Information and Communication Technology in Early Childhood Education: Challenges for effective implementation and integration

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Submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy

School of Education

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2013-2014

Dedication

First and foremost, I wish to thank my beloved family, to whom I dedicate this thesis.

To my father, for always challenging me to approach my research from different perspectives and objectively presenting other points of view; I could not have found a better devil's advocate. His support has given me inspiration to achieve my goal. I will always appreciate his efforts to mould me (successfully, I would hope) into a real researcher.

To my mother, for always lending a supportive and calming ear to my daily conversations and the endless experiences I learned during my study years; both she and her prayers have been an encouraging light in the most challenging moments of my research.

To my sisters,
Shaza, I sincerely thank for being an equal partner in our shared experience of moving so far from home together to study. Though our PhD theses are in entirely different disciplines, she has always been as patient a listener as she has been an encouraging talker.

My youngest sister, Noran, though an exhausted and busy physician, she has always found the time to cheer and delight me over the telephone with news of home.

Abstract

This is the first study in the field of Information and Communication Technology (ICT) integration into Early Childhood Education (ECE) to call upon a blended theoretical framework of Bronfenbrenner's ecological systems theory, Fullan's concepts of educational change and complexity theory. In drawing the collected data together within the framework of Bronfenbrenner's ecological systems theory, a range of linear factors that influence practitioners' use of ICT in the playroom at the micro-level (teachers' pedagogical beliefs, confidence, technological pedagogical knowledge); meso-level (local school policy, leadership, support) and macro-level (national ECE curriculum and national ICT policy) were identified.

Currently, structured research into ICT integration in ECE is completely absent in Saudi Arabia. This thesis addresses this substantial knowledge gap in the practice of ICT integration in Saudi Arabian ECE settings through a collective case study approach of Saudi Arabian programs. According to the literature, Scotland, for some time, has been at the forefront of developing strategies for the integration of ICT into early years. Policy in Scotland has also been supported by a range of literature, studies and reference to ICT use in the curriculum; that have assisted practitioners in making important pedagogical decisions for using ICT in the playroom. For these reasons, Scotland is included in this research as an example that can provide some insights for improvement in the Saudi Arabian context.

Six case studies were used to address the study's research questions: four in Jeddah city, Saudi Arabia and two in Scotland (located between Glasgow City Council and East Dunbartonshire). As part of the research's endorsement of a holistic approach, the researcher triangulated multiple research methods (questionnaire, semi-structured interview, playroom observation and documentary analysis) to investigate the status of ICT use in preschool settings and factors that influenced teachers' ICT practices. The target community was made up of practitioners in ECE settings, including head teachers and practitioners from both private and public preschools.

Research findings suggest that practitioners in both locations hold a positive perspective of the importance of ICT integration into ECE. Practitioners hope for the comprehensive improvement of ICT integration, and there is a clear desire for an explicit educational policy for ICT in preschool education and for continuous teacher training. However, enthusiasm and positive attitudes do not always lead to high levels of ICT integration. In Saudi Arabia in particular, much of the integration is achieved in an informational, teacher-centred/traditionalist manner, rather than encouraging child-centred, constructivist approaches. The results revealed that teachers' pedagogical beliefs and their relationship to teaching practices strongly influenced integration practices. Furthermore, school characteristics were equally, if not more, influential upon integration levels.

In general, in the Saudi ECE sector, the journey to ICT integration is at an initial, unstructured stage and observed attempts at integration are largely the result of practitioners' individual efforts. Scotland is more advanced in ICT integration than Saudi Arabia because it has a policy for ICT integration into ECE; however, in both sectors there exist similar factors that influence teachers' approaches to integration at both the micro- and meso-levels (practitioner confidence, ICT-based activity management skills). Investigating ICT integration into teaching and learning in the Scottish preschool case studies provides examples of child-centred learning through ICT that suggest ways of integrating ICT fruitfully into the micro-level of the playroom. The Saudi context can benefit from examining these constructivist practices.

Overall, this research provides the first detailed picture of Saudi preschool teachers' perspectives and attitudes toward ICT and will have the capacity to inform present and future ECE policy. Derived from the findings from these collective case studies, my end recommendations seek to encourage ECE practitioners to regard ICT integration as a holistic and collaborative process that encompasses the different ecosystems surrounding the playroom. The research findings reveal that ICT cannot be integrated without considering the ECE learning environment, and neither a purely bottom-up nor top-down approach to ICT integration suffices. Instead, to integrate ICT at a desirable level, a monitored and more systematic approach is called for - one that captures the intricacies of the bi-directional relationships between ecosystems that affect integration practices and encourages thinking of integration as a dynamic and continuous process. Preschool policies need to define their organisational vision and actions clearly in view of an evolutionary, rather than revolutionary, plan for change.

Keywords: Information and Communication Technology; Early Childhood Education; Preschool; ICT integration; Bronfenbrenner's ecological systems theory; Fullan's concepts of educational change; complexity theory; Saudi Arabia; Scotland

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Acknowledgment

First and foremost, I thank God (Allah) Almighty for providing me with the strength, faith and patience to pursue and accomplish my PhD.

For the past four years I have been fortunate enough to have the opportunity to devote my time entirely to the study of Early Childhood Education, and this has demanded considerable application. However, this research would not have been possible without the unerring support and constant advice of experts, colleagues, family and friends; this section I rightly dedicate to them.

I wish to express my appreciation and gratitude toward my three formal supervisors Dr. Jane Magill, Dr. Brian Canavan and Dr. Margaret Sutherland. Dr. Magill has been instrumental in this process, and I thank her for her time. Dr. Canavan has always given prompt and detailed feedback on my work; his door has always been open to me when I have needed advice. Dr. Sutherland began co-supervising me at a very critical stage, and has given a great deal of helpful suggestions to apply the finishing touches to my thesis; her support at the end was as helpful as her support at the beginning, when she set me on the right path to collect my data and introduced me to a number of obliging head teachers and preschool settings.

Secondly, I wish to recognise here the debt of gratitude I owe to the dozens of contributors to this research from both contexts: of a number of important and valued people who directly or indirectly assisted and supported me during my doctoral studies. To these people, I owe my gratitude and thanks.

Within Saudi Arabia, both the Saudi Arabian government and the King Abdul-Aziz University have been the principal sponsors of my doctorate, and for this I am truly grateful. The Ministry of Education, Jeddah Local Authority and the Early Childhood Education department must equally be thanked here for granting me permission to access the preschools under its jurisdiction and facilitating the data collection process. Within Scotland, the academic staff and technicians at the Glasgow University, School of Education and the administrative staff (particularly Mrs. Myrtle Porch) within the College of Social Sciences office are owed my wholehearted thanks for their patience, advice, and understanding, as are the Glasgow city and East Dunbartonshire LAs for facilitating my research by granting access to their preschools. I must also thank the many wonderful teachers and head teachers in both countries for demonstrating such patience and enthusiasm in assisting me with this project. I also would like to sincerely thank Ms. Karen Shepherd and Ms. Jean Stirling for their time and willingness to share their information and opinions.

