5) putting away materials by children; 6) bathroom, hand-washing, snacks and meals; 7) relaxation and middy nap; 8) outdoor activities; 9) group meeting at the end of the day and departure (Li, 2006).

Teachers and Training

Pre-service training of preschool teachers in China takes places in institutions of both secondary and higher education. Educational institutions at secondary education level cover independent normal schools, regular normal schools and vocational senior high schools. They offer two to four years of training programs. Educational institutions at higher education level can be further divided into two types: colleges and universities. Colleges including independent normal colleges and vocational colleges provide two years of training programs. In addition, the Department of Early Childhood Education in normal universities or regular universities can also offer training programs which

normally have four years of duration (Liu, 2007).

The teacher qualification system is applied in China to ensure teachers' professional qualities (Ministry of Education, the People's Republic of China, 1995). Whether an applicant can obtain the Teacher Qualification Certificate depends on three standards: 1) holding the required academic qualification - at least graduates of independent normal schools; 2) taking the National Test for Mandarin (Standard Chinese); 3) taking the National Examination for Teachers' Qualification. Teachers' qualification is checked every five years. Only the qualified teacher can continue their job (Huo, 2015; Ministry of Education, the People's Republic of China, 1993, 2013b).

New Educational Reform

Since the establishment of New China, preschool education in China has achieved great progress. However, it has been the weakest part of the whole educational system. Moreover, when compared globally, the developmental level of Chinese preschool education lags far behind the international average level, even behind the level of the countries that have a similar economic level (National Institute of Education Sciences, 2012). Meanwhile, a series of problems and challenges have emerged in recent years which urge Chinese preschool education to go beyond a simple educational issue and become a social issue (Li, 2011).

The main problems which preschool education in China faced before the new reform include: 1) the popularization rate was low and increased with a low rate; 2) a great gap emerged between regions, between urban and rural areas, and between preschools; 3) the administrative system was incomplete and disordered; 4) the funding from the government was insufficient; 5) the teacher group was unsteady and low-qualified; 6) the primary education-oriented phenomenon was common (Li & Liu, 2006; Liu, 2013; Liu & Xu, 2011; Ministry of Education, the People's Republic of China, 2010; National Institute of Education Sciences, 2012; Wang, 2013; Xu, 2011).

Therefore, in order to solve these problems and challenges and to promote a healthy and sustainable development of preschool education, the Chinese central government has formulated and issued a series of policies in preschool education since 2010. In

July 2010, the first national educational plan in the 21st century - “Outline of National Plan for Medium and Long-term Education Reform and Development (2010-2020)” (hereinafter referred to as “Plan”) (Central People’s Government of the People’s Republic of China, 2010a) was published. It highly emphasized the significance of preschool education, and listed preschool education as one of the key developmental goals in the next ten years. Based on the Plan, the State Council issued the “Several Opinions on the Current Development of Preschool Education” in November 2010 (Central People’s Government of the People’s Republic of China, 2010b). It provided more detailed arrangements and strategies for the implementation of the Plan. Later, a series of more specific policies were published, which included “Preschool Teachers’ Professional Standards (Provisional)” (Ministry of Education, the People’s Republic of China, 2011a), “Notice on the Regulation of Preschool Care and Education and the Prevention and Correction of Primary School-oriented Phenomenon” (Ministry of Education, the People’s Republic of China, 2011b), “Guidelines for Learning and Development of Children Aged 3-6” (Ministry of Education, the People’s Republic of China, 2012a), and “Measures for the Management of Preschool Charging” (Ministry of Education, the People’s Republic of China, 2012b).

These new policies in preschool education aim to: 1) enhance the popularization rate and basically achieve universal preschool education; 2) tilt towards disadvantaged areas and groups; 3) enhance preschool teachers’ professional qualities; 4) promote governments at all levels to take their due responsibilities for preschool education; 5) prohibit the primary education-oriented phenomenon and advocate for scientific care and education.

In summary, due to the impetus and guidance of the recent new policies, the reform and development of preschool education in China has entered a new stage. Preschool education has been regarded as a national priority and has been paid unprecedented attention by the government; preschool education has become a part of public welfare for which the government takes main responsibilities; the universal, high-quality and equitable preschool education has become the future direction and goal.

2.2 Young Children and ICTs: An Ongoing Debate

Because of the particularity of the developmental stage, the exposure to and the use of ICTs of young children has been a controversial issue since the 1980s. Pessimists hold a conservative attitude. They believe that it is inappropriate for young children to be exposed to and to use ICTs, because it may bring about a series of risks and harms to them. Thus, it will be wise to avoid and prevent children to encounter and use ICTs at a very young age. Some researchers and organizations even claim that the information society brings a toxic and unhealthful childhood to young children, and results in the disappearance and death of their childhood. The American Alliance of Childhood as a child advocate expresses the most radical view. It calls for an immediate moratorium for further introduction of computers into preschools in order to make young children return to a healthy and active childhood (Buckingham, 2000; Cordes & Miller, 2000, 2004; Palmer, 2006; Postman, 1994).

Conversely, optimists hold a view that pessimists only present a half-truth of the issue. They neglect possible benefits and opportunities which are brought by ICTs to young children. Thus, they express a positive and supportive attitude toward the introduction of ICTs to young children (Clements & Sarama, 2003; Παγγέ, 2016).

2.2.1 Pessimists: Risks and Harms

For the pessimists, the risks and harms which are brought by ICTs to young children include the following four categories:

Inappropriateness. ICT tools require complex analytic and abstract thinking. They are too abstract for young children who have concrete thinking. Besides, the physical and cognitive ergonomics of ICT tools is initially designed for adults, which is also not appropriate for young children (Clements, 2002; Cordes & Miller, 2000, 2004; Goodwin, Goodwin, & Garel, 1986).

Replacement for traditional activities. The introduction and use of ICTs will replace traditional activities which are more basic and important for young children, such as hands-on activities, face-to-face interaction, outdoor exploration, reading books, art

activities, physical activities, etc. (Bolstad, 2004; Cordes & Miller, 2000, 2004; Shah & Godiyal, 2004).

Inappropriate content and excessive time. The exposure to unsuitable content, such as commercial content, sexual content, violent content and content with cultural, social and gender stereotype, as well as excessive time have negative effects on young children (Bolstad, 2004; Goodwin et al., 1986; Shah & Godiyal, 2004).

Adverse impacts on learning and development. The use of ICTs may have adverse impacts on young children' physical development (e.g. obesity and vision problems), cognitive development (e.g. language and literacy, creative thinking, imagination and concentration), and social development (e.g. aggressive behaviors and social isolation) (Bolstad, 2004; Cordes & Miller, 2000, 2004; Goodwin et al., 1986; Plowman, McPake, & Stephen, 2010; Shah & Godiyal, 2004).

2.2.2 Optimists: Benefits and Opportunities

Four categories of benefits and opportunities that ICTs could bring to young children are also summarized from the perspective of optimists.

Firstly, children are capable of operating ICT tools after learning. They not only show confidence and comfort in using ICT tools, but also could understand, think and learn with ICT tools (Clements, 2002; Clements & Nastasi, 1993).

Secondly, ICT tools do not replace traditional activities. Instead, when they are used in an appropriate way, they can strengthen and promote traditional activities (Mouza, 2005; Pierce, 1994).

Thirdly, ICT tools contribute to children's learning and development in many domains, including physical development (e.g. eye-hand coordination and fine motor skills), cognitive development (e.g. language and literacy, mathematics, programming skills, social studies, natural science, creativity, problem-solving ability and decision-making ability), and social/emotional development (Espinosa, Laffey, Whittaker, & Sheng, 2006; Judge, Puckett, & Bell, 2006; Li & Atkins, 2004; Mouza, 2005; O'Hara, 2008;

Plowman, McPake, & Stephen, 2012; Weiss, Kramarski, & Talis, 2006; Zaranis, 2011; Zaranis, & Kalogiannakis, 2011).

Finally, ICT tools can transform teaching and learning paradigm. The use of ICT tools could shift traditional teaching and learning to a more personalized, collaborative and constructive teaching and learning (Dwyer, 1994; Walker, 1983; Παγγέ, 2016).

2.2.3 New Perspective: Developmentally Appropriate Practices

As the growing ubiquity of ICTs in young children's lives, there is a consensus that if they are used in an appropriate and effective way, ICTs could lead to positive impacts and rich benefits for young children. Therefore, there is a necessity to shift the focus from "if" ICTs should be used to "how" ICTs are used appropriately and effectively (Clements & Sarama, 2003; Cook, 2003; Mioduser, Tur-Kaspa, & Leitner, 2000; Mouza, 2005; Shah & Godiyal, 2004; Verenikina, Harris, & Lysaght, 2003; Παγγέ, 2016).

The concept of Developmentally Appropriate Practices (DAP) have been recognized and accepted by preschool education professionals throughout the world (Rentzou & Sakellariou, 2011; Sakellariou & Rentzou, 2011). In light of the new perspective, the project of DATEC in Europe and the organization of NAEYC in the US raise the concept of "Developmentally Appropriate Practices" and provide a series of practical principles to guide preschool teachers to implement ICT-related developmentally appropriate practices.

Specifically, the DATEC proposed eight principles for ICT-based developmentally appropriate practices, including: 1) ICT applications should be educational; 2) ICT tools should encourage children's collaboration; 3) integration and play through ICTs; 4) children should be in control; 5) ICT applications should be transparent and intuitive; 6) ICT applications should not contain violence or stereotyping; 7) be aware of health and safety issues; 8) educational involvement of parents (Siraj-Blatchford &

Siraj-Blatchford, 2003).

In the position statement of the NAEYC, twelve principles are presented: 1) the use of technologies should not harm children; 2) developmentally appropriate practices must guide teachers' decisions about whether and when to integrate technologies into early childhood programs; 3) professional judgment is required to determine if and when a specific use of technology is age appropriate, individually appropriate, and culturally and linguistically appropriate; 4) developmentally appropriate practices must always guide the selection of any classroom materials, including technology; 5) appropriate use of technologies depends on the age, developmental level, needs, interests, linguistic background and abilities of each child; 6) effective use of technologies are active, hands-on, engaging and empowering; give children control; provide adaptive scaffolds to ease the accomplishment of tasks; are used as one of many options for learning; 7) when used appropriately, technologies can enhance cognitive and social abilities; 8) interactions with technologies should be playful and support creativity, exploration, pretend play, active play and outdoor activities; 9) technologies can help educators make and strengthen home-school connections; 10) technologies can enhance early childhood practices when integrated into the environment, curriculum and daily routines; 11) assistive technologies must be available to provide equitable access for children with special needs; 12) technologies can be effective for dual language learners (NAEYC, 2012).

2.3 Teachers' ICT Access in Teaching and Learning

The availability and access of ICT equipment and resources is a crucial precondition for teachers to use and integrate ICTs in teaching and learning (Law, Pelgrum, & Plomp, 2008; Wastiau et al., 2013). A series of previous literature has documented the reality of ICT access of preschool teachers in their teaching and learning activities. This section reviews the relevant literature and is shown in three contexts, including global, Greek and Chinese context.

2.3.1 Global Context

The literature from several countries, including both developed (e.g. the US, Sweden, New Zealand, Australia and Spain) and developing countries (e.g. Chile, Turkey and Malaysia), has reported that the access of preschool teachers to ICT-related equipment and resources became easier and more diverse. The most available equipment was the desktop computer. A high proportion of preschool teachers had access to at least one desktop computer. In several better-equipped preschools, teachers were also provided with laptop computers, digital cameras, educational software, the Internet, tablets and interactive whiteboards (Bayhan, Olgun, & Yelland, 2002; Bolstad, 2004; Brito, 2010; Chen & Chang, 2006; Hinostroza, Labbé, & Matamala, 2013; Masoumi, 2015; Zaki, 2013).

2.3.2 Greek Context

The relevant literature revealed that the desktop computer was the most accessible ICT equipment in the classroom for Greek preschool teachers. They were often placed as a computer corner with one or two computers. However, the computer laboratory was usually not equipped in Greek preschools (Gialamas & Nikolopoulou, 2010; Nikolopoulou, 2014a).

The overall level of ICT access of Greek preschool teachers was reported to be low. A recent study which was carried out in Athens revealed that more than one third of the participating teachers did not have computers in the classroom. For the teachers who had been provided computers, around one third of them could not have access to the Internet. In addition, the teachers' access to educational software was also reported to be limited (Nikolopoulou & Gialamas, 2015a; Χριστοδούλου-Γκλιάου & Γουργιώτου, 2009).

2.3.3 Chinese Context

A number of studies examined the reality of ICT access of Chinese preschool teachers. It was reported that the overall nationwide level of ICT access of preschool teachers was low, especially in terms of the availability of and access to educational software

and resources (Guo, Qian, Wang, & Zeng, 2006; Zhu & Wang, 2013). Besides, a big digital divide emerged between regions, between urban and rural areas, and between preschools. In other words, eastern regions had better ICT equipment and resources than central and western regions; urban areas had better ICT conditions than rural areas; model and public preschools were equipped better than non-model and private preschools (Guo et al., 2006; Liu, 2006; Liu, 2007; Zhang & Yu, 2010; Zhu & Wang, 2013).

More specifically, Guo et al. (2006) and Liu (2007) looked at the availability of ICTs of preschool teachers in Shanghai and Zhejiang which are economically developed cities. They all reported that most of the participating preschools were equipped with desktop computers, digital cameras/video cameras, the Internet, preschool websites and touchscreen devices. Some better preschools had also been provided with a multimedia classroom or a computer laboratory. Moreover, some recent studies found that as the rapid advance and popularity of ICT tools, a number of preschools in urban areas had accessed to a range of more advanced ICT equipment and resources, such as interactive whiteboards, interactive televisions, touchscreen televisions, television whiteboards, multimedia courseware platforms and digital resource databases (Zhang & Wang, 2015; Zhu & Wang, 2013). On the contrary, Yang (2013) reported a rather limited ICT-related condition of preschools in rural areas.

2.4 Teachers' ICT Use Practices in Teaching and Learning

Although some relevant studies were found, they could not depict a comprehensive landscape for preschool teachers' ICT use practices in teaching and learning. Thus, in order to build a better theoretical foundation and a better understanding of the nature and level of ICT use practices in teaching and learning activities of preschool teachers, the relevant literature regarding preschool teachers and teachers in general education is all involved. More precisely, a total of five respects are presented, including: 1) use frequency; 2) types of ICT hardware and software; 3) use contexts; 4) use approaches; 5) learning areas; and 6) influencing factors.

2.4.1 Use Frequency

Global Context

A number of studies indicated a low percentage of teachers in general education who used ICTs in teaching and learning practices. Teachers from several countries rarely or never used ICTs in teaching and learning, such as Malaysia, Nigeria, Turkey, Ghana and New Zealand (Ajayi & Ekundayo, 2009; Amenyedzi, Lartey, & Dzomeku, 2011; Keong, Horani, & Daniel, 2005; Samuel & Bakar, 2007; Varol, 2013; Ward, 2003). On the contrary, some other studies reported a high percentage of teachers in general education in Norway and South Africa using ICTs in teaching and learning (Wikan & Molster, 2011; Wilson-Strydom, Thomson, & Hodgkinson-Williams, 2005).

Limited empirical studies were carried out in the preschool education context. Both a high proportion of preschool teachers who used ICTs and a high frequency of ICT use in teaching and learning were revealed by the literature. The relevant studies are from New Zealand, Spain, Chile, Turkey, Australia and Malaysia (Bolstad, 2004; Brito, 2010; Hinostroza et al., 2013; Yurt & Cevher-Kalburan, 2011; Zaki, 2013)

Greek Context

The literature in general and preschool education all reported a low frequency of ICT use of Greek teachers in teaching and learning practices (Demetriadis et al., 2003; Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011; Eteokleous & Laouris, 2005; Jimoyiannis & Komis, 2006; Konstantinos, Andreas, & Karakiza, 2013; Nikolopoulou, 2014a; Nikolopoulou & Gialamas 2015b; Paraskeva, Bouta, & Papagianni, 2008; Petrogiannis, 2010; Χριστοδούλου-Γκλιάου & Γουργιώτου, 2009) .

Chinese Context

It was revealed by the literature that in some schools, especially those in rural areas as well as central and western areas, a high percentage of teachers in general education were still using the traditional chalk and blackboard teaching method (Hu, 2014; Lin, 2008; Rong & Li, 2005; Zhang, 2007). However, in some other schools, teachers were

reported to use ICTs on a regular basis in teaching and learning (Li, Song, & Zhang, 2006; Lin & Huang, 2009).

The earlier literature found that a small proportion of preschool teachers used ICTs in teaching and learning. For the teachers who used ICTs, most of them used ICTs with a medium frequency (Guo et al., 2006; Liu, 2006). However, the recent studies revealed that both the percentage of preschool teachers who used ICTs and their frequency of ICT use in teaching and learning activities had increased (Liu & Pange, 2015a).

2.4.2 Types of ICT Hardware and Software

Ward (2003) raised two kinds of ICT use of teachers: generic use and subject specific use. Generic use refers to the use of "the Internet and basic applications such as word processing and simple multimedia presentation", while subject specific use refers to the use of "more specialist software".

A series of related studies were found for teachers in general education, while limited studies existed for teachers in preschool education. The studies in general education in the global context arrived at the same conclusion that teachers preferred "generic use" to "subject specific use" in teaching and learning activities (Ward, 2003). That is, they used general software more often, such as word processor, spreadsheet, presentation software, search engine, browser and email. But they used specialized and advanced software infrequently, such as educational software, database, graphic visualizing tool, hypermedia, multimedia, online demonstration tool, drawing software, programming, simulation, game, concept mapping software and web-page designing (Al-Zaidiyeen, Mei, & Fook, 2010; Buabeng-Andoh, 2012; Gulbahar & Guven, 2008; Keong et al., 2005; Lau & Sim, 2008; Varol, 2013). The same situation was also revealed for Greek and Chinese teachers (Li, Xie, Wang, Shu, & Zhang, 2012; Paraskeva et al., 2008).

2.4.3 Use Contexts

Global Context

The literature in the global context examined the contexts of ICT use of preschool teachers and revealed different findings. Yurt and Cevher-Kalburan (2011) found that Turkish preschool teachers used computers more often to search materials before the class and to support teaching and learning in the class. However, they used rarely to evaluate teaching and learning after the class. Hinostroza et al. (2013) revealed that Chilean preschool teachers mainly used educational software for children's learning, while used ICTs very rarely to prepare teaching and learning before the class, present teaching and learning materials in the class and evaluate teaching and learning after the class. Bolstad (2004) reported that using ICTs to document and evaluate teaching and learning was quite common for preschool teachers in New Zealand. In the study of Brito (2010), Portuguese preschool teachers were found use ICTs not only for the preparation of teaching and learning before the class but also for the evaluation of learning and teaching after the class.

Greek Context

It was reported by some studies in the Greek context that computer-based activities in the preschool mainly took place in children's free play activities. These activities were initiated and conducted by children on the computer with commercial and educational software in order to develop their language and literacy, fine motor skills and learning motivation. Children were usually organized into small groups, and played freely with the supervision and guidance of teachers (Nikolopoulou, 2014a, 2014b).

Chinese Context

In the Chinese context, it was found by the previous literature that preschool teachers used ICT tools for preparing teaching and learning before the class and implementing teaching and learning in the class (Liu & Pange, 2015a; Zhang & Wang, 2015).

2.4.4 Teaching Approaches

There has been an expectation by policy makers and researchers that the introduction and use of ICTs will bring about the transformation of teaching and learning paradigm, namely, from teacher-centered teaching and learning to student-centered teaching and learning (Cartwright & Hammond, 2007; Gobbo & Girardi, 2001).

Global Context

However, a number of studies in general education reported that teachers still relied on traditional teacher-centered teaching and learning when they used ICTs. They used ICTs mainly to support rather than transform existing teaching and learning paradigm (Buabeng-Andoh, 2012; Draper, 2010; Hu, Wang, Wang, & Zhang, 2011; Jamieson-Proctor, Burnett, Finger, & Watson, 2006; Jimoyiannis & Komis, 2007; Konstantinos et al., 2013; Law et al., 2008; Li et al., 2006; Lin & Huang, 2009, 2010; Rong & Li, 2005; Wastiau et al., 2013; Wikan & Molster, 2011; Yunus & Suliman, 2014).

On the contrary, some evidence was also found that the shift of teaching and learning paradigm in general education was taking place or had been realized in some schools in some countries. Teachers in these schools used ICT tools more for student-centered constructivist activities than teacher-centered instruction delivery activities. ICTs were more used as a learning tool of students than as a teaching tool for content delivery of teachers (Inan, Lowther, Ross, & Strahl, 2010; Law et al., 2008).

The literature reported two contradicted findings with regard to preschool teachers in the global context. Some studies found that teachers were the only users of ICTs while children were not allowed to use ICTs in teaching and learning (Bolstad, 2004; Zaki, 2013). However, it was revealed by some other studies that children also took part in ICT-based activities (Brito, 2010; Chen & Chang, 2006; Hinostroza et al., 2013).

Greek Context

The relevant studies revealed a great difference between Greek and Chinese preschool

teachers in teaching approaches. In the Greek classroom, ICTs including the computer and educational software were applied by children in the free play time for a series of learning and development activities, such as language, literacy and fine motor skills. Children were organized into small groups, and played freely with the supervision and guidance of preschool teachers (Nikolopoulou, 2014a, 2014b).

Chinese Context

In the Chinese classroom, however, only preschool teachers used ICTs for a series of teacher-directed activities, such as creating teaching and learning scenarios, and presenting multimedia teaching and learning content. But there were very few cases in which children used ICTs for learning activities (Dong, 2014; Zhang & Yu, 2010).

2.4.5 Learning Areas

Several studies in the global and Chinese context reported the learning areas in which preschool teachers used ICTs more frequently. The global studies found that preschool teachers preferred to use ICTs in Language, Mathematics and Music (Bayhan et al., 2002; Bolstad, 2004; Hinostroza et al., 2013; Yurt & Cevher-Kalburan, 2011). The Chinese studies found that ICTs were used more by preschool teachers in Language, Science and Art than Health and Society (Zhang & Yu, 2010).

2.4.6 Influencing Factors

Whether and how teachers use ICT tools in teaching and learning are determined by a series of factors which interrelate one another (Afshari, Bakar, Luan, Samah, & Fooi, 2009; Mumtaz, 2000; Tondeur, Valcke, & Van Braak, 2008).

Influencing Factors in General Education

A broad range of influencing factors have been documented by the previous empirical studies in the general education context. Specifically, the factors could be divided into five categories: 1) attributes of ICTs; 2) classroom-level factors; 3) teacher-level factors; 4) school-level factors; and 5) contextual factors.

Attributes of ICTs

Rogers (1983) proposed five attributes which might influence potential users to accept and adopt a certain innovation, which included advantages, compatibility, complexity, trialibity and observability. Potential users would be more likely to use an innovation if it had advantages, was compatible with existing practices and needs, was easy to use, could be experimented and could show visible results. Besides, in his Technology Acceptance Model (TAM), Davis (1989) emphasized the impact of two attributes of technologies on users' actual acceptance and use: usefulness and ease of use.

A number of empirical studies further examined the impact of the attributes of ICTs on teachers' intentional or actual ICT use. They found a positive relationship between teachers' intentions or actual behaviors of ICT use and advantages (Beggs, 2000; Sooknanan, Melkote, & Skinner, 2002), compatibility (Albirini, 2006a; Beggs, 2000; De Grove, Bourgonjon, & Van Looy, 2012; Kumar, Rose, & D'Silva, 2008; Sooknanan et al., 2002), usefulness (Kumar et al., 2008; Teo, 2011), ease of use (Beggs, 2000; Kumar et al., 2008; Teo, 2011), and observability of ICTs (Sooknanan et al., 2002). However, Sooknanan et al. also (2002) revealed that the complexity of computers did not influence teachers' actual ICT use.

Classroom-level Factors

Factors at the classroom level were reported to be important to affect teachers' use of ICTs. These factors included students' attitudes toward the use of ICTs (Bullock, 2004; ChanLin, Hong, Horng, Chang, & Chu, 2006), students' ICT competences (Kale & Goh, 2014; Somekh, 2008), students' learning needs and characteristics (Kale & Goh, 2014), students' learning achievement (ChanLin et al., 2006; Liu, 2011), and teaching objectives (ChanLin et al., 2006).

Teacher-level Factors

Teacher-level factors were further composed by teachers' demographic characteristics, attitudes toward ICT use in teaching and learning, ICT competences and pedagogical

beliefs.

Teachers' demographic characteristics had a significant impact on their ICT use: 1) gender. Male teachers used more often than female teachers (Hermans, Tondeur, van Braak, & Valcke, 2008; Jones, 2004; Tondeur et al., 2008); 2) age. Increased age led to decreased use (Inan & Lowther, 2010; Isleem, 2003; Rahimi & Yadollahi, 2011); 3) teaching experiences. On the one hand, increased teaching years were found relate to increased level of use (Isleem, 2003). On the other hand, teachers with more teaching years were reported to use less (Inan & Lowther, 2010; Rahimi & Yadollahi, 2011); 4) educational level. Teachers with a higher educational level were more likely to use (Law & Chow, 2008); 5) ICT use experiences. Teachers with a rich and successful use experiences in personal lives or in teaching and learning activities more tended to use (Bullock, 2004; ChanLin et al., 2006; De Grove et al., 2012; Hermans et al., 2008; Mumtaz, 2000).

A great body of theories and empirical studies have proved the crucial role and effect of **teachers' attitudes** on their intentional and actual ICT use behaviors in teaching and learning (Isleem, 2003; Knezek & Christensen, 2002; Kumar et al., 2008; Lee, Cerreto, & Lee, 2010; Zhang, Aikman, & Sun, 2008). Teachers' positive attitudes were related to frequent and effective ICT use (Berner, 2003; Isleem, 2003; Kersaint, 2003; Kumar et al., 2008; Şahin-Kizil, 2011; Larbi-Apau & Moseley, 2012; Rastogi & Malhotra, 2013). Conversely, negative attitudes could impede teachers to use ICTs frequently and successfully (Bullock, 2004; Steel & Levy, 2009). Thus, an agreement was made by educational researchers that teachers should be convinced to believe that ICTs could be useful and beneficial tools for teaching and learning activities (Sabzian & Gilakjani, 2013).

A number of empirical studies documented that teachers' intentions and levels of ICT use in teaching and learning greatly depended on their **ICT competences** (Anderson, Groulx, & Maninger, 2011; Buabeng-Andoh, 2012; Chai, 2010; Isleem, 2003; Kriek & Stols, 2010; Rastogi & Malhotra, 2013; Tezci, 2010). For example, Rastogi and Malhotra (2013) revealed that the teachers who were competent in ICT use not only were more likely to use ICTs, but also had a higher level of ICT use. Chai (2010) also found that teachers' basic ICT competences were significantly related to both their

traditional use and their constructivist use of ICTs.

Teachers' pedagogical beliefs could affect their instructional decisions (Sakellariou, & Rentzou, 2012). Law et al. (2008) found that teachers with traditional pedagogical beliefs were less likely to use ICTs, while teachers with new pedagogical beliefs more tended to use ICTs. Hermans et al. (2008) also reported that constructivist pedagogical beliefs positively related to teachers' decisions on ICT use, while traditional pedagogical beliefs had a negative impact on teachers' decisions on ICT use.

Teachers' pedagogical beliefs were also a factor for their ICT use frequency (Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011). Teachers with constructivist pedagogical beliefs used ICTs more frequently than those with traditional pedagogical beliefs (Afshari et al., 2009; Tondeur, Hermans, van Braak, & Valcke, 2008).

The previous literature also proved that teachers' pedagogical beliefs could affect their use approaches of ICTs. Some studies reported that constructivist pedagogical beliefs were related to constructivist ICT use, but traditional pedagogical beliefs more led to traditional ICT use (Friedrich & Hron, 2011; Tondeur et al., 2008). However, in the study of Chai (2010), traditional pedagogical beliefs were more related to traditional ICT use, while constructivist pedagogical beliefs were related to both traditional and constructivist ICT use.

School-level Factors

Four categories of school-level factors have been documented by the literature, which include school leadership, school ICT policy, school support and school culture.

School leadership was a crucial factor to affect teachers' decision on ICT use. A good school leadership could contribute to a high level of ICT use of teachers (ChanLin et al., 2006; Hodgkinson-Williams et al., 2007; Miller, Naidoo, Van Belle, & Chigona, 2006; Schiller, 2002; Teo, 2011; Tondeur et al., 2008; Tondeur, Devos, Van Houtte, van Braak, & Valcke, 2009).

ICT policy was identified as a predictor for teachers' successful ICT use (Friedrich &

Hron, 2011; Vanderlinde, Dexter, & van Braak, 2012). A comprehensive ICT policy included both ICT vision and ICT action plan (Vanderlinde et al., 2012). An ICT vision offered general expectations and goals. It is "a place to start, a goal to reach for, as well as a guidepost along the way" (Ertmer, 1999). An ICT action plan was detailed steps and methods (Afshari et al., 2009).

Sufficient **school support** was regarded as a catalyst for teachers' successful ICT use (Inan & Lowther, 2010; Law & Chow, 2008; Mumtaz, 2000; Tondeur et al., 2009). Teachers would be more willing to implement ICT-supported teaching and learning when they perceived that they could obtain sufficient support from the school (Law & Chow, 2008; Teo, 2011). School support involved a broad range of respects, including ICT equipment and resources support (Afshari et al., 2009; Bullock, 2004; ChanLin et al., 2006; Hodgkinson-Williams et al., 2007; Inan & Lowther, 2010; Miller et al., 2006; Mumtaz, 2000; Somekh, 2008; Tondeur et al., 2009), fund support (ChanLin et al., 2006; Mumtaz, 2000), technical support **(**Bullock, 2004; Hodgkinson-Williams, 2007; Inan & Lowther, 2010; Law & Chow, 2008; Miller et al., 2006), training support (Afshari et al., 2009; ChanLin et al., 2006; Hodgkinson-Williams, 2007; Mumtaz, 2000; Somekh, 2008), time support (Afshari et al., 2009; ChanLin et al., 2006; Mumtaz, 2000; Somekh, 2008), workload support (ChanLin et al., 2006), class size support (Becker 1994), reward support (ChanLin et al., 2006), etc.

School culture is a mixture of "the basic assumptions, norms and values, and cultural artifacts that are shared by school members" (Maslowski, 2001). A sound school culture was an enabler for successful ICT use of teachers (Law & Chow, 2008; Tondeur et al., 2008; Tondeur et al., 2009).

Contextual Factors

Teachers and schools are not free agents. When they conduct ICT-supported teaching and learning, they will also be affected by many contextual factors (Law, Lee, & Chan, 2010; Somekh, 2008). The support from parents, communities, educational authorities, the educational system and educational policies could promote teachers to use ICTs (Afshari et al., 2009; Bullock, 2004; ChanLin et al., 2006; Hodgkinson-Williams et al., 2007; Somekh, 2008). Besides, the social and cultural context (ChanLin et al., 2006;

Law & Chow, 2008; Somekh, 2008), social value about ICT use, and technological trend were also reported to affect teachers' ICT use (ChanLin et al., 2006).

Influencing Factors in Preschool Education

Global Context

Three categories of factors that influenced preschool teachers' ICT use in teaching and learning were documented by previous empirical studies in the global context: 1) classroom-level factors; 2) teacher-level factors; and 3) preschool-level factors.

Several classroom factors affected preschool teachers' ICT use, including children's age, children's fine motor skills, children's ICT abilities and teachers' consideration of teaching objectives (Edwards, 2005; Kerckaert, Vanderlinde, & van Braak, 2015).

Teacher-level influencing factors further consisted of three respects: 1) demographic characteristics; 2) general characteristics; and 3) ICT-related characteristics.

Factors regarding **teachers' demographic characteristics** included: 1) age. It was not reported as a factor for teachers' ICT use (Blackwell, Lauricella, & Wartella, 2014); 2) educational level. It was not a factor for teachers' ICT use in the study of Chen and Chang (2006), but negatively affected teachers' ICT use in the study of Blackwell, Lauricella, Wartella, Robb, and Schomburg (2013); 3) teaching experiences. Zaki (2013) found no correlation between teachers' teaching years and their ICT use. However, Blackwell et al. (2014) revealed a significant correlation between these two variables.

Regarding **teachers' general characteristics**, although teachers' innovativeness and self-efficacy were not identified as influencing factors for their ICT use (Kerckaert et al., 2015), teachers' pedagogical beliefs were found determine their strategies to use ICTs, as a threat, option or essential activity (Ljung-Djärf, 2008).

Teachers' ICT-related characteristics, including ICT competences (Chen & Chang, 2006; Edwards, 2005; Kerckaert et al., 2015), confidence in using ICTs (Blackwell et

al., 2014; Chen & Chang, 2006), attitudes toward ICT use in teaching and learning (Blackwell et al., 2013; Blackwell et al., 2014; Kerckaert et al., 2015; Ljung-Djärf, 2008; Zaki, 2013), and comfort in using ICTs (Zaki, 2013) were found as significant and positive factors for their ICT use. When teachers' perceptions of barriers to ICT use was identified as a negative factor for their ICT use in the study of Blackwell et al. (2013), no impact was found in the study of Zaki (2013). Besides, teachers' ICT experiences at home or in the preschool were found have no effects on their ICT use (Kerckaert et al., 2015).

Five categories of preschool-level factors were revealed by the literature: 1) preschool leadership. A strong leadership could promote teachers to implement successful and effective ICT use practices (Han, 2002); 2) ICT policy. A positive correlation was revealed between preschool ICT policy and teachers' ICT use (Blackwell et al., 2013); 3) preschool support. Sufficient support from the preschool could promote teachers to use ICTs (Blackwell et al., 2014); 4) ICT access. Whether and how much teachers had access to ICTs significantly affected their ICT use (Edwards, 2005; Zaki, 2013); 5) ICT training. Having attended ICT training was positively related to teachers' ICT use (Blackwell et al., 2014; Kerckaert et al., 2015). Besides, the length of ICT training was also a significant factor for teachers' ICT use. Teachers with more than a week of training were more likely to use ICTs (Chen & Chang, 2006).

Greek Context

A scarcity of systematic empirical studies was conducted in the Greek and Chinese context regarding influencing factors for preschool teachers' ICT use in teaching and learning.

Among these limited empirical studies, teachers' confidence of ICT use, ICT access in the classroom and in-service ICT training (A-level training) were found as positive factors for their ICT use in the Greek context. However, teachers' perceived barriers, teaching experiences and computer experiences were found no impacts on their ICT use (Nikolopoulou & Gialamas, 2015a).

Chinese Context

In the Chinese context, a positive correlation was reported between teachers' ICT use and their educational level and pre-service ICT training. On the contrary, teachers' age, teaching experiences, ICT access at home, whether using ICTs in the daily life and whether having attended in-service ICT training were found have no impacts on their decisions to use ICTs (Liu & Pange, 2015a).

2.5 Teachers' Attitudes toward ICT Use in Teaching and Learning

2.5.1 Definition

The attitude is defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (Eagly & Chaiken, 1993). It is "a relatively enduring organization of beliefs, feelings and behavioral tendencies towards socially significant objects, groups, events or symbols" (Hogg & Vaughan, 2011). It is considered as an important factor to affect an individual's real practices (Sakellariou & Rentzou, 2011).

2.5.2 Current Status

Global Context

A number of studies conducted in both developed and developing countries arrived at the same conclusion that preschool teachers in general held positive attitudes towards the use of ICTs in preschool teaching and learning. They realized the importance and role of ICTs in preschool teaching and learning. They also agreed that it was suitable and necessary to introduce and use ICTs in preschool teaching and learning (Aubrey & Dahl, 2008; Hinostroza et al., 2013; Kerckaert et al., 2015; Kol, 2012; Masoumi, 2015; Wood, Specht, Willoughby, & Mueller, 2008; Yurt & Cevher-Kalburan, 2011; Zaki, 2013).

On the contrary, some studies also reported preschool teachers' neutral and negative attitudes toward the introduction and use of ICTs in preschool teaching and learning.

These teachers expressed a series of uncertainties and concerns about the use of ICTs in preschool teaching and learning, particularly in term of harms which ICTs might bring to children's physical and social development, children's excessive exposure to ICTs, and inappropriate multimedia content (Aubrey & Dahl, 2008; Kol, 2012; Wood et al., 2008). Some of the teachers even believed that it was not necessary to introduce and use ICTs in preschool teaching and learning. On the one hand, it was not suitable for young children; on the other hand, it was a big threat for some traditional activities which were more valuable for young children (Masoumi, 2015).

Greek Context

Some studies reported a favorable attitude of Greek preschool teachers toward the use of ICTs in teaching and learning (Gialamas & Nikolopoulou, 2010; Nikolopoulou & Gialamas, 2015b; Pange, 2011; Toki & Pange, 2014; Ζαράνης & Οικονομίδης, 2005; Κόμης & Τζαβάρα, 2004; Μάνεση, 2016; Χριστοδούλου-Γκλιάου & Γουργιώτου, 2009). However, some other studies also reported that some Greek preschool teachers were skeptical about the use of ICTs in preschool teaching and learning, and had anxieties and fears about potential harms to children (Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011; Tsitouridou & Vryzas, 2003, 2004; Zaranis & Oikonomidis, 2015). Particularly, due to the economic crisis, the number of Greek preschool teachers who held skeptical attitudes toward the use of ICTs in preschool teaching and learning had increased (Petrogiannis, 2010).

Chinese Context

The previous studies also indicated a positive attitude of Chinese preschool teachers towards the use of ICTs in teaching and learning. They recognized the significance and necessity to introduce and use ICTs in preschool teaching and learning. They also supported to introduce and use ICTs in preschool teaching and learning (Dong, 2014; Liu, 2006; Liu, 2010; Pu, 2005; Yang, 2013).

2.5.3 Influencing Factors

Studies regarding the factors influencing preschool teachers' attitudes toward ICT use in teaching and learning were scarce and lacking. However, an abundance of studies were conducted in terms of the influencing factors for teachers in general education, which provided a good foundation to understand preschool teachers' attitudes.

Influencing Factors in General Education

Two groups of factors influencing teachers' attitudes toward ICT use in teaching and learning were documented in general education: external factors and internal factors. External factors consisted of attributes of ICTs, social and cultural norms, subjective norms and facilitating conditions; internal factors included teachers' demographic characteristics and teachers' ICT competences.

External Factors

Attributes of ICTs were found have a positive correlation with teachers' attitudes (Albirini, 2006b; Kriek & Stols, 2010; Samak & Tawfik, 2006; Teo, 2009). However, Moses, Wong, Bakar, and Mahmud (2013) reported that while perceived usefulness of ICTs was a predictor for teachers' attitudes, perceived ease of use had no impact on teachers' attitudes.

Both Albirini (2006b) and Samak and Tawfik (2006) revealed that teachers' **social and cultural perceptions of ICTs** were a predictor for their attitudes.

The subjective norm is "a person's perception that most people who are important to him or her think he should or should not perform the behavior in question" (Teo, 2009). It was identified as a significant predictor for teachers' attitudes (Teo, 2009).

Facilitating conditions include the provision of ICT equipment and resources, time support, technical support and training support. Firstly, ICT access was found have a positive impact on teachers' attitudes (Pavlou & Vryonides, 2009; Samak & Tawfik, 2006; Sipilä, 2010). Secondly, sufficient time support was regarded as a predictor for

teachers' positive attitudes (Yeung, 2001). Thirdly, teachers' attitudes were positively affected by sufficient technical support (Teo, 2009; Yeung, 2001). Finally, while some studies reported a positive correction between teachers' attitudes and ICT training (Christensen, 2002; Hismanoglu, 2012; Jimoyiannis & Komis, 2006; Pavlou & Vryonides, 2009; Ramírez, Cañedo, & Clemente, 2012; Samak & Tawfik, 2006; Tezci, 2010), there were also studies reporting no or negative correlation (Albirini, 2006b; Alghamdi & Prestridge, 2015; Sánchez, Marcos, & GuanLin, 2012).

Internal Factors

Teachers' demographic characteristics referred to gender, age, educational background, teaching experiences, ICT access at home and ICT use experiences.

A large number of studies reported that **gender** was not a good predictor for teachers' attitudes (Albirini, 2006b; Bakr, 2011; Cavas, Cavas, Karaoglan, & Kisla, 2009; Li et al., 2012; Li, Zhang, Guo, & Xu, 2010; Ramírez et al., 2012; Şahin-Kizil, 2011; Samak & Tawfik, 2006; Sipilä, 2010). However, there were also studies reporting a significant impact of gender on teachers' attitudes. That is, male teachers held more positive attitudes than female teachers (Jimoyiannis & Komis, 2006, 2007; Lin & Huang, 2009; Pavlou & Vryonides, 2009; Tezci, 2010).

Age was not identified as a factor to affect teachers' attitudes in some studies (Albirini, 2006), but a negative correlation between teachers' attitudes and age was revealed by some other studies. Young teachers usually held more positive attitudes than older teachers (Cavas et al., 2009; O'bannon & Thomas, 2014; Pavlou & Vryonides, 2009; Şahin-Kizil, 2011; Samak & Tawfik, 2006).

When some studies found that **teaching experiences** did not affect teachers' attitudes (Albirini, 2006b; Bakr, 2011; Li et al., 2012; Sipilä, 2010), there were studies that found a correlation between the two variables. On the one hand, a negative correlation was reported by some studies (Ramírez et al., 2012; Samak & Tawfik, 2006; Tezci, 2010). On the other hand, a positive correlation was reported by some other studies (Lin & Huang, 2009; Sahin-Kizil, 2011).

Both Albirini (2006b) and Yeung (2001) revealed no effect of **educational level** on teachers' attitudes. However, Samak and Tawfik (2006) revealed a positive impact of teachers' educational level on their attitudes.

ICT access at home was found as a positive factor by Cavas et al. (2009) and Pavlou and Vryonides (2009), but as a negative factor for teachers' attitudes by Sahin-Kizil (2011).

Many studies reported that rich **ICT use experiences** were a predictor for teachers' positive attitudes (Akaslan & Law, 2012; Cavas et al., 2009; Pavlou & Vryonides, 2009; Tezci, 2010). However, some studies find no significant impact of ICT use experiences on teachers' attitudes (Alghamdi & Prestridge, 2015).

A positive correlation was revealed by studies between **teachers' ICT competences** and their attitudes (Albirini, 2006b; Avidov-Ungar & Eshet-Alkalai, 2011; Madden, Ford, Miller, & Levy, 2005; Rastogi & Malhotra, 2013; Samak & Tawfik, 2006; Tezci, 2010). However, some studies did not find a significant difference of attitudes between teachers with high competencies and those with low competencies (Yeung, 2001).

Influencing Factors in Preschool Education

Global Context

In the global context, age, educational level, ICT use experiences, ICT competences and children's age were identified as factors to affect preschool teachers' attitudes. Precisely, the teachers who were younger, held a higher educational level, used ICTs more often in the classroom, had higher ICT competences and worked with older children (3 years old or above) were likely to hold positive attitudes (Bayhan et al., 2002; Derscheid, 2003).

Greek Context

A series of factors were reported to influence Greek preschool teachers' attitudes,

including teachers' teaching experiences, teachers' competences, teachers' training, teachers' ICT use experiences, teachers' self-efficacy, and teachers' confidence. Those teachers who had fewer teaching experiences, had a higher level of competences, self-efficacy an confidence on ICT use, had attended in-service ICT training and had richer ICT use experiences at home or in teaching and learning activities tended to hold positive attitudes (Gialamas & Nikolopoulou, 2010; Nikolopoulou & Gialamas, 2015b; Tsitouridou & Vryzas, 2003, 2004; Zaranis & Oikonomidis, 2015). However, teaching experiences, training and ICT use experiences had no impact on teachers' attitudes in some studies (Nikolopoulou & Gialamas, 2015b; Tsitouridou & Vryzas, 2003, 2004).

Chinese Context

Quite limited empirical studies were carried out to examine the influencing factors for Chinese preschool teachers' attitudes toward ICT use in teaching and learning.

2.6 Teachers' ICT Competences

2.6.1 Definition and Composition

In the generic sense, the competence is defined as "a set of related knowledge, skills, and attitudes that enable an individual to effectively perform the activities of a given occupation or job function to the standards expected in employment" (Klein, Spector, Grabowski, & de la Tejia, 2004). It is a prerequisite for a successful task or action, and could be acquired through learning and practices (Goktas, Yildirim, & Yildirim, 2009; Mandl & Krause, 2003).

In today's technological era and information society, one kind of new competence - ICT competence is required for every individual to live, work and learn, including teachers (UNESCO, 2008). In the professional setting, the teacher's ICT competence refers to "teacher's proficiency in using ICT in a professional context with good pedagogical-didactic judgment and his or her awareness of its implications for learning strategies and the digital Bildung of pupils and students" (Krumsvik, 2008).

Specifically, teachers' ICT competences are composed by two components: general ICT competences and specific ICT competences. The former refers to teachers' general knowledge and skills to operate and use ICT-related equipment and resources. The latter refers to teachers' knowledge and skills to make appropriate and effective use of ICT-related equipment and resources to conduct teaching and learning activities (Chai, 2010; Goktas et al., 2009; Mishra & Koehler, 2006).

The TPACK (Technological Pedagogical Content Knowledge) is a new framework to explain and model teachers' competences that are required to use and integrate ICTs in teaching and learning practices. It was developed by Mishra and Koehler (2006) based on Shulman's (1986) PCK framework (Pedagogical Content Knowledge). It has gained much recognition and popularity in recent years (Chai, Chin, Koh, & Tan, 2013; Chai, Koh, & Tsai, 2013; Jordan & Dinh, 2012). The TPACK framework covers seven types of teachers' competences, including Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). It is regarded that the TPACK framework emphasizes the complexity and versatility of teachers' new pedagogical competences. Therefore, it has transformed the perspective of researchers from a traditional techno-centered framework to a new integrated framework (Jordan & Dinh, 2012).

Specifically, Content Knowledge (CK) refers to the knowledge about a given subject. Pedagogical Knowledge (PK) is the knowledge about the nature, process and methods of teaching and learning activities. Pedagogical Content Knowledge (PCK) refers to the knowledge about what teaching methods fit the content and how the content can be arranged for better teaching. Technological Knowledge (TK) is the knowledge about technologies. Technological Content Knowledge (TCK) refers to the knowledge about the manner in which content can be changed by technologies. Technological Pedagogical Knowledge (TPK) refers to the potentials of different technologies for teaching and learning and how teaching and learning can be changed by technologies. Technological Pedagogical Content Knowledge (TPCK) is a new form of knowledge and involves a series of knowledge: the knowledge about the presentation of content using technologies; the knowledge about pedagogical techniques using technologies

in a constructive way to teach content; the knowledge about the problems students face and how technologies can help; the knowledge about students' prior knowledge and theories of epistemology; and the knowledge about how technologies can help develop new epistemology or strengthen old ones (Mishra & Koehler, 2006).

2.6.2 Current Status

Global Context

There were relatively limited empirical studies in the global context that examined the status of ICT competences of preschool teachers. However, an agreement was reached by these studies that preschool teachers generally had a low level of ICT competences. They lacked technical knowledge and skills, such as operating a computer, sending an email, writing documents, using spreadsheets, installing applications, downloading photos and doing a presentation. They were also not knowledgeable and skilled about how to select and apply suitable ICT tools for teaching and learning activities, which represented specific ICT competences (Aubrey & Dahl, 2008; Chen & Chang, 2006; Hinostroza et al., 2013; Kim, 2015; Ndiritu, Mburu, & Kimani, 2013).

Meanwhile, there were also empirical studies that looked into the reality of preschool teachers' ICT competences from the perspective of the TPACK framework. It was reported that preschool teachers were at a higher level in terms of pedagogy-related and content-related competences, such as PK, CK and PCK. However, the level of technology-related competences of preschool teachers was lower, such as TK, TPK, TCK and TPACK (Chuang & Ho, 2011; Liang, Chai, Koh, Yang, & Tsai, 2013). However, the relevant studies using the TPACK framework were lacking.

Greek Context

Very few studies were found regarding the reality of ICT competences of Greek preschool teachers. An earlier study reported that most of Greek preschool teachers had insufficient or no knowledge about computer use (Tsitouridou & Vryzas, 2004). A recent study, however, revealed a middle level of ICT competences of them (Gialamas & Nikolopoulou, 2010). Moreover, another recent study reported that they expressed

more confidence in technical competences than competences to integrate ICT tools in teaching and learning (Nikolopoulou & Gialamas, 2015b).

Chinese Context

A number of empirical studies investigated preschool teachers' ICT competences in the Chinese context. It could be seen that Chinese preschool teachers generally lacked ICT competences and were in an urgent need for systematic ICT training (Bi & Li, 2012; Guo et al., 2006; Liu, 2007; Liu, 2006; Liu, 2010; Quan & Pan, 2014; Zhang & Yu, 2010; Zhu & Wang, 2013; Yang, 2013).

On the one hand, Chinese preschool teachers had limited technical competences. They were able to use traditional and basic ICT hardware and software, such as radios, televisions, desktops, word processor, PowerPoint, the Internet and e-mail, but could not use latest and advanced ones, such as projectors and digital cameras (Bi & Li, 2012; Liu, 2007; Liu, 2010; Quan & Pan, 2014; Zhu & Wang, 2013). On the other hand, they also had a rather low level of specific ICT competences. In other words, they lacked the competences to design and implement teaching and learning activities with ICT tools (Bi & Li, 2012; Liu, 2006; Liu, 2010; Quan & Pan, 2014).

2.6.3 Influencing Factors

Insufficient empirical studies analyzed the influencing factors for ICT competences of preschool teachers. Thus, in order to better understand the impact of possible factors on teachers' ICT competences, relevant empirical studies in general education were also presented in this section.

Influencing Factors in General Education

A series of factors that affected ICT competences of teachers in general education were documented, which included ICT access and ownership, ICT use experiences, ICT training, attitudes and demographic information.

ICT access and ownership was reported to have a positive impact on teachers' ICT

competences. Teachers who had better access to ICTs or owned ICTs tended to have higher ICT competences (Anderson & Maninger, 2007; Goktas et al., 2009)

Teachers' ICT competences were positively influenced by their **ICT use experiences** either in daily lives (Tezci, 2010) or in teaching and learning practices (Jang & Tsai, 2012).

With regard to **ICT training**, studies reported that teachers who had participated in pre-service ICT traning had higher ICT competences than those who had not (Goktas et al., 2009; Tezci, 2010). However, Goktas et al. (2009) and Yang (2009) did not find a significant impact of in-service ICT training on teachers' ICT competences.

Teachers' attitudes were identified as a predictor for their ICT competences by Jegede, Dibu-Ojerinde, and Ilori (2007), whereas Anderson and Maninger (2007) did not find a correlation between teachers' ICT competences and their attitudes.

A range of studies showed a difference of ICT competences based on teachers' gender. Males had a higher level of ICT competence than females (Altun Alev, & Yigit, 2009; Ding & Wu, 2010; Goktas et al. 2009; Koh, Chai, & Tsai, 2010; Tezci, 2010). However, some other studies also reported that gender was not a factor for teachers' ICT competences (Jamieson-Proctor, Finger, & Albion, 2010; Jang & Tsai, 2012). Moreover, in the study of Lin, Tsai, Chai, and Lee (2013), gender played a more complex role in teachers' TPACK competences. Females had more confidence in pedagogical knowledge, but had less confidence in technological knowledge than males.

Age was found not be a predictor for teachers' ICT competences by Koh et al. (2010). Lin et al. (2013) found that age only negatively influenced TPACK competences of female teachers. However, some studies reported that young teachers had higher ICT competences than old teachers (Ding & Wu, 2010; Li et al., 2006).

Some studies did not reveal a correlation between **teaching experiences** and teachers' ICT competences (Koh et al., 2010; Omoniyi & Quadri, 2013). However, teaching experiences negatively affected teachers' ICT competences in the study of Tezci

(2010), while positively affected teachers' TPACK competences in the study of Jang and Tsai (2012).

Educational background may be a factor for teachers' ICT competences. However, both Ding and Wu (2010) and Omoniyi and Quadri (2013) did not find an impact of educational background on teachers' ICT competences.

Influencing Factors in Preschool Education

Global Context

Among the limited relevant literature in the global context, educational level was not found as a predictor for preschool teachers' ICT competences (Chen & Chang, 2006). However, the ownership of the home computer, the length of in-service training and the confidence of ICT use were found positively correlate with ICT competences of preschool teachers (Chen & Chang, 2006). A negative correlation was also reported between preschool teachers' teaching experiences and their ICT competences (Chen & Chang, 2006).

Some studies also analyzed the influencing factors for ICT competences of preschool teachers from the perspective of the TPACK framework. They found different effects of related factors on pedagogy-related knowledge and technology-related knowledge. Precisely, teachers' teaching experiences and age were positively correlated with their pedagogy-related knowledge (Chuang & Ho, 2011), but negatively influenced their technology-related knowledge (Chuang & Ho, 2011; Liang et al., 2013). Moreover, teachers' ICT use frequency in the daily life, ICT use experiences, educational level and attitudes were found positively affect technology-related knowledge (Chuang & Ho, 2011; Hsu, Liang, Chai, & Tsai, 2013; Liang et al., 2013).

Greek Context

In the Greek context, ICT competences of preschool teachers were reported to have a positive correlation with their ICT experiences and self-efficacy of ICT use, whereas in-service training was not identified as a factor (Nikolopoulou & Gialamas, 2015b).

Chinese Context

However, very limited relevant empirical studies were found in the Chinese context.

2.7 Teachers' Barriers to ICT Use in Teaching and Learning

2.7.1 Definition and Categories

Teachers' barriers to ICT use in teaching and learning are the conditions that do not support teachers to successfully use and integrate ICTs in teaching and learning. As an innovation, it is inevitable for teachers to meet a series of barriers when they make efforts to use and integrate ICTs in teaching and learning practices (Ertmer, 1999).

Ertmer (1999) classified the barriers that teachers might encounter into two categories: first-order barriers and second-order barriers. First-order barriers refer to a series of conditions which are missing or are inadequately provided by schools or educational authorities. They are extrinsic to teachers and are relatively easy to be overcome on which are often focused by early efforts. These barriers typically include lack of ICT hardware and software, lack of time, lack of teacher training, lack of technical support and lack of administrative support.

Second-order barriers are intrinsic to teachers and involve teachers' existing teaching and learning beliefs and practices. They are mainly composed by teachers' beliefs about ICT use, teachers' willingness of ICT use, teachers' beliefs about teaching and learning, and teachers' established teaching and learning practices. They are related to teachers' belief systems and established practices that will cause more difficulties and take more time to be overcome. Moreover, it was also pointed out by Ertmer (1999) that teachers might encounter different barriers at different time, but it would be wiser to emphasize both first-order and second-order barriers at the same time, because of their interactive relationship.

In a recent study, Tsai and Chai (2012) proposed a new type of barrier of teachers - lack of design thinking. They believed that teachers would still meet with some other

barriers even though they had overcome first-order and second-order barriers. One of these barriers was the lack of design thinking, which was the "third-order barrier". It referred to the disposition and ability to "re-organize or create learning materials and activities, adapting to the instructional needs for different contexts and varying groups of learners". It was regarded that the removal of the third-order barrier would promote teachers to use ICT tools at the right time and in the right place.

2.7.2 Teachers' Barriers Encountered

Barriers in General Education

A body of studies in both developed and developing countries in general education documented the barriers which teachers encountered in actual ICT-based teaching and learning practices. More specifically, the first-order barriers included lack of hardware, software and Internet (Ajayi & Ekundayo, 2009; Alwani & Soomro 2010; Bingimlas 2009; Chen, Tan, & Lim, 2012; Goktas, Gedik, & Baydas, 2013; Khan, Hasan, & Clement, 2012; Kokkinaki, 2010; Nikolopoulou & Gialamas, 2016; Pamuk, Cakir, Ergun, Yilmaz, & Ayas, 2013; Ran, 2014; Zhang & Fan, 2011), outdated hardware, software and slow Internet (Nikolopoulou & Gialamas, 2016; Nim Park & Son, 2009; Toprakci, 2006), lack of time (Al-Senaidi, Lin, & Poirot, 2009; Alwani & Soomro 2010; Bingimlas 2009; Chen et al. 2012; Khan et al. 2012; Kokkinaki, 2010), lack of training (Ajayi & Ekundayo, 2009; Al-Senaidi et al, 2009; Bingimlas 2009; Goktas et al. 2013; Khan et al. 2012; Pamuk et al., 2013; Ran, 2014; Zhang & Fan, 2011), lack of technical support (Al-Senaidi et al., 2009; Goktas et al. 2013; Kokkinaki, 2010; Lin & Huang, 2010; Pamuk et al., 2013; Toprakci, 2006; Nikolopoulou & Gialamas, 2016), lack of pedagogical support (Schoepp 2005), lack of administrative support (Al-Senaidi et al., 2009; Khan et al. 2012; Nim Park & Son, 2009; Schoepp 2005; Toprakci, 2006), lack of fund (Ajayi & Ekundayo, 2009; Al-Senaidi et al., 2009; Alwani & Soomro, 2010; An & Reigeluth, 2011; Khan et al. 2012; Nikolopoulou & Gialamas, 2016; Toprakci, 2006), lack of space (Alwani & Soomro, 2010), big class size (An & Reigeluth, 2011; Goktas et al. 2013; Nikolopoulou & Gialamas, 2016), curriculum constrain (Chen et al., 2012; Nim Park & Son, 2009), evaluation method constrain (An & Reigeluth, 2011; Jones, 2004), attributes of ICTs (Butler & Sellbom, 2002), lack of teachers' competences (Ajayi & Ekundayo, 2009; Bingimlas 2009;

Khan et al. 2012; Nim Park & Son, 2009; Pamuk et al., 2013; Ran, 2014; Zhang & Fan, 2011), lack of support from parents and communities (An & Reigeluth, 2011), as well as political, economical, social and cultural barriers (Khan et al. 2012; Nim Park & Son, 2009).

Meanwhile, the second-order barriers included teachers' negative attitudes toward and unwillingness of ICT use (Ajayi & Ekundayo, 2009; Bingimlas 2009; Chen et al. 2012; Goktas et al. 2013; Khan et al. 2012; Nim Park & Son, 2009; Schoepp 2005; Toprakci, 2006), the lack of teachers' confidence of ICT use (Bingimlas 2009; Jones, 2004), and teachers' beliefs and practices about teaching and learning (Unal & Ozturk, 2012).

Barriers in Preschool Education

The existing literature on the barriers that preschool teachers were facing in the use of ICTs in teaching and learning was quite scant.

Global Context

The mentioned first-order barriers in the global context referred to four categories: 1) child-related barriers. They included children's lack of ICT competences and lack of ICT access outside the preschool (Hinostroza et al., 2013); 2) teacher-related barriers. They included teachers' lack of competences (Ihmeideh, 2009; Kol, 2012; Li, 2006; Plumb & Kautz, 2015); 3) preschool-related barriers. They included the lack of fund (Ihmeideh, 2009; Plumb & Kautz, 2015), lack of hardware (Ihmeideh, 2009; Li, 2006; Plumb & Kautz, 2015), lack of the Internet (Ihmeideh, 2009; Plumb & Kautz, 2015; Zaki, 2013), lack of software and resources (Hinostroza et al., 2013; Ihmeideh, 2009; Kol, 2012; Li, 2006; Plumb & Kautz, 2015), outdated, incompatible and unreliable hardware, software and slow Internet (Kol, 2012; Plumb & Kautz, 2015), lack of time (Hinostroza et al., 2013; Ihmeideh, 2009; Plumb & Kautz, 2015), lack of technical support (Blackwell, 2013; Hinostroza et al., 2013; Li, 2006; Plumb & Kautz, 2015), lack of training (Blackwell, 2013; Ihmeideh, 2009; Plumb & Kautz, 2015), lack of administrative support (Ihmeideh, 2009; Plumb & Kautz, 2015), large class size (Ihmeideh, 2009; Plumb & Kautz, 2015), insufficient space (Ihmeideh, 2009; Plumb

& Kautz, 2015), and curriculum constrain (Han, 2003); 4) contextual barriers. They included parents' lack of ICT competences (Li, 2006), lack of parents' support (Li, 2006; Plumb & Kautz, 2015), and lack of national curriculum regulation and guidance (Ihmeideh, 2009; Plumb & Kautz, 2015).

The second-order barriers that were mentioned referred to teachers' negative attitudes towards ICT use (Blackwell, 2013; Plumb & Kautz, 2015), the lack of teachers' confidence on ICT use (Hinostroza et al., 2013; Plumb & Kautz, 2015), and teachers' teaching and learning beliefs and practices (Blackwell, 2013; Turbill, 2001).

Greek Context

Very limited empirical studies investigated the barriers that Greek preschool teachers encountered. It was reported by these studies that the main barriers Greek preschool teachers faced belonged to first-order barriers, including lack of computers, lack of Internet access, lack of fund, lack of educational software, lack of technical support, lack of ICT training, large number of children, lack of space to place computers, and lack of administrative support (Nikolopoulou & Gialamas, 2015a; Μάνεση, 2016) .

Chinese Context

There were also insufficient studies that looked at Chinese preschool teachers' barriers. Based on related studies, it could be found that preschool teachers in China met with a range of barriers, which included both first-order and second-order barriers.

The first-order barriers involved the lack of fund (Yang, 2013), lack of hardware and Internet (Dong, 2014; Liu & Pange, 2015b; Wu & Zhao, 2014; Yang, 2013), lack of educational software and resources (Dong, 2014; Liu, 2006; Liu & Pange, 2015b; Wu & Zhao, 2014; Yang, 2013; Zhu & Wang, 2013), lack of pedagogical model (Liu & Pange, 2015b), teachers' lack of competences (Dong, 2014; Guo et al., 2006; Liu, 2006; Wu & Zhao, 2014; Yang, 2013; Zhu & Wang, 2013), teachers' lack of training (Dong, 2014; Wu & Zhao, 2014; Zhu & Wang, 2013), lack of time (Liu, 2006), lack of positive attitudes and support of leaders (Liu, 2006), lack of reward, incentive and encouragement system in the preschool (Liu, 2006), lack of regulations and guidance

of educational authorities (Liu, 2006), lack of curriculum guidance (Dong, 2014), and constrains of cultural and educational traditions (Dong, 2014). The second-order barriers included teachers' negative attitudes and concerns (Dong, 2014).

2.7.3 Influencing Factors

Relevant literature regarding influencing factors for teachers' barriers in both general education and preschool education was lacking and insufficient.

In the general education setting, Nikolopoulou and Gialamas (2016) found significant impacts of teachers' gender, in-service ICT training and teaching experiences on their perceptions of barriers. Female teachers more tended to perceive the lack of support as a major barrier than male teachers; attendance of in-service training (pedagogical training) and fewer years of teaching experiences made teachers more perceive the lack of confidence and the lack of equipment as minor barriers.

In the preschool education setting, teachers' teaching experiences, confidence about ICT use and ICT use experiences were reported to significantly correlate with the perceptions of the lack of support of Greek preschool teachers. In other words, more teaching experiences, lower confidence and fewer use experiences of ICT tools made teachers more perceive the lack of support as a major barrier. Moreover, confidence about ICT use was found negatively affect their perceptions of the barrier on class conditions (Nikolopoulou & Gialamas, 2015a).

Regarding Chinese preschool teachers, Liu and Pange (2015b) found that ICT use in the daily life had a negative impact on their perceptions of barriers.

According to the relevant literature review, a series of research gaps were summarized: 1) compared with related studies on teachers in general education, the relevant studies on preschool teachers were scarce and insufficient; 2) existing studies in both general and preschool education mainly focused on one or two dimensions, and thus lacked systematic and comprehensive study involving more dimensions; 3) although some international comparative studies were carried out on teachers in general education, similar studies on preschool teachers were lacking; 4) most studies were quantitative

studies, lacking qualitative and mixed studies. Thus, in order to fill in these research gaps, this study aimed to make a systematic comparison between Greek and Chinese preschool teachers in ICT access, ICT use practices, attitudes, ICT competences and barriers. Moreover, the mixed research methodology with both the quantitative and qualitative study was adopted.

Concluding Remarks

This chapter gives a brief introduction to the Greek and Chinese preschool education system, which sets a historical and structural context for this study. It also analyzes in detail the long-standing debate on young children and ICTs, and presents the new shift from "if" to "how" and the new perspective of the "developmentally appropriate practice". The related literature on teachers' ICT access, ICT use, attitudes toward ICT use, ICT competences and barriers to ICT use in teaching and learning in both global, Greek and Chinese setting is reviewed. Based on the literature review, it summarizes the gaps in the research perspective and methodology, and points out the necessity to carry out systematic, comparative and mixed studies in the preschool education field.

The next chapter will present the general research design and the detailed research methods which are applied to achieve the research aim of this study.

Chapter 3 Methodology

This chapter provides a detailed description for the methodology which is adopted by this study. It begins with the research design (3.1). The introduction to the sampling methods (3.2), the data collection instruments (3.3), the data collection processes (3.4) and the data analysis methods (3.5) are followed. Finally, the validity and reliability of the study (3.6) are also discussed.

3.1 Research Design

3.1.1 Comparative Study

This study was a comparative study. It investigated and compared preschool teachers' experiences, thoughts and competences of ICT use in teaching and learning practices between two countries: Greece and China. It aimed to find out the common trends and contextual differences between the two countries regarding preschool teachers' status of preparedness and adaptation for the information society.

3.1.2 Case Study

The case study method is "a kind of research that concentrates on one thing, looking at it in detail, not seeking to generalise from it". A case may be "a person, group, an institution, a country, an event, a period in time or whatever" (Thomas, 2011). This study aimed to portray and understand the experiences, thoughts and competences on ICT use in teaching and learning of preschool teachers in two similar cities from two countries - Ioannina in Greece and Changchun in China. Therefore, a case study was suitable to be adopted by the study. The reasons for the case selection were as follows:

On the one hand, the two cities are quite similar in geographic, political and economic

conditions. Geographically, both of them are situated at a remote region. Ioannina is at Northwest Greece, and Changchun is at Northeast China; politically, neither of them are the country's capital, but both of them are the capital city of their respective region. Ioannina is the capital city of Epirus Region, and Changchun is the capital city of Jilin Province; economically, they are all among middle-ranking cities in their country.

On the other hand, it is convenient for the researcher to carry out the field work in the two cities. The researcher is studying or studied in these two cities. The interpersonal relationship and familiar environment creates much convenience and save much time for her to look for potential participants and conduct the field work in the preschool.

3.2 Sampling

3.2.1 Sampling in the Quantitative Study

In the Greek context, the samples in the survey study included 108 preschool teachers. They were working in public preschools (Νηπιαγωγεία) which were located at the city center and near suburb in Ioannina. The children in their classrooms were aged 4 to 6 years old. The census method was used, which sampled the whole teacher population of public preschools in the city center and near suburb in Ioannina.

In the Chinese context, 155 preschool teachers constituted the samples of the survey study. They came from 13 public preschools (You Er Yuan) which were located at the city center in Changchun. They were teaching in either the middle or the senior class holding children aged 4 to 6 years old. Because of the obvious heterogeneity of urban public preschools in Changchun, both the stratified sampling and the cluster sampling were adopted.

Specifically, the public preschools in the urban area in Changchun were firstly divided into five groups: provincial government-run preschools, municipal government-run

preschools, municipal educational bureau-run preschools, state enterprise-run preschools and university-run preschools. Each subgroup of the preschools was then sampled. Because of the fact that the number of the former three types of preschools is larger than that of the latter two types of preschools, three preschools were sampled from each of the former three types of preschools and two preschools from each of the latter two types of preschools. All the teachers from the middle or senior class in these 13 public preschools became the subjects of sampling.

3.2.2 Sampling in the Qualitative Study

Three methods were adopted in the sampling of the interview study in both the Greek and Chinese setting: 1) convenience sampling. The selection of the interviewees was based on the introduction of the friends or interpersonal relationship of the researcher; 2) volunteer sampling. An extra page was designed and put by the researcher at the end of the questionnaire in order to look for voluntary teachers for the following interview study. The teachers who were willing to participate in the interview study needed to write down their contact information on this page and would be contacted later by the researcher; 3) authority arrangement. Several authorities, including the director of educational authorities and the principal of preschools, arranged teachers to participate in the interview study.

Finally, a total of 15 Greek teachers working with children aged 4 to 6 years old from 13 public preschools in the city center or near suburb in Ioannina participated in the interview. Among them, 4 teachers were selected by the convenience sampling, 10 by the volunteer sampling, and 1 by the authority arrangement. Meanwhile, a total of 19 Chinese teachers teaching 4- to -6-year-olds in 11 public preschools in the city center in Changchun were interviewed by the researcher. 8 out of them were selected by the convenience sampling and 11 by the authority arrangement.

3.3 Instruments

3.3.1 Instrument in the Quantitative Study

A questionnaire titled “Questionnaire on the Use of ICTs in Teaching Activities of Preschool Teachers” was used as the measurement instrument in the survey study. It was self-designed by the researcher based on several previous studies, questionnaires and scales. Most of the items in the questionnaire were multiple-choice questions. But some items were also in the form of gap filling questions. Both the Greek and Chinese version of the questionnaire were included.

The questionnaire specifically consisted of eight sections: 1) teachers’ demographic information. It involved gender, age, educational background, teaching experiences, number of teachers in the classroom, number of children in the classroom, age of classroom children and working hours per day. Due to the fact that both half-day and full-day preschools exist in Greece, an extra item on the preschool type was added in the Greek version of the questionnaire; 2) teachers’ previous experiences of ICT use. It included teachers’ ICT access and ICT use frequency in the daily life; 3) preschool support. It consisted of six types of support offered by the preschool, including policy support, hardware, Internet and software support, training support, technical support, pedagogical support and time support; 4) teachers’ ICT training. The items on whether having attended pre-service ICT training (general and pedagogical training), whether having attended in-service ICT training, as well as perceived benefits of in-service training were referred to; 5) teachers’ ICT access and ICT use in teaching and learning. A series of items on access, use frequency, teaching stages, using years, learning areas, time allocation and teaching approaches were included; 6) teachers’ attitudes towards ICT use in teaching and learning. A total of twelve statements about teachers’ attitudes were listed which could be divided into three dimensions, including attitudes toward the effect of ICTs on teaching and learning, attitudes toward the appropriate teaching and learning practice with ICTs, and affections and willingness on ICT use in teaching

and learning; 7) teachers' ICT competences. It consisted of nine statements and four dimensions, including Technological Competences (TC), Technological Pedagogical Competences (TPC), Technological Content Competences (TCC) and Technological Pedagogical Content Competences (TPCC); 8) teachers' barriers to ICT use in teaching and learning. A total of fifteen types of barriers were involved.

3.3.2 Instrument in the Qualitative Study

According to the research questions of the study and the questionnaire of the survey study, an interview outline was developed by the researcher as an instrument in the interview study. It was composed by eighteen questions which could be grouped into seven aspects: 1) daily routine of classroom children; 2) teachers' ICT access and ICT use. The questions on teachers' ICT access aimed to examine teachers' ICT access in the classroom and in the computer laboratory/multimedia classroom. The questions on teachers' ICT use aimed to find out teachers' experiences in using ICTs in teaching and learning practices. Four contexts of teaching and learning practices were involved, including teaching and learning preparation before the class, teaching and learning implementation in the class, teaching and learning evaluation and reflection after the class, and other teaching and learning contexts; 3) teachers' attitudes towards ICT use in teaching and learning activities. It aimed to understand teachers' attitudes towards the introduction and use of ICTs in preschool teaching and learning, attitudes towards the effect of ICTs on teachers' teaching activities, attitudes towards the effect of ICTs on children's learning activities, feelings on ICT use in teaching and learning, as well as concerns about ICT use in teaching and learning; 4) teachers' ICT competences. One question was to find out the current status and future improvement of teachers' ICT competences; the other focused on teachers' in-service ICT training, including training experiences, perceived impacts of training and suggestions for future training; 5) teachers' barriers to ICT use in teaching and learning; 6) preschool support. Both the support offered by the preschool and the support needed in the future were asked; 7) teachers' personal information. It included gender, age, teaching years, educational

background, age of classroom children, number of classroom children and number of classroom teachers.

3.4 Data Collection

3.4.1 Data Collection in the Quantitative Study

The collection of the quantitative data in the Greek public preschools lasted around one month, which was from Mid May 2015 to Mid June 2015. The researcher firstly obtained the contact information of the public preschools located at the city center and near suburb in Ioannina. She then visited the relevant preschools one by one in person and asked the agreement of the principals or teachers to take part in the survey study. A suitable time to return the questionnaire was also agreed on between the researcher and the teachers. Before the day for the questionnaire's return, the researcher made a telephone call for a reminder or a confirmation. As a result, 130 questionnaires were totally distributed, 115 questionnaires were returned (response rate 88.5%), and 108 questionnaires were identified valid (valid response rate 83.1%).

Regarding the collection of the quantitative data in the Chinese public preschools, the duration was from Mid August 2015 to the end of September 2015, lasting around one and half month. The researcher first found several "mediators" in order to contact the responsible person of preschools, including principals or secretaries of principals. The "mediators" were the friends of the researcher working either in the preschool or in the Department of Early Childhood Education in the university. After the introduction and recommendation of "mediators", the researcher got in touch with the responsible persons of preschools and got a permission of them to distribute the questionnaires in the preschool. The questionnaires were distributed at teachers' convenient time, such as meeting time or noon break. A total of 217 questionnaires were finally distributed, 209 questionnaires were returned (response rate 96.3%), and 155 questionnaires were identified as valid (valid response rate 71.4%).

3.4.2 Data Collection in the Qualitative Study

With regard to the Greek preschool teachers, the researcher got the first contact with the potential interviewees by telephone or face to face. After a brief introduction to herself and the study, the researcher got an agreement from the teachers for the following interview. A suitable time and place were agreed on between the researcher and the teachers. The interviews were mostly conducted in the places of the preschool, such as classroom, teachers' office. There were also two interviews that took place in the office of the researcher. Moreover, an interview time which was convenient for the interviewed teachers was selected, either in the morning, at noon or in the afternoon, which depended on the individual teacher.

A similar procedure took place on the collection of the interview data for the Chinese preschool teachers. After the contact with the responsible persons of preschools or "mediators", the researcher introduced her study and her interview plan to them. Most of them made an agreement to look for or arrange suitable teachers for the interview. When they found suitable teachers, they had a contact with the researcher and told the researcher about the suitable interview time and place. The interviews were conducted in the preschool, such as classroom, meeting room and teachers' office. Moreover, the interviews mostly took place at noon, when teachers had a break lasting around two hours. Some interviews also took place in the afternoon, when teachers finished their preschool work.

A similar interview process was conducted for both the Greek and Chinese teachers. At first, a short introduction and explanation of the researcher and the study was made. It consisted of a self-introduction of the researcher, an introduction to the study, an explanation of the scope of ICTs, a declaration of confidentiality and anonymity, and a request for the permission for recording. The interviews were mostly conducted based on the interview outline and the interview questions were asked in order. The teachers

were not intervened by the researcher only if they had deviated from the core question. The researcher finally asked for extra comments for the study, expressed the gratitude to the interviewees and gave a small present to the interviewees. The whole process of the interview was recorded by a digital voice recorder. The duration of the recordings of the Greek teachers varied from 27 to 74 minutes and totaled around 10 hours. The duration of the recordings of the Chinese teachers totaled around 14 hours, each from 30 to 68 minutes.

3.5 Data Analysis

3.5.1 Data Analysis in the Quantitative Study

This study applied the statistical data analysis software package SPSS 22.0 for the management and analysis of the quantitative data. Three stages were performed in the data analysis process: 1) screening and coding. The questionnaires were coded by the researcher one by one, which included coding each questionnaire and each item of the questionnaire. Moreover, the invalid questionnaires, including incomplete or repeated questionnaires were screened out and rejected; 2) inputting. The researcher input the code of each item of each questionnaire into the SPSS data editor. When the inputting process of a questionnaire was finished, the researcher checked again the codes which had just been input to make sure that no mistakes were made. After the whole process of data inputting for a country, a random check for the codes was also conducted; 3) analyzing. A series of analysis methods were used to analyze the data. The descriptive analysis was used to present the general information of a given issue; the Pearson's Chi-square test was used to look at the relationship between two nominal variables, between a nominal and an ordinal variable or between two ordinal variables; the Independent-samples T test was used to compare two groups on a continuous variable; the Pearson's r correlation analysis was used to analyze the correlation between two continuous variables; the one-way ANOVA was used to compare over two groups on a continuous variable or an ordinal variable with continuous scale points. In order to

examine the impacts of multiple independent variables on one dependent variable, the Multiple Linear Regression was also applied. Moreover, the Principal Factor Analysis and Cronbach's alpha coefficient were also used to validate the construct validity and internal reliability of a certain scale.

3.5.2 Data Analysis in the Qualitative Study

The researcher used Microsoft Word to transcribe, manage and analyze the qualitative data. A total of four steps were involved in the data analysis process: 1) transcription and translation. The recordings were transcribed from the audio form to the text form. The text was written literally while listening to the recordings. The recordings of the Chinese teachers were transcribed by the researcher, while the recordings of the Greek teachers were transcribed by a Greek native speaker. In order to ensure the accuracy of the transcription of the Greek recordings, the researcher listened to the recordings and checked the transcribed texts once more. Moreover, the transcribed Greek texts were further translated into English to have a better understanding by the researcher; 2) identifying core themes and labeling. The researcher skimmed the transcribed texts in an open mind and identified a series of key themes, based on which a thematic index referring to all the themes was developed. The researcher then read each piece of texts in details and labeled on it according to the thematic index; 3) sorting. The content of the transcribed texts was re-organized into a series of thematic charts, in which each row represented an interviewee and each column a theme; 4) refining dimensions and categorization. Through reading a certain theme in a corresponding column across all the rows with all the interviewees, the researcher clarified the structure of this theme and refined all the dimensions and elements of this theme.

3.6 Validity and Reliability

3.6.1 Validity and Reliability in the Quantitative Study

The validity in the quantitative study is defined as “whether we are measuring what we want to measure”; the reliability is defined as “the extent to which test scores are free of measurement error” (Muijs, 2004). The two concepts determine whether a measurement instrument is valid and reliable.

The validity of a measurement instrument includes both content validity and construct validity. In this study, a series of measures were taken by the researcher to make sure the questionnaire to be both content-valid and construct-valid. More specifically, four measures were taken for the content validity: 1) making an extensive search for the previous literature and measurement instruments to obtain a complete understanding of relevant concepts and issues; 2) sending the English version of the questionnaire to two professors who were specializing in Educational Technology and Statistics for evaluating; 3) translating the English version of the questionnaire to the Greek and Chinese version by native speakers who knew both English and their native languages; 4) Sending the final Greek and Chinese version of the questionnaire to three teachers in respective country to examine the accuracy and clearness of the translation.

For the construct validity, two measures were taken: 1) covering comprehensive items for a concept or an issue by means of reviewing existing theoretical foundations and measurement instruments; 2) using the Principal Factor Analysis to validate whether the hypothesized sub-scales existed and whether each item measured the sub-scale.

The Cronbach’s alpha coefficient was calculated to validate the internal consistency of each scale as a whole and their sub-scales. The alpha coefficient of all the scales as a whole and their sub-scales was beyond 0.7, which indicated a satisfactory reliability (Muijs, 2004).

3.6.2 Validity and Reliability in the Qualitative Study

The requirement and measurement of the quality of the qualitative study are different from that of the quantitative study. Instead of validity and reliability, the researchers of the qualitative study prefer to use such kinds of terms, like credibility, tansferability, trustworthiness and dependability (Lewis & Ritchie, 2003).

The researcher also took a series of measures to ensure the quality of the qualitative part of this study, including: 1) designing the interview outline based on the previous literature and the questionnaire in order to be consistent with the quantitative study; 2) translating the interview outline by native speakers who knew both English and their native languages; 3) sending the Greek and Chinese version of the interview outline to three native speakers in each country to look at its accuracy and clearness; 4) trying to maintain neutrality in the data collection, analysis and interpretation process in order to objectively understand and interpret the views and experiences of the interviewees; 5) incorporating the views and experiences of all the interviewees in order to present a comprehensive and rich landscape of a given issue, including the deviant ones.

In conclusion, this study was a mixed study, in which the quantitative and qualitative study methods were all adopted. Specifically, the quantitative study applied a survey method, aiming to examine the general characteristics and trend of preschool teachers' ICT use in teaching and learning by means of obtaining and analyzing a great deal of statistical data. In order to analyze and interpret preschool teachers' experiences and thoughts on the use of ICTs in teaching and learning in a detailed and in-depth way, the qualitative study by using the interview method was also applied.

Concluding Remarks

The methodology applied by this study is described in detail by this chapter. Based on

the research aim and problems, this study is designed as a comparative study and a case study. In addition, in the context of a mixed study, the process of data gathering and analyzing, and the strategies to ensure the validity and reliability in the Greek and Chinese setting are presented separately. It is composed by a quantitative study using a survey and a qualitative study using an interview. The next two chapters will report and analyze the results of the quantitative and qualitative study respectively.

Chapter 4 Results of the Quantitative Study

This chapter reports the results of the quantitative part of this study. Firstly, it presents the demographic characteristics of the participating preschool teachers in Greece and China (4.1). It is followed by a series of comparisons between the Greek and Chinese preschool teachers in terms of ICT access in teaching and learning (4.2), ICT use in teaching and learning (4.3), attitudes towards ICT use in teaching and learning (4.4), ICT competences (4.5), and barriers to ICT use in teaching and learning (4.6).

4.1 Demographic Information

A series of demographic characteristics of the participants are showed in this section, including gender, age, educational level, teaching experiences, number of children in the classroom, age of children in the classroom, working hours and preschool types.

As seen in **Table 4.1**, most of the participating Greek teachers (N = 108) were female (99.1%). The ages of them mostly ranged from 36 to 55 years old (98.2%), while the teachers aged below 36 years old or beyond 55 years old accounted for a quite small proportion (1.8%). The majority of them held a Bachelor degree (88.5%), while some of them held a Master degree (10.5%) or a Doctor degree (1.0%), but no teachers had a degree below Bachelor. Their mean teaching experiences were 17.26 years (SD = 5.60). Their classrooms had an average of 17.07 children (SD = 4.27). The children in their classrooms were age-mixed and were aged 4 to 6 years old. They were working for 4 to 5 hours per day with the mean of 4.40 hours (SD = 0.43). Half-day (κλασικά, 46.3%) and full-day preschools (ολοήμερα, 53.7%) were all involved.

All of the Chinese participants (N = 155) were female (100%). A large proportion of them were aged 35 years old or below (71.0%). Only a small percentage of them were aged 36 to 55 years old (29.0%). Nearly two thirds of them were Bachelor degree

holders (65.6%), and some of them held a below-Bachelor degree (30.5%). However, a quite small proportion of them held a Master (3.9%) or Doctor degree (0). They had an average of 9.32 years of working experiences (SD = 8.51). The mean amount of children in their classrooms was 28.95 (SD = 5.62). In China, preschool children are mostly grouped into various grades based on their ages. In this study, more than a half of the teachers were in the classroom having children aged 4 to 5 years old (51.6%), while the rest were working with 5- to 6- year-olds (48.3%). The working time of the teachers varied from 6 to 11 hours per day with the mean of 8.30 hours (SD = 0.90). All the teachers were working in the full-day preschool, which is the common type of preschools in China.

The Pearson's Chi-square Test found a significant difference between the Greek and Chinese teachers in age (Chi-square = 130.62, df = 3, p = .000) and educational level (Chi-square = 42.04, df = 3, p = .000). There were more old teachers and the teachers holding a Bachelor degree in Greece than in China.