I am also grateful to my friends and colleagues for their overall help and for any beneficial suggestions they made over our informal discussions.

Finally yet importantly, special thanks and appreciation are due to my family who have stood beside me, shared with me the ups and downs throughout the duration of my studies and tolerated me and provided endless encouragement, support, and patience throughout my studies.

I initially came to Glasgow to study for my doctorate, but undertaking the PhD was just a small part of the experience of finding another culture and way of life. These past years have given me the chance to develop in so many more ways than just academically; I thank everyone who has contributed to that development.

Author Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Signature: ______________________________

Printed Name: ______________________________

List of Abbreviations

AAP	American Academy of Paediatrics AAP
Becta	British educational communications and technology agency
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CPD	Continuing Professional Development
DAP	Developmentally Appropriate Practices
DATU	Developmentally Appropriate Technology Use
DATEC	Developmentally Appropriate Technology in Early Childhood
DCECE	Developed Curriculum for Early Childhood Education
ECE	Early Childhood Education
ECERS-SA	Early Childhood Education Rating Scale- Saudi Arabian version
EDC	East Dunbartonshire Council
EDCLEA	East Dunbartonshire Council Local Education Authority
FG	Focus Group
FN	Field Note
GCC	Glasgow City Council
GCCLEA	Glasgow City Council Local Education Authority
HT	Head Teacher
I	Interview
ICT	Information and Communication Technology
ISTE	International Society for Technology in Education
JLED	Jeddah Local Education Authority
KAAU	King Abdul-Aziz University
KG1	Kinder Garden level One
KG2	Kinder Garden level Two
KG3	Kinder Garden level Three
KSA	Kingdom of Saudi Arabia
LA	Local Authority
LEA	Local Education Authority
LTS	Learning and Teaching Scotland

MAP	More Able Partner
MoE	Ministry of Education
NAEYC	National Association for the Education of Young Children
OECD	Organisation for Economic Cooperation and Development
PU	Perceived Usefulness
PE	Perceived Ease of use
RAT	Reasoned Action Theory
SA	Saudi Arabia
T	Teacher
TAM	Technology Acceptance Model
TPACK	Technological Pedagogical Content Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization
ZAA	Zone of Available Assistance
ZPA	Zone of Proximal Adjustment
ZPD	Zone of Proximal Development

Chapter 1

Introduction to the Research

Chapter outline

Chapter One

Introduction to the Research

1.0. Introduction

This thesis will investigate the ways in which Information and Communication Technology (ICT) is integrated into Early Childhood Education (ECE) in an international context. It examines the complexities and variations of ICT integration into ECE from the perspectives of practitioners in Glasgow, Scotland and Jeddah City, Saudi Arabia. It considers, through questionnaires, interviews and observations, early years' practitioners' perspectives, practices, and attitudes towards ICT in order to gain a deeper insight into the phenomenon of ICT and its potential role in supporting and developing teaching and learning in ECE.

The current chapter explains the background of the research, as well as its purpose, significance and parameters. This chapter will therefore act as a foundation for the entire thesis in terms of introducing the research context, arguing why the research should be undertaken, and the aim and objectives that the research will address.

1.1. Background of the research

The Information and Communication Technology (ICT) revolution of recent times has occurred at breathtaking pace. The speedy evolution of ICT has caused significant alterations to our personal, social and work lives. We live in an 'information society' that relies upon ICT use; it is also a 'knowledge society', of intangible capital and learning, in which progress is based upon knowledge and creativity (Commission of the European Communities, 2000; Kozma, 2003; OECD, 2001; Plomp et al., 2003). There is enhanced access to new technologies and these are altering our methods of communication, how we consider ideas and enhance existing knowledge, and also how we provide entertainment (Swaminathan & Yelland, 2003).

As a result of the proliferation of ICT in society, the education agendas of world organisations emphasise the role of ICT in transforming teaching and learning (British Educational Communications and Technology Agency [Becta], 2009, 2006, 2004a & b; Organisation for Economic Cooperation and Development [OECD], 2001). The OECD claims that ‘perhaps the factor most identified as heralding fundamental change in the structure and organisation of schooling is the spreading impact of ICT on learning’ (OECD, 2001:66). Not only world organisations, but also global market companies such as Microsoft, have joined the promotion of the embedding of ICT in education (Microsoft Corporation, 2005). There is now a strong focus on the development of ICT policy and integration of ICT in curriculum and practice across the whole education sector. The majority of industrialized countries (e.g. UK, USA, Singapore and South Korea), and an increasing number of developing countries (e.g. Ethiopia, Estonia and Chile) have generated detailed national ICT strategies for the education sector. These strategies are designed with broadly the same objective; supporting the use and development of ICT for teaching and learning in primary, secondary, and higher education. The focus of these policies has largely centred on improved access and facilities within schools, requiring significant investment in computer provision and internet access, sufficient for teaching use. Resources have also been invested in providing ICT training for teachers, and revising the curriculum to support the incorporation of ICT technology into the learning environment.

In the field of ECE, the pupils at preschools are now ‘digital natives’; they are learners who take many ICT tools for granted as engaging parts of their daily routine and home life. Indeed, it was noted even 15 years ago that young children were surrounded on a daily basis by ICT tools (Tapscott, 1998). When ICT technologies were first becoming prevalent, there was some public debate about how educative and nurturing it was to integrate technology into the early learning environment, and some voices of dissent still exist to a degree (e.g. Corders & Miller, 2000, 2004). However, most of the literature now reports that ICT integration into ECE can benefit the social and cognitive skills of children (Sarama & Clements, 2002; Subrahmanyam et al., 2000; Yelland & Siraj-Blatchford, 2002).

In most countries, policy and curriculum support for the development of ICT in the ECE sector has lagged behind the school sector (O'Hara, 2004; Sheridan & Pramling Samuelsson, 2006; Stephen & Plowman, 2008), however this situation is beginning to change. Creating a suitable policy to guide ICT integration into ECE has so far only been addressed in a small number of countries in recent times. It is only in the last few years that scholarly interest has began to focus on generating an ICT policy for preschool learners and practitioners (Plowman et al., 2010, Selwyn et al. 2010). For example, the *Digital Britain* report produced by the UK Government argues that 'in education and training for digital life skills, we need a step change in approach, starting with the youngest' (BERR/ DCMS, 2009: 64). In Scotland, the policy of the *Early Years Framework* is founded upon the idea that first learning can affect adult life and even later issues of employability (Scottish Government, 2008a: 7). This belief mirrors the earlier *No Child Left Behind* (2002) legislation in the United States. Indeed, the aim of a section of this legislation is 'to assist every student in crossing the digital divide by ensuring that every student is technologically literate' (U.S Department of Education 2002: Section 2042).