The Independent-samples T-Test revealed a significant difference between the Greek and Chinese teachers in teaching experiences (t = 8.98, df = 252.97, p = .000), number of children in the classroom (t = -19.45, df = 257.62, p = .000), and teaching hours (t = -46.03, df = 237.35, p = .000). The Greek teachers (M = 17.26, SD = 5.60) reported longer years of teaching experiences than the Chinese teachers (M = 9.32, SD = 8.51). However, the Chinese teachers reported more classroom children (M = 28.95, SD = 5.62), and longer working time per day (M = 8.30, SD = 0.43) than the Greek teachers (M = 17.07, SD = 4.27; M = 4.40, SD = 0.90).

4.2 Teachers' ICT Access in Teaching and Learning

This section presents the results on the access to ICT equipment and resources of the participating teachers in teaching and learning. It is further separated into two respects: 1) ICT access in the classroom; and 2) access to the computer laboratory/multimedia

room. **Table 2** shows the detailed information.

Table 4.1 Demographic Information of the Participants in the Quantitative Study

Variables	Greek participants (N = 108)		Chinese participants (N = 155)	
	Frequency	Percent	Frequency	Percent
Gender				
Male	1	.9%	0	0
Female	107	99.1%	155	100%
Age				
30 or below	0	0	72	46.5%
31-35	2	1.8%	38	24.5%
36-45	61	56.5%	36	23.2%
46-55	45	41.7%	9	5.8%
Beyond 55	0	0	0	0
Educational Level				
Below Bachelor	0	0	47	30.5%
Bachelor	93	88.5%	101	65.6%
Master	11	10.5%	6	3.9%
Doctor	1	1%	0	0
Teaching experiences				
	M = 17.26	SD = 5.60	M = 9.32	SD = 8.51
Number of children				
	M = 17.07	SD = 4.27	M = 28.95	SD = 5.62
Age of children	**Mixed age**		**Graded age**	
4-5			80	51.6%
5-6			75	48.3%
Working hours per day				
	M = 4.40	SD = 0.43	M = 8.30	SD = 0.90
Preschool types				
Half-day	50	46.3%	0	0
Full-day	58	53.7%	155	100%

4.2.1 ICT Access in the Classroom

The most available equipment and resources in the classroom for the Greek teachers were computers (desktops or laptops) (73.1%) and the Internet (72.9%). Besides, over a half of them had also accessed educational software (53.7%) and TVs/DVD players

(51.4%). On the contrary, a quite small percentage of them were provided with digital cameras/video cameras (37.0%), smartphones (14.8%), projectors (9.3%), tablets (8.4%), and interactive whiteboards (0.9%).

The situation of the Chinese teachers' ICT access in the classroom was quite different. Except for computers (95.5%) and the Internet (77.4%), a large proportion of the teachers also accessed TVs/DVD players (97.4%), projectors (82.8%), smartphones (73.9%), digital cameras/video cameras (73.2%), and educational software (70.4%). Besides, over a half of them also obtained interactive whiteboards (61.2%) and tablets (52.9%).

Table 4.2 Teachers' ICT Access and Comparison

Variables	Country	No (%)	Yes (%)	Chi-square	df	Sig. (two-sided)
TV/DVD player	Greece	48.6	51.4	79.274	1	.000
	China	2.6	97.4			
Desktop/laptop	Greece	26.9	73.1	26.877	1	.000
	China	4.5	95.5			
Tablet	Greece	91.6	8.4	55.165	1	.000
	China	47.1	52.9			
Internet	Greece	27.1	72.9	.701	1	.402
	China	22.6	77.4			
Camera/video camera	Greece	63.0	37.0	34.047	1	.000
	China	26.8	73.2			
Projector	Greece	90.7	9.3	136.390	1	.000
	China	17.2	82.8			
Interactive whiteboard	Greece	99.1	0.9	99.320	1	.000
	China	38.8	61.2			
Smartphone	Greece	85.2	14.8	88.289	1	.000
	China	26.1	73.9			
Educational software	Greece	46.3	53.7	7.586	1	.006
	China	29.6	70.4			
Computer laboratory	Greece	75.0	25.0	60.769	1	.000
	China	26.1	73.9			

The difference between the Greek and Chinese teachers in terms of ICT access in the classroom was also proved by the Pearson's Chi-square Test. Except for the Internet

(Chi square = .701, df = 1, p = .402), a significant difference was found between the two groups in terms of the access to the other equipment and resources ($p < .05$). The Chinese teachers expressed a higher level of the access to each ICT equipment and resources than the Greek teachers.

4.2.2 Access to the Computer Laboratory/Multimedia Room

A high percentage of the Chinese teachers had been provided by their preschools with the computer laboratory/multimedia room (73.9%), while a quite small percentage of the Greek teachers had been provided (25.0%). This difference was also proved to be significant by the Pearson's Chi-square Test (Chi square = 60.769, df = 1, p = .000).

4.3 Teachers' ICT Use Practices in Teaching and Learning

The results on ICT use practices of the participating teachers in teaching and learning are reported in this section. It is specifically presented by seven aspects, including use frequency, using years, teaching stages, learning areas, time allocation per class, teaching approaches and influencing factors.

4.3.1 Use Frequency

Table 4.3 showed the details for the frequency of ICT use of the participating teachers. It could be seen that the use frequency of the Greek teachers who could have access to ICT equipment and resources was mostly at a medium or low level. On the one hand, except for the Internet with a high level (M = 3.65, SD = 1.019), the use frequency of computers (M = 3.48, SD = 1.207), computer laboratory/multimedia room (M = 3.07, SD = 1.107), digital cameras/video cameras (M = 3.05, SD = 1.358), and educational software (M = 2.95, SD = 1.083) was medium. On the other hand, the use frequency of the remaining ICT equipment and resources was at a low level, including projectors (M = 2.10, SD = .994), TVs/DVD players (M = 2.00, SD = .720), interactive

whiteboards (M = 2.00), smartphones (M = 2.00, SD = 1.592), and tablets (M = 1.89, SD = .928).

Table 4.3 Teachers' ICT Use Frequency and Comparison

Variables	Country	N	M	SD	Levene's Test		T-test		
					F	Sig.	T	df	Sig. (two tails)
TV/DVD player	Greece	55	2.00	.720	31.256	.000	-15.593	161.114	.000
	China	150	4.16	1.210					
Desktop/laptop	Greece	79	3.48	1.207	.736	.392	-4.181	225	.000
	China	148	4.19	1.220					
Tablet	Greece	9	1.89	.928	8.144	.005	-4.265	13.900	.001
	China	81	3.41	1.587					
Internet	Greece	78	3.65	1.079	.447	.505	-4.369	196	.000
	China	120	4.39	1.211					
Camera/video camera	Greece	40	3.05	1.358	1.981	.161	-.354	150	.724
	China	112	3.14	1.455					
Projector	Greece	10	2.10	.994	6.255	.014	-4.840	11.995	.000
	China	125	3.74	1.386					
Interactive whiteboard[1]	Greece	1	2.00						
	China	93	3.45	1.500					
Smartphone	Greece	16	2.00	1.592	.050	.823	-5.421	127	.000
	China	113	4.11	1.435					
Educational software	Greece	58	2.95	1.083	15.144	.000	-3.456	143.491	.001
	China	107	3.63	1.398					
Computer laboratory	Greece	27	3.07	1.107	4.068	.046	-3.522	47.969	.001
	China	113	3.96	1.398					

However, the use frequency of ICT equipment and resources of the Chinese teachers was at a high or medium level. More specifically, the use frequency of the Internet (M = 4.39, SD = 1.211), computers (M = 4.19, SD = 1.220), TVs/DVD players (M = 4.16, SD = 1.210), smartphones (M = 4.11, SD = 1.435), computer laboratory/multimedia room (M = 3.96, SD = 1.398), projectors (M = 3.74, SD = 1.386), and educational software (M = 3.63, SD = 1.398) was at a high level. The use frequency of interactive whiteboards (M = 3.45, SD = 1.500), tablets (M = 3.41, SD = 1.587), and digital

[1]No valid comparison could be done in the SPSS, because only one Greek teacher had access to the interactive whiteboard.

cameras/digital video cameras (M = 3.14, SD = 1.455) was at a medium level.

A significant difference was reported by the Independent-Samples T-Test between the Greek and Chinese teachers in the use frequency of TVs/DVD players (t = -15.593, df = 161.114, p = .000), computers (t = -4.181, df = 225, p = .000), tablets (t = -4.265, df = 13.900, p = .001), the Internet (t = -4.369, df = 196, p = .000), projectors (t = -4.840, df = 11.995, p = .000), smartphones (t = -5.421, df = 127, p = .000), educational software (t = -3.456, df = 143.491, p = .001), and the computer laboratory/multimedia room (t = -3.522, df = 47.969, p = .001). The Chinese teachers used these equipment and resources more frequently than the Greek teachers. No significant difference was found between the two groups in the use frequency of digital cameras/video cameras (t = -.354, df = 150, p = .724).

4.3.2 Using Years

The majority of the teachers in both Greece (91.0%) and China (82.7%) who had used ICTs had used them for at least one year. Specifically, the percentage of the teachers in Greece who had used ICTs for 1-3 years, 4-6 years and over 6 years was 35.0%, 30.0% and 26.0% respectively. Similarly, there were 38.7%, 16.7% and 27.3% of the Chinese teachers who had used ICTs for 1-3 years, 4-6 years and over 6 years respectively. No significant difference was found between the two groups in the using years of ICT equipment and resources (Chi square = 8.081, df = 3, p = .054).

4.3.3 Teaching Stages

It was revealed that ICT equipment and resources were applied most frequently in the teaching and learning implementation stage by both the Greek and Chinese teachers. A large proportion of the Greek (70.1%) and Chinese teachers (64.7%) reported that they used ICT equipment and resources frequently at this stage. The second popular stage for the use of ICTs of the participating teachers was the teaching and learning

preparation stage before the class. More than a half of the teachers in Greece (53.3%) and China (58.0%) reported this stage. However, a relatively small percentage of the teachers both in Greece (34.6%) and China (38.7%) mentioned that they used ICTs in the documentation and evaluation stage after the class. The Pearson's Chi-square Test did not find significant difference between the two groups in terms of teaching stages of ICT use ($p > .05$).

4.3.4 Learning Areas

The most popular learning areas for the Greek teachers to use ICTs were Theme-based Curriculum (63.8%), Environmental Studies (61.0%) and Language (43.8%). Some of the teachers also used ICTs in Expression and Creation (33.3%) and Mathematics (29.5%). It was very surprising to find that very few teachers used ICTs in Computer Science (12.4%).

The teachers in China preferred to use ICTs in Art (66.7%), Theme-based Curriculum (65.4%) and Language (63.4%). On the contrary, less than a half of the teachers used ICTs in Science (46.4%), Health (45.8%) and Society (41.2%).

4.3.5 Time Allocation per Class

In the Greek context, more than a half of the teachers reported that their time duration of ICT use was dependent on teaching and learning activities (54.3%). For the rest teachers, most of them spent 50% or less of class time for ICT use (43.6%), with 31.9% for 25% or less and 11.7% for 26% - 50% of class time. Very few teachers used ICTs for over 50% of class time (2.2%).

In the Chinese context, around two thirds of the teachers (66%) used ICTs for 25% or less (39.0%) or 26% - 50% of class time (27.0%). However, a small percentage of the teachers spent 50% or more of class time to use ICTs (12.1%). Besides, some teachers

also reported that different time duration would be chosen based on different teaching and learning activities (22.0%).

4.3.6 Teaching Approaches

Three teaching approaches rooted in constructivist learning theories are examined in this part, including independent learning, collaborative learning and inquiry learning. The relevant results are presented in **Table 4.4**.

Table 4.4 Teachers' Teaching Approaches and Comparison

Variables	Country	M	SD	Levene's Test		T-test		
				F	Sig.	T	df	Sig. (two tails)
Independent learning	Greece	3.08	.967	4.028	.046	1.003	203.998	.317
	China	2.94	1.143					
Collaborate learning	Greece	3.56	.945	2.903	.090	2.237	245	.026
	China	3.25	1.115					
inquiry learning	Greece	3.39	1.066	.604	.438	.411	240	.681
	China	3.32	1.154					
Overall	Greece	3.37	.840	4.257	.040	1.591	236.262	.113
	China	3.18	1.041					

It could be seen that the use frequency of each teaching method by both the Greek and Chinese teachers was at a medium level. Moreover, the overall use frequency of these three methods by the teachers both in Greece and China was also medium.

The significant difference between the Greek and Chinese teachers only existed in the use frequency of collaborative learning ($t = 2.237$, $df = 245$, $p = .026$). The teachers in Greece ($M = 3.56$, $SD = .945$) showed a higher frequency in using collaborative learning than those in China ($M = 3.25$, $SD = 1.115$). No significant difference was reported between the two groups in the use frequency of independent learning ($t = 1.003$, $df = 203.998$, $p = .317$), inquiry learning ($t = .411$, $df = 240$, $p = .681$), and the overall use frequency ($t = 1.591$, $df = 236.262$, $p = .113$).

4.3.7 Influencing Factors for Teachers' ICT Use Frequency

Demographic Information

The effect of demographic information on teachers' ICT use frequency was examined by using the One-way ANOVA and Pearson's r correlation analysis. It involved age, educational level, teaching years, number of children in the classroom and teaching hours per day.

With regard to the Greek teachers, no significant effect of demographic information was found on their ICT use frequency ($p > .05$).

With regard to the Chinese teachers, age ($F = 4.138$, $p = .007$), educational level ($F = 3.374$, $p = .037$), teaching years ($r = -.236$, $p < .01$), as well as number of children in the classroom ($r = -.265$, $p < .01$) were found significantly influence teachers' ICT use frequency. Young teachers (35 years old or below) tended to use ICTs more frequently than old teachers (36 to 55 years old); the teachers with a lower educational level used ICTs more frequently than those with a higher educational level; the teachers having longer years of teaching experiences were less likely to use ICTs frequently; larger number of children in the classroom was related to teachers' less frequent use of ICTs.

ICT Access in the Daily Life

The Pearson's r correlation analysis did not indicate a significant correlation between teachers' access to ICTs in the daily life and their ICT use frequency in teaching and learning in the Greek context ($r = -.112$, $p > .05$).

On the contrary, in the Chinese context, the correlation between teachers' ICT access in their daily lives and ICT use frequency in teaching and learning was found not only significant but also negative ($r = -.241$, $p < .01$). In other words, the teachers who had

access to ICTs in the daily life were less likely to use them frequently in teaching and learning practices.

ICT Use Frequency in the Daily Life

A significant and positive correlation between teachers' use frequency of ICTs in the daily life and their use frequency of ICTs in teaching and learning was revealed by the Pearson's r correlation analysis in the Greek ($r = .283$, $p < .01$) and Chinese context ($r = .455$, $p < .01$). Frequent ICT users in daily lives tended to be frequent ICT users in teaching and learning practices.

Pre-service ICT Training

Pre-service ICT training includes general ICT training and pedagogical ICT training. The Independent-Samples T-Test showed that whether attending general ICT training had a significant effect on the Greek teachers' ICT use frequency ($t = -2.494$, $df = 91$, $p = .014$). The teachers who attended general ICT training were reported to use ICTs more frequently than those who did not. Whether attending pedagogical ICT training, however, did not significantly affect ICT use frequency of the Greek teachers ($t = -1.234$, $df = 91$, $p = .220$).

In the Chinese context, neither general ICT training ($t = .399$, $df = 149$, $p = .691$) nor pedagogical ICT training ($t = .842$, $df = 149$, $p = .401$) in the pre-service period had a significant impact on teachers' ICT use frequency.

In-service ICT Training

The results of the Pearson's r correlation analysis did not find a significant correlation between teachers' in-service ICT training and their ICT use frequency in both Greece ($r = .048$, $p > .05$) and China ($r = .082$, $p > .05$).

Benefits of In-service ICT Training

The impact of teachers' perceived benefits of in-service ICT training on their ICT use frequency was examined by the One-way ANOVA. It was found that this impact did not reach the significance in both the Greek ($F = 1.969$, $p = .114$) and Chinese context ($F = 2.292$, $p = .083$).

Preschool Support

The Pearson's r correlation analysis indicated that there was a significant and positive correlation between teachers' ICT use frequency and policy support ($r = .249$, $p < .05$), time support ($r = .314$, $p < .01$), and overall support ($r = .207$, $p < .05$) in Greece. This means that more support, especially policy support and time support, resulted in more frequent ICT users.

Regarding the Chinese teachers, no significant correlation was revealed between ICT use frequency and both overall support and each individual support ($p > .05$).

ICT Access in the Classroom

No significant correlation was found by the Pearson's r correlation analysis between teachers' ICT access in the classroom and their ICT use frequency, which took place in both Greece ($r = -.045$, $p > .05$) and China ($r = -.089$, $p > .05$).

Access to the Computer Laboratory/Multimedia Room

The Independent-samples T Test revealed that whether having access to the computer laboratory/multimedia room was not a significant factor for ICT use frequency of the Greek teachers ($t = -.039$, $df = 92$, $p = .969$). However, it significantly influenced the

use frequency of ICTs of the Chinese teachers (t = -3.983, df = 150, p = .000). In other words, the teachers who had access to the computer laboratory/multimedia room (M = 4.06, SD = .861) used ICTs more frequently than those who did not (M = 3.40, SD = .963).

Years of ICT Use in Teaching and Learning

The correlation between teachers' ICT using years in teaching and learning and their ICT use frequency in teaching and learning was not reported to be significant by the Pearson's r correlation analysis both in Greece (r = .147, p > .05) and China (r = -.114, p > .05).

Teaching Approaches

As showed in **Table 4.5**, ICT use frequency of the Greek teachers was significantly and positively correlated with their use frequency of independent learning (r = .322, p < .01), collaborative learning (r = .477, p < .01), inquiry learning (r = .349, p < .01) and overall teaching approaches (r = .444, p < .01). This means that the teachers who had a higher frequency to use each individual constructivist teaching approach or use them as a whole more likely to use ICTs frequently.

Table 4.5 Correlation between Teaching Approaches and ICT Use Frequency

Country	Independent learning	Collaborative learning	Inquiry leaning	Total
Greece	.322**	.477**	.349**	.444**
China	.124	.132	.092	.123

Note: ** p < .01

However, the correlation between ICT use frequency of the Chinese teachers and their use frequency of each individual teaching approach or teaching approaches as a whole was not found significant (p > .05).

Teachers' Attitudes

Table 4.6 presents the results on the impact of teachers' attitudes toward ICT use in teaching and learning on their ICT use frequency.

Table 4.6 Correlation between Attitudes and ICT Use Frequency

Country	Attitude F1	Attitude F2	Attitude F3	Attitude Total
Greece	.197	.116	.235*	.221*
China	.231**	.186*	.256**	.237**

Note: * $p < .05$; ** $p < .01$

In the Greek context, teachers' overall attitudes and teachers' individual attitude factor "teachers' affections and willingness" (F3) were found have a significant and positive correlation with their ICT use frequency ($r = .221$, $p < .05$; $r = .235$, $p < .05$). It means that the more positive teachers' attitudes were, especially affections and willingness, the more frequently they used ICTs.

In the Chinese context, both teachers' overall attitudes and all the three attitude factors were found significantly correlate with their ICT use frequency ($p < .01$; $p < .05$). The teachers with favorable attitudes, including positive attitudes toward appropriate ICT use practices, positive attitudes toward the effect of ICTs on teaching and learning and positive affections and willingness on ICT use in teaching and learning were likely to use ICTs frequently.

Teachers' ICT Competences

Regarding the Greek teachers, the correlation between their overall ICT competences or each individual competence factor and their ICT use frequency was not significant ($p < .05$) (**Table 4.7**).

Table 4.7 Correlation between ICT Competences and ICT Use Frequency

Country	Competence F1	Competence F2	Competence F3	Competence F4	Competence Total
Greece	.150	.166	.170	.087	.168
China	.101	.185*	.109	.213**	.180*

Note: * p < .05; ** p < .01

For the Chinese teachers, however, a significant and positive correlation was reported between their overall ICT competences (r = .180, p < .05), TPC (F2) (r = .185, p < .05) and TC (F4) (r = .213, p < .01) and their ICT use frequency. The teachers who used ICTs with a higher frequency were those who had a higher level of ICT competences, particularly Technological Pedagogical Competences and Technological Competences (**Table 4.7**).

Teachers' Barriers

Table 4.8 revealed that no significant correlation existed between the Greek teachers' perceptions of total barriers or each individual factor and their use frequency of ICTs (p > .05).

Table 4.8 Correlation between Barriers and ICT Use Frequency

Country	Barrier F1	Barrier F2	Barrier F3	Barrier Total
Greece	-.132	-.097	.026	-.105
China	.193*	-.050	.138	.114

Note: * p < .05

In the Chinese context, only the correlation between teachers' perceived barrier "lack of external support" (F1) and their ICT use frequency was significant and positive (r = .193, p < .05). It was very surprising to find that the teachers who encountered more external barriers tended to use ICTs more frequently (**Table 4.8**).

Predicting Teachers' ICT Use Frequency with the Multiple Linear Regression

Two Multiple Linear Regression Analyses that adopted the Stepwise entering method were performed separately to predict ICT use frequency of the Greek and Chinese teachers. The variables that were mentioned above were all involved.

With regard to the Greek teachers, three variables entered the regression model ($F = 11.062$, $p = .000$), including teaching approaches, pre-service general ICT training and ICT access in the classroom. The combination of these three variables could explain 33.1% of the variance of teachers' ICT use frequency ($R = .576$, $R^2 = .331$, adjusted $R^2 = .301$).

Table 4.9 Predicating ICT Use Frequency of the Greek teachers

Predictors	B	Beta	T	Sig.
Teaching approaches	.398	.449	4.315	.000
Pre-service general ICT training	.474	.317	3.134	.003
ICT access in the classroom	-.983	-.227	-2.199	.031

It could be seen in **Table 4.9** that the effects of the three predictors on teachers' ICT use frequency was significant ($p < .05$). Teaching approaches had the strongest effect ($B = .398$, $Beta = .449$), which was followed by pre-service general ICT training ($B = .474$, $Beta = .317$), and ICT access in the classroom ($B = -.983$, $Beta = -.227$). The effects of the first two predictors were positive, while the impact of the rest one was negative. It means that the teachers who used constructivist teaching approaches more frequently, attended related training on general ICT use in the pre-service period were likely to use ICTs frequently. Conversely, the teachers who had access to ICTs in the classroom tended to use them less frequently.

In terms of the Chinese teachers, a statistically significant regression model was found ($F = 14.301$, $p = .000$). The overall regression model was composed by three variables, including preschool support, ICT use frequency in the daily life and ICT access in the

classroom. A total of 31.1% of the variance of teachers' ICT use frequency could be explained by the three predictors ($R = .558$, $R^2 = .311$, adjusted $R^2 = .289$).

Table 4.10 Predicating ICT Use Frequency of the Chinese teachers

Predictors	B	Beta	T	Sig.
Preschool support	.422	.428	4.655	.000
ICT use frequency in the daily life	.376	.312	3.619	.000
ICT access in the classroom	-1.196	-.262	-.2.882	.005

As seen in **Table 4.10**, each individual predictor significantly affected teachers' ICT use frequency ($p < .05$). Preschool support was the strongest predictor ($B = .422$, $Beta = .428$). Then it was the turn to ICT use frequency in the daily life ($B = .376$, $Beta = .312$) and ICT access in the classroom ($B = -1.196$, $Beta = -.262$). Preschool support and ICT use frequency in the daily life had a positive effect, while ICT access in the classroom had a negative effect. That is, the teachers who were provided with more support by their preschools and used ICTs with a higher frequency in their daily lives tended to use ICTs more frequently in teaching and learning. However, the teachers with a higher access to ICTs in the classroom were less likely to use ICTs.

4.4 Teachers' Attitudes toward ICT Use in Teaching and Learning

This section reports the results on the attitudes of the participants towards the use of ICTs in teaching and learning practices. It begins with the verification of the validity and reliability of the scale. The following parts then successively present the status of teachers' attitudes in each individual country, the comparison of the status of teachers' attitudes between the two countries, and influencing factors for teachers' attitudes.

4.4.1 Validity and Reliability of the Scale

A total of twelve statements were included in the attitude scale, which was composed by three dimensions. The first dimension referred to four items (A1 - A4), aiming to

understand teachers' attitudes towards the impact of ICTs on teaching and learning. The second dimension focused on teachers' attitudes towards appropriate teaching and learning practices with ICTs, which involved four items (A5 - A8). The last dimension consisted of three items (A9 - A12), which aimed to examine teachers' affections and willingness about ICT use in teaching and learning.

Table 4.11 Factor Loadings of Each Item of the Attitude Scale

Variables	Factors		
	F1	F2	F3
A7The use of ICT should support children's collaborative learning	.831	.259	.243
A8Teachers are supporters and guides in children's learning with ICT	.807	.165	.289
A6The use of ICT should encourage children to build their own knowledge	.737	.263	.294
A5The use of ICT should consider children's abilities, needs and interests	.690	.396	.173
A2ICT can help children better learn content knowledge	.343	.815	.208
A3ICT can develop children's higher-order skills (e.g. critical thinking, problem solving, creativity)	.192	.777	.377
A4ICT can improve documentation and evaluation of children's learning	.259	.665	.396
A1ICT can provide a better learning experience for children	.547	.646	.227
A9Using ICT in teaching does not scare me	.388	.182	.783
A10I like to use ICT in teaching	.217	.403	.749
A12I would use ICT regularly in future teaching	.243	.317	.702

A factor analysis was adopted to examine the construct validity of the scale with both the Greek and Chinese samples. The Principal Factor Analysis was used for the factor extraction and the Varimax method was used for the rotation. The scree plot showed that one to three factors could be further extracted. According to the initial structure of the scale which consisted of three dimensions, three factors thus were selected for the extraction.

Precisely, the first factor (F1) which was labeled "appropriate ICT use practices" was related with four variables (A5 - A8). The second factor (F2) included four variables (A1 - A4), which was labeled "impacts of ICTs on teaching and learning". The third

factor (F3) involved three variables (A9, A10 and A12)[1] and was labeled "teachers' affections and willingness". The factor loadings for the variables of the first factor (F1) varied from .690 to .831, for the variables of the second factor (F2) from .646 to .815, and for the variables of the third factor (F3) from .702 to .783. The details could be seen in **Table 4.11**.

In order to validate the reliability of these three extracted factors and the overall scale, an internal reliability analysis was performed. The Cronbach's alpha coefficients showed a satisfactory internal consistency: .872 for F1, .877 for F2, .806 for F3, and .929 for the overall scale.

4.4.2 Status of Teachers' Attitudes

It could be seen in **Table 4.12** that both the Greek and Chinese teachers expressed a positive attitude towards ICT use in teaching and learning. Most of the Greek teachers agreed or strongly agreed the listed statements, with the percentages from 53.2% (A3) to 90.6% (A8) and the means from 3.56 (A3) to 4.24 (A5).

Similarly, there were also a large proportion of the Chinese teachers who agreed or strongly agreed these statements. The percentages varied from 68.4% (A3) to 88.2% (A9), and the means from 3.86 (A3) to 4.22 (A8).

Moreover, the overall attitudes of the teachers in both Greece (M = 4.02, SD = .458) and China (M = 4.07, SD = .757) were also found positive.

4.4.3 Comparison of Teachers' Attitudes

The Independent-samples T Test did not reveal a significant difference of the attitudes

[1]Variable A11 independently formed a factor, which means that this factor was poorly defined. Thus, variable A11 was removed from the scale.

towards ICT use in teaching and learning between the Greek and Chinese teachers (t = -.752, df = 256.420, p = .452).

Table 4.12 Percentages, Means and Standard Deviations of Each Item of the Attitude Scale

Variables	Country	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
A1	Greece	0	0.9	11.1	64.8	23.1	4.10	.610
	China	2.6	3.2	16.2	36.4	41.6	4.11	.967
A2	Greece	0	1.9	22.6	56.6	18.9	3.92	.700
	China	1.9	5.8	22.6	36.1	33.5	3.94	.985
A3	Greece	0	9.3	37.4	41.1	12.1	3.56	.826
	China	2.6	7.7	21.3	38.1	30.3	3.86	1.022
A4	Greece	0	6.5	31.5	47.2	14.8	3.70	.800
	China	2.6	1.9	21.3	43.2	31.0	3.98	.915
A5	Greece	0.9	0.9	11.2	46.7	40.2	4.24	.763
	China	1.9	3.9	12.3	43.5	38.3	4.12	.910
A6	Greece	0	0	12.0	57.4	30.6	4.19	.629
	China	1.9	1.9	21.3	40.0	34.8	4.04	.904
A7	Greece	0	1.9	10.3	57.9	29.9	4.16	.675
	China	2.6	1.9	11.0	41.6	42.9	4.20	.903
A8	Greece	0	0	9.4	63.2	27.4	4.18	.582
	China	2.6	1.9	13.6	34.4	47.4	4.22	.938
A9	Greece	1.9	2.8	15.7	50.9	28.7	4.02	.854
	China	1.3	2.6	7.8	50.3	37.9	4.21	.800
A10	Greece	0	1.9	17.8	57.9	22.4	4.01	.694
	China	1.3	1.9	16.1	40.6	40.0	4.16	.856
A12	Greece	2.8	0.9	13.2	50.9	32.1	4.08	.863
	China	1.9	6.5	17.4	38.7	35.5	3.99	.984
Overall	Greece						4.02	.458
	China						4.07	.757

4.4.4 Influencing Factors for Teachers' Attitudes

Demographic Information

A series of One-way ANOVA and Pearson's r correlation analyses were performed to

examine the effect of teachers' demographic information on their attitudes toward ICT use in teaching and learning. The mentioned variables involved age, educational level, teaching experiences, number of children in the classroom and working hours per day.

In the Greek context, only age ($F = 8.282$, $p = .000$) and number of children in the classroom ($r = -.192$, $p < .05$) were reported to significantly affect teachers' attitudes. In other words, the old teachers (36 to 55 years old) had more positive attitudes than the young teachers (31 to 35 years old); the teachers teaching fewer children in the classroom tended to have more positive attitudes.

In the Chinese context, no significant impact of teachers' demographic information was found on their attitudes ($p > .05$).

ICT Access in the Daily Life

The correlation between teachers' ICT access in the daily life and their attitudes was not reported to be significant in both the Greek ($r = .112$, $p > .05$) and Chinese context ($r = .040$, $p > .05$).

ICT Use Frequency in the Daily Life

No significant correlation was reported between teachers' attitudes and their ICT use frequency in the daily life in the Greek context ($r = .129$, $p > .05$). But a significant and positive correlation was found between the two variables in the Chinese context ($r = .285$, $p < .01$). The teachers who used ICTs more frequently in the daily life were those who held more positive attitudes.

Pre-service ICT Training

It was revealed that ICT training in the pre-service period, including both general and

pedagogical training, had no significant effects on teachers' attitudes in both Greece and China ($p > .05$).

In-service ICT Training

With regard to the Greek teachers, a significant and positive correlation was revealed between their in-service ICT training and attitudes ($r = .266$, $p < .01$). This means that the teachers who attended in-service training held more positive attitudes. This result particularly took place in the basic ICT training, pedagogical ICT training and online self-learning ($p < .05$).

With regard to the Chinese teachers, in-service ICT training was not reported to be a significant factor to influence their attitudes ($p > .05$).

Benefits of In-service ICT Training

The impact of teachers' perceived benefits of in-service ICT training on their attitudes was also examined. This effect was found not significant for the Chinese teachers ($r = .133$, $p > .05$), while both significant and positive for the Greek teachers ($r = .292$, $p < .05$). It means that the teachers who obtained more benefits from in-service training held more positive attitudes.

Preschool Support

Table 4.13 showed that not only preschool support as a whole but also each individual support were significantly and positively correlated to teachers' attitudes in the Greek context ($p < .01$). The teachers who were provided more support by their preschools had more positive attitudes.

However, no significant correlation was found between preschool support and

teachers' attitudes in the Chinese context ($p > .05$).

Table 4.13 Correlation between Preschool Support and Attitudes

Country	Policy support	Hardware, the Internet and software support	Training support	Technical support	Pedagogical support	Time support	Total
Greece	.371**	.289**	.249**	.258**	.282**	.311**	.374**
China	-.004	-.086	.028	-.150	-.105	-.071	-.077

Note: ** $p < .01$

ICT Access in the Classroom

Teachers' attitudes were reported not to significantly correlate with their ICT access in the classroom in both Greece ($r = .139$, $p > .05$) and China ($r = .035$, $p > .05$).

Access to the Computer Laboratory/Multimedia Room

Whether having access to the computer laboratory/multimedia room did not influence the attitudes of the Greek ($t = .931$, $df = 33.427$, $p = .358$) and Chinese teachers ($t = -.502$, $df = 151$, $p = .616$).

ICT Use Frequency in Teaching and Learning

There was a significant and positive correlation between teachers' ICT use frequency in teaching and learning and their attitudes in Greece ($r = .221$, $p < .05$) and China ($r = .237$, $p < .01$). In other words, frequent ICT users in teaching and learning practices were related to positive attitudes.

Years of ICT Use in Teaching and Learning

More years in the use of ICTs in teaching and learning did not result in more positive attitudes. No significant correlation between the two variables was reported for both

the Greek ($r = .192$, $p > .05$) and Chinese teachers ($r = .020$, $p > .05$).

Teaching Approaches

In the Greek context, teachers' attitudes were significantly and positively correlated to their use frequency of teaching approaches as a whole ($r = .422$, $p < .01$), independent learning ($r = .412$, $p < .01$), collaborate learning ($r = .391$, $p < .01$), and inquiry learning ($r = .401$, $p < .01$). The teachers who used the three teaching approaches with a higher frequency more tended to express positive attitudes (**Table 4.14**).

Table 4.14 Correlation between Teaching Approaches and Attitudes

Country	Independent learning	Collaborate learning	Inquiry learning	Total
Greece	.412**	.391**	.401**	.422**
China	.129	.222**	.201*	.197*

Note: * $p < .05$; ** $p < .01$

Except for independent learning ($r = .129$, $p > .05$), there was also a significant and positive correlation between the Chinese teachers' attitudes and their overall teaching approaches ($r = .197$, $p < .05$), collaborate learning ($r = .222$, $p < .01$), and inquiry learning ($r = .201$, $p < .05$) (**Table 4.14**).

Teachers' ICT Competences

It could be seen from **Table 4.15** that teachers' ICT competences, including overall ICT competences and each individual ICT competence, significantly and positively correlated with their attitudes in both Greece and China ($p < .01$). This means that the more competent the teachers were, the more favorable attitudes they held.

Table 4.15 Correlation between ICT Competences and Attitudes

Country	Competence F1	Competence F2	Competence F3	Competence F4	Competence Total
Greece	.457**	.486**	.469**	.354**	.526**
China	.457**	.518**	.542**	.420**	.549**

Note: ** $p < .01$

Teachers' Barriers

With regard to the Greek teachers, a significant and negative correlation was found between their perceptions of overall barriers ($r = -.199$, $p < .05$) or the barrier of "lack of competences" (F3) ($r = -.257$, $p < .01$) and their attitudes. That is, the teachers who encountered more barriers, especially the barriers on their ICT competences, were less likely to have positive attitudes (**Table 4.16**).

Table 4.16 Correlation between Barriers and Attitudes

Country	Barrier F1	Barrier F2	Barrier F3	Barrier Total
Greece	-.162	-.115	-.257**	-.199*
China	.049	.069	-.008	.052

Note: * $p < .05$; ** $p < .01$

With regard to the Chinese teachers, their attitudes did not significantly correlate with their perceptions of barriers ($p > .05$) (**Table 4.16**).

Predicting Teachers' Attitudes with the Multiple Linear Regression

In the Greek context, the regression model was entered by two variables, that is, ICT competences and preschool support ($F = 15.370$, $p = .000$). The combination of the two predictors accounted for 41.7% of the variance of teachers' attitudes ($R = .646$, $R^2 = .417$, Adjusted $R^2 = .390$).

Table 4.17 showed that ICT competences ($t = 3.687$, $p = .001$) and preschool support ($t = 2.340$, $p = .024$) all had significant and positive effects on teachers' attitudes. The teachers who were more competent in the use of ICTs and were offered more support by their preschools had more positive attitudes. ICT competences had a stronger effect ($B = .267$, Beta = .468) than preschool support ($B = .172$, Beta = .297).

Table 4.17 Predicting Attitudes of the Greek Teachers

Predictors	B	Beta	T	Sig.
ICT competences	.267	.468	3.687	.001
Preschool support	.172	.297	2.340	.024

In the Chinese context, a regression model with three predictors was formed including ICT competences, ICT use frequency in the daily life and ICT access in the daily life (F = 24.509, P = .000). The combination of the three predictors could explain 43.6% of the variance of teachers' attitudes (R = .661, R^2 = .436, Adjusted R^2 = .418).

Table 4.18 Predicting Attitudes of the Chinese Teachers

Predictors	B	Beta	T	Sig.
ICT competences	.686	.573	7.256	.000
ICT use frequency in the daily life	.235	.210	2.629	.010
ICT access in the daily life	.668	.161	1.994	.049

Table 4.18 presented the details for each individual predictor. The correlation between teachers' attitudes and their ICT competences (t = 7.256, p = .000), ICT use frequency in the daily life (t = 2.629, p = .010) and ICT access in the daily life (t = 1.994, p = .049) was significant and positive. The teachers who had higher ICT competences, used ICTs more frequently in their daily lives and had access to ICTs in their daily lives held more positive attitudes. Moreover, ICT competences had a stronger effect (B = .686, Beta = .573), while the effect size of ICT frequency in the daily life (B = .235, Beta = .210) and ICT access in the daily life was relatively smaller (B = .668, Beta = .161).

4.5 Teachers' ICT Competences

The results about ICT competences of the participating teachers are reported in this section. A total of four specific parts compose this section, including the validation of the competence scale, the description of the status of teachers' ICT competences, the comparison of teachers' ICT competences, and the analysis of influencing factors for teachers' ICT competences.

4.5.1 Validity and Reliability of the Scale

According to the TPACK framework, a total of four categories of competences were designed in the scale. The first category was on teachers' Technological Competences (TC), which consisted of two statements (C1, C2). The second category covered three statements (C3, C4, C5), which were focused on teachers' Technological Pedagogical Competences (TPC). The third category aimed to understand teachers' Technological Content Competences (TCC) and involved two statements (C6, C7). The last category also referred to two statements (C8, C9) and was focused on teachers' Technological Pedagogical Content Competences (TPCC).

The factor analysis with all the Greek and Chinese samples was conducted to examine the construct validity of the scale. The Principal Factor Analysis was adopted for the factor extraction and the Varimax method was used for the rotation. According to the initial scale construct, four factors were expected to be extracted.

Table 4.19 Factor Loadings of Each Item of the Competence Scale

Variables	Factors			
	F1	F2	F3	F4
C6I can use the software that is created specially for a certain subject	.838	.250	.256	.185
C7I can use appropriate technology to present the content of a certain subject	.745	.236	.496	.165
C3I can help children use technology to plan and monitor their own learning	.096	.806	.268	.344
C4I can help children use technology to construct their own knowledge	.432	.758	.335	.179
C5I can help children use technology to collaborate with each other	.554	.690	.274	.158
C8I can select appropriate technology that enhance what I teach, how I teach and what children learn	.256	.306	.849	.202
C9I can design lessons that appropriately integrate content, technology and pedagogy for children-initiated learning	.335	.279	.829	.183
C2I can solve my own technical problems	.044	.184	.242	.905
C1I have technical skills to use technology effectively	.454	.292	.080	.752

It could be seen in **Table 4.19** that the first factor (F1) included two variables (C6, C7) with factor loadings .836 and .745. This factor was labeled "technological content competences". The second factor (F2) was composed by three variables (C3, C4, C5), which was labeled "technological pedagogical competences". The factor loadings of the variables were from .690 to .806. Two variables (C8, C9) formed the third factor (F3) which was labeled "technological pedagogical content competences". The factor loadings of the two variables were .849 and .829. The final factor (F4) was labeled "technological competences" which also covered two variables (C1, C2) with factor loadings .752 and .905.

Furthermore, the Cronbach's alpha coefficient analysis indicated that the competence scale and its four factors were internally consistent. The alpha coefficients were .930 for the overall scale, .844 for F1, .880 for F2, .885 for F3 and .808 for F4.

4.5.2 Status of Teachers' ICT Competences

It could be seen in **Table 4.20** that the Greek teachers were at a medium or high level for most of the items, with the means varying from 3.32 (C3) to 3.71 (C5). Moreover, at least half of them agreed or strongly agreed these items, with the percentages from 50.0% (C3) to 70.4% (C4). On the contrary, their competences in solving technical problems (C2) were the lowest with a low level (M = 2.50, SD = 1.144). Over half of them disagreed or strongly disagreed this item (56.1%).

Table 4.20 also showed that the Chinese teachers were at a high level for all the items. The means ranged from 3.65 (C2) to 4.01 (C9). There were also a high proportion of them agreed or strongly agreed the items, with the percentages from the lowest 54.6% (C4) to the highest 75.5% (C9). Like the Greek teachers, their competences in solving technical problems on their own (C2) were also at the lowest level (M = 3.65, SD = .940).