Some countries, like Scotland, have developed ICT strategies for the ECE sector (Learning and Teaching Scotland, 2003b). The 'Harnessing Technology' strategy laid down for England and Wales outlines a series of technology focused priorities to reform ICT use in education and children's services. The development of ICT within preschool and primary schools is also emphasised as a principal aim of Singapore's ten year 'Intelligent Nation 2015' vision. In New Zealand, the government have released a 'digital strategy' in response to technological developments, with preschool ICT as a key component and the goal to use 'ICT meaningfully in ECE services to help children grow up as competent and confident learners and communicators' (2008). Similar priorities are also noted in Australia's 'Digital Education Revolution strategy', which outlines a commitment to establishing fibre broadband connections for all schools across the country, in addition to developing internet accessible resources for teachers and pupils, related to the curriculum. A similar interest in the digital agenda can be observed throughout Europe, from the French government's 'Digital Strategy' to Austria's ambitious 'Future Learning strategy' with its focus on implementing e-portfolios into education.

The imperative for education to keep up in the ‘technology society’ leads practitioners to be faced with a complex problem (Kirschner & Selinger, 2003; Loveless & Dore, 2002; Scrimshaw, 2004). Researchers of ICT integration into education encounter a number of issues that they need to understand more fully: ICT attitudes (van Braak et al. 2004; Albirini 2006), experience with technology (van Braak 2001; Bovée et al., 2007) and training (Tan et al., 2003; Galanouli et al., 2004). Globally, there is some literature across the field that supports ECE practitioners in making well-informed decisions about ICT integration (Buckingham, 2007; Downes et al., 2001; NAEYC, 1996; O'Hara, 2004; Siraj-Blatchford & Siraj-Blatchford, 2006; Yelland, 2008). Literature, too, concentrates on how young children use computers (Bolstad, 2004; Yelland, 2005). Some of this research focuses principally on children’s interactions with the technology. While other studies have viewed children’s interactions with the technology in a wider social context that includes practitioners, parents, and the ECE setting.

Studying the contemporary literature shows that there has been a notable surge in research and writing on the use of ICT in ECE, particularly in New Zealand, United States and UK. However, there remains insufficient thorough literature in the international research community. A review of Scottish literature relating to ICT in ECE suggested that there was a ‘scarcity of good quality research findings on using ICT in educational settings for preschool children’ (Stephen & Plowman, 2003b; Stephen & Plowman, 2002). A universal criticism of using technology as a tool to support learning in ECE is the lack of empirical research (Couse & Chen, 2010; Schmidt & Vandewater, 2008; Yelland, 2008), where some of the outcomes of ICT research draw on and recycle a limited number of older studies. Plowman et al. (2010) state that while it is widely accepted that the opportunities and challenges brought by technologies should be addressed for the years of compulsory schooling, especially for older children who will enter employment more imminently, there has, so far, been less attention to the period before children start school. Shore (2008) calls for more research into how young children learn with digital media, the impact of adult participation, and how children choose media experiences. Certainly, with some exceptions (Kirkorian et al., 2008; Marsh et al. 2005; Rideout 2007; Plowman et al., 2010), there have been few research-informed accounts of young children’s uses of technologies to date.

A limited number of studies have sought to address the general lack of literature concerning preschools ICT use in comparison with that of primary and secondary schools, each reflecting the resources available to practitioners within the national context of the country of study. In New Zealand, a literature review supported the development of an ICT strategy for ECE that ‘seeks to inform both the early childhood education sector and the Ministry of Education about the role and potential of ICT in early childhood education’ (Bolstad, 2004:1). In England, a report from Becta (2008: 3) aims to ‘gather evidence on the technology potential to support the development of educational policy and practice’. In Scotland, research by (Stephen & Plowman, 2002; Stephen & Plowman, 2003a) took place over a number of years in preschool settings to inform the development of the Scottish government’s policy *Early Learning, Forward Thinking* (2003b). The formulation of this strategy began with a review of the literature on ICT integration into early years, and was supplemented by an observational study that provided a snapshot description of existing practice.

Introducing ICT into preschools is not simply a matter of adapting existing policies and literature on integration into later levels of schooling (Plowman et al., 2010). In contemporary discussions, in spite of the obvious proliferation of technology, ICT should be recognised as a tool with limitations: it cannot fix, or act as a substitute for, an underdeveloped educational philosophy or poor practice (Ertmer, 2005; Niederhauser & Stoddart, 2001). Studies from countries including Australia (Cooper et al. 2007; Downes et al., 2005), Finland (Kankaanranta & Kangalasso, 2003); the UK (O’Hara, 2004; Plowman et al. 2010), and New Zealand (Bain, 2006) suggest that ‘over the time many changes occurred in preschool children education and technology: computers and other technologies have become more commonplace in the playroom, practitioners’ confidence has increased and there has been more political interest in the value of ICT integration into ECE’. However, in general, the pace of change has not kept up with the technological changes in society and their influence on how to communicate or spend our leisure time. Technologies such as computers, touch screens, and other devices have a role in driving up standards, as stated in the *No Child Left Behind* legislation, but in preschool education it is not given the high profile it has in schools (Plowman et al., 2010). Still many nurseries think of ICT as being primarily concerned with desktop computers, but it is unusual to find activities involving the internet in the playroom and practitioners continue to find it a challenge to adapt their pedagogy to include ICT (McManis & Gunnewing, 2012; Plowman et al., 2010, Siraj-Blatchford & Siraj-Blatchford, 2006).

Stephen & Plowman (2002: 1) have noted in their literature review that ‘many preschool playrooms in Scotland may now contain a computer used by children throughout the sessions […] there is a lack of developed pedagogy for the use of ICT in these contexts. This is also not a phenomenon restricted to ICT and preschools in Scotland’. Most of the literature about ICT in ECE strongly supports the view that technology on its own should never drive the process of ICT development in the sector. Mioduser et al. (2000) generally refer to the presence of technology in ECE as ‘hardware reality’ that has not yet become a technology-based learning reality. In addition, Higgins (2003) suggests that giving schools and teachers ICT tools to work with is not enough; these resources have to be used in a meaningful way. Schibeci et al. (2008: 2) argue that ‘first hardware-based enthusiasm, then pedagogical reflection’ are widespread phenomena when it comes to integrating technology into the learning environment.

Given that any of the attention that has been turned to young learners in nurseries has happened long after it was given to those aged five to 16 in schools, it is not surprising that changes in preschool pedagogy for integrating ICT are still emerging. The slow pace of change concerning ICT is highlighted by a recent report published by Becta. The report, referring to ICT in schools rather than preschools, states:

> ‘The development of new pedagogies can be a substantial professional challenge: teachers must learn new skills and rethink and refashion the teacher-learner relationship. Developing pedagogical approaches of active learner engagement, facilitating and scaffolding learning rather than transmitting knowledge, using new, more open, questioning techniques, and undertaking assessment for learning all provide significant challenges to a teacher’s role and identity. A lack of time, willingness or the resources to develop new pedagogical approaches is a major barrier to fully exploiting the educational potential of digital technology.’
>
> (Chowcat et al., 2008: 20)

Teachers need to rethink pedagogy and learn new skills in technology to drive educational change. However, educational change can be slow. All planning for the introduction and use of ICT by children and adults in ECE should be grounded in a clear understanding of the purposes, practices, and social context of ECE (O'Hara, 2004). Clear educational objectives have to be chosen to direct integration (Sugar et al., 2004). These objectives have to consider distinct preschool cultures, professional practice, learning through play, and a more flexible curriculum and assessment process. The development of a national strategy for ICT in preschool education represents an ideal opportunity for pedagogical reflection (Stephen & Plowman, 2008). As a consequence of the unclear plan on ICT integration in the Saudi ECE sector, there is uncertainty and discontinuity in ICT usage by practitioners.

While studying the literature on international initiatives, the researcher's attention was engaged by the Scottish context, particularly the nation's process of integrating ICT into ECE. This triad of research -> policy -> practice is a schematic that may be adopted by other countries that still need to address the lack of research into ICT integration into ECE (Refer to chapter two for further details). The development and integration of ICT into the ECE curriculum in Scotland has been both a gradual and a recent process. Internationally, different countries are currently occupying a variety of different positions relative to Scotland in terms of this embedding of ICT into an ECE curriculum, but it is clear that Scotland has advanced relatively far down this road in comparison to its international counterparts. This approach to integration encouraged the researcher to explore the Scottish context along with the Saudi context and, in turn, to conduct this research.

The situation in Saudi Arabia is not totally different from the experiences of the general international community. The use of ICT has been established in primary and secondary schools for a number of years (General Directorate for Planning, 2005). Furthermore, there is now a general endorsement of the value of technology in education and a governmental obligation for the formation of a 'Technological literacy'. The King Abdullah bin Abdul-Aziz Public Education Development Project (2007) is one of the programmes on the ICT development agenda that gives priority to this issue in the school sector. Moreover, the first International Conference on E-learning and Distance Learning was held in 2009 in Riyadh.

The conference concluded by recommending the development of a national strategic plan for e-learning and distance learning in primary, secondary and higher education.

In contrast to ICT usage in the school sector, there has been little attention paid to the use of ICT in the preschool education sector. It is clear from the outcomes of the abovementioned conference that once again ECE has been excluded from the agenda. However, this researcher has had experience in the field of ECE as a lecturer in the Childhood Studies Department at King Abdul-Aziz University (KAAU) in Saudi Arabia. In this capacity, she recognised that although some ICT resources have been used in ECE settings for many years, for instance the use of television, video and audio equipment and limited computer resources, there is still a discontinuity in the use of ICT owing to the lack of a holistic plan. Any successful integration is usually due to the individual effort of the practitioners. As a result there are differences in the integration of ICT in the daily programme from preschool to preschool (public and private sectors). In observing and experiencing these difficulties of integrating ICT as a teaching and learning aid for teachers and children alike, the researcher has seen that problems need to be addressed.

The Educational Goals for Preschool Education in the National Policy for Education in the Kingdom of Saudi Arabia (1985) have no explicit aims for ICT skills at a preschool stage. In addition, the preschool curriculum in Saudi Arabia, entitled *The Developed Curriculum for ECE* (Samadi & Marwa, 1991; MoE, 2005b), does not have a specific section covering the use of technology nor does it directly encourage the use of technology when explaining the practical aspects. Although the Developed Curriculum for ECE (DCECE) was compiled in 1991, when the use of technology was minimal, when it was revised in 2005 using ICT in ECE was not added. However, there were several attempts in the Saudi ECE sector to encourage the use of technology, which were not always successful. This lack of a clear plan on the use of ICT in the playroom means that implementation plans are left to the discretion of practitioners, with most of this coming from individual pre-school teachers' efforts. The literature suggests that the practitioners need guidance, and opportunities to become capable, competent, and informed about the educational role and potential of ICT, and support to make the most of the opportunities that ICT presents for strengthening all aspects of ECE practice.

In the literature there is a lack of locally applied research about ICT in the Saudi ECE sector and insufficient evidence to support the role and potential of ICT in preschools in Saudi Arabia (Hammed, 2011). Researchers such as Al-Dayel (2009), Bogus (2009), Al-Shoaiby (2010); Al-Showayer (2006), Al-Sanee (2003), and Zamka (2001) take this view in their studies. Much of the available research focuses upon specific contexts, but with some overlap, such as the role and use of computers by young children (e.g. Al-Shoaiby, 2010; Al-showayer, 2006), investigation of children's behaviour using the technology, attitudes of the users and teachers to the technology – particularly computers (e.g. Al-Dayel, 2009; Al-Sanee, 2003) – and the role of computer software in ECE (e.g. Zamka, 2001; Bogus, 2009). In these studies the issue is sometimes presented in terms of an overly simple question: should children use technology or not? While this question is valid, the larger issues are broader and more complex than such restricted analysis can address, and research focuses have to adapt. This is particularly pertinent as technologies are now already in homes and playrooms, and young children are using them outside the instruction of teachers. A more useful question for research to focus on is, what are appropriate and meaningful uses of technology with children? Moreover, since technology is being used, how can educators take advantage of the power of these tools to enhance children's learning and development, while avoiding potential problems?

The findings of previous studies into practitioners' perspective are valid and of interest here, but their findings are often limited by their lack of consideration of whole-preschool issues that may affect integration. The purpose of this research is to address this lack and consider practitioners' perspectives as part of a whole-preschool, holistic approach. Tondeur et al. (2008a; 2008b) have noted that current studies in primary education still look at ICT integration in parts, rather than from a wider perspective. This also remains the case in the preschool field with no studies paying attention to the systemic, complex nature of ICT integration. It is necessary to look at two strands: both the preschool characteristics and the practitioners' perspectives.