Table 4.20 Percentages, Means and Standard Deviations of Each Item of the Competence Scale

Variables	Country	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
C1	Greece	5.6	17.6	25.0	36.1	15.7	3.39	1.118
	China	.6	5.2	29.7	41.3	23.2	3.81	.874
C2	Greece	20.6	35.5	21.5	17.8	4.7	2.50	1.144
	China	1.3	9.1	32.5	37.7	19.5	3.65	.940
C3	Greece	5.7	15.1	29.2	41.5	8.5	3.32	1.019
	China	.6	10.4	26.0	35.1	27.9	3.79	.988
C4	Greece	2.8	9.3	17.6	55.6	14.8	3.70	.930
	China	.6	8.4	36.4	32.5	22.1	3.67	.936
C5	Greece	1.9	7.5	21.7	55.7	13.2	3.71	.862
	China	.7	4.6	24.8	43.1	26.8	3.91	.869
C6	Greece	4.7	6.6	23.6	47.2	17.9	3.67	1.002
	China	.7	5.2	26.8	41.8	25.5	3.86	.882
C7	Greece	3.7	5.6	26.9	45.4	18.5	3.69	.961
	China	.6	3.9	18.1	51.6	25.8	3.98	.810
C8	Greece	2.8	10.2	28.7	45.4	13.0	3.56	.941
	China	.6	2.6	22.7	45.5	28.6	3.99	.824
C9	Greece	7.4	9.3	27.8	44.4	11.1	3.43	1.052
	China	0	1.9	22.6	48.4	27.1	4.01	.760

Regarding the levels of the four factors of ICT competences, the Greek teachers had the highest level in Technological Content Competences (F1) (M = 3.67, SD = .935), then in Technological Pedagogical Competences (F2) (M = 3.57, SD = .853) and Technological Pedagogical Content Competences (F3) (M= 3.49, SD = .955). They had the lowest level in Technological Competences (F4) (M = 2.95, SD = 1.028) (**Table 4.21**).

For the Chinese teachers, their Technological Pedagogical Content Competences (F3) (M = 4.00, SD = .735) were at the highest level. Then it was the turn to Technological Content Competences (F1) (M = 3.92, SD = .769) and Technological Pedagogical Competences (F2) (M = 3.79, SD = .836). Their Technological Competences (F4) were also at the lowest level (M = 3.73, SD = .838) (**Table 4.21**).

Regarding the level of overall ICT competences, when the Greek teachers were at a medium level (M = 3.44, SD = .790), the Chinese teachers were at a high level (M = 3.85, SD = .710) (**Table 4.21**).

Table 4.21 Comparison of Teachers' ICT Competences

Variables	Country	N	M	SD	Levene's Test		T-test		
					F	Sig.	T	df	Sig.
F1	Greece	108	3.67	.935	5.147	.024	-2.302	200.632	.022
	China	155	3.92	.769					
F2	Greece	108	3.57	.853	.019	.891	-2.050	261	.041
	China	155	3.79	.836					
F3	Greece	108	3.49	.955	10.081	.002	-4.634	191.066	.000
	China	155	4.00	.735					
F4	Greece	108	2.95	1.028	3.954	.048	-6.521	199.384	.000
	China	155	3.73	.838					
Overall	Greece	108	3.44	.790	.899	.344	-4.419	261	.000
	China	155	3.85	.710					

4.5.3 Comparison of Teachers' ICT Competences

A significant difference of ICT competences was found by the Independent-samples T Test between the Greek and Chinese teachers ($p < .05$). The teachers in China showed a higher level than those in Greece in not only overall ICT competences but also each individual factor of ICT competences (**Table 4.21**).

4.5.4 Influencing Factors for Teachers' ICT Competences

Demographic Information

ICT competences of the Greek teachers were significantly affected by age ($F = 8.876$, $p = .000$) and teaching experiences ($r = -.235$, $p < .05$). The teachers aged 36 to 45 years old were more competent than those aged 46 to 55 years old. Moreover, the

teachers with fewer teaching experiences had a higher level of competence than those with more teaching experiences.

No significant impact was found of demographic information on ICT competences of the Chinese teachers ($p > .05$).

ICT Access in the Daily Life

ICT competences of the teachers in Greece were significantly different based on their ICT access in the daily life ($r = .212$, $p < .05$). The teachers who got better access to ICTs in their daily lives were reported to be more competent.

However, ICT competences of the Chinese teachers did not significantly vary based on their ICT access in the daily life ($r = .040$, $p > .05$).

ICT Use Frequency in the Daily Life

A significant and positive correlation between teachers' ICT competences and their ICT use frequency in the daily life was found in China ($r = .222$, $p < .01$), while was not found in Greece ($r = .071$, $p > .05$). The Chinese teachers with a higher frequency of ICT use in their daily lives tended to have a higher level of ICT competences.

Pre-service ICT Training

The Greek teachers who attended general ICT training ($t = 3.646$, $df = 105$, $p = .001$) or pedagogical ICT training ($t = 2.355$, $df = 105$, $p = .020$) in their pre-service period were significantly different in ICT competences than those who did not. They were more competent than those who did not.

However, whether attending pre-service ICT training was not a significant factor to

impact ICT competences of the Chinese teachers, which took place in both general ($t = .665$, $df = 150$, $p = .507$) and pedagogical training ($t = .718$, $df = 150$, $p = .474$).

In-service ICT Training

Regarding the Greek teachers, there was a significant and positive correlation between their in-service ICT training and ICT competences ($r = .238$, $p < .05$). Those teachers who attended in-service training tended to possess higher ICT competences. This case especially happened in the specific equipment training ($t = -2.100$, $df = 105$, $p = .038$), pedagogical training ($t = -2.106$, $df = 105$, $p = .038$), and online self-learning ($t = -3.338$, $df = 72.584$, $p = .001$).

However, the Chinese teachers' ICT competences were not significantly correlate with their in-service ICT training ($r = .145$, $p > .05$).

Benefits of In-service ICT Training

Teachers' perceived benefits of in-service ICT training which they had attended were found significantly and positively correlate with ICT competences in both Greece ($r = .299$, $p < .05$) and China ($r = .368$, $p < .01$). In other words, the teachers who more perceived that in-service training was helpful for teaching and learning practices were more competent ICT users.

Preschool Support

As shown in **Table 4.22,** regarding the teachers in Greece, not only the total scores of preschool support but also the scores of each individual support were significantly and positively correlated with their ICT competences ($p < .05$; $P < .01$). This means that more support from the preschool was more likely to lead to more competent teachers.

Table 4.22 Correlation between Preschool Support and ICT Competences

Country	Policy support	Hardware, the Internet and software support	Training support	Technical support	Pedagogical support	Time support	Total
Greece	.302**	.230*	.318**	.224*	.201*	.282**	.336**
China	.098	.100	.116	.004	.079	.106	.097

Note: *< .05; ** p < .01

However, a totally different result was revealed in terms of the Chinese teachers. That is, both the total support and individual support which were provided by the preschool did not have a significant correlation with their ICT competences ($p > .05$).

ICT Access in the Classroom

No significant correction was revealed between teachers' ICT access in the classroom and ICT competences in both Greece ($r = .129$, $p > .05$) and China ($r = .079$, $p > .05$).

Access to the Computer Laboratory/Multimedia Room

Whether or not having access to the computer laboratory/multimedia room was not a significant factor to influence ICT competences of both the Greek ($t = 1.606$, $df = 106$, $p = .111$) and Chinese teachers ($t = -.036$, $df = 151$, $p = .972$).

ICT Use Frequency in Teaching and Learning

ICT use frequency in teaching and learning was found have no significant correlation with ICT competences of the Greek teachers ($r = 168$, $p > .05$), but significantly and positively correlate with ICT competences of the Chinese teachers ($r = .180$, $p < .05$). That is, the teachers who used ICTs more frequently in teaching and learning practices were often competent ICT users.

Years of ICT Use in Teaching and Learning

Teachers' ICT competences were not significantly different based on their using years of ICTs in teaching and learning, which took place in both Greece ($r = .194$, $p > .05$) and China ($r = .141$, $p > .05$).

Teaching Approaches

With regard to the Greek teachers, their ICT competences significantly and positively correlated with not only the use frequency of overall teaching approaches ($r = .420$, $p < .01$), but also the use frequency of each individual teaching approach ($p < .01$). This means that frequent users of the three teaching approaches as a whole or individually were related to competent ICT users (**Table 4.23**).

Table 4.23 Correlation between Teaching Approaches and ICT Competences

Country	Independent learning	Collaborative learning	Inquiry leaning	Total
Greece	.379**	.421**	.322**	.420**
China	.138	.249**	.232**	.224**

Note: ** $p < .01$

With regard to the Chinese teachers, although no significant correlation was reported between ICT competences and the use frequency of independent learning ($r = .138$, $p > .05$), a significant and positive correlation was revealed between ICT competences and the use frequency of teaching approaches as a whole ($r = .224$, $p < .01$), as well as and the use frequency of collaborative learning ($r = .249$, $p < .01$) and inquiry learning ($r = .232$, $p < .01$) (**Table 4.23**).

Teachers' Attitudes

It was shown in Table 4.24 that for both the Greek and Chinese teachers, there was a significant and positive correlation between their ICT competences and total attitudes

and each individual factor of attitudes ($p < .05$; $p < .01$). The more positive attitudes the teachers held, the more competent they were.

Table 4.24 Correlation between Attitudes and ICT Competences

Country	Attitude F1	Attitude F2	Attitude F3	Attitude Total
Greece	.246*	.454**	.571**	.526**
China	.504**	.492**	542**	.549**

Note: * $p < .05$; ** $p < .01$

Teachers' Barriers

With regard to the teachers in Greece, except for the barrier "lack of external support" (F1) ($r = -.176$, $p > .05$), their ICT competences were significantly and negatively correlated with their perceptions of the barriers as a whole ($r = -.310$, $p < .01$), as well as with the two individual barriers "lack of preschool support" (F2) ($r = -.250$, $p < .01$) and "lack of competences" (F3) ($r = -.431$, $p < .01$). This means that the teachers who encountered more barriers, particularly the barriers about preschool support and ICT competences were less competent ICT users (**Table 4.25**).

Table 4.25 Correlation between Barriers and ICT Competences

Country	Barrier F1	Barrier F2	Barrier F3	Barrier Total
Greece	-.176	-.250**	-.431**	-.310**
China	.052	-.136	-.047	-.041

Note: ** $p < .01$

A different situation emerged in the Chinese context. It was found that teachers' ICT competences did not have a significant correlation with their perceived barriers as a whole, neither with their perceptions of each individual barrier ($p > .05$) (**Table 4.25**).

Predicating Teachers' ICT Competences with the Multiple Linear Regression

The results of the Multiple Linear Regression Analysis for the Greek teachers showed

that a total of four predictors entered the regression model (F = 12.760, p = .000). They consisted of teaching approaches, age, teachers' barriers and teachers' attitudes. Overall, the regression model could explain 55.5% of the variance of teachers' ICT competences (R = .745, R^2 = .555, Adjusted R^2 = .511).

As shown in **Table 4.26**, all the four predictors had a significant effect on teachers' ICT competences (p < .05). The effects of teachers' attitudes and teaching approaches were positive, but the effects of teachers' barriers and age were negative. This means that the teachers who held more positive attitudes and used constructivist approaches more frequently were likely to have higher ICT competences. However, the teachers who encountered more barriers and were older were less likely to be competent in ICT use. Teaching approaches had the largest effect size (B = .393, Beta = .371), then it was the turn to age (B = -.467, Beta = -.284), teachers' barriers (B = -.279, Beta = -.270) and teachers' attitudes (B = .464, Beta = .265).

Table 4.26 Predicting ICT Competences of the Greek Teachers

Predictors	B	Beta	T	Sig.
Teaching approaches	.393	.371	3.109	.003
Age	-.467	-.284	-2.405	.021
Teachers' barriers	-.279	-.270	-2.470	.018
Teachers' attitudes	.464	.265	2.062	.046

With regard to the Chinese teachers, three variables entered the regression model (F = 29.235, p = .000), which included teachers' attitudes, preschool support and years of ICT use in teaching and learning. The combination of the three predictors accounted for 48.0% of the variance of teachers' ICT competences (R = .693, R^2 = .480, Adjusted R^2 = .464).

Table 4.27 Predicting ICT Competences of the Chinese Teachers

Predictors	B	Beta	T	Sig.
Teachers' attitudes	.484	.579	7.761	.000
Preschool support	.196	.255	3.434	.001
Years of ICT use	.114	.177	2.384	.019

Table 4.27 presented the detailed results of the predictors. Both of them significantly and positively affected teachers' ICT competences ($p < .05$). This means that positive attitudes, sufficient preschool support and long years of ICT use in teaching and learning were more likely to lead to competent teachers. Moreover, teachers' attitudes were the strongest predictor (B = .484, Beta = .579), followed by preschool support (B = .196, Beta = .255) and years of ICT use in teaching and learning (B = .114, Beta = .177).

4.6 Teachers' Barriers to ICT Use in Teaching and Learning

This section reports the findings regarding the barriers which were encountered by the participants. It is divided into four parts, including the verification of the validity and reliability of the barrier scale, the presentation of main barriers, the comparison of main barriers, and the analysis of relevant influencing factors.

4.6.1 Validity and Reliability of the Scale

In order to examine the construct validity of the scale, the factor analysis using the Principal Factor Analysis for the factor extraction and the Varimax method for the rotation was conducted. As a result, a total of three factors were extracted.

As seen from **Table 4.28**, the factor loadings for the variables in the first factor (F1) ranged from .711 to .826. This factor was composed by six items (B7, B8, B12, B13, B14, B15) and was labeled "lack of external support". There were also six items (B1 - B6) in the second factor (F2), which was labeled "lack of preschool support". The factor loadings for the variables of this factor varied from .558 to .877. The last factor (F3) covered three variables (B9 - B11) with factor loadings from .595 to .790. This factor was labeled "lack of competences".

The internal reliability analysis of the overall scale and the three sub-factors was then

performed. The relevant Chronbach's alpha coefficients were acceptable: .919 for the overall scale, .894 for F1, .875 for F2, and .748 for F3.

Table 4.28 Factor Loadings of Each Item of the Barrier Scale

Variables	Factors		
	F1	F2	F3
B14My preschool does not have a related policy	.826	.235	.153
B12I can not see the benefits of using ICT in teaching	.823	.118	.220
B8Most parents are not in favor of the use of ICT in teaching	.758	.207	.221
B7My colleagues are not in favor of the use of ICT in teaching	.722	.333	.027
B15Lack of support of national/regional educational authority	.717	.332	.110
B13It is difficult for me to use ICT in teaching	.711	.059	.375
B3Lack of technical support	.226	.877	.056
B4Lack of pedagogical support	.309	.802	.210
B1Lack of hardware, the Internet and software	.241	.802	-.054
B2Lack of training on pedagogical use of technology	.258	.668	.332
B5Lack of time to learn and use ICT in teaching	.123	.603	.594
B6Large number of children in the classroom	-.023	.558	.453
B10Technology is changing very fast	.208	.218	.790
B9Children don't have abilities to appropriately use ICT	.478	-.028	.625
B11I lack competencies to use ICT in teaching	.541	.159	.595

4.6.2 Main Barriers Teachers Encountered

Table 4.29 showed that the leading barriers that the Greek teachers encountered were "large number of children in the classroom" (B6) (M = 3.50, SD = 1.227) and "lack of hardware, the Internet and software" (B1) (M = 3.48, SD = 1.180). A large number of the teachers reported that they ever encountered these barriers "much" or "very much" (50.9%; 48.1%). Besides, other barriers, including "technology is changing very fast" (B10) (M = 3.28, SD = 1.169) and "lack of technical support" (B3) (M = 3.25, SD = 1.245) were also leading barriers. A large proportion of the teachers reported that they ever encountered these two barriers "much" or "very much" (38.7%; 43.0%).

On the contrary, some barriers were perceived as the least main barriers by the Greek

teachers, including “I cannot see the benefits of using ICT in teaching” (B12) (M = 1.73, SD = 1.004), “it is difficult for me to use ICT in teaching” (B13) (M = 2.04, SD = 1.126), “most parents are not in favor of the use of ICT in teaching” (B8) (M = 2,10, SD = 1.064) and “my colleagues are not in favor of the use of ICT in teaching” (B7) (M = 2.13, SD = 1.175). The majority of the teachers stated that they “never” met or met “a little” these barriers, with the percentages of 84.0%, 71.4%, 74.3% and 65.4% respectively.

With regard to the Chinese teachers, as shown in **Table 4.29**, their leading barrier was “large number of children in the class” (B6) (M = 3.37, SD = 1.100). Over a half of the teachers met with this barrier “much” or “very much” (51.6%). This finding was consistent with the finding which was reported by the Greek teachers. Moreover, there were also other barriers that were perceived as main barriers by the Chinese teachers, including “technology is changing very fast” (B10) (M = 3.20, SD = 1.244) and “lack of time to learn and use ICT in teaching” (B5) (M = 3.17, SD = .958). The percentage of the teachers who reported these two barriers “much” or “very much” was also high, with 38.7% and 34.0% respectively.

However, the barriers, including “my colleagues are not in favor of the use of ICT in teaching” (B7) (M = 2.27, SD = 1.221), “I cannot see the benefits of using ICT in teaching” (B12) (M = 2.32, SD = 1.314) and “most parents are not in favor of the use of ICT in teaching” (B8) (M = 2.37, SD = 1.280) were the least leading barriers for the Chinese teachers. A number of the teachers reported that they did not encounter these barriers very frequently (“Never” or “A little”), with the percentages of 61.4%, 58.7% and 59.4% respectively. This was consistent with the relevant finding on the Greek teachers.

Table 4.29 Percentages, Means and Standard Deviations of Each Item of the Barrier Scale

Variables	Country	Never	A little	Sometimes	Much	Very Much	M	SD
B1	Greece	4.6	16.7	30.6	22.2	25.9	3.48	1.180
	China	11.6	8.4	54.8	15.5	9.7	3.03	1.047
B2	Greece	7.5	39.3	26.2	18.7	8.4	2.81	1.091
	China	6.5	19.4	47.1	18.1	9.0	3.04	.999
B3	Greece	6.5	26.2	24.3	21.5	21.5	3.25	1.245
	China	9.8	22.9	39.2	21.6	6.5	2.92	1.048
B4	Greece	8.8	26.5	31.4	18.6	14.7	3.04	1.185
	China	12.3	20.0	40.0	19.4	8.4	2.92	1.105
B5	Greece	12.0	27.8	30.6	17.6	12.0	2.90	1.191
	China	7.2	9.8	49.0	26.8	7.2	3.17	.958
B6	Greece	5.6	17.6	25.9	23.1	27.8	3.50	1.227
	China	8.4	10.3	29.7	38.7	12.9	3.37	1.100
B7	Greece	39.4	26.0	21.2	8.7	4.8	2.13	1.175
	China	34.6	26.8	20.9	11.8	5.9	2.27	1.221
B8	Greece	31.4	42.9	13.3	8.6	3.8	2.10	1.064
	China	32.9	25.8	20.0	13.5	7.7	2.37	1.280
B9	Greece	24.3	38.8	22.3	10.7	3.9	2.31	1.076
	China	17.1	11.8	36.8	23.7	10.5	2.99	1.212
B10	Greece	7.5	15.1	38.7	18.9	19.8	3.28	1.169
	China	14.9	9.7	29.9	31.2	14.3	3.20	1.244
B11	Greece	15.9	36.4	26.2	15.0	6.5	2.60	1.123
	China	14.9	18.2	46.8	14.3	5.8	2.78	1.056
B12	Greece	53.0	31.0	10.0	2.0	4.0	1.73	1.004
	China	38.1	21.3	18.1	15.5	7.1	2.32	1.314
B13	Greece	40.0	31.4	19.0	3.8	5.7	2.04	1.126
	China	28.4	18.1	31.6	18.1	3.9	2.51	1.192
B14	Greece	33.7	25.0	22.1	13.5	5.8	2.33	1.234
	China	34.4	19.5	24.7	14.3	7.1	2.40	1.286
B15	Greece	17.0	25.5	29.2	12.3	16.0	2.85	1.300
	China	28.6	16.9	24.0	18.8	11.7	2.68	1.371

Table 4.30 further presented the results about teachers' overall barriers and its three sub-factors. Specifically, the overall level of teachers' perceptions of barriers both in Greece and in China was low (M = 2.70, SD = .735; M = 2.80, SD = .827). It means that both the Greek and Chinese teachers did not perceive that they frequently faced these barriers when they used ICTs in teaching and learning practices.

In terms of the three factors, "lack of preschool support" (F2) was the biggest barrier

for both the Greek and Chinese teachers (M = 3.16, SD = .873; M = 3.08, SD = .858). It was then the barrier of "lack of competences" (F3) (M = 2.72, SD = .900; M = 2.99, SD = .969). However, the barrier of "lack of external support" (F1) was regarded as the least main barrier by them (M = 2.21, SD = .866; M = 2.43, SD = 1.069).

Table 4.30 Overall Barriers, Individual Barriers and Comparison

Variables	Country	N	M	SD	Levene's Test		T-test		
					F	Sig.	T	df	Sig. (two tails)
F1	Greece	108	2.21	.866	5.650	.018	-1.811	255.082	.071
	China	155	2.43	1.069					
F2	Greece	108	3.16	.873	1.799	.181	.783	261	.434
	China	155	3.08	.858					
F3	Greece	108	2.72	.900	.011	.918	-2.276	261	.024
	China	155	2.99	.969					
Overall	Greece	108	2.70	.735	.315	.575	-.996	261	.320
	China	155	2.80	.827					

4.6.3 Comparison of Teachers' Barriers

It could also be seen from **Table 4.30** that there was no significant difference in the overall perception level of barriers between the Greek and Chinese teachers (t = -.996, df = 261, p = .320). For the three factors of barriers, the significant difference only existed in "lack of competences" (F3) (t = -2.276, df = 261, p = .024). The teachers in China more tended to perceive the lack of related competences as a barrier than those in Greece. However, the difference between the two groups in "lack of preschool support" (F2) (t = .783, df = 261, p = .434) and "lack of external support" (F1) (t = -1.811, df = 255.082, p = .071) was not found significant.

4.6.4 Influencing Factors for Teachers' Perceptions of Barriers

Demographic Information

Working hours per day was identified as a significant and positive factor to influence the perceptions of barriers of the Greek teachers ($r = .213$, $p < .05$), while number of children in the classroom was found significantly and negatively affect the Chinese teachers' perceptions of barriers ($r = -.183$, $r < .05$).

More precisely, the Greek teachers with longer working time were likely to perceived more barriers. It was surprising to find that more classroom children were more likely to lead to less perceived barriers of the Chinese teachers.

ICT Access in the Daily Life

The Greek teachers' perceptions of barriers did not vary based on their access to ICTs in the daily life ($r = -.072$, $p > .05$). However, the perceptions of the Chinese teachers were significantly and negatively correlate with their ICT access in the daily life ($r = -.217$, $p < .01$). The teachers with better access to ICTs in their daily lives tended to perceive that they faced fewer barriers.

ICT Use Frequency in the Daily Life

In the Greek context, the use frequency of ICTs in the daily life was not reported to have a significant correlation with teachers' perceived barriers ($r = -.102$, $p > .05$).

In the Chinese context, however, a significant and positive correlation was reported between teachers' perceived barriers and ICT use frequency in the daily life ($r = .195$, $p < .05$). This means that the teachers who faced more barriers were those who used ICTs more frequently in their daily lives.

Pre-service ICT Training

Whether attending pre-service ICT training, either general training ($t = -.411$, $df = 105$, $p = .682$) or pedagogical training ($t = 1.094$, $df = 105$, $p = .277$), did not significantly influence the perceptions of barriers of the Greek teachers.

However, in the Chinese context, a significant difference existed in the perceptions of barriers between the teachers who attended pre-service training and those who did not. The difference was reflected in both general training ($t = -7.429$, $df = 150$, $p = .000$) and pedagogical training ($t = -6.115$, $df = 150$, $p = .000$). In other words, the teachers who encountered more barriers were those who attended neither general training ($M = 3.33 > 2.47$) nor pedagogical training ($M = 3.25 > 2.51$).

In-service ICT Training

A significant and negative correlation was revealed between teachers' ICT in-service training and perceived barriers in both Greece ($r = -.193$, $p < .05$) and China ($r = -.463$, $p < .01$). The teachers who attended in-service training tended to meet fewer barriers. This case particularly took place in the training offered by educational authorities ($t = 2.284$, $df = 103$, $p = .024$) and online self-learning ($t = 2.702$, $df = 104$, $p = .008$) in the Greek context, but in all types of training in the Chinese context ($p < .05$).

Benefits of In-service ICT Training

A significant and negative correlation was found between teachers' perceived barriers and their perceived benefits from in-service ICT training in both the Greek ($r = -.275$, $p < .05$) and Chinese setting ($r = -.427$, $p < .01$). This means that the more benefits the teachers obtained from in-service training, the fewer barriers they would encounter.

Preschool Support

Table 4.31 revealed a significant and negative correlation between teachers' perceived barriers and either the total preschool support or the individual preschool support in both Greece and China ($p < .01$). That is, the more support the teachers obtained from the preschool, the less barriers they encountered.

Table 4.31 Correlation between Preschool Support and Barriers

Country	Policy support	Hardware, the Internet and software support	Training support	Technical support	Pedagogical support	Time support	Total
Greece	-.256**	-.313**	-.281**	-.451**	-.330**	-.299**	-.420**
China	-.561**	-.595**	-.537**	-.546**	-.523**	-.559**	-.636**

Note: ** $p < .01$

ICT Access in the Classroom

Regarding the access to ICT tools in the classroom, even though it has no significant correlation with the perceptions of barriers of the Greek teachers ($r = -.161$, $p > .05$), a significant and negative correlation was found between it and the Chinese teachers' perceptions of barriers ($r = -.283$, $p < .01$). It means that the better ICT access in the classroom there was, the fewer barriers the teachers would encounter.

Access to the Computer Laboratory/Multimedia Room

Regarding the access to the computer laboratory/multimedia room, it was identified as a significant factor for the perceptions of barriers of the Greek teachers ($t = 2.525$, $df = 106$, $p = .013$). The teachers without the access to the computer laboratory/multimedia room perceived more barriers. But it had no significant impact on the perceptions of barriers of the Chinese teachers ($t = .672$, $df = 113.249$, $p = .503$).

ICT Use Frequency in Teaching and Learning

ICT use frequency in teaching and learning was found no significant correlation with perceived barriers of both the Greek ($r = -.105$, $p > .05$) and Chinese teachers ($r = .114$, $p > .05$).

Years of ICT Use in Teaching and Learning

Years of using ICTs in teaching and learning was also found not significantly affect teachers' perceptions of barriers, which took place in both Greece ($F = .352$, $p = .788$) and China ($F = 2.388$, $p = .071$).

Teaching Approaches

It was shown in **Table 4.32** that a significant and negative correlation was only found between the use frequency of collaborative learning and the perceptions of barriers of the Greek teachers ($r = -.219$, $p < .05$) .

Table 4.32 Correlation between Teaching Approaches and Barriers

Country	Independent learning	Collaborative learning	Inquiry leaning	Total
Greece	-.139	-.219*	-.027	-.145
China	-.267**	-.371**	-.391**	-.374**

Note: * $p < .05$; ** $p < .01$

However, in terms of the Chinese teachers, a significant and negative correlation was found between their perceived barriers and their use frequency of teaching approaches as a whole and each individual teaching approach ($p < .01$). That is, the teachers with a higher frequency in using these teaching approaches perceived to have encountered fewer barriers.

Teachers' Attitudes

With regard to the Greek teachers, both their total attitudes ($r = -.199$, $p < .05$) and attitudes of "affections and willingness" (F3) ($r = -.268$, $p < .01$) were significantly and negatively correlated with their perceived barriers. It means that the more positive attitudes the teachers held, in particular more positive affections and willingness, the less barriers they encountered (**Table 4.33**).

With regard to the Chinese teachers, however, no significant correlation was found between their perceptions of barriers and either their total attitudes or each individual factor of attitudes ($p > .05$) (**Table 4.33**).

Table 4.33 Correlation between Attitudes and Barriers

Country	Attitude F1	Attitude F2	Attitude F3	Attitude Total
Greece	-.077	-.147	-.268**	-.199*
China	-.040	.152	.017	.052

Note: * $p < .05$; ** $p < .01$

Teachers' ICT Competences

The perceptions of barriers of the Greek teachers were reported to be significantly and negatively correlated with both their ICT competences as a whole and each individual factor of ICT competences ($p < .05$; $p < .01$), which means that the more competent the teachers were, the less barriers they met with (**Table 4.34**).

Table 4.34 Correlation between ICT Competences and Barriers

Country	Competence F1	Competence F2	Competence F3	Competence F4	Competence Total
Greece	-.321**	-.217*	-.233*	-.288**	-.310**
China	-.129	-.025	-.062	.058	-.041

Note: * $p < .05$; ** $p < .01$

On the contrary, the perceptions of barriers of the Chinese teachers were significantly

correlated with neither their overall ICT competences nor individual ICT competences ($p > .05$) (**Table 4.34**).

Predicating Teachers' Perceived Barriers with the Multiple Linear Regression

In the regression model for the Greek teachers, a total of three variables were entered ($F = 13.491$, $p = .000$). They were preschool support, ICT access in the classroom and working hours per day. The model could explain 49.1% of the variance of teachers' perceived barriers ($R = .701$, $R^2 = .491$, Adjusted $R^2 = .454$).

Table 4.35 Predicting Barriers of the Greek Teachers

Predictors	B	Beta	T	Sig.
Preschool support	-.512	-.521	-4.580	.000
ICT access in the classroom	-1.682	-.300	-2.625	.012
Teaching hours per day	.000	.261	2.352	.023

As seen in **Table 4.35**, all these three variables could significantly predict teachers' perceived barriers ($p < .05$). However, preschool support ($B = -.512$, $Beta = -.521$) and ICT access in the classroom ($B = -1.682$, $Beta = -.300$) had a negative effect, while working hours ($B = .000$, $Beta = .261$) had a positive effect. That is, the teachers with more support from the preschool and had access to ICT tools in the classroom were likely to perceive fewer barriers, whereas the teachers working for fewer hours tended to perceive fewer barriers. Besides, preschool support had the strongest effect, which was followed by ICT access in the classroom and working hours per day.

For the teachers in China, four variables constituted the regression model ($F = 12.208$, $p = .000$). They were per-service general ICT training, teaching approaches, perceived benefits of in-service ICT training and educational level. The combination of the four predictors accounted for 34.2% of the variance of teachers' perceptions of barriers ($R = .585$, $R^2 = .342$, Adjusted $R^2 = .314$).

Table 4.36 Predicting Barriers of the Chinese Teachers

Predictors	B	Beta	T	Sig.
Pre-service general ICT training	-.462	-.289	-3.195	.002
Teaching approaches	-.198	-.259	-2.848	.005
Perceived benefits of in-service training	-.194	-.218	-2.240	.027
Educational level	.301	.208	2.484	.015

It was seen from **Table 4.36** that each predictor had a significant effect on teachers' perceptions of barrier ($p < .05$). Three of them which included pre-service general ICT training (B = -.462, Beta = -.289), teaching approaches (B = -.198, Beta = -.259) and perceived benefits of in-service ICT training (B = -.194, Beta = -.218) had negative effects, while educational level (B = .301, Beta = .208) had a positive effect. In other words, the teachers who had attended general ICT training in their pre-service period used constructivist teaching approaches more frequently and perceived more benefits from in-service ICT training perceived fewer barriers. However, the teachers who had a higher educational degree perceived more barriers. Furthermore, pre-service general ICT training had the largest effect size. It was then followed by teaching approaches, perceived benefits of in-service ICT training and educational level.

Concluding Remarks

This chapter presents and analyzes the results of the quantitative section of this study. After an introduction to the demographic characteristics of the samples, it compares the similarities and differences between the Greek and Chinese samples in ICT access, ICT use practices, attitudes toward ICT use, ICT competences and barriers to ICT use in teaching and learning. The main findings of the quantitative study include:

1) **ICT access**. The Chinese teachers had a higher level of ICT access than the Greek teachers. The Greek teachers could easily access the computer and Internet, followed by educational software and TVs/DVD players. But they had difficulties to access

other equipment, including digital camera/video camera, smartphone, projector, tablet, interactive whiteboard and computer laboratory/multimedia room. But the availability of all these equipment and resources of the Chinese teachers was high.

2) **ICT use**. Not only similarities but also differences between the Greek and Chinese teachers were reported in terms of ICT use practices.

- **Use frequency**. The Chinese teachers used ICTs more frequently than the Greek teachers.
- **Using years**. Both the Greek and Chinese teachers had used ICTs for at least one year.
- **Teaching stages**. Both the Greek and Chinese teachers used ICTs most frequently in the teaching and learning implementation stage, then the teaching and learning preparation stage. They all used ICTs least frequently in the teaching and learning evaluation stage.
- **Learning areas**. The Greek teachers more tended to apply ICTs in Theme-based curriculum, Environment Studies and Language while the Chinese teachers in Art, Theme-based curriculum and Language.
- **Time allocation**. Both the Greek and Chinese teachers preferred to spend half or less of teaching hours for ICT use.
- **Teaching approaches**. The use frequency of constructivist teaching approaches was medium by both the Greek and Chinese teachers. No significance difference was found between these two group in the use frequency of overall constructivist teaching approaches.
- **Influencing factors for ICT use frequency**. Four common factors were reported, including ICT use frequency in the daily life, preschool support, ICT access in the classroom and teachers' attitudes. Besides, the Greek teachers were also affected by pre-service general ICT training and teaching approaches, while demographic characteristics (age, educational level, teaching years and number of children), ICT access in the daily life, access to the computer laboratory/multimedia room, ICT competences and barriers had significant impacts on the Chinese teachers.

3) **Attitudes towards ICT use**. No significant difference was reported between the Greek and Chinese teachers in their attitudes toward ICT use in teaching and learning. Both of them expressed positive attitudes. ICT use frequency in teaching and learning, teaching approaches and ICT competences were factors affecting both the Greek and Chinese teachers' attitudes. Meanwhile, the Greek teachers were also affected by age, number of children in the classroom, in-service ICT training, benefits of in-service ICT training, preschool support and barriers. The Chinese teachers were also affected by ICT access in the daily life and ICT use frequency in the daily life.

4) **ICT competences**. The Chinese teachers reported higher ICT competences than the Greek teachers. The Chinese teachers had a high level, while the Greek teachers had a medium level of ICT competences. However, these two groups all reported the lowest Technological Competences (TC), particularly in terms of the competences in solving technical problems. Five factors affected the ICT competences of both the Greek and Chinese, including in-service ICT training, benefits of in-service training, preschool support, teaching approaches and teachers' attitudes. Besides, the Greek teachers were also affected by age, teaching experiences, ICT access in the daily life, pre-service ICT training and barriers. The Chinese teachers were also affected by their ICT use frequency in the daily life, ICT use frequency in teaching and learning, and using years of ICTs in teaching and learning.

5) **Barriers**. The overall perceptions of barriers to ICT use in teaching and learning of both the Greek and Chinese teachers was low. The leading barriers encountered by the Greek teachers were "large number of children in the classroom", "lack of hardware, the Internet and software", "technology is changing very fast" and "lack of technical support". The main barriers reported by the Chinese teachers included "large number of children in the classroom", "technology is changing very fast" and "lack of time to learn and use ICT in teaching". However, both the Greek and Chinese teachers did not perceive "many colleagues are not in favor of the use of ICT in teaching", "I cannot

see the benefits of using ICT in teaching" and "most parents are not in favor of the use of ICT in teaching" as leading barriers.

The perceptions of barriers of the Greek and Chinese teachers were affected by four common factors, including in-service ICT training, preschool support, ICT access in the classroom and teaching approaches. When the Greek teachers were also impacted by number of working hours per day, access to computer laboratory/multimedia room, teachers' attitudes and ICT competences, the Chinese teachers were also affected by educational level, number of children, ICT access in the daily life, ICT use frequency in the daily life, pre-service ICT training and benefits of in-service ICT training.

The results of the qualitative section of this study will be reported in the next chapter.

Chapter 5 Results of the Qualitative study

This chapter presents the results of the qualitative part of this study. Similarly with the previous chapter, six sections constitute this chapter, which include the participants' demographic characteristics (5.1), access to ICT equipment and resources in teaching and learning (5.2), use of ICT equipment and resources in teaching and learning (5.3), attitudes towards ICT use in teaching and learning (5.4), ICT competences (5.5), and barriers which were encountered in using ICTs in teaching and learning (5.6).

5.1 Demographic Information

This section shows the demographic information of the participants. It begins with a brief introduction to the method used to identify participating teachers and preschools. It then successively presents the specific demographic characteristics of the Greek and Chinese participating teachers.

5.1.1 Identification of Participants

Both the participants and preschools where they were working were identified with a letter and were listed in an alphabetical order. Moreover, for the participants who were from the same preschool, they were given the same letter, but were differentiated with a number. For instance, the two teachers who came from the Greek preschool H were identified as H1 and H2 respectively.

5.1.2 Demographic Information of the Greek Participants

Table 5.1 shows that a total of 15 Greek teachers who were from 13 public preschools were interviewed. Nearly all of them were female, but there was also one who was male. Their ages ranged from 34 to 52 years old and most of them were in their forties

and fifties. Their teaching experiences varied from 7 to 28 years. More specifically, 5 teachers had worked for over 20 years, 7 teachers for over 10 years but less than 20 years, and 3 teachers for over 5 years but less than 10 years. Most of them held a Bachelor degree, but one teacher was also pursuing a Master degree, and one who had completed a Doctor degree. Moreover, the teachers in half-day (κλασικά) and full-day (ολοήμερα) classrooms were all included.

Table 5.1 Demographic Information of the Greek Participants in the Qualitative Study

No.	Preschool	Teacher	Gender	Age	Teaching Years	Educational Level	Classroom Type
1	A	A	Female	42	16	Bachelor	Half-day
2	B	B	Female	50	29	Bachelor	Half-day
3	C	C	Male	34	9	Bachelor	Full-day
4	D	D	Female	41	18	Bachelor	Half-day
5	E	E	Female	42	18	Master student	Full-day
6	F	F	Female	52	29	Bachelor	Half-day
7	G	G	Female	46	14	Bachelor	Full-day
8	H	H1	Female	45	15	Bachelor	Half-day
9	H	H2	Female	47	9	Bachelor	Full-day
10	I	I	Female	49	17	Doctor	Full-day
11	J	J	Female	50	27	Bachelor	Half-day
12	K	K	Female	44	7	Bachelor	Full-day
13	L	L	Female	50	23	Bachelor	Full-day
14	M	M1	Female	44	16	Bachelor	Half-day
15	M	M2	Female	52	28	Bachelor	Full-day

5.1.3 Demographic Information of the Chinese Participants

Table 5.2 shows the detailed demographic information for the participants in China. There were a total of 19 teachers working in 11 public preschools who took part in the interview. All of them were female. Their ages ranged from 23 to 48 years old, among

whom 7 teachers were in their twenties, 3 teachers in their thirties and 9 teachers in their forties. Their teaching experiences varied from 1 to 30 years. More specifically, 9 teachers had worked between 1 to 10 years, 3 teachers between 11 to 20 years, and 7 teachers between 21 to 30 years. Most of them held a College or a Bachelor degree, but there were also 2 teachers who completed a Master degree. Moreover, 8 teachers were teaching in the senior class for children aged 5-6 years old, while the remaining 11 teachers were teaching in the middle class for 4- to 5- year-olds.

Table 5.2 Demographic Information of the Chinese Participants in the Qualitative Study

No.	Preschool	Teacher	Gender	Age	Teaching years	Educational level	Grade
1	A	A1	Female	43	30	College	Senior
2	A	A2	Female	30	10	College	Middle
3	B	B1	Female	26	7	College	Senior
4	B	B2	Female	43	23	Bachelor	Middle
5	C	C1	Female	42	22	Bachelor	Middle
6	C	C2	Female	30	7	Bachelor	Senior
7	D	D	Female	27	4	Master	Middle
8	E	E1	Female	40	20	Bachelor	Middle
9	E	E2	Female	48	30	Bachelor	Senior
10	F	F	Female	43	23	Bachelor	Middle
11	G	G	Female	26	3	College	Middle
12	H	H1	Female	42	22	Master	Senior
13	H	H2	Female	26	5	Bachelor	Middle
14	I	I1	Female	34	13	Bachelor	Middle
15	I	I2	Female	23	1	Bachelor	Senior
16	J	J1	Female	42	23	College	Senior
17	J	J2	Female	28	7	College	Middle
18	K	K1	Female	25	2.5	Bachelor	Middle
19	K	K2	Female	45	15	Bachelor	Senior

5.2 Teachers' ICT Access in Teaching and Learning

This section presents the results on the ICT access of the participants in teaching and learning. The results for the Greek and Chinese teachers are presented respectively.

According to the interview transcripts, two types of ICT access emerged in both the Greek and Chinese contexts. The first type was called "ICT access in the classroom", because it featured that ICT equipment and resources were accessed by the teachers in the classroom. The feature of the other type was that the teachers accessed and shared ICT equipment and resources via a common place located outside the classroom. Thus, this type was called "ICT access out of the classroom".

5.2.1 ICT Access of the Greek Teachers

ICT Access in the Classroom

The most popular ICT tools that were accessed by the Greek teachers in the classroom were a CD player, a computer and educational CD-ROMs. For those teachers who had access to the computer, most of them could also connect to the Internet currently or in the near future. "*Although we don't have wireless Internet now, we will have it soon*" (Teacher M1). There were also some teachers who mentioned that a television set, a DVD player and a digital camera were available for them to use.

Except for the traditional ICT tools which were mentioned above, some new tools had already entered the classrooms of the Greek teachers, such as a smartphone (Teacher I and Teacher K), and an interactive whiteboard (Teacher G). However, the access to the new tools was quite limited.

ICT tools in the classroom were mostly provided by the preschool. Nevertheless, there were also cases where ICT tools were offered by the teachers themselves or some

organizations, which made up the limited ICT equipment and resources which were available. "*It (a digital camera) is mine. It is a personal one..... Our preschool does not offer one.....*" (Teacher G). "*A classroom (in my preschool) has a good computer. It was donated by a bank. The one (a computer) in my classroom is also very good and fast. I brought it here.....*" (Teacher M1).

ICT Access out of the Classroom

Because of the lack of fund to provide sufficient ICT tools for each classroom, several Greek teachers mentioned that some ICT tools, including a television set, a DVD player and a computer (or computers), could be accessed from a common place out of the classroom, such as the preschool hall or teachers' office. Thus, all the teachers in the preschool could share them. Three teachers stated that their preschools provided them with a shared television set and a DVD player, while five teachers said that they could get access to one or two computers outside the classroom.