Studies into ICT are often non-specific, lacking detailed articulation of the intricacies that can occur within the socio-cultural context of ICT use in ECE. Research, instead, should focus upon interrogating the specific events, activities, contents and interpersonal processes taking place in the ICT learning environment. This approach will generate research that is 'usable knowledge'. In other words, knowledge that is ‘responsive to the current or emerging needs of practitioners and ultimately to the solution of professional and social problems’ (Richey 1998: 7). Literature that solely focuses upon issues at the level of the classroom tends to be centred on 'individual responsibility' as opposed to 'system responsibility'. To produce 'system responsibility' involves conducting research at three distinct levels: the national level (macro); the school level (meso); and the classroom level (micro).

‘System responsibility’ research is more complex, time consuming, can require a team of researchers and can be challenging to carry out. However, it is important that research exposes and investigates the differences between ICT strategy on a macro level, the practices at the meso-level of the local school, and the actual implementation of ICT at the micro level of the classroom. Crucially, research has shown a functional difference between an ICT curriculum proposed on a macro level and its implementation at the micro level (Tondeur et al., 2007a; 2007b). Visscher and Cole (2003) also argue that, owing to variability in types of school, general reforms created at a macro level do not translate equally well even at the meso level of the school. Schools usually differ, not only in how they use ICT but also in how effectively they implement it. Even local school strategies cannot accurately reflect the performance of ICT in the classroom and Fullan (2001) has urged more consideration for the local meso and micro conditions.

The variation in ICT integration into educational establishments has so far only been partly explained. This is due to the isolated focus of research upon single factors that may affect integration (O’Dwyer et al., 2004; Tang & Ang, 2002). However, ICT is not an isolated instrument; it is interwoven into the learning environment with a range of other tools (Lim, 2002). Research should therefore consider the whole configuration of the activities, happenings and interpersonal processes that occur (Salomon, 1993). In other words, a holistic approach needs to be taken (Fullan, 2001; Kennewell et al., 2000; Kozma, 2003; Salomon, 1991). Contemporary researchers are faced with the challenge of leading this holistic approach.

Laverick et al. (2008), in their recent review of literature, advise that integrating ICT into ECE is a multifaceted process that requires a number of different types of integration for it to be carried out effectively. If this goal is achieved, pupils become part of, as Williams argues, a dynamic technology-led world, in which ICT directly or indirectly influences the daily lives of everyone (cited in Siu & Lam, 2005). ICT forms part of many pupils' early-learning experiences (Fischer & Gillespie, 2003) and they should be taught to be confident ICT users (Stephen & Plowman, 2003). As part of a preschool's duty to prepare children for life in society it should allow pupils to interact with and learn through these new technologies (Swaminathan & Yelland, 2003).

Effective integration of ICT should involve a holistic plan that considers the needs of preschools on both a meso and micro level. The curriculum itself is a reference for teachers who are not properly trained in the use of ICT in a preschool environment. The training of teachers should play a crucial role in integrating ICT effectively. Recent review studies in general (Webb 2005; Wellington 2005), as well as empirical studies (e.g. McKenzie 2002; O'Brannon & Judge 2005), have shown the importance of teacher input into ICT use in the classroom. An ideal plan will have to consider the perspectives and experiences of both educators and learners who will use ICT.

The outcomes of this thesis are a series of recommendations for the integration of ICT in ECE for practitioners globally. It will be particularly pertinent to consider what lessons can be learnt by countries such as Saudi Arabia who are yet to embark down this road of ICT integration development, almost ten years after this stage was reported from international contexts such as Scotland and New Zealand. From my personal experience in higher education in Saudi Arabia, specifically focusing on preschool teacher education and developing their skills for being involved with ECE environments, there is a similar optimism but one which lacks rigorous literature and structure. ICT integration is underway in Saudi preschools but it is mostly down to the individual efforts of teachers. Therefore, studying the current situation in the Saudi context is fundamental to gaining a more complete understanding of both the local and wider global picture.

1.2. Significance of this research

Structured research on the area of ICT integration into ECE in Saudi Arabia is currently very limited. This research's explorative case studies in Jeddah preschools are therefore a valuable addition to the field. In Saudi Arabia, the journey of integrating ICT into ECE is at an initial, unstructured stage and the wide-spread attempts at integration that exist are purely down to practitioners' individual efforts; there exists no literature or policy to support these practices. According to the literature (e.g. Plowman et al., 2010; Taguma et al., 2012; Kalas, 2010; Stephen & Plowman, 2008; Bolstad, 2004), Scotland's ICT use is relatively advanced in comparison to its international counterparts. It has a good deal of experience in terms of ICT integration in ECE (there is an availability of literature, policy and references to ICT use in the curriculum). For these reasons, Scotland is included in this research as an example of integrating ICT to a level that may provide some insights for improvement in the Saudi Arabian (and indeed international) context.

The research findings here will (1) contribute significantly to the somewhat limited research in this field within Saudi Arabia, thereby encouraging further research that helps ECE practitioners gain a deeper understanding of how to integrate ICT meaningfully; (2) provide preschool policy and decision makers with a fresh, detailed picture of Saudi teachers' *actual* uses of ICT and the issues faced by teachers in preschools in carrying out ICT integration. This can inform present and future educational policies and encourage curriculum guidelines for ECE to explicitly incorporate how meaningful ICT integration can be carried out and (3) add to preschool practitioners' knowledge and understanding of ICT integration into teaching and learning in ECE.

The results from this research will also be useful for those concerned with preschool education in both developed and developing countries: (1) as discussed earlier, many countries have recently developed or are in the process of developing an ICT strategy for ECE; this study's findings offer valuable and substantial lessons to be considered by ECE settings worldwide; (2) the findings will help ECE settings that have begun ICT integration to follow it with more rigor; (3) the findings will provide insights into ICT integration globally, promoting knowledge, international collaborative research and giving recommendations that can revolutionise current practices; (4) finally, these results are intended for policy makers to encourage them to provide adequate support and training for preschool practitioners with ICT.

In the Saudi Arabian context, the research will be of particular interest to the Ministry of Education and King Abdul Aziz University. For Scotland, the thesis is likely to be of particular interest to the Scottish Executive and Learning and Teaching Scotland. The final recommendations, however, are of interest to the global context.

1.3. Purpose of this research

The main purpose of this research is to gain insight into the actual use of ICT in ECE settings through a series of explorative case studies in Saudi Arabian and Scottish ECE contexts. This allows for the generation of a set of guidelines for ICT integration that will be of interest to the global ECE community. The research also aims to investigate a number of issues at the different levels of the ecosystem, i.e. at the teacher, preschool and system levels, to create a better understanding of key factors that affect ICT integration into ECE and to provide a guideline for successful integration. Thus, the main aim in the present research is to investigate the central factors that influence ICT integration in ECE settings.