Moreover, three teachers mentioned that even though no computer laboratory existed in their preschools, they could have access to the one in the primary school which was co-located with their preschools. However, most of the preschools were not equipped with a computer laboratory.

5.2.2 ICT Access of the Chinese Teachers

ICT Access in the Classroom

Hardware and the Internet

The Chinese participating teachers had better and more comprehensive ICT access in the classroom. Most of them had been provided with a broad range of ICT hardware and the Internet in the classroom, including conventional and emerging ICT tools.

On the one hand, many teachers mentioned that they could have access to a series of conventional ICT hardware in the classroom, including a computer, a digital camera, a digital visualizer, a television set and a DVD/CD player. Some teachers referred to a type of "*old-fashioned*" television that supports a USB drive and various multimedia files such as audios, videos and photos, but it does not have a touchscreen and is not interactive like a new television. Moreover, the Internet was available for most of the teachers, even though some teachers still could not access the Internet or had a poor connection to the Internet.

On the other hand, a series of emerging ICT hardware had appeared in the classroom of the Chinese teachers. They were either provided by the preschool or brought by the teachers themselves. The most common hardware was the newest-version television. Some teachers stated that it has a "*big screen*" with "*multiple functions*". It supports "*touchable technology*" and a special pen for "*handwriting*" like a "*big smartphone*" or an "*interactive whiteboard*". Another hardware which was commonly available was the smartphone. Nearly all of the teachers said that they could bring their smartphones to the classroom and used it for teaching and learning activities. Moreover, there were also some teachers who had access to an interactive whiteboard, a projector, a touch and talk pen, and a tablet in the classroom.

Software and Resources

Unlike the ICT hardware and the Internet mentioned above, ICT educational software that could be accessed by the Chinese teachers was relatively limited. Less than a half of them stated that they had access to educational software, which could be divided into two categories.

The first category was "*courseware*". It consisted of a series of fixed and systematic multimedia teaching and learning materials which were developed by a professional

curriculum team and could be installed into different equipment, such as computers, televisions, interactive whiteboards and tablets.

Teacher A2 mentioned a courseware on Language which was previously introduced by her preschool. "*There are many stories inside which are presented in the form of animation or 3D technology*". Teacher J1 also mentioned a courseware on Science that the teachers in her preschool were currently using. "*It is a systematic curriculum on Science, which covers all live things in nature, such as animals, plants and so on..... It is supported by an interactive whiteboard*".

The second category was "*online educational resources*". They were either bought by the preschool from the Internet or shared online by the teachers themselves.

Teacher K1 stated that her preschool bought an account for the teachers to log in and access an "*educational resource bundle*" on Science. So the teachers could "*log in the account to download the educational resources which are needed*". Also, Teacher E2 stated that her preschool created a website in which all the preschool teachers could share educational resources with one another. "*Teachers can upload their educational resources to this website, and other teachers can see and use them*".

ICT Access out of the Classroom

The Chinese teachers had access to richer and more diverse ICT equipment outside the classroom. More precisely, except for a computer laboratory, the preschools where the participants were working were also equipped with several other independent ICT rooms, including a lesson preparation room or a multi-functional room. Also, some teachers could also access some shared ICT equipment outside the classroom.

Lesson Preparation Room

Many teachers mentioned one kind of independent room in which many computers were provided. This room was named "*lesson preparation room*", because the computers in the room were used by teachers to prepare their lessons before the class, including searching for and downloading teaching and learning materials on the Internet or writing teaching plans. However, this room was not used by the teachers to implement teaching and learning activities. Moreover, classroom children could not access and use this room. The following two teachers proved this point of view:

"*There are about 30 computers inside. When teachers are preparing their lessons and need to look for materials, they will use them. But we don't use the room for teaching activities (in the class). Children are not allowed to use it.*" (Teacher C2)

"*Teachers prepare the lesson in the lesson preparation room. Teachers from the same classroom share a computer. We write our teaching plans on the computer.*" (Teacher E2)

Multi-functional Room

Many teachers also mentioned another type of independent room which was equipped with a wide range of ICT equipment, usually including a computer, a projector, a large screen and a set of sound equipment. The teachers called it "*multi-functional room*". Just as the name implies, this room performed multiple functions. "*This room has many functions. It can be used as a meeting room, a dancing room or a multimedia room*" (Teacher I1).

In most cases, this room was used for preschool-wide activities. One common activity was "*open teaching*" or "*open class*". It is a special form of teaching activity or class, in which the teacher presents his/her teaching method to many types of participants,

that is, not only to classroom children, but also to preschool principals, colleagues, etc. In addition, a series of preschool affairs also took place in this room, such as teacher training, large-scale video/movie watching, meetings, parental education, celebration activities, competitions, etc.

However, this room was rarely used by the teachers for regular teaching and learning, because "*the multimedia in the classroom is enough for teaching activities*" (Teacher B2). Only a few teachers said that they used it to conduct teaching activities, but only when they needed a "*large space*" or a "*big screen*". "*When I organize some activities which need a large space, I will use it (the multi-functional room).....*" (Teacher I2).

Computer Laboratory

For most of the participating Chinese teachers, the preschools were not equipped with a computer laboratory. One important reason was the concern about children's heath. "*My preschool doesn't have a computer room. Children's use is very limited. This is mainly for the sake of their health*" (Teacher A2). Moreover, the limited space to build an independent room was regarded as another reason. "*My preschool is located in the city center. There is no enough space..... All the rooms have been used for classrooms and bedrooms*" (Teacher D).

There were three teachers who stated that their preschools once had a computer room, but it was re-designed into another room because of the fear of children's vision and due to the fact that the space was insufficient. "*There was a computer room before..... Children could learn on the computer in a fun way. But today's children commonly have a vision problem, (therefore) the preschool got rid of it*" (Teacher H1); "*It (the computer room) ceased to operate..... The preschool has too many lessons, but does not have enough classrooms and activity rooms*" (Teacher J1).

Only one teacher (Teacher A1) stated that even though her preschool did not have a

computer laboratory, the teachers in her preschool could access the one in the primary school next to her preschool. However, due to the concern about children's vision, she had not used the computer laboratory in her teaching activities. "*I haven't used it (the computer laboratory) in my teaching, because we (teachers) don't allow children to operate computers..... This thing (the computer) is not good for children's eyes.*"

Shared Equipment

There were two teachers who mentioned some shared ICT equipment which were not placed in an independent room. They were outside the classroom and could be taken into the classroom when teachers needed them. "*Our preschool has only one projector. It is movable. The teacher who needs it can take it to her classroom*" (Teacher D); "*There is one shared digital camera in my preschool.....*" (Teacher J1).

5.3 Teachers' ICT Use Practices in Teaching and Learning

The results on how the interviewed teachers used ICT tools in teaching and learning activities are reported in this section. Specifically, the teachers' ICT use behaviors are described in detail based on the three stages of teaching and learning activities: 1) preparing teaching and learning activities before the class; 2) implementing teaching and learning activities in the class; and 3) evaluating and reflecting on teaching and learning activities after the class. Moreover, the ICT use behaviors of the teachers in informal teaching and learning activities are finally presented. Unlike formal teaching and learning activities which are always given pre-designed goals and processes, informal teaching and learning activities take place randomly and with improvisation.

5.3.1 ICT Use Practices of the Greek Teachers

Preparing Teaching and Learning Activities before the Class

At the preparation stage of teaching and learning activities, ICT tools were used by the Greek teachers for four types of activities: 1) searching materials and getting ideas; 2) making worksheets; 3) designing PowerPoint slides; and 4) writing teaching plans.

Searching Materials and Getting Ideas

Searching for teaching and learning materials and getting new ideas for teaching and learning activities by means of a computer and the Internet before the class was quite common and regular for the Greek teachers.

More precisely, according to the theme which would be taught and learned in the class, the teachers entered the Internet to search and collect various multimedia resources, such as images, audios, videos, games, worksheets, etc. "*I find many things (materials) which I can do with children from the Internet. I take almost all things from there..... This is on a daily basis.....*" (Teacher C); "*I use them (a computer and the Internet) more to obtain visual materials, (including) images, articles, information, videos and music*" (Teacher D).

The teachers also used a computer and the Internet to obtain new ideas which could be conducted in their own classrooms. "*I use a computer and the Internet very often. I get ideas from some websites specifically for preschool teachers.....*" (Teacher I).

However, there were also teachers who mentioned that due to their low competences to operate a computer and the Internet, they did not apply them frequently to prepare teaching and learning activities before the class. "*I use them (a computer and the Internet) to prepare lessons on very few occasions, not on a daily basis, because I*

don't know how to use them well" (Teacher J); "*I need the help from my colleagues. I know very few things (about the Internet). So I don't use it (the Internet) very often*" (Teacher L).

Making Worksheets

A worksheet is a sheet of paper by which children do some exercises and teachers can understand the result of a certain teaching and learning activity. As mentioned above, the worksheet could be found and downloaded on the Internet which was ready-made, but some teachers also mentioned that they had to prepare and design the worksheet by themselves before the class based on the characteristics of classroom children. For instance, the following two teachers proved this point of view:

"*I use a computer to make worksheets based on a theme. Because it is not good to use something which is completely ready. So I make them by myself.....*" (Teacher E)

"*I usually create the worksheet by myself with the computer..... I have to prepare the appropriate worksheet for the children in my classroom. Because one worksheet can't be appropriate for all children. So each worksheet should be tailored to the special needs and abilities of classroom children.*" (Teacher H1)

Designing PowerPoint Slides

Three teachers stated that they prepared PowerPoint slides before the class in order to present something for children either to learn new knowledge or to complete exercises. "*Sometimes I design PowerPoint slides before the class at home. I put some images and simple words on each slide. On the next day, I gather all the children together to watch and learn*" (Teacher A); "*I may design PowerPoint slides on which there are both images and words for children to match..... Children need to see both the words and images, and also to use their knowledge to guess which word matches the image*"

(Teacher G).

Writing Teaching Plans

Writing teaching plans with Microsoft Word before the class was also mentioned by two teachers. "*I prepare my teaching plan with Word*" (Teacher A); "*When I design a theme, I will write the lesson goals and related activities in Word*" (Teacher B).

Implementing Teaching and Learning Activities in the Class

ICT use behaviors of the Greek teachers at the teaching and learning implementation stage could be classified into two categories: "ICT use by the teacher" and "ICT use by the child". In the first category, the teacher performed ICT use behaviors. ICT tools were used by the teacher to present multimedia materials, to document teaching and learning activities and to document for teaching and learning activities. In the second category, ICT use behaviors were performed by the child. The child used ICT tools for self-learning and for documenting for their learning activities.

ICT Use by the Teacher

Presenting Multimedia Materials

To present teaching and learning materials in various media to classroom children was the most common behavior of the teachers when they conducted teaching and learning activities in the class. For this action, a CD player or a computer were used most often. Besides, a television set, a DVD player or an interactive whiteboard were also used by some teachers. The teachers used ICT tools to present a range of multimedia materials, such as images, music, songs, fairy tales, stories, documentaries, games, PowerPoint slides, etc. The multimedia was used as a "*cause*" (Teacher A) or a "*start*" (Teacher E) to a certain teaching and learning activity, or as a medium to "*learn more things*

(knowledge)" (Teacher E). The following teachers proved this point of view:

"*For the theme 'Recycling', I found some videos on YouTube. Then I showed them to the children. They saw how recycling takes place, what kinds of materials could be recycled and how materials are sent to the factory to be recycled.....*" (Teacher A)

"*If we want to watch an educational DVD, for example, a DVD on animals, I will use television and a DVD player.*" (Teacher E)

"*The interactive whiteboard is used in some cases..... For example, there was a theme on animals. We went to the computer room and saw some images of animals on the interactive whiteboard.*" (Teacher F)

On the contrary, some teachers stated that they used ICT equipment quite rarely in the class, because of insufficient ICT abilities and equipment. "*I learned how to use the computer at a very old age and I don't use it very often..... It is like another object for my work*" (Teacher J); "*I don't use the computer frequently..... I don't have adequate knowledge about the computer..... There is only one computer in the classroom and it is very old..... When I want to present something to the children, they have to come to the computer one team after another.....*" (Teacher B); "*I don't use the interactive whiteboard every day. Because it is for all the children in the preschool and in the primary school*" (Teacher F).

Documenting Teaching and Learning Activities

Many teachers referred to the documentation of teaching and learning activities with ICT tools. In most of the cases, documentation was done by means of a digital camera. "*I use the camera in each activity*" (Teacher C); "*I take the camera (to my preschool) and take photos every day*" (Teacher G).

Using a smartphone to document teaching and learning activities was also mentioned by two teachers. "*I often use my smartphone to take photos and make videos of the children*" (Teacher I); "*I use my smartphone to record activities*" (Teacher K).

Nevertheless, there were three teachers who mentioned that due to the concern about children's personal privacy and security, taking photos or making videos of children by teachers was prohibited by the law. "*I don't take photos or make videos of the children in the preschool, because it is not allowed by the law. The photos and videos may be uploaded on the Internet*" (Teacher D); "*I used a digital camera before..... But some parents uploaded photos on the Internet, so I stopped taking photos..... There is a lot of personal data on the photos. It is not legal.....*" (Teacher J).

Documenting for Teaching and Learning Activities

Three teachers mentioned that they sometimes used a digital camera to take photos for ongoing activities, especially for outdoor activities. "*We organized an activity on insects last year. We found ants, butterflies and other insects outdoors. We also took photos of them and finally made a board on which we displayed both the photos and names of them*" (Teacher E); "*In spring, we took photos of ants and printed them. We also took photos of flowers in the preschool yard. Then we arranged them based on their colors*" (Teacher G).

ICT Use by the Child

The children in the Greek preschool were allowed by teachers to use ICT tools for their learning activities, which mainly took place on the computer. But the interactive whiteboard and the digital camera were also mentioned by some teachers.

Guided Self-learning

Many teachers stated that the children in their classrooms often used the computer and several software to learn a specific theme with the supervision and the guidance of the teachers. The software included both general software, such as Microsoft Word, and specific educational software, such as painting or counting software. "*In the language activity, I may ask the children to write their names on a Word document one by one*" (Teacher D); "*There is software on Mathematics which is used to help children count, such as Kidspiration..... I (also) organize the children to paint on a Word document. It is good for them to practice their fine motor skills.....*" (Teacher E).

There were also some teachers who discovered and used online games which were suitable for children to play. "*There is an online game for making puzzles. I took a photo for each child and made each of them into a puzzle. Then I asked each child to come to the computer and put the pieces of their own photos in order*" (Teacher A); "*For the theme of 'Recycling', I prepared a game which I found on the Internet. The children played it in the class*" (Teacher D).

The children could also search for information and materials on the Internet in the classroom of some teachers. "*For the children who know letters and can recognize words, they can type and search them on the Internet to find something for a specific theme.....*" (Teacher G); "*They can search and see some information on the Internet*" (Teacher H1).

With regard to the interactive whiteboard, Teacher F organized the children to use and play with it. This is reflected in her own words: "*The children also did something with animals on the interactive whiteboard, for example, they played with the puzzle on it*."

Documenting for Learning Activities

One teacher reported that except for the teachers, the children in her classroom were also allowed to use the digital camera to take photos for their learning activities. "*For the theme of 'Spring', the children also take photos of insects outdoors..... I am not afraid that they will break it, because I am there*" (Teacher K).

On the contrary, for some other teachers, they did not allow the children to use the digital camera to take photos, because they were afraid that the children would break it. "*I don't give the camera to the children. If they break it, I don't have money to buy another one*" (Teacher G).

Evaluating and Reflecting on Teaching and Learning Activities after the Class

Unlike the first two stages which were described earlier, ICT tools were rarely used by the Greek teachers at the teaching and learning evaluation and reflection stage.

In other words, most of the teachers used a series of traditional methods to evaluate and reflect on teaching and learning activities. These methods involved taking notes, conducting interviews with children, observing, handing out worksheets, assessing children's creations, etc. "*I usually write what I have done on paper*" (Teacher F); "*I often ask the children several things and write their answers down on paper*" (Teacher C); "*The evaluation may take place after the completion of a team task from which I can see what the children have gained. I also use children's paintings or worksheets. It can also happen with a drama performance.....*" (Teacher G).

Writing Reports

There were three teachers who said that their evaluation and reflection activities may involve ICT tools. One of them used Microsoft Word to write the evaluation and

reflection report. "*After the lesson, I will see how many activities have been done, how many have not, which activity is interesting for the children and which is not. I will write them down on a Word document on the computer*" (Teacher B).

Doing Exercises

The remaining two teachers designed exercises for the children to do with Microsoft applications on the computer, such as PowerPoint or Word. "*For the theme of 'the Life Cycle of the Butterfly', I designed PowerPoint slides in which the children matched the images and the words. In this way, I knew if the children had understood and learned the lesson*" (Teacher G); "*I prepared worksheets with simple exercises on the computer. The children could do them on the computer*" (Teacher M1).

However, these teachers further pointed out that they used the computer to design exercises quite rarely, because of limited computers and time. "*Technology is used on very few occasions, because the children need to be organized individually. This will take much time*" (Teacher G); "*I try to do it (designing exercises on the computer) in this preschool, but it is difficult, because I have only one computer in the classroom and time is not enough*" (Teacher M1).

Informal Teaching and Learning Activities

In the Greek context, teachers' ICT use behaviors mainly emerged on three occasions of informal teaching and learning activities, which included free play time, break time, and sleep time.

Free Play Time

For the teachers who were provided a computer in the classroom, they often allowed classroom children to use it for learning activities, which mostly took place during

free play time in the morning. Children often played some educational games which had been installed into the computer from CD-ROMs or online. These games were used by the teachers to develop and improve children's various abilities, such as language, mathematics, painting, memory and fine motor skills. "*I have downloaded some educational games on the computer. They can help children develop language skills, mathematical skills, fine motor skills and painting skills*" (Teacher I); "*There are many CD-ROMs with educational games in the classroom, such as games for improving memory, mathematical and language skills*" (Teacher M1).

Moreover, two teachers also stated that they had prepared some videos or photos on the computer for the children's learning needs. "*I send the children to the computer corner to watch a DVD related to the theme which I want to teach*" (Teacher I); "*I transferred the photos which I took before to the computer. The children watch them every day on the computer. They will remember what we have done, how we have done from the beginning of the semester until now*" (Teacher M2).

The CD player was also mentioned by several teachers during the morning's free play time. In other words, the teachers used the CD player to play some relaxing music, songs or fairy tales. "*I use the CD player in the morning.....When the children are working on the table, I will play relaxing music*" (Teacher A); "*I send the children to a corner to listen to a CD with fairy tales or music*" (Teacher I).

However, four teachers also stated that due to the lack of a computer or the Internet, although they had the willingness to let the children play on the computer during their free play time, they could not realize it in practice. "*If there was a computer corner in the classroom, I would let the children use the computer in their free time. They could use the computer to paint or play some games which I had downloaded*" (Teacher H2). "*I know many websites, but the children can't play now, because there is no Internet in the classroom*" (M2).

One teacher, however, described that although there was a computer in the classroom, the children were not allowed to use it in their free time, because he believed that the children already used the computer so much at home that the preschool should not add more. "*We have the computer in the classroom, but the children never use it, because they use the computer a lot at home. It is better not to use the computer both here (in the classroom) and at home*" (Teacher C).

Break Time

During break time, some ICT tools were also used by some teachers, mainly including a television set, a DVD player, a computer and a CD player.

The use of the television/DVD player was reported by four teachers. More specifically, the television/DVD player was usually used for some special situations, especially on rainy days or during festivals. "*I usually use them (the television/DVD player) when it is raining, especially in winter. We can't go outside, so we can have a rest with them in the classroom.....*" (Teacher J); "*I only use the television during festivals to show something to the children*" (Teacher M1). When the teachers used the television/DVD player, they often showed educational videos. "*We watch fairy tales which teach the children valuable lessons. We don't watch Barbie*" (Teacher A); "*We watch something that is good and educational, such as Little Scientists which explains scientific themes in a simple way to the children..... Or fairy tales, such as Little Red Riding Hood*" (Teacher D).

The use of the computer was also mentioned by two teachers. One teacher stated that the children in her classroom played educational games on the computer during their break time at noon. "*The children can paint, play games, write their own names or do maths exercises at noon when there is a break before lunch*" (Teacher G). The other teacher in the full-day class sometimes took the children to the teachers' office and watched fairy tales on the computer in the afternoon. "*There are not many children in*

the afternoon, so we may come here (the teachers' office), pull out a long chair and watch a fairy tale together" (Teacher K).

Sleep Time

There was also a teacher who mentioned that she may use the computer to play quiet and relaxing music or use the CD player to play fairy tales or stories during sleep time at noon. The aim was to calm the children down or practice the children's listening skills. "*When the children are sleeping at noon, I may play relaxing and quiet music on YouTube*"; "*I also use the CD player to play fairy tales or stories instead of music to build their listening skills and calm them down*" (Teacher D).

5.3.2 ICT Use Practices of the Chinese Teachers

Preparing Teaching and Learning Activities before the Class

The Chinese teachers commonly used a computer and the Internet to prepare teaching and learning activities before the class. Specifically, three types of ICT use behaviors were mentioned, which included 1) writing teaching plans; 2) searching and collecting materials; and 3) designing courseware.

Writing Teaching Plans

It was commonly found that the Chinese teachers designed and wrote teaching plans on the computer. Most of them frequently used the computer, mainly Microsoft Word, to write teaching plans. "*(Except for handwritten teaching plans), we (teachers) also have to write electronic teaching plans on the computer*" (Teacher A2); "*I use a laptop most to prepare lessons based on a theme. Here, Word is needed to make tables and sort (the content)*" (Teacher I1).

Searching and Collecting Materials

Most of the teachers also mentioned that they used a computer and the Internet with a high frequency to search and collect teaching and learning materials in order to extend and enrich teaching and learning activities. The materials collected varied, including information, photos, music, videos, stories, songs, animations, etc. The following two teachers expressed this point of view:

"*I search materials on the Internet in order to enrich the content of teaching activities. Merely depending on the textbook is not suitable.*" (Teacher K2)

"*For the theme of 'Autumn', it is a little difficult for children in urban areas to feel and observe autumn outdoors. So I found and downloaded related pictures and videos, and then presented them to the children.*" (Teacher G)

On the contrary, two teachers reported that they did not search for and collect online materials frequently. One reason was that they had a comprehensive textbook which was offered by the provincial educational authority. "*It (the content of the textbook) is comprehensive. All the teaching content has been included*" (Teacher C1). Meanwhile, the popularity of the children-centered corner teaching and learning approach was reported as another reason. "*The teachers use the Internet less to collect materials now, unlike the case with the past collective activity*" (Teacher B2).

Designing Courseware

Courseware includes multimedia teaching and learning content, which makes teaching and learning more attractive and interesting. Designing courseware was also reported to be a common practice among the interviewed teachers. Thanks to the easiness and convenience, the most popular courseware was made by the teachers with Microsoft PowerPoint, usually called "*PPT*". "*It (PPT) is very simple and fast*" (Teacher A2); "*I*

make PPT presentation before the class. There are photos, animations and music inside" (Teacher B1).

Only two teachers mentioned other types of courseware, such as the courseware developed by Adobe Flash. But they also reported that they did not use it very often, because it is "*time-consuming*" (Teacher A2), and "*hard and complex*" (Teacher F2).

Implementing Teaching and Learning Activities in the Class

Main Actor: the Teacher

Unlike the Greek context, in the Chinese context, the teacher was the main actor who used ICTs at the teaching and learning implementation stage. It was the teacher who operated and used ICT tools in the class, while the operation and use of ICT tools by children were not allowed. "*The operation (of ICTs) by the children is rare* (Teacher A2); "*We don't have the activities which let the children operate (ICTs)*" (Teacher F2).

The first reason which was mentioned was the concern about potential threats of ICTs to children, such as the threats to vision, divergent thinking, exploration abilities and hands-on skills. "*This is for the sake of their vision*" (Teacher A2); "*The children are at a developmental stage, if they watch the television too much or are too near to it, their vision will be harmed. It is also not good for their divergent thinking, hands-on abilities and exploration abilities*" (Teacher F2).

Children's insufficient abilities, including ICT operation and protection abilities and literacy skills, were regarded as another reason. "*The children are too young, so they don't know how to protect it (the iPad)*" (Teacher I1); "*The children don't have a high enough literacy level. When they want to search for something on the Internet, they should first know Pinyin (the spelling system of Chinese), and then know how to type corresponding characters (the writing system of Chinese). They should understand the*

characters on the website. It is quite difficult for young children to mater these things" (Teacher K1).

Moreover, an insufficient equipment condition, parents' negative attitudes, teachers' insufficient abilities and the concern about internet safety were also important reasons. "*There are many children in the classroom but the equipment is rare. (Besides) some traditional parents believe that it is not good for children to use electronic devices too much. It is (also) difficult for some older teachers to guide children to use (ICTs)*" (Teacher K1); "*When children open a website, some content which is unsuitable for them usually emerges.....*" (Teacher K2).

However, since the introduction and expansion of corner activities focusing more on child-centered teaching and learning, ICT tools, in turn, were operated and used by children as learning tools in some classrooms. This case was mentioned by a teacher whose preschool was experimenting corner activities. "*In the language corner, I may provide a tablet. The children can listen to stories and learn characters on their own. There are also a touch and talk pen, a CD player and some CDs.....*" (B1).

More specifically, the teacher as the main actor used ICTs to conduct three categories of activities at the teaching and learning implementation stage, including 1) presenting multimedia materials; 2) documenting teaching and learning activities; 3) modeling painting work.

Presenting Multimedia Materials

Presenting multimedia teaching and learning materials with a variety of ICTs was the most frequent activity for the participating teachers. Two categories of ICT tools were involved. One category involved a computer, the Internet, a DVD/CD player, a digital visualizer, a smartphone and a tablet, which were used to present multimedia teaching and learning materials. The other category aimed to magnify multimedia materials on

a big screen, including a television set, a projector and an interactive whiteboard. Based on different aims, teachers' presentation behaviors could be further divided into three different types: 1) as an introduction to a new activity; 2) as an aid to transfer knowledge; 3) as an object of observation and imitation.

As an Introduction to a New Activity

Many teachers usually started and introduced a new teaching and learning activity by presenting multimedia materials. This usually happened at the beginning of an activity and lasted for a short time. The main aim was to prepare children for further thinking and learning, including arousing children's learning interests, activating children's thinking or developing children's physical abilities. The following teachers shared this point of view:

"*In the lesson 'Little Mouse on the Lamp-stand', I firstly presented a little mouse (on the television) to arouse children's interests..... I also presented the images which had been collected by the children on the television through the digital visualizer. (So) the children could build their divergent thinking.*" (Teacher A2)

"*I taught a song about seasons. I used a PPT presentation. On the first slide there was a mountain in the background and a small black spot. I first required the children to ask who the black spot was in order to do a vocal practice.....*" (Teacher C1)

As an Aid to Transfer Knowledge

Another aim when presenting multimedia materials was to assist the transmission and reinforcement of new knowledge. Multimedia materials therefore became the carrier of knowledge in an interesting and engaged way. This point of view was expressed by the following teachers:

"*There was a picture book on directions..... I presented PPT slides on the computer and the television when I was telling the story..... It was interesting and the children learned the content naturally and remembered it solidly.*" (Teacher B1)

"*Math is abstract and many children don't like it. (So) I often use PowerPoint slides to create games. They make the children more interested in math.*" (Teacher H1)

As an Object of Observation and Imitation

There were also some teachers who stated that multimedia materials were presented as an object of observation and imitation for children. This case often took place in the painting or dancing activity. "*For instance, we are going to paint a ladybug. I first will play a video about the ladybug for the children to observe. The children will then paint it by themselves*" (Teacher J1); "*In the dance activity, I usually present some movement videos and let the children imitate*" (Teacher G).

Documenting Teaching and Learning Activities

Documenting teaching and learning activities with ICT tools was also reported to be a frequent behavior among the participants. It might take place indoors or outdoors, in collective activities or corner activities. If the teachers observed and noticed valuable behaviors displayed by the children, they would take photos or make videos of them. "*During outdoor activities, I may take photos or record short videos of the children* (Teacher I2); "*During corner activities, I first observe the classroom children. When I see valuable behaviors, I will take photos of them*" (Teacher H2).

After photo taking or video making, some teachers stated that they would also make a portfolio or album with the photos in order to document the whole process of a certain teaching and learning activity. "*These photos are saved and printed out. Later I will make a portfolio with them*" (Teacher I2); "*I make an electronic album every semester*

to document the process of an activity with photos" (Teacher J1).

Because of the popularity and convenience of smartphone technology, the traditional documentation tool - the digital camera- had been replaced by the smartphone, which played the main role in the documentation of teaching and learning activities of the Chinese participants. "*There is a digital camera in the classroom, but I don't use it often, because it is not convenient. It's better to use a smartphone, especially when I want to snap some moments*" (Teacher H1); "*Every classroom has been provided with a digital camera, but we (teachers) don't use it very often to take photos, because it is too old and slow. We all use the smartphone. It is fast and convenient*" (Teacher K1).

Modeling Painting Work

Three teachers stated that they used ICT tools to model painting work for the children. "*At the beginning, I paint on the television with a special pen to make a model for the children*" (Teacher A1); "*I put a piece of white paper on a digital visualizer and then paint on it. Because the digital visualizer is connected to a big television, the children thus can see the whole painting process very clearly*" (Teacher B2).

Evaluating and Reflecting on Teaching and Learning after the Class

It is the same with the Greek teachers that the Chinese teachers rarely introduced ICTs into the evaluation and reflection of teaching and learning. For the teachers who used ICTs at this stage, they often used them for writing reports, evaluating and reflecting on activities, and solving teaching problems.

Writing Reports

The most frequent practice of the teachers was the use of ICT tools to write evaluation and reflection reports on Microsoft Word. This was mentioned by the majority of the

teachers. "*I need to write reflection and evaluation reports on Word*" (Teacher E2).

Instant Evaluation and Reflection on Activities

Five teachers referred to their use of ICTs to instantly evaluate and reflect on teaching and learning activities at the end of a certain activity. "*When the children complete the painting work, I will use a digital visualizer to present their work on the television. The child whose work is presented will evaluate it first, followed by the other children, and finally the teacher*" (Teacher A1); "*I often organize a 'recall' part at the end of a corner activity. I send the photos which I have taken to the computer and present them to the children on a big television. I then make some comments for the whole activity*" (Teacher B2).

Solving Teaching Problems

When teachers are evaluating and reflecting on teaching and learning activities, they may find some weaknesses and problems in the activities. In this case, some teachers stated that they might look for possible causes and solutions of these problems on the Internet or via social networking. "*When I am not satisfied with my teaching activities, I will go to the Internet to determine the root cause and how to improve it*" (Teacher E1); "*I will ask my colleagues on QQ (a popular social network site in China) if they have encountered the similar problem and how they have solved it*" (Teacher K1).

Informal Teaching and Learning Activities

Chinese teachers' ICT use behaviors mainly appeared on two occasions of informal teaching and learning activities. One was at break time, and the other was at interval time.

Break Time

Break time involved a range of daily life activities, including dining, drinking water, eating fruits, going to the bathroom, break and sleeping. Almost a half of the teachers mentioned that they used ICTs very often at this moment. More precisely, they mainly used the computer or the CD player to play some quite and relaxing music which they selected themselves. "*Technology is very important. I use it almost every day. The children always listen to special music when they are dining, sleeping and going to the bathroom*" (Teacher A1); "*The teachers select and play music. I generally play some quiet music*" (Teacher C1).

Different music may be chosen for different activities. Even for the same activity, the music may also be different. "*When the children hear a specific music piece, they will go and wash their hands. When they hear another music piece, they will go and drink water*" (Teacher A2); "*When the children go to the bathroom, the music for the boys and girls is very different. If the music is 'Little Red Riding Hood', the girls will go to the bathroom. If the music is 'Hulk', the boys will go*" (Teacher G).

Special music was used by the teachers in order to create a comfortable atmosphere or to promote the formation of children's behavioral habits. It could also relieve teachers from tiring work. The following teachers expressed this point of view:

"*Before we (teachers) always shouted at the children, 'stand up and get ready for the bathroom'. Now when we play the light music, the children will know that they need to stand up and go to the bathroom. So we are not as tired as before. Everyone feels comfortable.*" (Teacher A2)

"*Habits need to be cultivated from an early age..... At the beginning the children may find it difficult to get used to. However, after a few days, if you (the teacher) play the music, they will understand and follow.*" (Teacher G)

Interval Time

In the daily routine of Chinese preschools, there is a series of short intervals between activities. These were called "*free time*", "*preparation time*" or "*waiting time*" by the teachers. They usually emerged in the morning activity, before/after a formal teaching and learning activity, before dining, sleeping and departure, or after dining and sleep time.

Many teachers stated that they used ICT tools at intervals. That is, they used various ICT tools to present music, videos, stories, animations, photos or storybooks, such as a computer, a television set, an interactive whiteboard and a CD player. The following teachers supported this point of view:

"*At times when we finish the lesson, there is free time. We do not have anything to do, so I may play a short story for the children on the computer.*" (Teacher A2)

"*Before dining it is preparation time for the children..... Some children have finished eating, while others may have not. I will play music during this time.*" (Teacher K1)

"*I may present e-storybooks to the children on the television.*" (Teacher D)

Using ICT tools during intervals would be helpful to make children calm down and not be chaotic. They also offered much convenience for the teachers to manage all the classroom children at the same time. "*I use music during this time (interval time) to comfort the children who have nothing to do or who are waiting*" (Teacher K1); "*The teachers can take care of all the children at the same time*" (Teacher H2).

5.4 Teachers' Attitudes toward ICT Use in Teaching and Learning

In this section, the results on the attitudes of the interviewed teachers toward ICT use in teaching and learning are presented. More specifically, a total of five components are involved. First, a description on the general attitudes of the teachers toward the introduction and use of ICT tools in preschool teaching and learning is provided. Next, the teachers' attitudes toward the impact of ICTs on teachers' teaching activities are shown. The third part focuses on the teachers' attitudes toward the impact of ICTs on children's learning activities. Finally, both feelings and concerns of the teachers about ICT use in teaching and learning are described.

5.4.1 Attitudes of the Greek Teachers

Attitudes toward ICT Use in Preschool Teaching and Learning

The attitudes of the interviewed Greek teachers toward ICT use in preschool teaching and learning were twofold. On the one hand, they expressed positive attitudes toward the introduction and use of ICTs in teaching and learning activities. On the other hand, they believed that their positive attitudes were conditioned by the use of ICTs in a moderate and appropriate way.

Positive Attitudes

Most of the teachers held positive attitudes towards the use of ICT tools in preschool teaching and learning. An in-depth analysis and interpretation of the transcripts further revealed that the teachers' positive attitudes were mainly based on two reasons. One was the influence of the technological era on preschool teaching and learning, and the other was the positive effects of ICTs on preschool teaching and learning.

Many teachers emphasized today's technological era, in which technology flooded not

only people's daily lives, but also children's daily lives and the educational system. Thus, to introduce and use ICT tools in preschool teaching and learning was necessary and indispensable.

On the one hand, from the perspective of the teacher, it was regarded as necessary to use ICTs in the preschool setting. Teachers' teaching activities without the use of ICTs were regarded as impossible. "*They (ICTs) are indispensable for our (teachers') job. We need them. Without them, we can't do our job*" (Teacher A); "*It is impossible to do school work without the use of technologies*" (Teacher B).

On the other, from the perspective of the child, it was also considered as indispensable to use ICT tools in the preschool setting. In other words, the preschool should play an important role in the connection between children's preschool life and society, and in the response to children's early exposure to ICTs and existing ICT abilities. "*Children are living in a world which is full of technologies. It is a little mad if they come to the preschool without anything (ICTs). It is not right if there is no connection between preschools and society. It is not a real life*" (Teacher E); "*Children are experts of the technology..... They know how to operate all the devices*" (Teacher K).

Furthermore, many teachers also stated that the use of ICTs in preschool teaching and learning was necessary and important, because they were effective tools which could bring "*positive*" (Teacher I) and "*catalytic*" (Teacher B) impacts on both teaching and learning activities. "*They (ICTs) provide much convenience for teachers. Children can also learn much easier*" (Teacher G); "*They (ICTs) are very important and decisive..... They are a great teaching tool*" (Teacher M1).

Conditional Positive Attitudes

Although the interviewed teachers had made an agreement on the introduction and use of ICT tools in preschool teaching and learning, they further pointed out that this

agreement depended on if ICT use behaviors were appropriate. More specifically, an appropriate ICT use behavior referred to: 1) moderate use; 2) appropriate content; 3) keeping the balance; and 4) being independent thinkers.

Moderate Use

Several teachers mentioned that the use of ICTs in teaching and learning should be in moderation. That is, ICT tools should be used only when they were needed and should not be overused. "*Teachers should not use the computer continuously. That is, they should use the computer to find things that are required*" (Teacher C); "*We should use the computer in moderation, that is, to use it when we need it and not to overuse it*" (Teacher K).

Appropriate Content

Some teachers stated that when teachers used ICT tools in teaching and learning, they should be careful about the content which would be presented to children. That is, the content should always be checked and be age-appropriate and educational. "*Teachers have to present appropriate things to children..... This is more important*" (Teacher E); "*We (teachers) should check and restrict what we will present to children first..... The things that children watch should be age-appropriate, rather than be something aiming at older children or be something making children afraid or worried..... The content should also be educational*" (Teacher L).

Keeping the Balance

It was also referred to that teachers should keep a good balance between ICT-related activities and traditional activities. "*Teachers can teach some things with technologies. But there must also be a practical part. Teachers can not exclusively use the computer or camera..... These two things should go together*" (Teacher F); "*The best method is*

to combine teachers' (face-to-face) teaching and technologies. This provides the best result, because there are both technology and a direct interaction between teachers and children, and children and children" (Teacher I).

Being Independent Thinkers

There was one teacher who believed that although today's teachers could easily obtain various teaching and learning materials with the help of ICT tools, they should not use them directly, but should adapt them with their own ideas based on the characteristics of classroom children. "*Today's teachers obtain things and ideas from the Internet, but they should adapt them using their own ways which are suitable to classroom children*" (Teacher C).

Attitudes toward the Impact of ICTs on Teachers' Teaching Activities

The attitudes of the Greek teachers towards the impact of ICTs on teachers' teaching activities were generally positive. Most of them believed that ICTs were helpful tools for teaching activities. Specifically, this positive attitude was reflected in four aspects: 1) promoting the collection of teaching and learning materials; 2) providing new ideas for teaching and learning activities; 3) facilitating the documentation of teaching and learning activities; 4) bringing unusual events into the classroom.

Promoting the Collection of Teaching and Learning Materials

The benefits of the computer and the Internet on searching for and collecting teaching and learning materials were commonly agreed on by the participants. Almost all of them mentioned that the computer and the Internet had created much convenience for teachers to search for and collect teaching and learning materials.

First of all, compared with traditional methods, it was much easier and faster to search

and obtain teaching and learning materials. "*They (the computer and the Internet) free your hands, because they offer you with ready materials..... You don't need to sit, think, draw or create a worksheet on your own. You just need to photocopy it..... It offers lots of convenience*" (Teacher I); "*Many years ago, I had to go to the public library to look for what I wanted. But now I can find materials much faster and easier (with the computer and the Internet)*" (Teacher K).

Secondly, the computer and the Internet provided a variety of multimedia materials for teaching and learning activities. "*They (the computer and the Internet) can provide a lot of materials for children to watch. Thus, they can benefit from multiple stimuli*" (Teacher C); "*They (the computer and the Internet) never let you down, because you always have something to present to children on the spot. There are so many sources*" (Teacher M2).

Finally, it was also an economical way for teachers to obtain teaching and learning materials. "*They (the computer and the Internet) are financially viable, because teachers don't need to buy books anymore*" (Teacher G); "*Before we (teachers) had to find painting work and print them, which cost money. But now, we can find and watch them on the computer without any money*" (Teacher M1).

Providing New Ideas for Teaching and Learning Activities

Some teachers referred to that the use of ICT tools provided many new ideas for them to organize new teaching and learning activities. "*There are many blogs for preschool teachers where we (teachers) can get many new ideas*" (Teacher H1); "*Technology is very important, because we (teachers) can get new ideas and perspectives*" (Teacher M1).

Facilitating the Documentation of Teaching and Learning Activities

One teacher agreed that the use of the digital camera facilitated teachers to document teaching and learning activities. "*Teachers can instantly record children's valuable moments with the camera*" (Teacher C).

Bringing Unusual Events into the Classroom

There was also one teacher who referred to that the use of ICT tools could bring some unusual personal experiences into the classroom. "A father of a child in my classroom went to Mytilene to help refugees. One day, he presented his real experience to the classroom children. We watched the photos which he took on the computer and finally learned many things about refugees. This is the glory of technology, or else it would be difficult for children to learn about this experience" (Teacher M1).

Attitudes toward the Impact of ICTs on Children's Learning Activities

When most of the interviewed Greek teachers believed that the use of ICT tools could result in positive effects on children's learning, some teachers believed that using ICT tools may also bring some negative or no effects to children's learning.

Attractive and Enjoyable Learning Process

Many teachers reported that the characteristics of multimedia brought children a more attractive and enjoyable learning process. Children therefore became more interested in and more dedicated to their learning activities. "*The children watch videos on the Internet..... They like them very much*" (Teacher D); "*They (ICTs) make the children very excited. The children have curiosity in what they are and how they work. They are very happy that everything happens so quickly and magically with them*" (Teacher M2).

Effective Learning Results

There were also a number of teachers who mentioned that the use of ICT tools could lead to better learning results for children.

First, the use of ICT tools made children understand and learn more easily and faster. "*With the help of technologies, children can learn easily and quickly.....*" (Teacher I); "*Children can learn better, 'one picture, one thousand words'.....*" (Teacher L).

Next, children could gain more knowledge with ICT tools. "*The computer is like an encyclopedia, when children open it, they can obtain knowledge directly and find whatever they want*" (Teacher J).