This aim involves meeting a series of research objectives and related sub-questions. The aim in reporting the Saudi cases is to provide an in-depth picture of ICT integration into ECE in that country, while the Scottish cases are used for purely explorative purposes. As aforementioned, Scotland has a good experience in terms of integrating ICT into early childhood education (Stephen & Plowman, 2002a; Stephen & Plowman, 2003a; Stephen & Plowman, 2003b; Learning & Teaching Scotland, 2003; Hall, 2005; Plowman et al., 2005; McPake et al., 2007; Plowman et al., 2010; 2012). For that reason Scotland is included in this research as an example that can provide some insights for improvements internationally. The core purpose of this research is not to compare the Scottish and Saudi contexts solely for the sake of comparison; instead, it is to seek out evidence in these contexts that can provide insights for ICT practitioners' globally, promote knowledge, assist the development of ICT integration and form recommendations that can aid and revolutionise current practices. Comparison is only made when it is absolutely necessary to the formulation of a useful recommendation for the good practice of ICT integration in an international context. The findings from both case studies will help to inform a series of guidelines for integration that are aimed at international stakeholders and practitioners. As informed by the literature review (see chapter 3), the related research objectives (RO) and sub-research questions (RQ) are as follows:

RO1. To explore how ICT is integrated into ECE settings in both Saudi Arabia and Scotland.

RQ1. What ICT resources are available in preschool settings?

RQ2. How do practitioners use available ICT resources?

RO2. To identify the factors that help or hinder ECE practitioners to integrate ICT into ECE in Saudi Arabia.

RQ3. What are important preschool characteristics?

RQ4. What are the important teacher characteristics that influence ICT integration?

RO3. To put forward a framework that integrates the teacher and preschool characteristics that are associated with ICT integration.

RQ5. How can we move forward with ICT integration in ECE on both a local and international scale?

1.4. Parameters of the research

In order to investigate the issues of ICT integration, this research focuses on perspectives in the early years environment - in particular, preschool Head Teachers (HTs) and practitioners. The early childhood stage, from birth through to 8 years-old, is the foundation of all future learning, so the use of ICT in these early stages is not only of particular interest to this research, but is also crucial to children's development as learners. Furthermore, factors influential to practitioners' perspectives with respect to ICT integration in the early learning environment are explored.

The study takes place in two contexts. The first is Jeddah, in the Kingdom of Saudi Arabia, and the second is Glasgow, Scotland. The two locations are important cities in their respective countries and may be deemed to fairly represent the education on offer in the respective countries. The fieldwork for this research was conducted over two periods, the first in January 2009 and the second in September 2009. It involved preschool teachers and HTs in both public and private preschools. Saudi preschools are under the supervision of the Jeddah Local Authority, Ministry of Education; the Scottish preschools are under the supervision of the Glasgow City Council and the East Dunbartonshire Council. Next, the two research contexts are further justified.

1.4.1. Why Saudi Arabia?

As previously mentioned, there is clearly a lack of literature on ICT integration into Saudi Arabian ECE. This is corroborated by the researcher's personal experience in the field of ECE (see section 1.2). ICT practice in Saudi ECE is clearly based upon the individual efforts of practitioners who are using ICT without pedagogical guidelines. In observing and experiencing these difficulties with integrating ICT as a teaching and a learning tool, the researcher has uncovered the problems that need to be addressed. Consequently, the current exploratory study is driven by the researcher's ambition to discover and describe how ICT is integrated into ECE settings in Saudi Arabia. In addition to identifying the factors that influenced practitioners' ICT practices.

1.4.2. Why Scotland?

While studying the literature on international initiatives, the researcher's attention was drawn to the Scottish context. Scotland's ICT use is relatively advanced in comparison to its international counterparts (Plowman et al., 2010; Taguma et al., 2012; Kalas, 2010; Stephen & Plowman, 2008; Bolstad, 2004). Scotland is regarded as one of the first countries worldwide to create a national policy for ICT use in preschools - 'Early learning, forward thinking: The policy framework for early years' - that was launched in 2003. As mentioned earlier in the chapter, this strategy came as a compliment to the 'curriculum framework for children 3-5 years' (Scottish Consultative Council on the Curriculum, 1999) in Scotland. The policy was a response to the prevalence of technology in society and how it already surrounds children in their early years (further details are provided in chapter 2).

The written policy in Scotland (Learning and Teaching Scotland, 2003) has also been critiqued and supported by a range of academic writings, studies that have assisted practitioners in making important pedagogical decisions for using ICT in the playroom (Hall, 2005; Plowman et al., 2005; McPake et al., 2007; Plowman et al., 2010; 2012). Plowman et al. (2010) stated that the development and integration of ICT into the ECE curriculum in Scotland has been both a gradual and a recent process. The triad Scotland followed (research → policy → practice) is a schematic that may be adopted by other countries, such as Saudi Arabia, that still need to address the lack of research into ICT integration in ECE.

An investigation of the Scottish context is justifiable here because it provides cases that have been regarded previously in the literature as demonstrating a good example of ICT integration and gives, consequently, a more rounded data set. It also provides an opportunity to explore cases that are more advanced than Saudi Arabia; ones that will help inform the final recommendations here. The researcher decided to give the study broader dimensions by exploring the actual situation in the Scottish context and taking advantage of the geographical closeness of the University of Glasgow to preschools in the surrounding area that are said to contribute to Scotland's renowned and innovative use of technology in ECE (rather than rely solely on the findings in the existing literature). The aim is to gain a series of beneficial insights for global practitioners who have already started to integrate ICT into ECE. This is to determine whether the context is at an advanced stage, such as Scotland, or not as far down the road, such as Saudi Arabia.

1.5. Definition of the terms used within this research

To understand the purpose and the focus of this research better, the researcher formulated some basic concepts she will work with all throughout the study.

1.5.1. Information and Communication Technology (ICT)

Throughout the study the term ICT is used to denote infrastructure and resources used in the context of education, where it usually refers to implementing ICT tools, techniques and equipment to support teaching, learning and other cognitive activities. ICT was previously known as "Information Technology" (IT), a term coined in the 1970s (Loveless & Dore, 2002) to mean technology that allows uninhibited access to a range of information sources (Ertmer et al., 1999). However, the term IT has become archaic in the field in a number of countries, having been replaced by "Information and Communication Technology", a term which also encompasses electronic communication (Kennewell et al., 2000; Plomp et al., 2003). Selwyn et al. (2011) note that some countries still use IT to denote computer based systems and communicative technologies, but that ICT remains the term of choice in educational and academic discussions in the UK.

According to the International Society for Technology in Education (ISTE) ICT often may replace the term "technology" in discussions about standards or skills in technology use (2007). The National Association for the Education of Young Children (NAEYC) apply ICT for computer technology as well as related technologies, such as telecommunications and multimedia, as these are becoming increasingly integrated with computer technology (1996). ICT is, in turn, "anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment" (Siraj-Blatchford & Siraj-Blatchford, 2003, p. 4). In the literature it can be referred to as both learning technologies, and simply as a technology.

Becta (2008) has detailed many of the ICT products available to young children although this is a changing and evolving process. Furthermore, the NAEYC & the Fred Rogers centre in their 2012 joint position statement used the term 'technology and interactive media' to refer to the variety of technologies surrounding children from birth to age 8. Table 1.1 presents the term ICT/ technology as defined by both Becta (2008) and NAEYC & the Fred Rogers centre (2012).

Table 1.1 Becta (2008) vs. NAEYC & Fred Rogers centre (2012) definition of ICT/ Technology

Becta		NAEYC and Fred Rogers centre	
Everyday technology	There is an array of electronic and digital equipment that permeates young children's lives and shapes their understanding of the world: barcode scanners, calculators, camcorders, cameras, cash machines, computers, console games, dishwashers, laptops and tablet PCs, ICT based 'smart' toys, microwave ovens, mixers, mobile phones, networked desktop PCs, photocopies, scanners, televisions and washing machines.	**Technology tools**	The definition of technology tools encompasses a broad range of digital devices such as computers, tablets, multi-touch screens, interactive whiteboards, mobile devices, cameras, DVD and music players, audio recorders, electronic toys, games, e-book readers, and older analog devices still being used such as tape recorders, VCRs, VHS tapes, record and cassette players, light tables, projectors, and microscopes.
New technologies available specifically for the Early Years' market, as well as 'toy' versions of the everyday technologies	Bee-Bot programmable floor robots, Roamers or Pixie Robots, digital audio players (DAPs), CD or cassette players, digital cameras, Digital Blue Computer Microscopes, mini DV camcorders and Digital Blue Movie Creators, DVD or video players, iPods, interactive whiteboards, laptops, mobile phones, photocopiers, scanners and televisions (Becta, 2008, p.3).	**Interactive media**	Interactive media refers to digital and analog materials, including software programs, applications (apps), broadcast and streaming media, some children's television programming, e-books, the Internet, and other forms of content designed to facilitate active and creative use by young children and to encourage social engagement with other children and adults (NAEYC & the Fred Rogers center, 2012,p.1-2).

Educators in the area of ECE desire to understand the needs of young children when they try to widely define what is meant by ICT. A restricted understanding of ICT as simply computers or software related to computers is to be avoided (Plowman et al., 2010), even though from my observations, many practitioners in Saudi Arabia still seem subject to this perceptive error.

Classifications

In the research on technology in education there are two different schools of classification that are adopted when categorising ICT tools. These are the 'standard viewpoint' and the 'viewpoint of purpose'.

Standard viewpoint

The standard viewpoint divides ICT tools up in terms of whether they are hardware of software. In ECE, ICT can encompass the following hardware and software (Siraj-Blatchford & Siraj-Blatchford 2003; Bolstad, 2004):

- Computers (including desktop, laptop, and handheld computers)
- Digital cameras and digital video cameras
- Creativity and communication software and tools
- The Internet
- Telephones, fax machines, mobile telephones, tape recorders
- Interactive stories, simulated environments, and computer games
- Programmable toys and "control" technologies
- Videoconferencing technologies and closed-circuit television
- Data projectors, electronic whiteboards, etc.

As such, the terms 'ICT' and 'technology' are used interchangeably in the current work where the above examples can be more neatly packaged into the follow types of tools (adapted from Selwyn et al., 2010; Selwyn, 2011):

- Computer hardware (not just computers such as PCs or laptops but also other educative tools such as electronic whiteboards).

- Personal devices (such as MP3 players, modern telephones or mobile phones).
- Audio-visual devices (digital cameras, digital radios, electronic dictaphones).
- Games consoles or handheld gaming devices.
- ‘Content free’ computer software (such as Microsoft Word or Excel).
- ‘Content related’ computer software (such as educational-specific software).
- Web content and applications (such as online teaching resources).
- Web communicative tools (such as email or voice-chat).

Viewpoint of purpose

The viewpoint of purpose categorises ICT tools by what they are actually being used to achieve. It is concerned with whether technology is being used as an information medium or a construction medium. Such a division follows Papert’s (1999) view of education itself either being informational (gaining skills and information) or constructional (discovering, creating and generally constructing knowledge). In the current study I am using ICT in its broadest sense that includes and gives equal respect to informational and constructional learning tools.

In order for ICT integration to become more deeply embedded in the playroom environment there is the necessity to move from a solely informational use of ICT to a constructional use, which is an emerging trend in some preschool contexts (Plowman et al. 2010). Informational use involves using ICT as a teaching aid to deliver information to students (such as presenting a learning topic through a PowerPoint presentation). Constructional use involves embedding ICT into playroom activities themselves (such as encouraging children to record their own voices during a role play situation with a digital dictaphone so that they may listen back and reflect upon their play). The ‘emerging’ nature of this process suggests that it is not complete and that in-depth integration in this sense still has some way to go. Ertmer and Ottenbreit-Leftwich (2010) have called for more practical guidance to be given to teachers in translating the ideals of practice from the literature into playroom and organisational practices, as well as encouraging teacher confidence with ICT. In this way, teachers may be able to learn to distinguish between informational and constructional practices, as well as become more aware that constructional use leads to a deeper, more productive integration of ICT into the playroom.

1.5.2. ICT Integration

The definition of “technology integration” in the context of 3-18 schools has not been standardised or consistently applied, and consequently can incorporate a variety of meanings (Bebell et al., 2004). In some instances, integration has been considered exclusively in terms of the type of applications for which teachers have used ICT within the classroom (Cuban et al. 2001). Another, alternative interpretation, has involved looking at how ICT is being used by teachers to enhance and support *existing* classroom practice, and how such use may be transforming these learning activities (Hennessy et al., 2005). For others a definition which incorporates the impact of ICT integration in terms of teachers developing pupils’ cognitive ability was considered most pertinent (Lim et al., 2003). Despite the lack of a clear standard definition, certain prevailing elements appear to cut across the many different current discussions about ICT integration in K-12 schools. These elements typically include the use of ICT devices for instruction. In this research, ICT integration is thus viewed as the use of ICT devices such as desktop computers, laptops, software, Internet, or other tools such as still and video cameras in preschool education for instructional and supportive purposes.