Finally, using ICT tools could make knowledge more impressive and lasting. "*It helps children sustain the knowledge they have learned*" (Teacher D); "*The image firmly imprints the knowledge in their (children's) minds*" (Teacher L).

Negative or No Effects

Some teachers also believed that if ICTs were used inappropriately, some negative effects could emerge.

First, it may endanger children's health. "*When children sit in front of the computer for long hours, there will be side effects on children's eyes and bodies. Games which are not monitored will also have negative effects on children*" (Teacher B).

Next, ready-made materials may harm children's independent thinking. "*Knowledge gained from the Internet is too ready-made and children don't need to think with their own minds*" (Teacher K); "*It does not leave room for children to think on their own.*

Thus, they don't live like the real children" (Teacher L).

Last, ICT tools may lead to children's isolation. "*If they (ICTs) are used continuously, they may lead to children's isolation*" (Teacher L); "*Children should not stay in front of the computer for long hours because they may become isolated*" (Teacher J).

Moreover, one teacher also stated that the effect of ICTs on children's learning may differ based on their different learning styles. That is, ICTs may be effective for some children, but may also have no impact for some other children. "*For some children, they (ICTs) help more. However, for others, they don't help. Because there are some children who like to watch something (on the computer), but some other children may be not interested and want to observe real things*" (Teacher F).

Feelings on ICT Use in Teaching and Learning

Many Greek teachers expressed positive feelings on ICT use in teaching and learning activities, but there were also some Greek teachers who expressed negative feelings. This part describes the Greek teachers' feelings, presents the shift in their feelings and points out the factors that influence their feelings.

Positive Feelings

Nine teachers reported that they held positive feelings on the use of ICTs in teaching and learning. They liked to use ICTs, because they could provide much convenience to teaching and learning activities. "*I like to use the computer because it provides me convenience*" (Teacher M1); "*I like to use the computer very much, because children can learn better*" (Teacher J).

Meanwhile, nearly half of them stated that they did not have fears or difficulties to use ICTs, because they had been equipped with sufficient abilities. "*It (ICT use) is not*

difficult for me, because I have been trained" (Teacher E); "*I don't have difficulties (in using ICTs), because I have attended a training course, from which I had obtained guidance*" (Teacher M1).

Negative Feelings

Conversely, there were some teachers who expressed negative feelings on ICT use in teaching and learning, such as discomfort, fears or difficulties. The main reasons were the lack of competences and the lack of systematic training. "*It is difficult for me. For ICT skills, I have to repeat them again and again, because I always forget them..... I am not comfortable*" (Teacher B); "*I have fears and difficulties..... When a problem occurs, I will panic, because I don't know how to use them (ICTs) well*" (Teacher J).

Shift in Feelings

Three teachers mentioned a shift in their feelings on the use of ICTs in teaching and learning. They held negative feelings at the beginning, including fears, difficulties and unwillingness. But they gradually became delighted and comfortable to use ICT tools. Meanwhile, ICT tools also became easier for them to use.

One reason was that they experienced the use of ICTs in practice and thus realized the usefulness of ICTs for teaching and learning activities. "*The computer was something new and difficult for me at the beginning. I didn't want to use it. But when I used it in teaching activities, I found that it was quite useful. So I began to like it*" (Teacher A).

Another reason was the role and impact of in-service training. "*I attended the B-level training two years ago, from which I obtained basic computer knowledge and skills. Since then, I have become more comfortable with the computer, and I also like to use it*" (Teacher G).

Influencing Factors for Feelings

Six teachers pointed out the difference of teachers' feelings based on several factors, including age, abilities and perceived effects of ICTs on teaching and learning.

Three teachers referred to the impact of age on teachers' feelings. They believed that older teachers had more difficulties and unwillingness than young teachers in the use of ICTs in teaching and learning, which was often related to their insufficient abilities. "*Older teachers have more difficulties and fears to use the computer (than young teachers), because they don't know how to use it*" (Teacher A); "*Many teachers at my age (older teachers) don't know how to use the computer. It is very difficult for them to get used to it*" (Teacher H2).

Two teachers mentioned the influence of abilities on teachers' feelings. In other words, when teachers had acquired abilities, they felt happy and delighted to use ICTs and did not have fears or difficulties. Conversely, when they lack relevant abilities, they had anxieties, fears or difficulties. "*When I can manage (ICTs), I feel happy, but when I can't manage, I feel annoyed and fearful*" (Teacher B); "*Regarding new technologies which I have heard about but don't know what they are and how to use them, I have fears and anxieties, because I am not familiar with them*" (Teacher D).

There was also one teacher who stated that her feelings were dependent on the effects of ICTs on teaching and learning. "*When the children are watching something (on the computer), if I observe that they are happy with it, they like it or they can get a good impression from it, I will be happy and like it. However, if I observe that they don't like it, I will also not like it*" (Teacher L).

Concerns about ICT Use in Teaching and Learning

Three types of concerns arose from the Greek participants in ICT use in teaching and

learning, which included: 1) concerns about children; 2) concerns about abilities; 3) concerns about content.

Concerns about Children

From the perspective of children, their health, distraction and independent thinking skills were the main sources of teachers' concerns.

Five teachers had concerns about children's heath, especially when children used ICTs. "*For us (teachers), we don't have concerns, because we know when to stop and what to choose. But when children use ICTs, we have concerns*" (Teacher H2). Therefore, in order to avoid potential harms and dangers to children's health, these teachers further mentioned that they always set a time limit for ICT use. "*I don't leave the children (on the computer) for a long time*" (Teacher E).

On the contrary, another six teachers mentioned that children's health did not concern them, because they used ICTs moderately and appropriately, that is, within a suitable time duration and content. "*It (children's health) does not concern me, because there is a short time, for only 10 minutes or a quarter of an hour..... The children always use the computer for specific activities which I have chosen*" (Teacher A); "*I don't have concerns (about children's health), for I know how and when to use the computer. I decide on content before I present it to the children. What I present to the children is always modified first*" (Teacher I).

One teacher had concerns about children's distraction. Thus, she further believed that teachers must supervise and intervene children. "*My concern is children's distraction. It is very easy for children to be distracted (on the Internet). Teachers have to know which pages they visit, and don't let them go somewhere else*" (Teacher K).

Another teacher mentioned her concern on the negative effect of ICTs on children's

independent thinking and the necessity to provide opportunities for children to think independently. "*If children use ICTs continuously, they can't think on their own..... So it is necessary to use ICTs for a short time and leave some room for them to think with their own minds*" (Teacher L).

Concerns about Abilities

One teacher stated that she was concerned about her insufficient abilities to use the computer. "*I can't operate the computer well and don't know how to use it, this is my concern*" (Teacher J).

Concerns about Content

There were also three teachers who mentioned that the unsuitable multimedia content to which children were exposed concerned them. "*The things which children watch at home have bad effects, such as war games. Children at this age can't understand that they (games) are not real*" (Teacher E).

Therefore, they pointed out that teachers should be quite careful about the multimedia content and select appropriate content for children. "*I avoid presenting content with wars and something that children watch on the television at home*" (Teacher E); "*We (teachers) should be careful about the content. It should be age-appropriate..... We must check and control what we present to children*" (Teacher L).

5.4.2 Attitudes of the Chinese Teachers

Attitudes toward ICT Use in Preschool Teaching and Learning

Like the Greek teachers, on the one hand, a favorable attitude was generally expressed by the Chinese teachers toward the introduction and use of ICTs in preschool teaching

and learning. On the other hand, they also pointed out that ICTs should be used in an appropriate way, which was the precondition for their positive attitudes.

Positive Attitudes

In general, the Chinese teachers were in agreement on ICT use in preschool teaching and learning. They held the view that ICT use in preschool teaching and learning was correct and important. One teacher even said that preschools "should use more ICTs than primary and secondary schools, and also universities" (Teacher I1). The positive attitudes of the Chinese teachers were mainly based on four factors: 1) adaptation to a new society; 2) children's early ICT experiences and abilities; 3) positive effects of ICTs on teaching and learning; 4) appropriateness of ICTs for children's learning characteristics.

Adaptation to a New Society

Many teachers pointed out that today's society was a new society, in which ICTs were ubiquitous in people's daily lives and were developing rapidly. Thus, preschools and teachers should adapt and follow the pace of this new society, or else they would lag behind. "*It (the ICT) is a good trend. We (teachers) can't always teach with traditional methods. We need to adapt to this new society..... It will be very bad if we lag behind society*" (Teacher A1); "*The development of technologies is beyond imagination. We (teachers) must follow it. If we don't follow, we will lag behind*" (Teacher E1).

In particular, it was regarded as common or a matter of course for young teachers who were born in the new technological age to use ICTs in teaching and learning practices. "*It (using ICTs) is a matter of course and a common thing. They (ICTs) should be used by everybody*" (Teacher C2); "*At my age (young age), using the computer and other ICT tools is a common phenomenon*" (Teacher H2).

Children's Early ICT Experiences and Abilities

Several teachers stated that today's children were surrounded by a broad range of ICT tools out of preschool, especially at home. They were also competent in using the ICT tools, even better than adults. "*Among today's children, who can't use the iPad? They can use it better than me*" (Teacher C1); "*Today's children are exposed to many media, such as iPad and smartphones. They can use them better than adults*" (Teacher H1).

Therefore, they further mentioned that based on the rich ICT experiences and abilities which were acquired by young children outside of preschool, there was a necessity to transform the traditional teaching and learning approach and introduce ICT tools into preschool teaching and learning. "*Children have been exposed to these things (ICTs), thus teaching and learning activities should not be conservative*" (Teacher A1); "*If the preschool can satisfy children's desire (for ICTs), their learning results will be better*" (Teacher K1).

Positive Effects of ICTs on Teaching and Learning

A number of teachers stated that they agreed to use ICT tools because of their positive effects on preschool teaching and learning. Specifically, the use of ICT tools could not only bring much convenience and usefulness to teachers' teaching activities, but also improve children's learning activities. "*If you (teachers) don't have ICTs, it will be difficult for you to conduct teaching activities. But if you use ICTs, teaching activities will become easier*" (Teacher G); "*Children can understand content easier*" (Teacher C2); "*If teaching activities involve multimedia, children would have greater interest in learning, like to attend lessons and become active participants*" (Teacher I2).

Appropriateness of ICTs for Children's Learning Characteristics

Some teachers mentioned that children were concrete thinkers and learned from visual,

concrete and intuitive materials. Thus, multimedia supported by ICTs was appropriate for children's learning needs and characteristics. "*They (children) can't understand if teachers only explain content with words, but they can understand better when seeing visuals and concrete things provided by ICTs*" (Teacher G); "*Children are concrete thinkers. They can't build their imagination only with teachers' (verbal) descriptions. They need intuitive objects to observe and experience*" (Teacher K1).

Conditioned Positive Attitudes

The Chinese teachers also stated that they agreed to use ICTs in teaching and learning only under certain conditions, including moderate use and guided use.

Moderate Use

Several teachers mentioned that although ICTs offered much convenience and created new possibilities for teaching and learning, they should not be overused, but should be used based on teaching and learning needs. "*If I need them (ICTs) in teaching, I will use them. However, if I don't need them, I will not use*" (Teacher B1); "*They (ICTs) are a good way or means to help you (teachers) better achieve educational goals, but you can't totally be dependent on them*" (Teacher D).

Guided Use

The teachers expressed a more cautious attitude towards the use of ICTs by children. They believed that children should always be accompanied and guided by teachers.

On the one hand, they pointed out that children should be presented with educational content instead of entertainment content. "*If there is systematic software that matches the textbook, children can be left alone to learn by themselves..... But if children only play (for entertainment) on the computer, it is not necessary to use the computer.....*"

(Teacher J1); "*Not playing (entertainment) games..... Let them know that ICTs can be very beneficial for their future.....*" (Teacher E1).

On the other, they believed that in consideration of children' ages and health, teachers should always play a crucial role in supervising and guiding children when they use ICTs in learning activities. "*Children can be exposed to ICTs from an early age, but teachers should guide and control them.....*" (Teacher E1); "*Children should master ICTs. But teachers should limit use time, because their eyes are at a developmental stage. On the premise that their health isn't at risk, teachers should let them enter the Internet era..... (But) teachers need to guide them.....*" (Teacher K2).

Attitudes toward the Impact of ICT Use on Teachers' Teaching Activities

The Chinese teachers expressed a positive attitude towards the impact of ICT use on teachers' teaching. They believed that the use of ICTs not only could make teachers' teaching more convenient, resource-saving, varied and richer, vivid and attractive, and effective, but also generated a new teaching approach.

Making Teaching Activities More Convenient

Most of the teachers stated that the use of ICTs brought much convenience and ease in teachers' teaching activities. In other words, they saved time for teachers and relieved them from heavy workloads in creating teaching and learning aids. "*For teachers, they (ICTs) reduce workload. Some teaching aids that were previously created by our own hands can be downloaded on the Internet now..... It is very convenient*" (Teacher E2); "*It was time-consuming for teachers to create teaching aids. It saves teachers lots of time when they searching materials on the Internet. This is the biggest benefit for teachers*" (Teacher I1).

As a result, teachers had more time to consider teaching activities and accompany the

children in the classroom. "*They (ICTs) save time for teachers. Teachers are able to think about other things (teaching activities)..... (And) I have more time to play with children*" (Teacher C1); "*I have more time to think about how to organize the class and what the children should learn*" (Teacher H2).

Making Teaching Activities More Resource-saving

Some teachers proposed that the use of ICTs was a good way to save resources, unlike one-off handmade teaching and learning aids which were a waste of resources. "*They (hand-made teaching and learning aids) were used for one class, (so) it was a waste of resources..... (But) now I just find one photo (on the Internet) and children can paint on it. This doesn't waste many resources*" (Teacher A2); "*(Previously) after only one lesson, the teaching aids would be thrown away.....*" (Teacher C1).

Making Teaching Activities More Varied and Richer

Most of the teachers made an agreement that the use of ICTs offered a wide range of media which made teaching activities richer and more varied. "*They (ICTs) provide various means to teach themes. Sometimes children watch PowerPoint presentations or animations, sometimes they can also listen to music and watch the big screen (the television)*" (Teacher A2); "*They (ICTs) make teaching activities much richer. In the past without ICTs, teachers only used pictures, but now they can use many forms of media.....*" (Teacher H1).

Making Teaching Activities More Vivid and Attractive

Because of the use of multimedia, teaching activities were reported by many teachers as more vivid, and further more attractive and interesting. "*If only the teacher talks, it is not vivid..... but in a short video, children can watch a tree grow..... it is very vivid and attractive*" (Teacher H2); "*When I apply ICT tools, the teaching activity becomes*

very interesting" (Teacher E1).

Making Teaching Activities More Effective

The use of ICTs was also regarded as an effective way to achieve teaching goals. "*It is easier to achieve teaching goals*" (Teacher E2); "*It is good for final goals of teachers' teaching activities*" (Teacher J1).

Generating a New Teaching Approach

It was also stated by some teachers that using ICTs transformed teaching activities to be more child-centered, which focused more on children's independent learning and knowledge construction. "*I present each slide (of PowerPoint) one by one and ask the children what they have seen. (At the same time) they (the children) create the lyrics (of a song) on their own that exactly matches the original one. There is no (traditional) teaching.....*" (Teacher I1); "*It (teaching with ICTs) is a new form of teaching. We don't advocate 'force-feeding duck teaching'. We let children become interested and willing to learn, thus shifting from 'I want you to learn' to 'I want to learn'*" (Teacher K2).

Attitudes toward the Impact of ICT Use on Children's Learning Activities

There were also two categories of attitudes toward the impact of ICT use on children's learning activities which were expressed by the Chinese teachers. In other words, they not only believed that ICT use could bring positive effects to children's learning, but also supported the view that ICT use may also negatively impact children's learning.

Positive Effects

The positive effects of the use of ICTs on children's learning activities were two-fold:

1) positive effects on the learning process; 2) positive effects on learning outcomes. Positive effects on the learning process included learning with interest; learning with motivation and initiative; and learning with concentration. Positive effects on learning outcomes included learning more easily and faster; learning more long-lasting and solid knowledge; learning more varied and comprehensive knowledge; and promoting the development of higher-order skills.

Learning with Interest

Many teachers were in agreement that children became more interested in and more pleased with learning activities with the assistance of multimedia. "*Children don't like language activities, (because) they are boring and dull. If teachers add animations into teaching, children will become quite interested*" (Teacher B1); "*When teaching involve videos, pictures and sounds, children become more interested and like more to attend the lesson.....*" (Teacher I2).

Learning with Motivation and Initiative

Some teachers believed that the use of ICT tools inspired children's motivation and initiative for learning. "*If ICTs are used to create playful (teaching and learning) materials, children will have more willingness to learn*" (Teacher E1); "*They (children) think actively (with the help of ICTs)..... They do not passively accept, but actively discover*" (Teacher K1).

Learning with Concentration

Several teachers also mentioned that due to the use of ICTs, children become more concentrated, and accordingly distraction problems were reduced. "*When the children were watching a story on the television, they were concentrated. They didn't even blink. They wanted to know what came next and were afraid that they couldn't follow*

the story" (Teacher I2); "*The distraction problem of children was reduced with the use of ICTs*" (Teacher E1).

Learning More Easily and Faster

Many teachers agreed that the visualized and vivid multimedia of ICT tools offered a good way for children to understand knowledge more easily and faster. "*It (the video) is visualized and vivid. Children can understand it more easily than content which is narrated by the teacher*" (Teacher H2); "*It may take ten minutes for children to learn with traditional teaching methods, but it only takes two minutes with ICTs*" (Teacher I1); "*The effect of animations is one hundred times better than the traditional method with words*" (Teacher D).

Learning More Long-lasting and Solid Knowledge

It was stated by some teachers that ICT use was related with more solid knowledge and long-lasting memory. "*After using ICTs, the knowledge that children have gained is more solid*" (Teacher A1); "*The use of pictures and animations boosts children's long-term memory for the story*" (Teacher B1).

Learning More Varied and Comprehensive Knowledge

Using ICTs was considered to offer more comprehensive and varied knowledge which went beyond the textbook. "*Children can gain some knowledge on the Internet which is not available in the textbook, namely, they gain more comprehensive knowledge*" (Teacher A1); "*Modern technologies provide many forms of knowledge. They have widened children's vision and have broadened their knowledge*" (Teacher B2).

Promoting the Development of Higher-order Skills

Two teachers also proposed that the use of ICTs could facilitate the development of children's higher-order skills, such as divergent thinking and imagination abilities. "*Animations are very helpful for the development of children's divergent thinking*" (Teacher A1); "*Children's imagination can be improved with ICTs*" (Teacher F).

Negative Effects

Some teachers pointed out that the use of ICTs may bring about negative effects on children's learning and development, particularly in terms of face-to-face interaction and concentration. "*They (ICTs) also have bad aspects. Many stimuli, such as sounds, pictures and videos, may decrease children's interests in human beings..... They have no life, unlike teachers who can interact with children even with a single glance.....*" (Teacher D); "*Some children are more interested in other things (things unrelated with content), such as how to operate (ICTs) or some buttons (of ICTs).....* " (Teacher J1).

Feelings on ICT Use in Teaching and Learning

The interviewed Chinese teachers expressed two types of feelings on the use of ICTs in teaching and learning, namely, positive feelings and negative feelings. The reasons resulting in each type of feeling are further analyzed. The shift in teachers' feelings and relevant reasons are also presented.

Positive Feelings

Most of the Chinese teachers stated that they did not have negative feelings on ICT use in teaching and learning. In other words, they liked and were willing to introduce and use ICT tools in teaching and learning activities. There was one teacher who even regarded herself as a "*pioneer*" (Teacher K2). Not only did she like to use, but also

she motivated and guided her many colleagues to use ICTs in teaching and learning.

Some of the teachers who expressed positive feelings further explained their reasons. The convenience and usefulness of ICT tools in teaching and learning was mentioned most. "*I like to use them (ICTs), because they bring me much convenience*" (Teacher C1); "*I don't reject them (ICTs), because they are very useful*" (Teacher J1).

Moreover, creating attractive and interesting teaching and learning activities with ICT tools was another reason mentioned by some teachers. "*The animation is very vivid and visual..... It is interesting for children*" (Teacher E1); "*When you (teachers) use ICTs, you may create some animations with Flash..... It is quite vivid for children*" (Teacher G).

Negative Feelings

There were also some teachers who expressed negative feelings on the use of ICTs in teaching and learning. That is, they were afraid or unwilling to use ICTs. A series of reasons were further provided.

The lack of sufficient ICT competences was a reason which was mentioned by many teachers. "*I feel difficult (to use the computer). I have to find someone to help me..... The main reason is that I am not skilled on computer's operation.....*" (Teacher E2); "*Some teachers are not willing to use (ICTs), because they don't know how to use them*" (Teacher J2). Some teachers believed that this was the case especially for older teachers. "*Some older teachers don't like to use ICT tools, because it is tiring to make PowerPoint presentations and they don't know how to do*" (Teacher C2).

Limited time and heavy workloads was another important reason. "*I don't have time to use (ICTs), because I have many affairs both in the classroom and in the preschool*" (Teacher E1); "*I find it tiring (to use ICTs). It takes time to create PowerPoint sides. If*

you (teachers) want to create a good presentation, it is time-consuming..... You will burn out if you create it every day" (Teacher D).

One teacher mentioned the lack of Internet connection. "*There is no Internet in the classroom. I have to use the Internet in the teachers' lesson preparation room, save the materials (found on the Internet) into the USB drive and then bring the USB drive to the classroom. It is very troublesome*" (Teacher E1).

The re-use issue of courseware was also considered as a reason by Teacher H1. She stated that teachers did not have enough time to create courseware. Thus, they would take into account the "*financial*" and "*reuse*" issue of courseware, in other words, "*if the courseware can be used time and time again*".

A teacher also mentioned that teachers who were concerned about children' vision and health usually had negative feelings. "*Teachers who have this (negative) feeling may be owed to the consideration of children. They think that using (ICTs) too much will have negative effects on children's eyes and health.....*" (Teacher A2).

Shift of Feelings

Some teachers mentioned the change of feelings on ICT use in teaching and learning. When their preschools began to introduce ICT tools many years ago, they disliked or were unwilling to use them. The reason was that they were not equipped with required competences. "*I didn't know how to use ICTs, so I had some (negative feelings) at the beginning*" (Teacher A2); "*I didn't know how to use them (ICTs) at the beginning, so I didn't want to use them*" (Teacher E1).

However, as the familiarity with ICTs grew and ICT competences were improved, the feelings of these teachers gradually changed, that is, from negative feelings to positive feelings. "*We (teachers) had training and we also communicated with one another.....*

After having learned (how to use ICTs), I became interested (in ICTs). The negative feelings were also gone" (Teacher A2); "*I have gradually learned (how to use ICTs) by myself..... (After that) I liked to use them*" (Teacher B1).

Concerns about ICT Use in Teaching and Learning

The concerns of the Chinese teachers about ICT use in teaching and learning were three-fold: 1) concerns about children; 2) concerns about teachers; 3) concerns about ICT accidents.

Concerns about Children

The teachers presented five main concerns about children, which included concerns about vision; concerns about safety; concerns about interests in traditional activities; concerns about distraction; and concerns about divergent thinking, hands-on abilities and exploration abilities.

Concerns about Vision

The possible harm of ICT tools on children's vision was a concern that was referred to frequently by some teachers. "*I have lots of concerns about children's vision. Because when children are watching television, they are watching continuously and they don't know to take a break or look at other places*" (Teacher E1); "*Children are at a developmental stage. If they watch television a lot, or are too close to the television, their vision will be harmed*" (Teacher F). Thus, the teachers further stated that they set a limit on the duration of exposure, the distance between children and the screen, the form of multimedia and the aim of ICT use.

Most teachers referred to the time limit. "*We (teachers) have a time limit, because it is not good for children's vision.....*" (Teacher C2). In general, the time duration was

limited to less than ten minutes. "*In a regular lesson, children watch television for five to six or seven to eight minutes*" (Teacher E1); "*I limit the time length from five to eight minutes when using the interactive whiteboard*" (Teacher G); "*I usually choose videos which are no more than five minutes. If the video is too long, I will adapt it*" (Teacher H1).

Some teachers said that they set a fixed distance between children and the screen. "*We (teachers) set a line (for the distance). For a 47 inch television, the distance is about 1.5 meters. Children should not sit within 1.5 meters from the television*" (Teacher D).

Many teachers referred to the limit for multimedia forms. They used more audios than videos. "*There are few videos in teaching. Audios are the main form*" (Teacher A1); "*I use more audios and less video.....*" (Teacher G).

Regarding the limit on the aim of ICT use, the teachers were in agreement that they used ICTs only when they required. "*Only when I have the need for ICTs, I will use them. I will not use them if I don't need them*" (Teacher B1); "*If the activity needs ICTs and they will lead to a better result, I will use them*" (Teacher F); "*The children don't watch (entertainment) animations in the classroom*" (Teacher E1).

Concerns about Safety

Two teachers, Teacher D and Teacher F, brought forward the safety issue when children used ICTs in the classroom. That is, ICT tools are "*electrical appliances*" and are connected with "*various wires*". If the wires were "*in a mess*" or the children "*touched*" them, they may "*trip over*" or "*get injured*". Thus, in order to avoid these potential dangers, they had taken some measures. For instance, Teacher D "*twined the wires together*" and "*put them behind the television*". When ICTs were not needed, she would "*turn them off*" and "*keep the children away*". Teacher F chose "*a special corner*" to place equipment which was "*against the wall*".

Concerns about Interests in Traditional Activities

Children's lack of interest in book-related knowledge was a concern for Teacher E1. "*I have concerns that children will lose their interest in book-related knowledge after watching television. It is a big problem and it is difficult to solve*".

Concerns about Distraction

One teacher referred to her concern about children's distraction, especially when ICT equipment was first introduced into the classroom. "*ICTs are too fresh to the children, so they are often immersed in the previous (teaching) stage and it is difficult for them to go to the next stage..... But it is better now, because they have become acquainted with many ICTs.....*" (Teacher I1).

Concerns about Divergent Thinking, Hands-on Skills and Exploration Abilities

One teacher also had concerns about the negative impact of ICT tools on children's divergent thinking, hands-on skills and exploration abilities. "*Watching television too much is not good for the development of children's divergent thinking and hands-on skills, as well as their exploration abilities*" (Teacher F).

Concerns about Teachers

Concerns about teachers were two-fold. One was the concern about ICT competences, and the other was the concern about over-dependence on ICTs.

Some teachers were concerned about insufficient competences to use ICTs in teaching and learning activities. "*I don't have sufficient abilities. I am afraid that mistakes will happen when I am operating the computer, such as pressing a wrong button or*

making mistakes on the operation of a PowerPoint presentation" (Teacher B2); "*What we (teachers) have known is limited to simple skills..... for deeper things, we don't have enough understanding..... It is a bottleneck for us*" (Teacher K2).

Moreover, some teachers were also concerned about being so dependent on ICT tools that they could not organize the lesson without them or could not think independently. "*I have a concern about myself, that is, if I can organize a lesson without these things (ICTs). If you use them often, you will be familiar with and dependent on them.....*" (Teacher A2); "*Teachers will become dependent (on ICTs) after using ICTs for a long time. They will not think on their own first*" (Teacher D).

Concerns about ICT Accidents

Some teachers were concerned that they encountered some technical problems, which made them embarrassed or ashamed. "*I am concerned that courseware won't play on the computer*" (Teacher C2); "*I am concerned that the music in the PPT presentation won't play, (or) the font in the PPT presentation will change*" (Teacher I1).

5.5 Teachers' ICT Competences

The results on the ICT competences of the interviewed teachers are presented in this section, which include two issues. One focuses on the status of ICT competences of the teachers, and the other is on the perceptions of the teachers for the improvement of ICT competences in the future.

5.5.1 ICT Competences of the Greek Teachers

Status of ICT Competences

A total of three levels of ICT competences in the Greek teachers were identified. The

first level was coded as “high-level ICT competences”. The teachers who were at this level not only were good at general competences, such as Word, PowerPoint, Excel and the Internet, but also had specific competences, such as using specific educational software. The second level was coded as “basic-level ICT competences”. The teachers who belonged to this group had general competences but lacked specific competences. The third level of ICT competences was the lowest, which was coded as “low-level ICT competences”. The teachers who were at this level lacked sufficient competences, even the basic ones.

From a general perspective, the overall level of ICT competences of the interviewed Greek teachers was not satisfactory. In other words, most of them had “basic-level” or “low-level” ICT competences. However, the ICT competences of a very few teachers had arrived at the “high-level”.

High-level ICT Competences

Three teachers were included into the group of teachers who possessed high-level ICT competences. They believed that they had sufficient competences to use ICT tools in teaching and learning. The following teachers explained this point of view in detail: “*I have both B-level abilities (specific ICT competences) and A-level abilities (general ICT competences).....*” (Teacher I); “*I have attended both A-level and B-level training. I think that my ability is satisfactory. I don’t have problems*” (Teacher M1).

Basic-level ICT Competences

A total of six teachers had basic-level ICT competences. They were able to conduct basic activities with ICT tools, but they did not have sufficient competences to engage in advanced and subject-specific activities with ICT tools. “*For basic things, such as Word, Excel, PowerPoint and the Internet, I know and can use them well. However, to run specific (educational) software and create websites, I am not competent*” (Teacher

E); "*I know basic things..... (But) I still don't know many things, which can help me teach with technologies*" (Teacher H1).

Low-level ICT Competences

There were also six teachers who confessed that they had low-level ICT competences, even lacking some basic competences, such as searching for materials on the Internet, writing a document on the computer or presenting materials to classroom children. "*I have some ability gaps in technology..... I can't search and find materials easily (on the Internet)*" (Teacher F); "*I know very few things (about ICTs)..... I have difficulties in searching for materials (on the Internet), printing and presenting (materials) to children. I need help from others*" (Teacher L).

Age and ICT Competences

Furthermore, four teachers mentioned the effect of age on teachers' ICT competences. They believed that young teachers possessed a higher level of ICT competences than old teachers. "*For old teachers, it is difficult for them to use technologies in teaching. It is even difficult for them to use technologies for some job affairs, such as sending documents, communicating via e-mail*" (Teacher E); "*Some colleagues, such as the teachers who are younger than me and have worked with technologies for a long time, they can teach children with technologies in a more organized and fun way*" (Teacher F).

Improvement of ICT Competences

Willingness for Improvement

Most of the interviewed Greek teachers expressed a strong willingness to learn more in order to improve existing ICT competences. "*Live and learn. I want to learn more*

about technologies. You can see how fast technologies are advancing. I want to learn all new things (technologies) that are emerging" (Teacher A); "*I want to improve my abilities (on ICT use), so I am able to work better and show more things to children*" (Teacher I).

Conversely, one teacher stated that she was equipped with sufficient competences to use the computer in teaching and learning. So there was no necessity to improve her competences. "*I don't think that I need more abilities. For the children at this (age) level, I can manage..... I know how to use the computer correctly*" (Teacher D).

Improvement of Basic ICT Competences

With regard to the teachers who had low-level competences, they commonly showed the willingness to acquire basic knowledge and skills, especially in the computer, such as presentation software (e.g. PowerPoint), searching and downloading materials on the Internet, CD burning, etc. "*I want to be able to easily find some things (on the Internet) which I need..... I (also) want to learn something simple, such as burning a CD or sending an email*" (Teacher L); "*I want to know how to make a PowerPoint presentation and download materials (on the Internet).....*" (Teacher M2).

Improvement of Specific ICT Competences

With regard to the teachers who had been equipped with basic-level or high-level ICT competences, more complex and specific knowledge and skills were required by them to improve, especially the ones that were suitable for preschool teaching and learning. "*I want to learn more complex things, such as making a preschool website, creating a preschool blog and using software, especially special software*" (Teacher E); "*I don't want to learn how to operate on the computer anymore. I want to learn some software programs in order to work on the computer with children*" (Teacher H1).

5.5.2 ICT Competences of the Chinese Teachers

Status of ICT Competences

From a general perspective, the overall ICT competences of the Chinese teachers were not high. This point of view was also mentioned by one participating teacher: "*The overall technical competences of preschool teachers are not very high*" (Teacher I1). According to the interview transcripts, two groups of teachers emerged. The first group of teachers was defined as "basic-level teachers", who had a basic or average level of ICT competences. Most of the teachers belonged to this group. The second group of teachers was defined as "difficulty teachers". They possessed low-level ICT competences and had difficulties in using ICT tools in teaching and learning.

Basic-level Teachers

The "basic-level teachers" believed that they had basic and simple ICT competences, including operating equipment, word processing, making spreadsheets, searching for materials, creating courseware with PowerPoint software, and using simple functions of some professional software. "*My competence is fair to average, such as operating a computer, searching information, operating a camera or a projector, and looking for teaching materials on the smartphone*" (Teacher D); "*My competence is average..... For some simple things, such as word processing, making spreadsheets and creating PowerPoint slides, I can manage them*" (Teacher F).

However, the "basic-level teachers" lacked advanced and specific ICT competences, such as creating courseware with Flash, editing photos, etc. "*I lack more complex and professional skills, such as using Flash. I need someone to help me.....*" (Teacher C2); "*I can't use Flash, cut out images, insert music into slides and so on*" (Teacher E1).

Difficulty Teachers

There are also some teachers who pointed out that it was difficult for them to conduct a series of basic tasks, including operating equipment, searching for and downloading materials, creating courseware via PowerPoint software. The following teachers were representatives for this point of view:

"*I have a lot of difficulties in creating courseware (with PowerPoint). I always ask others for help.*" (Teacher C1)

"*At the beginning, it was quite difficult for me to operate the computer and make a PowerPoint presentation..... I have made some progress until now, but compared with other colleagues, these competences (of mine) are still poor.*" (Teacher E2)

"*I still don't know how to download materials (on the Internet). It is always the young teachers who help me.*" (Teacher J1)

Age and ICT Competences

Some Chinese teachers also mentioned the effect of age on teachers' ICT competences. For them, age was like a natural watershed which divided teachers into two groups: young teachers with high-level ICT competences and old teachers with low-level ICT competences. "*Some young teachers are very skilled (in ICT use). What they create is more advanced*" (Teacher A1); "*I can't make animations with Flash, cut out images and insert music into slides. These are what young teachers can do.....* " (Teacher E1); "*I am constrained by my age. (Thus) I am not so proficient like younger teachers.....*" (Teacher J1).

On the contrary, some teachers pointed out that age was not a necessary condition for ICT competences, because there were some young teachers who also had a low level

of ICT competences. "*I have met some new teachers..... It is very difficult for them to create some basic materials, for example, courseware with PowerPoint*" (Teacher B1); "*There are young teachers who are really proficient (in ICT use), but there are also some young teachers who know nothing*" (Teacher K2).

Improvement of ICT Competences

Willingness for Improvement

Most of the Chinese teachers had a strong desire and motivation to improve their ICT competences. "*My competence must be improved. I am a learning-based teacher..... I like them (ICTs) very much. (So) I am not passive, but willing to learn*" (Teacher K2).

However, there were also some teachers who expressed a relatively weak willingness to improve their ICT competences. This was mainly attributed to the low frequency of ICT use in teaching and learning activities. "*We (teachers) use these things (ICTs) very rarely..... There is nothing for me to be improved. I can manage them at present*" (Teacher H2).

Aspects for Improvement

Based on their existing competences, the Chinese teachers listed the ICT competences which they wanted to improve in the future, which specifically included the operation of the computer and basic software; the production of multimedia; and the integration of ICTs into the curriculum.

Operation of the Computer and Basic Software

With regard to the teachers who were not proficient in basic ICT competences, they showed a strong willingness to build their confidence in word processing, software

downloading and CD burning. "*I can only use the basic functions of Word, (but) I don't know the more complex ones. So I want to learn them..... I also want to learn how to download software*" (Teacher C2); "*I want to improve the abilities which have a close relationship with teaching practices, such as CD burning on the computer.....*" (Teacher H1).

Production of Multimedia

For most teachers, the ICT competences that they wanted to improve most were those related to the production of multimedia, such as courseware creation with PowerPoint, Flash creation, audio editing, video editing and image editing. "*I want to know how to create courseware (with PowerPoint) flexibly. I am still weak in this respect*" (Teacher B1); "*I want to improve abilities in creating Flash animations*" (Teacher K1); "*I want to learn how to integrate videos and music.....*" (Teacher I1).

Integration between ICTs and Curriculum

There was also one teacher who was willing to improve her know-how on integrating ICTs into the preschool curriculum. "*The ability to integrate ICTs into the curriculum should be improved*" (Teacher A2).

5.6 Teachers' Barriers to ICT Use in Teaching and Learning

The barriers which were encountered by the interviewed teachers when they used ICT tools in teaching and learning are shown in this section. Through the analysis and interpretation of the transcripts, a series of barriers for the Greek and Chinese teachers are presented respectively.

5.6.1 Barriers of the Greek Teachers

The barriers mentioned by the Greek teachers mainly involved: 1) a lack of hardware and the Internet; 2) a lack of funding; 3) a lack of competences; 4) a lack of training; 5) a lack of technical support; 6) large-sized classes.

Lack of Hardware and the Internet

The barrier related to the lack of hardware and the Internet was regarded as the main barrier by the Greek teachers, because most of them mentioned it. This barrier could be further broken down into the following items.

Lack of a Computer in the Classroom

Six teachers referred to the lack of a computer in the classroom as a difficulty to frequently and successfully use ICT tools in teaching and learning. "*The problem is that there is no computer in the classroom which can be used by both the children and teachers. (So) we can't use the computer every day*" (Teacher D); "*We don't have a computer in the classroom. The one we have is in the teachers' office. We can't use it whenever we want*" (Teacher L).

Limited Number of Computers

For some teachers, although they could have access to a computer in the classroom, the number of computers was insufficient for them to organize effective teaching and learning activities, especially for individual activities. The following teachers offered the evidence for this point of view:

"*There is only one computer. If the children work individually on the computer, it will take a lot of time..... It may take half day. Sometimes it may take more..... So it will be*

much easier to use the computer collectively, (that is) the children are together with the teacher to watch something (on the computer)....." (Teacher C)

"*There is one computer in the classroom, but it is for both teachers and the children. The difficulty is that teachers have so much work that it is impossible for teachers and the children to use it at the same time..... It is not easy (to use the computer), because there is just one*" (Teacher E).

Obsolete and Broken Hardware

Old and broken hardware was regarded as a barrier by some teachers. "*All we have is an old computer which often crashes and a broken CD player*" (Teacher B); "*We only have a DVD player for music, but it has been broken*" (Teacher L).

Lack of Large-screen Hardware

There were teachers who also mentioned that they needed large-screen hardware for collective activities, such as a projector or an interactive whiteboard. However, they were not provided by their preschools. "*We don't have a projector. There are so many children. It is difficult for them to watch on the (small) screen of the computer. One group at a time needs to go close to the computer to watch the things that I want to present. It is not so effective*" (Teacher B); "*It would be much better if there was an interactive whiteboard or a projector, because I could easily present some things to all the children. However, these things are currently lacking.....*" (Teacher F).

Lack of the Internet

The lack of the Internet was also pointed out as a barrier by several teachers. Teacher G mentioned the lack of the Internet for the interactive whiteboard, saying: "T*here is*

an interactive whiteboard in the preschool, but it can't be connected to the Internet." In addition, the lack of the Internet on the computer was also referred to by Teacher M1: "*One difficulty is that we don't have the Internet on the computer. If there was a connection, it would be much easier for us.*"

Lack of Funding

Five teachers stated the lack of funding for the preschool. They mentioned that they did not have enough funds to buy required ICT equipment and resources, especially in the context of the economic crisis. "*We want to have some other technologies, such as a projector, but our preschool doesn't have money. No money, no honey..... It is an financial problem*" (Teacher A); "*We don't have the financial means to buy computers for every classroom..... There is an economic crisis now. Everything is hard*" (Teacher H1).

Lack of Competences

The lack of ICT competences was regarded as a barrier by six teachers. In other words, their insufficient competences impeded them from frequently and effectively using ICTs in teaching and learning. "*I have many (competence) gaps, so I can't conduct teaching activities well with the computer*" (Teacher F); "*I don't know many things about the computer, so I can't use it well*" (Teacher L).

Lack of Training

Two teachers mentioned the lack of ICT training as a barrier. "*When you (teachers) don't know or have problems (about ICT use), you should receive training, however, there is no such kind of training in recent years*" (Teacher E); "*There is an interactive whiteboard in the preschool, but no training has been provided to teachers*" (Teacher G).

Lack of Technical Support

Three teachers pointed out that when they met technical problems, it was difficult for them to find a technician who could provide timely and professional technical support. "*If we (teachers) have some (technical) problems, we don't have someone who can help us. For example, we need to solve some issues arising with the IP address of the computer, but we can't find someone to help.....*" (Teacher B); "*I need professional staff to come to the preschool and solve technical problems. I have sent an application to the Municipality three times this year, but no one has come..... We (teachers) don't know these things (technical skills) well enough.....*" (Teacher E).

Large-sized Classes

One teacher also referred to the difficulty in conducting individual activities on the computer, because of the large class size. "*I tried to use the computer to evaluate each child..... But it was very difficult, because we (teachers) have many children and the exercise took lots of time to complete*" (Teacher M1).

5.6.2 Barriers of the Chinese Teachers

Most of the Chinese teachers stated that they encountered barriers or difficulties when they used ICT tools in teaching and learning. Only one teacher said that she did not meet any barriers or difficulties. More precisely, the Chinese teachers mentioned six types of barriers, which included: 1) a lack of hardware or the Internet; 2) a lack of educational software and resources; 3) a lack of competences; 4) a lack of training; 5) technical accidents; 6) a lack of time; and 7) a lack of support in the preschool policy.

Lack of Hardware or the Internet

A total of eight teachers pointed out that they were not provided sufficient, up-to-date or easy-to-access hardware or the Internet by their preschools.

Lack of Hardware

One teacher referred to insufficient hardware. "*The camera that I am using now in my classroom is mine. There are many classrooms in our preschool, (so) it is not possible for the preschool to provide a camera for each classroom*" (Teacher J1).

Lack of the Internet

Three teachers confirmed the lack of the Internet in their classrooms. "*We (teachers) have the Internet in the computer room (teachers' lesson preparation room), but there is no Internet in the classroom. We have to go to the computer room for the Internet, save materials to the USB drive and then bring the USB drive to the classroom to use. It is very troublesome*" (Teacher E1).

Two teachers from the same preschool also attested to the unsteady wireless network in their preschool. "*The Wi-Fi in the preschool is not good. Sometimes it is steady, while at times it's not steady. When we (teachers) want to send something online, we can't do it easily. We have to wait to go back home and do it. The Wi-Fi is not reliable to use at any time*" (Teacher K2).

Broken and Obsolete Hardware

Two teachers from Preschool E mentioned the broken and obsolete projectors in their classrooms. "*The projector in my classroom is too old. When we (teachers) want to use it, it either presents problems or doesn't work at all*" (Teacher E2).

Unsuitable Placement of Hardware

The two teachers from Preschool H explained how the unsuitable location of the computer and the projector made it difficult and inconvenient for teachers to use. The projector was placed in the classroom, but the computer was in another room next to the classroom. "*It is not convenient for us (teachers) to operate the computer and the projector at the same time..... Two teachers are needed, one operating the projector in the classroom and the other operating the computer in the other room*" (Teacher H2).

Lack of Educational Software and Resources

The lack of sufficient multimedia teaching and learning software and resources in the preschool education context was perceived as a main barrier by six teachers.

Lack of Appropriate Online Educational Resources

Two of the six teachers stated that the lack of appropriate and professional educational resources on the Internet posed a barrier for them. That is, it was difficult for them to find online educational resources which were age-appropriate, correct and detailed.

More specifically, two teachers referred to the difficulty in finding online educational materials which were age-appropriate for preschoolers. "*I can't find specific teaching content which I need on the Internet..... For example, for teaching the planet 'Earth', the materials I could find are all for pupils. There are very few materials which are targeted to preschoolers*" (Teacher A1); "*The (online) materials that are suitable for preschoolers are very few. We (teachers) can only find some related pictures or videos* (Teacher A2).

The uncertainty of online resources and the difficulties in finding correct knowledge online was also mentioned by Teacher A1. "*A story or poem has many versions online. It is difficult for me to know which version is suitable..... We (teachers) need the right things (information) which have been pre-assessed to use in the classroom.*"

Furthermore, Teacher A2 pointed out the lack of detailed and specific online resources for different ages of preschoolers. "*They (online materials) are quite simple and are not detailed. (That is) the online knowledge is not divided based on the age group (of preschoolers).*"

Lack of Ready-made and Reusable Educational Software and Resources

Due to the lack of ready-made and reusable educational software and resources which matched the preschool curriculum, teachers had to prepare and create by themselves. This was also considered as a barrier by some teachers. "*When teachers don't have ready-made materials for a certain theme-based activity, they need to create a Flash animation or PowerPoint presentation by themselves. This is troublesome and hard*" (Teacher F); "*If the courseware is used for a short time period rather than a longer one, I will consider whether it is worth making (using ICTs)*" (Teacher H1);

Lack of Updated Educational Software

One teacher stated that due to no update of the educational software in her preschool, the teachers could not use it in their teaching activities anymore. "*There is one kind of educational software on the computer, but the company hasn't come to update it..... So we (teachers) can't use it now*" (Teacher A2).

Lack of Free Online Educational Resources

One teacher raised the lack of free online resources. "*Now the biggest problem for me*

is that I have to pay if I want to download things (online resources)..... The principal doesn't think about how teachers obtain relevant resources" (Teacher K1).

Lack of Competences

Many teachers perceived insufficient ICT competences as the main barrier for them to successfully use ICTs in teaching and learning. "*My skills are not good. (So) when I conduct the lesson (with ICTs), I sometimes feel that my ability is not equal to my ambition*" (Teacher A2); "*My biggest problem is that I don't know how to use them (ICTs) well*" (Teacher I1); "*Our (teachers') difficulty is that we have ideas, but our abilities haven't achieved the corresponding level.....*" (Teacher J1).

Lack of Training

Three teachers referred to the lack of systematic and in-depth training and guidance on certain equipment. "*There is no guidance on the use of the interactive whiteboard, (so) I still don't know how to use it well*" (Teacher C2); "*For the digital camera and the projector, we (teachers) only know the simple functions. No one guides us on how to use them more professionally, such as how to adjust the projector, how to improve its visual effect, how to change its function, etc*" (Teacher K2).

Technical Accidents

Technical accidents and difficulties were perceived as a barrier by two teachers. "*The projector didn't work suddenly..... I tried to repair it for a long time but failed. So I had to stop using it*" (Teacher E2); "*When I was using the projector in the classroom, the sound stopped all of a sudden. I tried to find the problem, (but) I didn't know what was going on. This is a difficult moment for us (teachers)*" (Teacher K2).

Lack of Time

Five teachers declared the lack of time, especially the older teachers. They described a busy daily schedule, in which it involved a full range of work and family affairs. Thus, they had limited time to learn, prepare and use ICTs in teaching and learning. These words from the following teachers proved this point of view:

"*I don't have time to use (ICTs) now, because there are many affairs in the classroom which I have to attend to. The commitments in the preschool are also many..... Time is very tight. I am very busy.*" (Teacher E1)

"*At our age (an old age), the family burden is very heavy..... We (teachers) have other obligations when we are free. There isn't much time for us to learn ICTs.*" (Teacher J1)

Lack of Support in the Preschool Policy

One teacher also mentioned the preschool policy as a cause for the teachers' limited use of ICT tools in teaching and learning. "*In our preschool, there is a restriction for teachers to use their mobile phones. When a teacher is on duty (in the classroom), she is not allowed to turn on the mobile phone*" (Teacher J1).

Concluding Remarks

The results of the qualitative study are presented and interpreted in this chapter. A total of five issues are explored in detail, including the teachers' ICT access, ICT use, attitudes toward ICT use, ICT competences and barriers to ICT use in daily teaching and learning activities. The main findings are shown as follows:

1) **ICT access**. The Greek teachers' ICT access both in the classroom and outside the classroom was relatively limited. The most available equipment in the classroom were

conventional ones, while emerging ones were quite rare. There were also classrooms lacking conventional equipment and had to be placed out of the classroom and shared by all teachers in the preschool. Most of the Greek teachers were not offered with any forms of independent ICT room.

The Chinese teachers reported a better ICT access condition both in the classroom and outside the classroom. Most of the classrooms were equipped with various equipment, including both conventional and emerging ones. Meanwhile, a range of independent rooms which could be applied as a ICT room existed. However, limited educational software and resources were also reported.

2) **ICT use**. The teachers' ICT use practices were interpreted through four contexts.

- **Use contexts**. ICT use behaviors of both the Greek and Chinese teachers emerged more often in the teaching and learning preparation and implementation stage, but rarely in the teaching and learning evaluation and reflection stage. A range of ICT use behaviors were also indicated in informal teaching and learning activities, in which ICTs were used not only to promote children's learning and development, but also to cultivate good behaviors of children, manage children easily and calm children down.
- **Types of hardware and software**. Both the Greek and Chinese teachers tended a "generic use" rather than a "specific use". They applied the basic functions more often than the advanced and specific functions of ICTs. However, there were also some subject-specific use behaviors appeared in the Greek and Chinese context.
- **Teaching approaches**. In the Greek context, both the teacher and the child used ICTs. ICTs were used to support child-centered teaching and learning paradigm. In the Chinese context, only the teacher was the actor of ICT use, while ICT use by the child was restricted. ICTs were used to support teacher-centered teaching and learning paradigm. However, the introduction of corner teaching and learning activities brought opportunities for the child to use ICTs as a learning tool.
- **Influencing factors**. Insufficient equipment, teachers' low abilities, and teachers'

concerns about children's health and online privacy hindered some Greek teachers to use ICTs frequently. Besides, a lack of sufficient equipment, teachers' low abilities, teachers' concerns about children and unsuitable online content, children's insufficient abilities (e.g. operation and protection of ICT devices and literacy), and parents' negative attitudes were reasons for some Chinese teachers to hesitate to introduce ICTs to children as a learning tool.

3) **Attitudes towards ICT use**. The Greek and Chinese teachers generally expressed positive attitudes towards ICT introduction and use in preschool teaching and learning, the impact of ICTs on teachers' teaching activities, as well as the impact of ICTs on children's learning activities. Most of them also reported positive feelings on ICT use in preschool teaching and learning. However, their positive attitudes were conditioned by appropriate ICT use practices. Besides, some teachers also held concerns about and negative feelings on ICT use in teaching and learning.

A range of factors affecting the Greek and Chinese teachers' acceptance or refusal of ICT use and the shift of their attitudes were also indicated. In the Greek context, the factors consisted of adaptation to the technological era, positive effects of ICTs on teaching and learning, teachers' competences and training. In the Chinese context, the factors involved adaptation to the new era, children's existing ICT experiences and abilities, positive effects of ICTs on teaching and learning, appropriateness of ICTs for children's learning characteristics, teachers' competences and training, preschool support (time, workload, the Internet and recyclable courseware), and concerns about negative effects on children's health and vision.

4) **ICT competences**. Both the Greek and Chinese teachers reported an unsatisfactory level of ICT competences. Most of them belonged to "basic-level" and "low-level" (or "difficulty") teachers. But they expressed a strong willingness to improve existing ICT competences, including both basic and advanced/specific ones. In addition, some teachers also pointed out the age effect of ICT competences.

5) **Barriers to ICT use**. A lack of hardware and the Internet, a lack of funding, a lack of teachers' competences, a lack of teachers' training, a lack of technical support and large-sized classes were regarded as barriers by the Greek teachers. Meanwhile, a lack of hardware and the Internet, a lack of educational software and resources, a lack of teachers' competences, a lack of teachers' training, technical accidents, a lack of time and a lack of support in the preschool policy were barriers encountered by the Chinese teachers.

The following chapter will make a discussion and conclusion for the study. Based on the findings, it will offer a series of implications for educational authorities, preschool leaders and training programs. The limitations of the study and the recommendations for future studies will also be pointed out.

Chapter 6 Discussion and Conclusion

Within the framework of an information society, this thesis systematically examined the preparedness and adaptation of preschool teachers for this new form of society in both Greece and China. Specifically, with preschool teachers as research subjects and teaching and learning activities as the focus point, this thesis explored the similarities and differences between Greek and Chinese preschool teachers in terms of ICT access, ICT use practices, attitudes toward ICT use, ICT competences and barriers to ICT use. The case study methodology selected a similar city from both countries and the mixed study methodology adopted both quantitative and qualitative analyses. This chapter discusses the findings of this study (6.1). The implications of the findings (6.2), the limitations of the study (6.3), and the recommendations for further research (6.4) are also presented in this chapter.

6.1 Discussion and Conclusion

6.1.1 Teachers' ICT Access in Teaching and Learning

The first research question focused on the similarities and differences between Greek and Chinese preschool teachers in ICT access in teaching and learning practices. Both the quantitative and qualitative analysis revealed a significant difference of the access to ICT hardware between the Greek and Chinese participants. The preschool teachers in China were equipped with better hardware tools than those in Greece.

The available ICT hardware for the Greek participants was mostly the traditional one. Most of them were provided with a CD player, a computer and the Internet. Some of them also accessed a TV/DVD player and a digital camera/video camera. However, there were also some teachers who could not access basic hardware in the classroom, although they could share them with colleagues outside the classroom. Moreover, the

access to the latest and large-screen hardware by the Greek teachers was quite limited, such as a projector, an interactive whiteboard, a smartphone and a tablet. The Greek teachers also experienced the same situation in the access to a computer laboratory or a multimedia room. These findings were also proven by previous studies that reported a low availability of ICT hardware of Greek preschool teachers (Gialamas & Nikolopoulou, 2010; Nikolopoulou, 2014a; Nikolopoulou & Gialamas, 2015a; Pange & Kontozisis, 2001; Χριστοδούλου-Γκλιάου & Γουργιώτου, 2009).

Except for traditional hardware, including a computer, the Internet, a DVD/CD player, a digital camera/digital camera and a digital visualizer, the Chinese participants were also provided with a range of the latest and large-screen hardware in the classroom, such as a new-fashioned television set, an interactive whiteboard, a projector, a smartphone, a tablet, and a touch and talk pen. Moreover, many preschools were also equipped with different types of computer or multimedia rooms, such as a lesson preparation room or a multi-functional room. These findings were consistent with some previous studies conducted in urban preschools in China (Guo et al., 2006; Liu, 2007; Zhang & Wang, 2015; Zhu & Wang, 2013). They also agreed with some recent studies which revealed the reality of some better-equipped preschools in some other countries (Brito, 2010; Hinostroza et al., 2013; Masoumi, 2015; Zaki, 2013).

Although the quantitative study reported a relatively high proportion of the teachers in both Greece (53.7%) and China (70.4%) who had access to educational software, the qualitative study revealed a limited availability of educational software and resources of the Greek and Chinese teachers, especially in systematic and professional software and resources, including both offline and online ones. This finding was also supported by similar studies in both Greece (Nikolopoulou & Gialamas, 2015a) and China (Guo et al., 2006; Zhu & Wang, 2013).

6.1.2 Teachers' ICT Use Practices in Teaching and Learning

The aim of the second research question was to compare ICT use practices in teaching and learning between Greek and Chinese preschool teachers. This question was quite complex which involved multiple issues. The quantitative study revealed new information about the use frequency, years of use, teaching stages, learning areas, time allocation, teaching approaches and influencing factors of the participating teachers. The qualitative study further offered more detailed and comprehensive information on the use practices of the participants. It specifically described and analyzed the participants' behaviors of ICT use in four different contexts, including teaching and learning preparation before the class, teaching and learning implementation in the class, teaching and learning evaluation and reflection after the class, and informal teaching and learning activities.

Use Frequency of ICTs

The quantitative study revealed a significant difference of ICT use frequency between the Greek and Chinese teachers. The teachers in China showed a higher use frequency of ICTs than those in Greece. The use frequency of ICTs of the Chinese teachers was close to a high level (3-4 times/week). This finding was not consistent with previous studies that revealed a low use frequency of ICTs of Chinese preschool teachers (Guo et al., 2006; Liu, 2006), but it was consistent with some recent studies that reported an increased use frequency of ICTs of Chinese preschool teachers (Liu & Pange, 2015a). The Greek teachers had a medium level in the use frequency of ICTs (1-2 times/week), which was higher than that reported by some previous studies (Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011; Eteokleous & Laouris, 2005; Nikolopoulou, 2014a; Nikolopoulou & Gialamas, 2015b; Pange, 2004; Pange & Kontozisis, 2001; Petrogiannis, 2010). These findings from both the Greek and Chinese context accorded with a global trend that an increasing number of preschool teachers are introducing and using ICTs in teaching and learning activities on a regular basis (Brito,

2010; Hinostroza et al., 2013; Yurt & Cevher-Kalburan, 2011; Zaki, 2013).

Types of ICT Hardware and Software

A significant difference was reported by the quantitative study in terms of the types of ICT hardware and software used by the Greek and Chinese teachers. The teachers in China used more diverse hardware and software than those in Greece, which involved both traditional and latest ones. The Greek teachers used the Internet and a computer most frequently, followed by a digital camera/video camera and educational software. However, they used quite rarely latest and large-screen hardware, such as a projector, an interactive whiteboard, a TV/DVD player, a smartphone and a tablet. Except for the Internet and a computer, the Chinese teachers also used a large-screen television set (mainstream and latest technology) and a smartphone most frequently. They also used other ICT hardware and software with a high frequency. However, the digital camera/video camera was used least frequently. This finding was also affirmed by the qualitative study. It was found that the digital camera had been replaced by the new smartphone technology, which brought new opportunities and possibilities for the teachers to document teaching and learning activities.

When it came to a more in-depth analysis, the qualitative study revealed a surprising similarity. Both the Greek and Chinese teachers leaned toward a “generic use”. They used the basic functions of ICTs more often, such as using the Internet to search and collect materials, writing teaching plans and evaluation reports on a word processor (e.g. MS Word), creating and presenting courseware or worksheets with presentation software (e.g. MS PowerPoint), presenting multimedia materials, as well as modeling painting work. However, they used rarely the advanced and subject-specific functions of ICTs. Although limited similar studies have been performed on preschool teachers, this finding was proven by several studies focusing on teachers in general education (Al-Zaidiyeen et al., 2010; Buabeng-Andoh, 2012; Gulbahar & Guven, 2008; Keong et al., 2005; Lau & Sim, 2008; Li et al., 2012; Paraskeva et al., 2008; Varol, 2013).

However, in both the Greek and Chinese context, some subject-specific use practices also emerged from the qualitative study. In other words, the Greek teachers introduced educational CD-ROMs or online educational games to classroom children so that the children could learn by themselves on the computer. Meanwhile, the Chinese teachers applied subject-based courseware or online resource databases for teaching activities.

Use Contexts of ICTs

In the formal teaching and learning context, both the quantitative and qualitative study revealed that both the Greek and Chinese teachers used ICTs more frequently at the teaching and learning preparation and implementation stage, rather than the teaching and learning evaluation and reflection stage. This finding was also proven by previous studies (Hinostroza et al., 2013; Liu & Pange, 2015a; Yurt & Cevher-Kalburan, 2011; Zhang & Wang, 2015).

Another interesting context of ICT use practices was revealed by the qualitative study – the informal teaching and learning context, in which teaching and learning activities were improvised and took place randomly. The Greek and Chinese teachers applied a range of ICTs in the context of free play time, break time, sleep time and interval time. During these occasions, they used ICTs not only to promote children's learning and development, but also to cultivate children's good behavioral habits, manage children easily and calm children down.

Years of Use, Time Allocation and Learning Areas

The Greek and Chinese teachers had at least one-year experience in the use of ICTs in teaching and learning. They tended to spend half of teaching hours or less using ICTs in the classroom. Theme-based Curriculum, Environmental Studies and Language were the most common learning areas for the Greek teachers to apply ICT tools, while

the Chinese teachers preferred to use ICT tools in Art, Theme-based Curriculum and Language. These findings partially attested some previous studies related to preschool teachers (Hinostroza et al., 2013; Yurt & Cevher-Kalburan, 2011; Zhang & Yu, 2010).

Teaching Approaches

The quantitative study reported a similar level (medium level) between the Greek and Chinese teachers in the use frequency of constructivist teaching approaches. However, a big difference was found by the qualitative study between the two groups regarding the teaching approach in ICT use practices in teaching and learning.

In the Greek context, both teachers and children were involved in ICT use. ICTs were applied by teachers as a teaching tool to present teaching and learning materials, document teaching and learning activities, and document for teaching and learning activities. But under the guidance and supervision of teachers, ICTs were also used by children as a learning tool, which appeared in both formal and informal teaching and learning activities. In other words, the Greek teachers tended to used ICTs to conduct child-centered teaching and learning activities. This finding agreed with some similar studies on both Greek (Nikolopoulou, 2014a, 2014b; Pange &Kontozisis, 2001) and global preschool teachers (Brito, 2010; Chen & Chang, 2006; Hinostroza et al., 2013). It was also consistent with the evidence found in general education (Inan et al., 2010; Law et al., 2008).

Unlike the Greek teachers, the Chinese teachers were the sole ICT users, whereas the use of ICTs by children was restricted. In other words, ICTs were mainly used by the teachers as a teaching tool to present multimedia materials, document teaching and learning activities and model painting work. Therefore, ICTs were mainly used by the Chinese teachers to support traditional teacher-centered teaching and learning instead of child-centered teaching and learning. This finding was proven by previous studies on both Chinese (Dong, 2014; Zhang & Yu, 2010) and global preschool teachers

(Bolstad, 2004; Zaki, 2013). It was also consistent with the evidence found in general education (e.g. Buabeng-Andoh, 2012; Draper, 2010; Hu et al., 2011; Law et al., 2008; Lin & Huang, 2009, 2010)[1]. It was also revealed that recently popular corner activities which were more child-oriented brought opportunities for children to operate and use ICTs as a learning tool.

Influencing Factors of ICT Use Frequency

Four common influencing factors were revealed by the quantitative study for both the Greek and Chinese teachers, including: 1) ICT use frequency in the daily life. Those teachers who used ICTs frequently in their daily lives tended to use them frequently in teaching and learning. This finding was not supported by similar studies in preschool education (Kerckaert et al., 2015), but was supported by a series of studies in general education (Bullock, 2004; ChanLin et al., 2006; De Grove et al., 2012; Hermans et al., 2008); 2) preschool support. More support from the preschool led to a higher ICT use frequency. This finding was proven by previous studies in both preschool (Blackwell et al., 2014) and general education (Law & Chow, 2008; Teo, 2011); 3) ICT access in the classroom. It was very surprising that better ICT access in the classroom resulted in teachers' lower ICT use frequency, which was not consistent with previous studies (Edwards, 2005; Zaki, 2013); 4) teachers' attitudes. Positive attitudes were associated with frequent ICT users. This finding was reported by a number of previous studies in both preschool and general education (e.g. Berner, 2003; Blackwell et al., 2013, 2014; Isleem, 2003; Kerckaert et al., 2015; Larbi-Apau & Moseley, 2012)[2].

A series of different factors were also found separately affecting ICT use frequency of the Greek and Chinese teachers. The Greek teachers were significantly and positively affected by pre-service general ICT training and constructivist teaching approaches.

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[1]The details could be found in **Section 2.4.4**.

[2]The details could be found in **Influencing Factors in General Education** and **Influencing Factors in Preschool Education** in **Section 2.4.6 Influencing Factors**.

This finding agreed with previous studies in both preschool and general education reporting a positive correlation between teachers' ICT use frequency and ICT training (Afshari et al., 2009; Blackwell et al., 2014; Hodgkinson-Williams, 2007; Kerckaert et al., 2015; Mumtaz, 2000; Somekh, 2008), as well as and teaching and learning beliefs (Afshari et al., 2009; Hermans et al., 2008; Law et al., 2008; Ljung-Djärf, 2008; Tondeur et al., 2008).

Meanwhile, factors including demographic characteristics, ICT access in the daily life, access to the computer laboratory/multimedia room, competences and barriers had a significant impact on the ICT use frequency of the Chinese teachers. Those teachers who were younger (35 years old or below), had worked for fewer years, had fewer children in the classroom, could access the computer laboratory/multimedia room, had higher ICT competences (especially Technological Competences and Technological Pedagogical Competences) tended to use ICTs more frequently. These findings were supported by previous studies in both preschool and general education regarding the impact of teachers' age (Inan & Lowther, 2010; Isleem, 2003; Rahimi & Yadollahi, 2011), teaching experiences (Inan & Lowther, 2010; Rahimi & Yadollahi, 2011), ICT access in the school (Edwards, 2005; Zaki, 2013), and ICT competences (e.g. Anderson et al., 2011; Buabeng-Andoh, 2012; Chen & Chang, 2006; Edwards, 2005; Kerckaert et al., 2015)[1] on teachers' ICT use frequency. However, it was surprising to find that higher educational level, better ICT access in the daily life and fewer barriers to external support were associated with less frequent ICT users.

Furthermore, a series of influencing factors were also revealed by the qualitative study. Insufficient ICT-related equipment and resources, teachers' low ICT competences and teachers' concerns about children (e.g. children's health and online privacy) hindered some Greek teachers to use ICTs in teaching and learning practices. A lack of ICT-related equipment and resources, teachers' low ICT competences, teachers'

[1]The details could be found in **Influencing Factors in General Education** and **Influencing Factors in Preschool Education** in **Section 2.4.6 Influencing Factors**.

concerns about children (e.g. children's vision, divergent thinking, exploration skills and hand-on abilities), teachers' concerns about unsuitable online content, children's insufficient ICT-related abilities (e.g. abilities to operate and protect ICT devices and literacy skills) and parents' negative attitudes toward ICT use in teaching and learning were important reasons for some Chinese teachers to hesitate to expose children to ICTs in teaching and learning practices. Besides, some teachers stated that the use of the corner teaching and learning approach in the preschool offered fewer opportunities for teachers to use ICTs in teaching and learning.

6.1.3 Teachers' Attitudes toward ICT Use in Teaching and Learning

The third research question was related to the comparison between Greek and Chinese preschool teachers in terms of attitudes toward ICT use in teaching and learning. Both the status and influencing factors of teachers' attitudes were examined.

Status of Teachers' Attitudes

The attitudes of the Greek and Chinese teachers showed a surprising similarity. On the one hand, they generally held positive attitudes. They supported the introduction and use of ICTs in preschool teaching and learning, believed that ICTs brought benefits to teachers' teaching activities and children's learning activities, and expressed positive feelings on ICT use in teaching and learning. This finding was also revealed by some previous studies on preschool teachers in both the global context, and the Greek and Chinese context (Aubrey & Dahl, 2008; Dong, 2014; Hinostroza et al., 2013; Liu, 2006; Nikolopoulou & Gialamas, 2015b; Toki & Pange, 2014)[1].

On the other hand, they also pointed out conditional positive attitudes and emphasized the importance of appropriate ICT use practices. Precisely, for the Greek teachers, the

[1]The details could be found in **Section 2.5.2 Current Status**.

appropriate use of ICTs meant moderate use, providing appropriate content to children, keeping a good balance between ICT-related activities and traditional activities, and being independent-thinking teachers. For the Chinese teachers, the appropriate use of ICTs referred to moderate use and guided use.

Furthermore, there were also some teachers from both Greece and China who showed uncertainties about the benefits of ICTs and showed negative feelings on and concerns about the use of ICTs in teaching and learning. This finding also affirmed past studies (Aubrey & Dahl, 2008; Kol, 2012; Masoumi, 2015; Pange & Kontozisis, 2001; Petrogiannis, 2010; Tsitouridou & Vryzas, 2003, 2004; Wood et al., 2008; Zaranis & Oikonomidis, 2015).

More specifically, when talking about the impact of ICTs on children's learning, these teachers pointed out that ICT tools might cause negative effects on children's health, independent thinking, communication and concentration. In addition, they also argued that the benefits of ICTs were dependent on children's learning styles. ICTs would be helpful only for children who were interested to learn with ICT tools.

A series of negative feelings and concerns were also referred to by these teachers. The concern about children was mentioned most frequently, especially in children's health and vision. Besides, children's safety, distraction, divergent thinking, hands-on skills, exploration abilities and interests in traditional activities also concerned some teachers. Thus, they further emphasized the role of teachers in avoiding these possible harms to children, including controlling time duration, selecting suitable multimedia content and forms, setting a suitable distance between the screen and the children, supervising children and intervening when necessary, etc. The lack of ICT competences was also a concern for some teachers. Some Greek teachers also expressed concerns about the appropriateness of multimedia content, while teachers' over-dependence on ICT tools and technical accidents also concerned some Chinese teachers.

Influencing Factors for Teachers' Attitudes

Three common factors with positive effects on the attitudes of the Greek and Chinese teachers were reported by the quantitative study, including the ICT use frequency in teaching and learning, the constructivist teaching and learning approaches and the ICT competences. These finding were supported by previous studies in both preschool and general education, which reported a positive effect of ICT experiences in teaching and learning (Akaslan & Law, 2012; Cavas et al., 2009; Derscheid, 2003; Pavlou & Vryonides, 2009; Tezci, 2010) and ICT competences (Albirini, 2006b; Avidov-Ungar & Eshet-Alkalai, 2011; Tsitouridou & Vryzas, 2003) on teachers' attitudes[1].

Different factors for teachers' attitudes were also found in the quantitative study. The Greek teachers were significantly affected by age, number of classroom children, in-service training, benefits of in-service training, preschool support and barriers. The teachers who held more positive attitudes were older (36 to 55 years old), had fewer children in the classroom, attended in-service ICT training (especially basic training, pedagogical training and online self-learning), obtained more benefits from in-service ICT training, were offered more support by the administration of the preschool, and encountered less barriers (especially ICT competence-related barriers). These findings were consistent with previous studies in both preschool and general education on the impact of ICT training (Christensen, 2002; Jimoyiannis & Komis, 2006; Pavlou & Vryonides, 2009; Ramírez et al., 2012; Samak & Tawfik, 2006; Tezci, 2010) and school support (Ramírez et al., 2012; Sipilä, 2010; Teo, 2009; Tezci, 2010; Yeung, 2001) on teachers' attitudes. However, the finding on the impact of age on teachers' attitudes did not support most of the previous studies (Cavas et al., 2009; O'bannon & Thomas, 2014; Pavlou & Vryonides, 2009; Şahin-Kizil, 2011; Samak & Tawfik, 2006). In the Chinese context, ICT access in the daily life and ICT use frequency in the daily life were also factors affecting teachers' attitudes. The two factors were also

[1]The details could be found in **Influencing Factors in General Education** and **Influencing Factors in Preschool education** in **Section 2.5.3 Influencing Factors.**

reported by some similar studies in general education (Cavas et al., 2009; Pavlou & Vryonides, 2009; Tsitouridou & Vryzas, 2003).

The qualitative study also revealed a series of factors which influenced the acceptance, refusal and shift of teachers' attitudes toward ICT use in teaching and learning in both the Greek and Chinese setting. They included the necessity to adapt preschool teaching and learning to the new technological era; children's rich ICT experiences and competences; the positive impact of ICTs on preschool teaching and learning; the appropriateness of ICTs for children's learning characteristics; teachers' ICT-related competences and training; teachers' age; teachers' concerns about the possible threats to children's health and vision; preschool administration support (e.g. more time to learn and use ICTs, less workload, access to the Internet and provision of recyclable courseware).

6.1.4 Teachers' ICT Competences

The fourth question was to compare ICT competences between the Greek and Chinese preschool teachers. Three specific issues were further explored, including the status of competences, influencing factors of competences and improvement of competences in the future.

Status of ICT Competences

Although the quantitative study reported a medium level for the Greek teachers and a high level for the Chinese teachers in ICT competences, an unsatisfactory level of ICT competences of both the Greek and Chinese teachers were indicated by the qualitative study. In other words, most of the participants were "basic-level" and "low-level" (or "difficulty") teachers in ICT competences, and a very few of them were "high-level" teachers in ICT use. Previous studies on Greek, Chinese and global preschool teachers proved this finding (Aubrey & Dahl, 2008; Bi & Li, 2012; Chen & Chang, 2006;

Gialamas & Nikolopoulou, 2010; Guo et al., 2006; Pange, 2004; Tsitouridou & Vryzas, 2004)[1].

The quantitative study also reported that among the four factors of ICT competences, Technological Competences of both the Greek and Chinese teachers were the lowest, especially in terms of the competence in solving technical problems. This finding was not consistent with studies in both preschool and general education which reported a higher level of technological competences than specific technological competences of teachers (Chai et al., 2013; Md Yunus, 2007; Nikolopoulou & Gialamas, 2015; Rastogi & Malhotra, 2013).

Influencing Factors of ICT Competences

Five common factors were found by the quantitative study have positive impact on ICT competences of the Greek and Chinese teachers, which included in-service ICT training, benefits of in-service ICT training, preschool support, constructivist teaching approaches and attitudes. Factors including in-service ICT training (Chen & Chang, 2006) and teachers' attitudes (Jegede et al., 2007) were also found in similar studies in preschool and general education.

Five other factors were indicated to influence only the ICT competences of the Greek teachers, including age, teaching experiences, ICT access in the daily life, pre-service ICT training (both general and pedagogical training) and barriers (especially barriers on preschool administrative support and competences). Age, teaching experiences and barriers were negative factors, but ICT access in the daily life and pre-service training were positive factors. Factors including age (Chuang & Ho, 2011; Ding & Wu, 2010; Li et al., 2006; Liang et al., 2013; Lin et al., 2013), teaching experiences (Chen & Chang, 2006; Chuang & Ho, 2011; Liang et al., 2013; Tezci, 2010), ICT access in the

[1]The details could be found in **Section 2.6.2 Current Status**.

daily life (Anderson & Maninger, 2007; Chen & Chang, 2006; Goktas et al., 2009), and pre-service ICT training (Goktas et al., 2009; Tezci, 2010) were also reported by some previous studies in both preschool and general education.

Three more factors were also found for the ICT competences of the Chinese teachers, including ICT use frequency in the daily life, ICT use frequency in teaching and learning and years of ICT use in teaching and learning. All these factors had positive effects and were consistent with similar studies regarding ICT use frequency in the daily life, ICT use frequency in teaching and learning and ICT use experiences (Chen & Chang, 2006; Chuang & Ho, 2011; Hsu et al., 2013; Jang & Tsai, 2012; Kim, 2015; Liang et al., 2013; Nikolopoulou & Gialamas, 2015; Tezci, 2010).

In the qualitative study, some teachers mentioned the impact of teachers' age on ICT competences. In their perceptions, age differentiated teachers into young teachers with high ICT competences and old teachers with low ICT competences. However, there were also teachers who believed that young age was not always related to high ICT competences.

Improvement of ICT Competences

It was found by the qualitative study that most of the interviewed teachers from both Greece and China showed a strong willingness and motivation to enhance their ICT competences. For the teachers with a lower level of ICT competences, they would like to gain basic ICT-related knowledge and skills, such as how to operate a computer and to use basic computer software (e.g. the Internet, PowerPoint and Word). For the teachers who already had basic ICT competences, they were willing to be equipped with more advanced and curriculum-specific ICT-related knowledge and skills, such as the use of educational software, the production of multimedia and the integration of ICTs into the preschool curriculum.

6.1.5 Teachers' Barriers to ICT Use in Teaching and Learning

The final research question was to compare the Greek and Chinese preschool teachers in terms of the barriers which they encountered. The types of barriers and the factors influencing the participants' perceptions of barriers were all explored.

Types of Barriers

The most common barriers which were encountered by both the Greek and Chinese teachers included "large number of children in the classroom" and "the technology is changing fast". Moreover, "lack of hardware, the Internet and software" and "lack of technical support" were also considered as main barriers by the Greek teachers, while "lack of time to learn and use ICT in teaching" was also regarded as an important barrier by the Chinese teachers. There was also a consistency between the Greek and Chinese teachers in their least significant barriers, including "I cannot see the benefits of using ICT in teaching", "most parents are not in favor of the use of ICT in teaching" and "my colleagues are not in favor of the use of ICT in teaching".

The qualitative study strengthened the evidence of the quantitative study. A lack of ICT hardware and the Internet, a lack of funding and a lack of ICT competences and training were the barriers mentioned most frequently by the Greek teachers. A lack of technical support and large-sized classes were also barriers for some Greek teachers. A lack of ICT hardware and the Internet, a lack of appropriate and professional educational software and resources, a lack of ICT competences and training, technical accidents, a lack of time and a lack of support in the preschool policy were barriers encountered by the Chinese teachers.

Influencing Factors for Teachers' Perceptions of Barriers

The perceptions of barriers of both the Greek and Chinese teachers were significantly

negatively affected by four factors: in-service ICT training, preschool administration support, constructivisit teaching approaches and ICT access in the classroom.

There were four more factors which were found to affect the perceptions of barriers of the Greek teachers. Especially they included the number of working hours per day, the access to the computer laboratory/multimedia room, the attitudes and competences. Working hours per day had a positive impact, while the other factors had a negative impact on ICT use.

Six more factors were also reported for the perceived barriers of the Chinese teachers, including educational level, number of children in the classroom, ICT access in the daily life, ICT use frequency in the daily life, pre-service ICT training and perceived benefits of in-service ICT training. It was interesting to find that the educational level and the ICT use frequency in the daily life had a positive impact, while the number of children in the classroom had a negative impact on teachers' ICT use. The remaining factors negatively affected the perceptions of barriers of the Chinese teachers.

Concluding Remarks

A series of similar trends and different characteristics between the Greek and Chinese preschool teachers were summarized in this study.

Teachers' ICT Access in Teaching and Learning

The Chinese teachers had been equipped with a better hardware environment than the Greek teachers. The Chinese teachers accessed more adequate and diverse hardware, including both traditional and latest ones. The Greek teachers had limited access to both traditional and new, large-screen hardware. In other words, a basic computer and the Internet were still not available in some of the classrooms. Moreover, the new and large-screen hardware did not appear in most of the classrooms. However, both the

Greek and Chinese teachers could access limited educational software and resources, especially age-appropriate and curriculum-based ones.

Teachers' ICT Use Practices in Teaching and Learning

A significant difference existed between the Chinese and Greek teachers regarding the use frequency of ICTs, types of ICTs and teaching approaches. The Chinese teachers used diverse and more frequently ICTs than their counterparts, including not only a basic computer and the Internet but also other traditional and new ICT tools. On the other hand, in the Greek context, ICTs were used as both a teaching and a learning tool to support child-centered teaching and learning. However, ICTs were only used by the Chinese teachers as a teaching tool to support teacher-centered teaching and learning.

On the contrary, ICT types, use context, years of use and time allocation of the Greek and Chinese teachers showed a similarity. Both of them preferred a "generic use" to a "subject specific use". In other words, they used general functions of ICTs more often than curriculum-based and advanced ones, although several subject-specific ICT use behaviors were also observed. The preparation and implementation stage of teaching and learning activities were the most common contexts to introduce ICTs for both of them, but the evaluation and reflection stage was still far away from the technological era. Both of them conducted a series of practices of ICT use in the informal teaching and learning context, in which teaching and learning activities took place randomly and were improvised. Both of them had at least one year's experience in using ICTs in teaching and learning and spent half of classroom activities or less using ICTs.

Although a comparison could not be made in terms of learning areas, it was found that the Greek teachers liked to apply ICTs in Theme-based Curriculum, Environmental Studies and Language, while the teachers in China preferred to introduce ICTs in Art, Theme-based Curriculum and Language.

Teachers' Attitudes toward ICT Use in Teaching and Learning

The Greek and Chinese teachers expressed conditionally positive attitudes toward ICT use in teaching and learning. They had positive attitudes, but only when teachers used ICTs moderately and appropriately. Some teachers also expressed a series of negative feelings and concerns, especially for children.

Teachers' ICT Competences

Although the Chinese teachers had higher ICT competences than the Greek teachers, the overall level of ICT competences of both of them was not high, particularly in the Technological Competences (TC). Most of them were low-level and moderate-level ICT users. Moreover, most of them also expressed strong willingness and motivation for further improvement of their existing ICT competences.

Teachers' Barriers

The main barriers encountered by both the Greek and Chinese teachers belonged to first-order barriers, which could be overcome by providing adequate conditions and support. They all mentioned large-size classes, the rapid development of technologies, technical accidents/a lack of technical support, and a lack of competences and training. In addition, a lack of sufficient hardware and the Internet, and a lack of funding were also the main barriers for the Greek teachers. The Chinese teachers also experienced the barriers like a lack of hardware and the Internet, a lack of software and resources, a lack of time, and a lack of preschool policy support. Conversely, teachers' attitudes as a second-order barrier, and parents' support and colleagues' support as external barriers, were not the main barriers for both the Greek and Chinese teachers.

Influencing Factors

A series of factors should be emphasized as influencing factors for the use of ICTs in the preschool setting: 1) external factors. They included preschool support, ICT access, in the preschool, ICT training (including both quantity and quality), and ICT attributes (usefulness and appropriateness of ICTs); 2) internal factors. Teachers' age, ICT use experiences, attitudes and concerns, barriers, competences and teaching approaches were involved.

In conclusion, the preparedness and adaptation of the Greek and Chinese preschool teachers for the information society was at a primary stage. Moreover, the level of each dimension of adaptation and preparedness was uneven.

More precisely, the Greek teachers had a high level of ICT attitudes, but the level of their ICT access and ICT competences was low. They used limited ICT tools with a relatively low frequency, but aimed to support child-centered constructivist teaching and learning. They met with a range of first-order barriers, but had overcome several crucial second-order barriers, such as teachers' attitudes toward ICT use in teaching and learning, and teachers' teaching and learning beliefs and practices.

Similarly, the Chinese teachers had a high level of ICT attitudes and a low level of ICT competences, but their level of ICT access was high. Although they had a high frequency in using a variety of ICT tools, they also stayed with the "generic use" and the teacher-centered teaching and learning paradigm, which indicated a low level of ICT use. They encountered not only first-order barriers, but also second-order barriers, particularly in terms of the transformation of teachers' teaching and learning beliefs and practices, although their attitude-barrier had been overcome.

6.2 Implications of the Findings

According to the findings of this study, a series of implications are summarized for submission to educational authorities, preschool leaders and development of training programs in Greece and China.

6.2.1 Offering Adequate and Easy-to-access Hardware

For the Greek teachers who had limited ICT access in the classroom, they should first be offered with basic ICT hardware, including a computer, Internet access and a digital camera. If the director and the teachers of the preschool want to make further progress, a greater number of computers, at least a large-screen tool (e.g. a projector, an interactive whiteboard), and a series of latest equipment (e.g. tablets, smartphones, etc.) are also needed in the classroom.

Even though the Chinese teachers had accessed a broad range of ICT hardware, their ICT hardware condition should also be improved, especially for the teachers who had access problems. Measures recommended include: 1) providing steady Internet in the classroom; 2) repairing and updating broken and obsolete hardware; and 3) placing hardware in an easy-to-access place.

6.2.2 Developing and Offering Professional Software and Resources

More age-appropriate and curriculum-based ICT software and multimedia resources have to be developed and provided to both the Greek and Chinese teachers (Kazakou, Soulis, Morfidi, & Mikropoulos, 2011; Kekkeris & Paliokas, 2005; Toki, Pange, & Mikropoulos, 2012; Toki, Zakopoulou, & Pange, 2014), including educational CD-ROMs, online multimedia databases, curriculum-based multimedia courseware, online applications, children's websites, etc.

6.2.3 Providing Systematic Support

More comprehensive and systematic support should be offered to preschool teachers (Eteokleous, 2005). Except for the support for relevant hardware and software, many other interventions, including policy support, training support, technical support (Papachristos, Vrellis, Natsis, & Mikropoulos, 2014), pedagogical support, time support (Papachristos, Vrellis, Natsis, & Mikropoulos, 2014) and support for the class size, should also be considered.

6.2.4 Organizing Quality and Continuous Training

More ICT training, including pre-service and in-service training, should be conducted. These training should take into account not only their quantity, but also their quality and sustainability (Eteokleous-Grigoriou, Anagnostou, & Tsolakidis, 2011).

First, stratified training may be a solution. Teachers are grouped based on different levels of competences (often related with teachers' age) and training is delivered with different educational content.

Second, training should be continuous and regular. Due to the rapid development of ICTs, teachers should be informed of the latest ICT tools and how to use them to support preschool teaching and learning activities.

Third, both technical and pedagogical competences should be highlighted. On the one hand, training should train teachers on how to operate and use ICT tools. On the other hand, training should also inform teachers on how to integrate ICT tools into regular teaching and learning practices.

Last but not the least, training also needs to involve the attitude dimension. That is, it needs to cultivate teachers' positive attitudes towards the benefits of ICTs in teaching

and learning, the appropriateness of ICTs for preschool teaching and learning and the necessity to introduce ICTs into teaching and learning activities. Meanwhile, teachers' concerns and negative attitudes should also be emphasized and overcome.

6.2.5 Emphasizing Teachers' Successful Experiences in Practice

More opportunities should be provided for teachers to experience the role of ICTs and the benefits of ICTs and how to use effectively ICTs in teaching and learning practices. It is of great importance for training programs to offer more practical opportunities and best practices for teachers. It is also quite crucial to encourage and guide teachers to use ICTs in real teaching and learning practices.

6.2.6 Transforming the Traditional Teaching and Learning Paradigm

A lot of learning theories may be applied to ICT use in the preschool setting (Pange & Kontozisis, 2001). The constructivist teaching and learning approach was found to have a positive impact on teachers' attitudes, competences and perceptions of barriers. It is also a feature of the higher level of ICT use practices in teaching and learning. Therefore, it is quite crucial for teachers to transform traditional teacher-centered teaching and learning beliefs and practices to child-centered constructivist teaching and learning beliefs and practices (Toki & Pange, 2014; Toki & Pange, 2013). This is more important and urgent for the Chinese teachers.

6.3 Limitations of the Study

There are two main limitations to this study. The first limitation pertains to the data selection of the research design. This study used a case study methodology. It selected a middle-level city in the economic and technological development from each country. Besides, only the teachers who worked in public preschools of urban areas and taught 4- to -6-year-olds were sampled. Thus, this research design has some limitations in the

generalization of the findings.

The second limitation is related to the selection of participants to be interviewed. The convenience sampling and authority arrangement was used to select the participants in the interview, especially in the Chinese context. This may lead to sampling biases. For example, the principals of preschools prefer to promote good example teachers to the researcher.

6.4 Recommendations for Future Studies

A range of research perspectives can be conducted in future studies. First, the same study can be extended to multiple samples in order to validate and enrich the findings of this study. Future samples can involve not only teachers in public preschools but also teachers in private preschools, not only teachers in urban areas but also teachers in rural areas, not only teachers in middle-level cities but also teachers in high-level and low-level cities, and not only teachers teaching children aged 4 to 6 years old but also teachers teaching children under 4 years old, especially those providing services for children under 2 years old.

Second, the quasi-experimental research and action research can be used in the future. The former can be used to test the effect of a new ICT tool on teaching and learning activities, and the latter can be used in order to examine or solve some practical issues when a new tool is introduced into teaching and learning practices.

Third, future studies can focus on more specific studies. They can examine a certain ICT tool or a category of ICT tools, especially the latest ones, such as smartphones, tablets, interactive whiteboards, interactive televisions, educational software, etc.

Fourth, more factors can be examined. This study only looked into teacher-level and preschool-level factors. More influencing factors can be involved in the future, such

as child-related factors (e.g. children's family experiences of ICT use, attitudes toward ICT use and ICT competences), teacher-related factors (e.g. teachers' innovativeness, self-efficacy of ICT use and pedagogical beliefs), preschool-related factors (e.g. ICT policy in the preschool, preschool leadership, preschool culture), as well as contextual factors (e.g. social and cultural perceptions of ICT use)

Fifth, the existing theory models, such as the Technology Acceptance Model (TAM) (Davis, 1989) and Task-Technology Fit Model (TTF) (Goodhue & Thompson, 1995), can also be used in the future in order to test their validity and appropriateness for preschool teachers.

Last but not the least, the future research can involve children into research process. Recent years have witnessed an emphasis on the "Mosaic Approach", which values young children's perspectives and acknowledges both young children and adults as co-constructors of meaning (Clark & Moss, 2011; Σοφού & Μαρτίδου, 2012).

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Appendix 1 Greek Version of the Questionnaire

Ερωτηματολόγιο για τη χρήση ΤΠΕ ως ενίσχυση της διδασκαλίας στο νηπιαγωγείο

Αυτή η έρευνα αποσκοπεί στη διερεύνηση της χρήσης των ΤΠΕ από τους εκπαιδευτικούς που εργάζονται στα νηπιαγωγεία των Ιωαννίνων. Η συμμετοχή σας είναι σε εθελοντική βάση και θα είναι ανώνυμη. Η ενεργή σας συμμετοχή θα εκτιμηθεί ιδιαίτερα. Σας ευχαριστώ πολύ για το χρόνο σας.

Μέρος 1ο: Γενικές πληροφορίες (σημειώστε ή συμπληρώστε μια απάντηση για κάθε θέμα)

1. Το φύλο σας:
☐Άρρεν ☐Θήλυ

2. Η ηλικία σας:
☐30 ή λιγότερο ☐31-35 ☐36-45 ☐46-55 ☐Πάνω από 55

3. Ποιο είναι το επίπεδο σπουδών σας;
☐Δευτεροβάθμιας εκπαίδευσης ☐Πτυχίο πανεπιστημίου/ΤΕΙ
☐Μεταπτυχιακό ☐Διδακτορικό

4. Πόσο καιρό διδάσκετε στα νηπιαγωγεία; …… χρόνο (ια)

5. Σε τι είδους νηπιαγωγείου διδάσκετε;
☐Δημόσιο ☐Ιδιωτικό

6. Σε ποια τοποθεσία είναι το νηπιαγωγείο σας;
☐Αστική ☐Προαστιακή ☐Αγροτική

7. Το πρόγραμμα του νηπιαγωγείου σας είναι κανονικού ή ολοήμερου προγράμματος;
☐Κανονικού ☐Ολοήμερου

8. Πόσοι νηπιαγωγοί είναι στη τάξη σας (εκτός από τους κοινωνικούς λειτουργούς); ……

9. Πόσα παιδιά είναι στη τάξη σας; ……

10. Σε ποιες ηλικίες παιδιών διδάσκετε πρόσφατα; …… χρονών

11. Πόσες ώρες διδάσκετε ημερησίως; …… ώρες

Μέρος 2ο: Προηγούμενη εμπειρία στις ΤΠΕ (Σημειώστε ένα κουτί σε κάθε γραμμή)

12. Πόσο συχνά χρησιμοποιείτε τις παρακάτω τεχνολογίες στη καθημερινή σας ζωή (π.χ. σπίτι, δημόσια βιβλιοθήκη, ιντερνέτ καφέ);

	Δεν έχω πρόσβαση	Έχω πρόσβαση αλλά δεν τις χρησιμοποιώ ποτέ	1-3 φορές το μήνα	1-2 φορές τη βδομάδα	3-4 φορές τη βδομάδα	Σχεδόν καθημερινά
Τηλεόραση/DVD player	☐	☐	☐	☐	☐	☐
Επιτραπέζιος/φορητός Η/Υ	☐	☐	☐	☐	☐	☐
Ταμπλέτα (Tablet)	☐	☐	☐	☐	☐	☐
Ιντερνέτ	☐	☐	☐	☐	☐	☐
Βιντεοπαιχνίδια	☐	☐	☐	☐	☐	☐
Έξυπνο κινητό τηλέφωνο	☐	☐	☐	☐	☐	☐
Ψηφιακή κάμερα/βινεοκάμερα	☐	☐	☐	☐	☐	☐
MP3/MP4	☐	☐	☐	☐	☐	☐

13. Πριν γίνετε νηπιαγωγός, είχατε παρακολουθήσει κάποιο πρόγραμμα πάνω στις χρήσεις ΤΠΕ (π.χ. Η/Υ, εφαρμογές, διαδίκτυο);
☐Όχι ☐Ναι

14. Πριν γίνετε νηπιαγωγός, είχατε παρακολουθήσει κάποιο πρόγραμμα σχετικά με τη παιδαγωγική χρήση των ΤΠΕ;
☐Όχι ☐Ναι

Μέρος 3ο: Υποστήριξη από το νηπιαγωγείο (Σημειώστε ένα κουτί σε κάθε σειρά)

15. Έχετε την ακόλουθη υποστήριξη από το νηπιαγωγείο σας πάνω στη χρήση ΤΠΕ;

	Καθόλου	Λίγη	Αρκετή	Πολύ	Πάρα πολύ
Σαφής πολιτική του σχολείου για την εφαρμογή ΤΠΕ στη διδασκαλία	☐	☐	☐	☐	☐
Υλικοτεχνική υποδομή και εκπαιδευτικό λογισμικό	☐	☐	☐	☐	☐
Εκπαίδευση νηπιαγωγών	☐	☐	☐	☐	☐
Τεχνική υποστήριξη	☐	☐	☐	☐	☐
Παιδαγωγική υποστήριξη	☐	☐	☐	☐	☐
Υποστήριξη στο ωρολόγιο πρόγραμμα	☐	☐	☐	☐	☐
Άλλο	☐	☐	☐	☐	☐

Μέρος 4ο: Ενδουπηρεσική κατάρτιση (Σημειώστε ένα κουτί σε κάθε σειρά)

16. Τα τελευταία δυο χρόνια, παρακολουθήσατε καθόλου πρόγραμμα ενδουπηρεσιακής κατάρτισης;

	Όχι	Ναι
Στις γενικές χρήσεις ΤΠΕ (π.χ. Η/Υ, διαδίκτυο, εφαρμογές, πολυμέσα)	☐	☐
Τον ειδικό εξοπλισμό (π.χ. διαδραστικός πίνακας)	☐	☐
Στη παιδαγωγική χρήση των ΤΠΕ	☐	☐
Σε εκπαιδευτικό λογισμικό συγκεκριμένου θέματος	☐	☐
Κατάρτιση από εθνικούς ή τοπικούς φορείς	☐	☐

Κατάρτιση από το δικό μου σχολείο	☐	☐
Προσωπική εκμάθηση μέσω online μαθήματα /μέσω επαγγελματικών διαδικτυακών κοινοτήτων	☐	☐

17. Πόσο σας ωφέλησε η ενδουπηρεσιακή κατάρτιση ως προς την εφαρμογή των ΤΠΕ στη διδακτική πράξη;
☐Δεν παρακολούθησα ☐Καθόλου ☐Λίγο ☐Αρκετά ☐Πολύ ☐Πάρα πολύ

Μέρος 5ο: Πρόσβαση των νηπιαγωγών και χρήση των ΤΠΕ στη διδασκαλία

18. Όταν διδάσκετε στη τάξη, πόσο συχνά χρησιμοποιείτε τις παρακάτω τεχνολογίες;

Σημειώστε ένα κουτί σε κάθε σειρά	**Δεν έχω στη τάξη μου**	**Έχω αλλά δε χρησιμοποιώ σχεδόν ποτέ**	**1-3 φορές το μήνα**	**1-2 φορές τη βδομάδα**	**3-4 φορές τη βδομάδα**	**Σχεδόν καθημερινά**
Τηλεόραση/DVD player	☐	☐	☐	☐	☐	☐
Επιτραπέζιος/φορητός Η/Υ	☐	☐	☐	☐	☐	☐
Ταμπλέτα (Tablet)	☐	☐	☐	☐	☐	☐
Ιντερνέτ	☐	☐	☐	☐	☐	☐
Ψηφιακή κάμερα/βιντεοκάμερα	☐	☐	☐	☐	☐	☐
Προβολέας και οθόνη	☐	☐	☐	☐	☐	☐
Διαδραστικός πίνακας	☐	☐	☐	☐	☐	☐
Έξυπνο κινητό τηλέφωνο	☐	☐	☐	☐	☐	☐
Εκπαιδευτικό λογισμικό (λογισμικό διαδικτύου ή CD-ROM)	☐	☐	☐	☐	☐	☐
Άλλο	☐	☐	☐	☐	☐	☐

19. Πόσο συχνά χρησιμοποιείτε εργαστήρι Η/Υ για τη διδασκαλία σας (Σημειώστε ένα κουτί);
☐Το νηπιαγωγείο μου δεν έχει ένα εργαστήρι Η/Υ ☐Σχεδόν ποτέ ☐1-3 φορές το μήνα
☐1-2 φορές τη βδομάδα ☐3-4 φορές τη βδομάδα ☐Σχεδόν καθημερινά

20. Πόσο καιρό εφαρμόζετε ΤΠΕ στη διδασκαλία σας (Σημειώστε ένα κουτί);
☐Δεν χρησιμοποιώ ποτέ ☐Λιγότερο από 1 χρόνο ☐Από 1 έως 3 χρόνια
☐Από 4 έως 6 χρόνια ☐Περισσότερα από 6 χρόνια

21. Σε ποιό στάδιο της διδασκαλίας χρησιμοποιείτε ΤΠΕ πιο συχνά (Διαλέξτε ό,τι εφαρμόζετε);
☐Δεν χρησιμοποιώ ποτέ ☐Στο σχεδιασμό μαθημάτων πριν το μάθημα ☐Στη διδασκαλία μέσα στην αίθουσα ☐Στη τεκμηρίωση και αξιολόγηση της διδασκαλίας κατά τη διάρκεια/μετά το πέρας της διδασκαλίας

22. Σε ποιο μάθημα χρησιμοποιείτε πιο συχνά ΤΠΕ στη διδασκαλία σας (Διαλέξτε ό,τι εφαρμόζετε);
☐Δεν χρησιμοποιώ ποτέ ☐Γλώσσα ☐Μαθηματικά ☐Περιβαλλοντικές σπουδές
☐Έκφραση και δημιουργία ☐Επιστήμη υπολογιστών ☐Διαθεματική διδασκαλία

23. Όταν κάνετε διδασκαλία με χρήση ΤΠΕ, πόση ώρα αφιερώνετε στη χρήση ΤΠΕ (Σημειώστε ένα κουτί);
☐Δεν χρησιμοποιώ ποτέ ☐25% ή λιγότερο από το μάθημα ☐26% έως 50% του μαθήματος
☐51% έως 75% του μαθήματος ☐Περισσότερο από 75% του μαθήματος ☐ Εξαρτάται

24. Όταν κάνετε διδασκαλία με χρήση ΤΠΕ, πόσο συχνά χρησιμοποιείτε τις παρακάτω διδακτικές προσεγγίσεις;

Διαλέξτε ένα κουτί σε κάθε σειρά	**Δεν χρησιμοποιώ ποτέ ΤΠΕ**	**Δεν χρησιμοποιώ ποτέ αυτή τη προσέγγιση**	**Λίγο**	**Μερικές φορές**	**Πολύ**	**Πάρα πολύ**
Αυτενέργεια του μαθητή	☐	☐	☐	☐	☐	☐
Συνεργατική μάθηση	☐	☐	☐	☐	☐	☐
Διερευνητική μάθηση	☐	☐	☐	☐	☐	☐

Μέρος 6ο: Συμπεριφορές των νηπιαγωγών ως προς τη χρήση ΤΠΕ στη διδασκαλία

25. Κατά πόσο συμφωνείτε με τα παρακάτω ως προς τη χρήση ΤΠΕ στην διδασκαλία (Σημειώστε ένα κουτί);

Διαφωνώ απολύτως = 1; Διαφωνώ = 2; Ουδέτερος-η = 3; Συμφωνώ = 4; Συμφωνώ απολύτως = 5	**1**	**2**	**3**	**4**	**5**
ΤΠΕ μπορεί να προσφέρει μια καλύτερη μαθησιακή εμπειρία για τα παιδιά	☐	☐	☐	☐	☐
ΤΠΕ συμβάλλει καλύτερα στην θεωρητική κατάκτηση της γνώσης	☐	☐	☐	☐	☐
ΤΠΕ μπορεί να αναπτύξει τις ανώτερες δεξιότητες των παιδιών (π.χ. κριτική σκέψη, επίλυση προβλημάτων, δημιουργικότητα)	☐	☐	☐	☐	☐
ΤΠΕ μπορεί να βελτιώσει τη τεκμηρίωση και την αξιολόγηση της μαθησιακής διαδικασίας	☐	☐	☐	☐	☐
Η χρήση ΤΠΕ θα πρέπει να λάβει υπόψη τις ικανότητες, ανάγκες και ενδιαφέροντα των παιδιών	☐	☐	☐	☐	☐
Η χρήση ΤΠΕ θα πρέπει να ενθαρρύνει τα παιδιά να διαμορφώσουν τις δικές τους γνώσεις	☐	☐	☐	☐	☐
Η χρήση ΤΠΕ θα πρέπει να υποστηρίζει τη συνεργατική μάθηση των παιδιών	☐	☐	☐	☐	☐
Οι εκπαιδευτικοί είναι υποστηρικτές και καθοδηγητές της μάθησης με χρήση ΤΠΕ των παιδιών	☐	☐	☐	☐	☐
Η χρήση ΤΠΕ στη διδασκαλία δε με φοβίζει	☐	☐	☐	☐	☐
Μου αρέσει να χρησιμοποιώ ΤΠΕ στη διδασκαλία	☐	☐	☐	☐	☐
Δυσκολεύομαι στη χρήση ΤΠΕ στη διδασκαλία	☐	☐	☐	☐	☐
Θα χρησιμοποιούσα ΤΠΕ στη διδασκαλία στο προσεχές μέλλον	☐	☐	☐	☐	☐

Μέρος 7ο: Ικανότητες των νηπιαγωγών ως προς τη χρήση ΤΠΕ στη διδασκαλία (Σημειώστε ένα κουτί)

26. Πόσο καλά τα καταφέρνετε στους παρακάτω τομείς ως προς τη χρήση ΤΠΕ στην διδασκαλία;

Διαφωνώ απολύτως = 1; Διαφωνώ = 2; Ουδέτερος-η = 3 Συμφωνώ = 4; Συμφωνώ απολύτως = 5	**1**	**2**	**3**	**4**	**5**
Διαθέτω τις τεχνικές δεξιότητες για την αποτελεσματική χρήση των ΤΠΕ	☐	☐	☐	☐	☐
Μπορώ να διευθετήσω μόνος μου τυχόν τεχνικά ζητήματα που θα προκύψουν	☐	☐	☐	☐	☐
Μπορώ να βοηθήσω τα παιδιά στη χρήση ΤΠΕ προκειμένου να προγραμματίσουν και να επιβλέπουν τα ίδια τη μαθησιακή τους διαδικασία	☐	☐	☐	☐	☐
Μπορώ να βοηθήσω τα παιδιά στη χρήση ΤΠΕ προκειμένου να οικοδομήσουν τις δικές τους γνώσεις	☐	☐	☐	☐	☐

Μπορώ να βοηθήσω τα παιδιά να χρησιμοποιούν ΤΠΕ προκειμένου να μάθουν συνεργατικά	☐	☐	☐	☐	☐
Μπορώ να χρησιμοποιήσω το λογισμικό που είναι ειδικά διαμορφωμένο για ένα συγκεκριμένο μάθημα	☐	☐	☐	☐	☐
Μπορώ να χρησιμοποιήσω τη κατάλληλη τεχνολογία για τη παρουσίαση περιεχομένου από ένα συγκεκριμένο μάθημα	☐	☐	☐	☐	☐
Μπορώ να επιλέξω τη κατάλληλη τεχνολογία που ενισχύει τι διδάσκω, πως διδάσκω και τι μαθαίνουν τα παδιά	☐	☐	☐	☐	☐
Μπορώ να σχεδιάσω μαθήματα που ενσωματώνουν επαρκώς το περιεχόμενο, τη τεχνολογία και την παιδαγωνική για την αυτενέργεια των παιδιών	☐	☐	☐	☐	☐

Μέρος 8ο: Δυσκολίες στην εφαρμογή ΤΠΕ στη διδασκαλία

27. Συναντάτε τις ακόλουθες δυσκολίες όταν κάνετε χρήση ΤΠΕ στη διδασκαλία σας;

Σημειώστε ένα κουτί σε κάθε σειρά	**Ποτέ**	**Λίγο**	**Αρκετά**	**Πολύ**	**Πάρα πολύ**
Ανεπαρκής εξοπλισμός, λογισμικό ή σύνδεση στο ιντερνέτ	☐	☐	☐	☐	☐
Ανεπαρκής εκπαίδευση ως προς τη παιδαγωγική χρήση ΤΠΕ	☐	☐	☐	☐	☐
Ανεπαρκής τεχνική υποστήριξη	☐	☐	☐	☐	☐
Ανεπαρκής παιδαγωγική υποστήριξη	☐	☐	☐	☐	☐
Έλλειψη διαθέσιμου χρόνου για την εκμάθηση και χρήση ΤΠΕ στη διδασκαλία	☐	☐	☐	☐	☐
Μεγάλος αριθμός μαθητών	☐	☐	☐	☐	☐
Οι συνάδελφοί μου δεν είναι υποστηρικτές της χρήσης ΤΠΕ στην διδασκαλία	☐	☐	☐	☐	☐
Οι περισσότεροι γονείς δεν υποστηρίζουν τη χρήση ΤΠΕ	☐	☐	☐	☐	☐
Η ανικανότητα των μαθητών στη σωστή χρήση ΤΠΕ	☐	☐	☐	☐	☐
Η τεχνολογία αλλάζει πολύ γρήγορα	☐	☐	☐	☐	☐
Δεν διαθέτω τόσες ικανότητες στη χρήση ΤΠΕ	☐	☐	☐	☐	☐
Δεν καταλαβαίνω τα οφέλη ως προς τη χρήση ΤΠΕ	☐	☐	☐	☐	☐
Είναι πολύ δύσκολο για μένα να χρησιμοποιήσωΤΠΕ	☐	☐	☐	☐	☐
Το νηπιαγωγείο μου δεν έχει μια παρόμοια πολιτική υποστήριξης ΤΠΕ	☐	☐	☐	☐	☐
Απουσία υποστήριξης από ένα εθνικό/τοπικό εκπαιδευτικό φορέα	☐	☐	☐	☐	☐

Σας ευχαριστώ για το χρόνο σας!

Αγαπητή/έ Νηπιαγωγέ,

Σας παρακαλώ, αν έχετε την καλωσύνη και το χρόνο, να δώσετε μια μικρή συνέντευξη ή οποία θα με βοηθούσε στην έρευνα με τίτλο <**Η χρήση ΤΠΕ των νηπιαγωγών στην διδασκαλία**>. Η συνέντευξη διαρκεί περίπου 20 λεπτά. Αν είναι δυνατό, μπορεί να γίνει στο χώρο του νηπιαγωγείου που δουλεύετε.

Σημείωση:
Η συμμετοχή σας είναι σε εθελοντική βασή και θα είναι ανώνυμη. Τα στοιχεία από την συνέντευξη είναι μόνο για την ερευνητική χρήση. **Σαν ανταπόδοση για την βοήθειά σας, θα δώσουμε ένα CD με κινέζικα παιδικά τραγούδια**.

Για την εθελοντική συμμετοχή σας στην συνέντευξη, παρακαλώ να σημειώσετε τα στοιχεία επικοινωνίας ως εξής

Όνομα: _____

Νηπιαγωγείο: _____

Τηλέφωνο ή κινητό: _____

Appendix 2 Chinese Version of the Questionnaire

关于幼儿教师在教学活动中使用信息技术的问卷调查

尊敬的幼儿老师：

您好！为了解长春市幼儿教师在教学活动中使用信息技术的现状、态度和能力，我们设计了本次问卷。本问卷中的信息技术涵盖多种设备和服务，包括电视、DVD、数码相机/录像机、投影仪、台式/手提电脑、互联网、电子白板、平板电脑、智能手机、教育软件等。本问卷采用匿名形式，调查结果仅为研究之用。非常感谢您从百忙之中抽出时间参与本次调查。

第一部分：基本信息（请您勾选或填写一个答案）

1. 您的性别：
☐男　　☐女

2. 您的年龄：
☐30 岁及以下　　☐31-35 岁　　☐36-45 岁　　☐46-55 岁　　☐55 岁以上

3. 您的最高学历：
☐本科以下　　☐本科　　☐硕士　　☐博士

4. 您作为幼儿教师的时间： …… 年

5. 您所在的幼儿园属于：
☐公立　　☐私立

6. 您所在的幼儿园位于：
☐市区　　☐郊区　　☐农村

7. 您所在的班级有几位幼儿教师（不包括保育员）？ …… 位

8. 您所在的班级有多少名幼儿？ …… 名

9. 您目前所在班级的幼儿所属的年龄段为： …… 岁

10. 您每天在幼儿园工作的时间为： ..... 小时

第二部分：教师的信息技术使用经历（每行请您勾选一个答案）

11. 您在日常生活中使用下列信息技术设备或服务的频率为（如在家、公共图书馆、网吧等，但不包括幼儿园）：

	我不能获得此设备或服务	我能获得，但从不使用	每月 1-3 次	每周 1-2 次	每周 3-4 次	几乎每天
电视或 DVD 播放机	☐	☐	☐	☐	☐	☐
台式电脑或手提电脑	☐	☐	☐	☐	☐	☐
平板电脑	☐	☐	☐	☐	☐	☐
互联网	☐	☐	☐	☐	☐	☐
电子游戏机	☐	☐	☐	☐	☐	☐
智能手机	☐	☐	☐	☐	☐	☐
数码相机或数码录像机	☐	☐	☐	☐	☐	☐
MP3 或 MP4 播放器	☐	☐	☐	☐	☐	☐

12. 在成为幼儿教师之前，您是否参加过信息技术基本知识和技能方面的课程（学校开设或其他的私立机构开设的有关使用电脑、网络、基本的应用软件等方面的课程）？

☐否 ☐是

13. 在成为幼儿教师之前，您是否参加过有关教学活动中使用信息技术方面的课程（学校开设或其他的私立机构开设的相关课程）？

☐否 ☐是

第三部分：幼儿园层面的支持（每行请您勾选一个答案）

14. 在教学活动中使用信息技术方面，您从所在幼儿园获得以下支持的情况为：

	没有	很少	一些	很多	非常多
幼儿园层面关于教学中使用信息技术的规定	☐	☐	☐	☐	☐
提供相关的硬件、互联网和教育软件	☐	☐	☐	☐	☐
有关教学活动中使用信息技术的教师培训	☐	☐	☐	☐	☐
技术支持（指教师在日常教学中遇到技术上的问题时，能够得到幼儿园的帮助和解决，如配有信息技术方面的专业人员等）	☐	☐	☐	☐	☐
教学支持（指教师遇到如何将信息技术应用或融合到日常教学活动中的问题时，能够得到幼儿园的帮助和解决，如利用具体的学习领域的教育软件、利用信息技术呈现教学内容等）	☐	☐	☐	☐	☐
时间支持（培训的时间、使用的时间等）	☐	☐	☐	☐	☐
其他	☐	☐	☐	☐	☐

第四部分：教师的在职培训（每行请您勾选一个答案）

15. 在过去的两年中，您参加过以下方面的在职培训吗？

	没有	有
有关信息技术应用的基本知识和技能的培训（如电脑、互联网、应	☐	☐

用软件、多媒体等）		
针对具体设备的培训（如交互性白板等）	☐	☐
有关如何将信息技术应用到教学活动中的培训	☐	☐
针对具体学习领域的教育软件的培训	☐	☐
国家或地方教育部门提供的培训（以上的四种培训内容涉及一种或多种）	☐	☐
所在幼儿园提供的相关培训（以上的四种培训内容涉及一种或多种）	☐	☐
通过网络课程或网上专业社群进行的个人自主学习（以上的四种培训内容涉及一种或多种）	☐	☐

16. 您认为您所参加的在职培训（指 15 题所涉及的培训）对您在教学实践中使用信息技术有多大帮助？

☐我没有参加过在职培训　☐没有帮助　☐很少　☐一些　☐很多　☐非常多

第五部分：教师在教学活动中对信息技术的获得和使用

17. 当您在教室中开展教学活动时，您使用下列信息技术设备或服务的频率为（每行请您勾选一个答案）：

	我的教室不能获得	我的教室能获得，但我从不使用	每月 1-3 次	每周 1-2 次	每周 3-4 次	几乎每天
电视或 DVD 播放机	☐	☐	☐	☐	☐	☐
台式电脑或手提电脑	☐	☐	☐	☐	☐	☐
平板电脑	☐	☐	☐	☐	☐	☐
互联网	☐	☐	☐	☐	☐	☐
数码相机或数码录像机	☐	☐	☐	☐	☐	☐
投影仪及其屏幕	☐	☐	☐	☐	☐	☐
交互性白板	☐	☐	☐	☐	☐	☐
智能手机	☐	☐	☐	☐	☐	☐
教育软件（网络软件或 CD）	☐	☐	☐	☐	☐	☐
其他	☐	☐	☐	☐	☐	☐

18. 您在教学活动中使用独立的电脑教室或多媒体教室的频率为（请您勾选一个答案）：

☐我所在幼儿园没有电脑教室或多媒体教室　☐我所在幼儿园有，但我几乎不用　☐每月 1-3 次
☐每周 1-2 次　☐每周 3-4 次　☐几乎每天

19. 您在教学活动的哪个阶段使用信息技术较为频繁（多选题）？

☐我从不使用　☐课前教学设计阶段　☐课堂教学
☐课上及课后对教与学的记录和评价

20. 您在教学活动中使用信息技术的时间为（请您勾选一个答案）：

☐我从不使用　☐不到 1 年　☐1-3 年　☐4-6 年　☐6 年以上

21. 您在哪个学习领域的教学中使用信息技术较为频繁（多选题）？

☐我从不使用　☐健康　☐语言　☐社会
☐科学　☐艺术　☐主题课程

22. 当您在课堂上使用信息技术教学时，您使用信息技术的时间比例为（请您勾选一个答案）：

☐我从不使用　☐课堂时间的 25%及以下　☐课堂时间的 26%至 50%
☐课堂时间的 51%至 75%　☐课堂时间的 75%以上　☐不确定

23. 当您在课堂上使用信息技术教学时，您采用以下教学方法的频率为（每行请您勾选一个答案）：

	我从不使用信息技术	我从不采用此方法	很少	有时	很多	非常多
幼儿自主学习	☐	☐	☐	☐	☐	☐
幼儿合作学习	☐	☐	☐	☐	☐	☐
幼儿探索学习	☐	☐	☐	☐	☐	☐

第六部分：教师对教学活动中使用信息技术的态度（每行请您勾选一个答案）

24. 您同意以下关于教学活动中使用信息技术的陈述吗？

非常不同意=1；　不同意=2；　中立=3；　同意=4；　非常同意=5	1	2	3	4	5
信息技术能够为幼儿提供更好的学习体验	☐	☐	☐	☐	☐
信息技术能够促进幼儿更好地学习理论知识	☐	☐	☐	☐	☐
信息技术能够促进幼儿高级思维能力的发展（如批判性能力、问题解决能力、创造性能力等）	☐	☐	☐	☐	☐
信息技术能够更好地促进对幼儿学习的记录和评价	☐	☐	☐	☐	☐
在教学活动中使用信息技术应该考虑幼儿的能力、需求和兴趣	☐	☐	☐	☐	☐
在教学活动中使用信息技术应该鼓励幼儿建立自己的知识体系	☐	☐	☐	☐	☐
在教学活动中使用信息技术应该支持幼儿之间的合作学习	☐	☐	☐	☐	☐
当幼儿通过信息技术自主学习时，教师应扮演支持者和引导者的角色	☐	☐	☐	☐	☐
我不害怕在教学活动中使用信息技术	☐	☐	☐	☐	☐
我喜欢在教学活动中使用信息技术	☐	☐	☐	☐	☐
我感觉在教学活动中使用信息技术很难	☐	☐	☐	☐	☐
在未来的教学活动中，我将定期地使用信息技术	☐	☐	☐	☐	☐

第七部分：教师在教学活动中使用信息技术的能力（每行请您勾选一个答案）

25. 您同意您具备下列有关教学活动中使用信息技术的能力吗？

非常不同意=1；　不同意=2；　中立=3；　同意=4；　非常同意=5	1	2	3	4	5
我具备技术层面的知识和能力来有效地使用信息技术	☐	☐	☐	☐	☐
在使用信息技术时，我能够解决自身遇到的技术性问题	☐	☐	☐	☐	☐
我能够帮助幼儿通过使用信息技术来计划和监督他们自身的学习活动	☐	☐	☐	☐	☐
我能够帮助幼儿通过使用信息技术来建立他们自身的知识体系	☐	☐	☐	☐	☐
我能够帮助幼儿通过使用信息技术来开展合作学习	☐	☐	☐	☐	☐
我能够使用一些为具体的学习领域设计的教育软件	☐	☐	☐	☐	☐
我能够使用合适的信息技术来呈现某一学习领域的内容	☐	☐	☐	☐	☐
我能够选择合适的信息技术来增强教学内容、教学方式以及幼儿的学习活动	☐	☐	☐	☐	☐
在教学设计时，我能够合理地融合教学内容、信息技术和教学方法，来促进幼儿主导的学习活动	☐	☐	☐	☐	☐

第八部分：教师在教学活动中使用信息技术所遇到的障碍（每行请您勾选一个答案）

26. 您在教学活动中使用信息技术时，遇到过以下障碍吗？

	没有	很少	有时	很多	非常多
缺乏足够的硬件、网络和软件	☐	☐	☐	☐	☐
缺乏如何在教学活动中使用信息技术的培训	☐	☐	☐	☐	☐
缺乏**技术方面的支持（解释同第三部分 14 题）**	☐	☐	☐	☐	☐
缺乏**教学方面的支持（解释同第三部分 14 题）**	☐	☐	☐	☐	☐
缺少时间去学习和使用信息技术	☐	☐	☐	☐	☐
班级幼儿的数量较多	☐	☐	☐	☐	☐
我的同事不支持在教学活动中使用信息技术	☐	☐	☐	☐	☐
大部分家长不支持在教学活动中使用信息技术	☐	☐	☐	☐	☐
幼儿还没有具备合理地使用信息技术的能力	☐	☐	☐	☐	☐
信息技术变化得太快	☐	☐	☐	☐	☐
我自身缺乏在教学活动中使用信息技术的能力	☐	☐	☐	☐	☐
我看不到在教学活动中使用信息技术的益处	☐	☐	☐	☐	☐
在教学中使用信息技术对我来说很难	☐	☐	☐	☐	☐
我所在的幼儿园没有关于教学活动中使用信息技术的规定	☐	☐	☐	☐	☐
国家或地方教育行政部门缺少关于教学活动中使用信息技术的支持	☐	☐	☐	☐	☐

再次感谢您的参与，祝您工作顺利，生活幸福！

尊敬的幼儿园老师：

您好！本研究在后续阶段将对个别老师进行个人访谈，我们真诚地邀请您的参与。访谈的题目为**《幼儿教师在教学活动中对信息技术的使用》**。访谈时间大约为**20分钟**。访谈地点**以您的方便为主**。

提示：

本访谈为老师自愿参与，访谈结果仅为研究之用。对您及您幼儿园的信息，我们会绝对保密。**此外，对积极参与的老师，我们会赠与一份精美的礼物。**

想要参加此次访谈的老师，请您在下列表格中留下您的联系方式，我们将在日后与您联系。

姓　名：_____
幼儿园：_____
联系电话或手机：_____

再次感谢您的关注与参与！

Appendix 3 Greek Version of the Interview Schedule and Questions

Ερωτήσεις για τη Συνέντευξη

1. Πρόγραμμα μαθημάτων

(1) Πώς προγραμματίζετε τις καθημερινές σας διδακτικές δραστηριότητες;

2. Πραγματικές πρακτικές

(2) Τι είδους τεχνολογιών έχετε στην τάξη σας;

(3) Το δικό σας νηπιαγωγείο έχει εργαστήριο υπολογιστών ή αίθουσα πολυμέσων; Αν ναι, σε τι περιπτώσεις χρησιμοποιείτε;

(4) Χρησιμοποιείτε τεχνολογίες για να προετοιμάσετε τις δραστηριότητες πριν το μάθημα; Αν ναι, για τί πράγματα χρησιμοποιείτε;

(5) Χρησιμοποιείτε τεχνολογίες για να διδάξετε μέσα στην τάξη; Αν ναι, τι είδους τεχνολογιών χρησιμοποιείτε; Θα μπορούσατε να δώσετε δύο παραδείγματα για να περιγράψετε αυτήν την διδακτική διαδικασία;

(6) Χρησιμοποιείτε τεχνολογίες για να αξιολογήσετε τη διδακτική διαδικασία μετά το μάθημα; Αν ναι, πώς κάνετε;

(7) Χρησιμοποιείτε τεχνολογίες για άλλες μαθησιακές και διδακτικές δραστηριότητες; Αν ναι, ποία τεχνολογία χρησιμοποιείτε; Για ποίες δραστηριότητες;

3. Απόψεις

(8) Ποία είναι η γνώμη σας για να χρησιμοποιείτε την τεχνολογία στην διδασκαλία και την μάθηση του νηπιαγωγείου;

(9) Ποία είναι η γνώμη σας πάνω στην επιρροή της τεχνολογίας για την δική σας διδασκαλία;

(10) Ποία είναι η γνώμη σας πάνω στην επιρροή της τεχνολογίας για την μάθηση των παιδιών;

(11) Έχετε ανησυχίες στο να χρησιμοποιείτε την τεχνολογία στη διδασκαλία και τη μάθηση;

(12) Πώς αισθάνεστε όταν χρησιμοποιείτε την τεχνολογία στη διδασκαλία και τη μάθηση;

4. Ικανότητες

(13) Πώς αισθάνεστε για τις ικανότητες σας όταν χρησιμοποιείτε την τεχνολογία στη διδασκαλία και τη μάθηση; Ποία στοιχεία θα θέλατε να βελτιώσετε;

(14) Έχετε παρακολουθήσει κάποια κατάρτιση πάνω στην χρήση της τεχνολογίας στην διδασκαλία και την μάθηση; Αν ναι, θα μπορούσατε να το περιγράψετε λεπτομερώς; Τι πιστεύετε για τα αποτελέσματα τους; Έχετε μήπως ορισμένες συμβουλές για κάποια μελλοντική κατάρτιση;

5. Εμπόδια που αντιμετώπισαν οι δάσκαλοι.

(15) Τι είδους εμπόδιων ή προβλημάτων συναντήσατε όταν χρησιμοποιήσατε τεχνολογία για τη διδασκαλία και τη μάθηση των παιδιών;

6. Στήριξη

(16) Το νηπιαγωγείο σας στηρίζει για να χρησιμοποιήσετε την τεχνολογία στη διδασκαλία και τη μάθηση; Αν ναι, ποία μέτρα έχει λάβει; Ποία περαιτέρω στήριξη χρειάζεστε ακόμα;

7. Βασικές πληροφορίες

(17) Φύλο：

Ηλικία:

Χρόνια διδασκαλίας στο νηπιαγωγείο:

Επίπεδο σπουδών:

Ηλικία παιδιών:

Αριθμός παιδιών:

Αριθμός νηπιαγωγών:

Appendix 4 Chinese Version of the Interview Schedule and Questions

幼儿园教师访谈提纲

1. 引入语

（1）自我介绍；

（2）介绍访谈的用途和目的；

（3）解释“信息技术”的范围：包括电视、DVD、数码相机、数码录像机、台式电脑、手提电脑、平板电脑、网络、智能手机、MP3/MP4、电子白板、投影仪、网上的教育软件、CD/DVD 光盘等；

（4）阐明访谈的保密性和匿名性；

（5）征求录音的许可。

2. 背景性问题

（1）您能介绍一下您班级的一日生活是如何安排的吗？

3. 教师在教学活动中使用信息技术的状况

（2）在您的教室中，都有哪些信息技术？

（3）您的幼儿园有多媒体教室吗？如果有，您一般在什么情况下使用？

（4）在备课阶段，您使用信息技术吗？都使用什么？如何使用？可以举例说明吗？

（5）在上课的时候，您使用信息技术吗？都使用什么？如何使用？可以举例说明吗？

（6）在课后教学评价和反思的时候，您使用信息技术吗？都使用什么？如何使用？可以举例说明吗？

（7）您还在其他的教与学活动中使用信息技术吗？如果有，是什么活动？使用了什么？如何使用？

4. 教师对教学活动中使用信息技术的态度

（8）您如何看待在幼儿园教学活动中使用信息技术这种现象？

（9）您觉得信息技术对您的教学活动有什么影响？

（10）您觉得信息技术对幼儿的学习活动有什么影响？

（11）您在教学中使用信息技术时，曾经有什么顾虑吗？

（12）您在教学中使用信息技术时，有过消极的情绪吗（如不喜欢、不情愿、排斥、困难等）？

5. 教师在教学活动中使用信息技术的能力

（13）您觉得您在教学中使用信息技术的能力怎么样？您觉得您还需要哪方面能力的提高？

（14）您参加过相关的培训吗？什么样的培训？你觉得效果怎么样？您对以后的培训有什么好的建议？

6. 教师在教学活动中使用信息技术时遇到的困难

（15）您在教学中使用信息技术时，遇到了哪些困难？

7. 幼儿园的支持

（16）您的幼儿园鼓励老师在教学活动中使用信息技术吗？如果是，都有哪些措施？您还需要其他哪些方面的支持？

8. 教师基本信息

（17）性别：

年龄：

工作年限：

教育程度：

班级幼儿的年龄：

班级幼儿的数量：

班级教师的数量：

7. 结束语

（1）询问：您对教学活动中使用信息技术还有要补充的吗？

（2）表达感谢，赠送礼物。

（3）提供联系方式。约定下次访谈的时间和地点。