1.5.3. Early Childhood Education (ECE)

Early childhood is the period of life from birth through to 8 years-old (Copple & Bredekamp, 2009), when growth and development is rapid. During that time, many children attend preschool, where they have access to an immense number of learning tools (Couse & Chen, 2010). In different countries ECE or preschool education may have different interpretations in terms of the ages of children. In the United States and Canada, children start school at age 6. Nursery schools generally cater for children aged 3-5 years old, and kindergartens cater for children aged 4-5 years old. In England, Scotland, and Wales, children in nursery schools are normally aged between 3 and 5 years, and in Northern Ireland, between 2 and 4 years. Sweden has preschools for children aged 0-5 and another preschool for 6 years olds. In this study, the focus is on the age groups from three to six - before children move to school in Saudi (in Scotland children can attend school from 4.5 years old). Throughout the study the terms ECE, preschool education, nursery school, or early years education are used as synonyms.

1.6. Thesis structure

This study uses both qualitative and quantitative methods to investigate the situation and the status of ICT use in pre-school settings. The emphasis, however, will be on qualitative approaches and a collective case study is employed to investigate how ICT is integrated into ECE settings (this approach is the subject of Chapter 5). It is from these collective case studies that a series of recommendations will be made that will be of interest to the global preschool community (see Chapter 8).

Following this introductory chapter, in order to articulate the research and academic issues of adopting this research approach and achieving the research aims, the remainder of this thesis will be structured as detailed below:

Chapter 2: An overview of the study context

Chapter 2 will, in brief, provide an overview of the issues that are relevant to ECE in Saudi Arabia, such as the education system and the integration of ICT into education. This will provide a deeper understanding of the study's principles and this will be useful for those in particular who are unfamiliar with the context. The second half of the chapter will detail a number of global perspectives on ICT integration into ECE and, in particular, will use the Scottish ECE system as a prominent example.

Chapter 3: Literature Review

Chapter 3 critically analyses important literature with regard to the contemporary views on ICT and ECE, ICT integration models and theories. It is concerned with literature that informs a theoretical and holistic approach towards the study of ICT in ECE settings.

Chapter 4: Theoretical Foundations

This chapter explains the ecological framework employed as the central theoretical tool used in this research. This framework has a number of distinct levels and encompasses a range of different models. It is used to understand the factors and different levels of system that influence teachers ICT integration into ECE in teaching and learning. The ecological framework is used analytically throughout the thesis to help structure the research tools to collect the data, to structure and analyse the data and finally to discuss the integration of ICT into ECE.

Chapter 5: Research Methodology

Chapter 5 presents the multi-case study approach used to collect the data, as well as the characteristics of the target population, data validity, piloting, and reliability issues. The chapter describes how questionnaires, interviews, focus groups and observations were carried out to gather the data set in a cross-case collection.

Chapter 6: Actual practice of ICT in case study cases (Saudi Arabia and Scotland)

Chapter six begins by creating a description of the cases and their settings. It also incorporates a description of the actual use of ICT in the multi-cases from both contexts. In this study, a chronology is involved (moving from questionnaires, to interviews and then to observations) and so data analysis considers the data from each stage.

Chapter 7: Factors influencing ICT integration into ECE in Saudi Arabia

This chapter identifies the influential factors upon teachers' ICT integration in the Saudi Arabian cases. These factors will be holistic and understood at the different levels of the adopted ecological framework. They are divided into two main categories of teacher factors and school-level factors. The discussion in chapter seven also will highlight the influential factors that emerged from the data analysis and suggest the complex relationships between them from a theoretical and a holistic perspective. Beginning to emerge is a series of themes that will inform a number of recommendations to assist higher levels of integration of ICT into ECE.

Chapter 8: Conclusive Summary and Recommendations

Chapter eight outlines the study's conclusions and gives a series of recommendations for the effective integration of ICT in ECE settings. Moreover, the limitations of the study are presented and suggestions for future research into the area are provided.

The following chapter provides background information on the preschool education system in Saudi Arabia and the status of ICT in ECE. Also, it provides brief information about ICT integration into preschool settings in Scotland.

Chapter 2

Overview to the Research Context

Chapter outline

Chapter Two

Overview to the Research Context

2.0. Introduction

This chapter contains a brief introduction to the research context of the Kingdom of Saudi Arabia, and is intended to give an overview of its ECE system. In addition, this chapter introduces the experience of ICT in early years' settings in Scotland.

The first part of this chapter presents a brief description of the Early Childhood Education (ECE) system in Saudi Arabia, followed by information about ICT in the Saudi educational system and the issues that surround ICT integration, in order to provide the reader with a basis for understanding the context of the research. The second part of the chapter provides a short summary of ICT integration into ECE settings in Scotland.

2.1. The Early years curriculum

Despite differences in principles and practice of preschool education between nations, there is a certain degree of commonality worldwide with regard to the underlying features of ECE.

Bertram & Pascal (2002), in their research across 20 primarily, but not exclusively, developed nations, identified four features that are common to curricula for preschool over-3-year-olds:

- A prevalent holistic emphasis; curricula are structured around learning areas, rather than school-style subjects.
- Based around 6 key developmental areas: social and emotional; cultural, aesthetic and creative; physical; environmental; language and literacy; numeracy.
- Play-based learning; emphasis is on activity; development of independent thinking and learning are encouraged.

- Playroom practitioners are seen as facilitators, offering support to children, rather than as teachers in a didactic class-leading role.

Guidance published by the National Association for the Education of Young Children (NAEYC, 2009) forms the foundation of the 'developmentally-appropriate' practice typical in the US. This is also representative of the consensus in the UK (Siraj-Blatchford, 1999). Key points include:

- A balance between self- and practitioner-guided activities
- Availability of meaningful choices
- Scope for exploration
- Activities vary between three types: individual, small-group and whole-group
- Play is seen to be important, but is not the only learning medium
- Practitioners question, demonstrate actions, suggest alternatives, model problem-solving and reflection
- Children's development is observed and recorded

These features are common to the principles by which Early Childhood Education is imparted in Saudi Arabia, as described in the following section.

2.2. Early childhood education system in Saudi Arabia

2.2.1. Principles and general objectives

There are certain goals of education in the Kingdom of Saudi Arabia: for children to understand the tenets of Islam; for them to learn to spread Islamic ideals; give them the skills and knowledge to live in modern society; to help them conduct themselves fruitfully; and to build a sense of community in the learner (Al-Sunbul et al., 1998).

Specifically, the Ministry of Education Ten–Year Strategic Plan 2004-2014 was established in 2004, and it set several goals with respect to the education of young people in the Kingdom. Of these, the first is most pertinent to the preschool context, referring to 'the education of 4-6 year-old children and the consideration of kindergarten as an independent stage as compared with other educational stages in terms of its buildings and syllabi' (MoE, 2005a: 13). This goal to be achieved through the following objectives:

1. To accommodate 4-6 year-old children (kindergarten stage) at a rate of 40% by the end of the plan.
2. To update the programmes and activities on which early childhood education is based.
3. To supply kindergarten with specialized cadres to meet such stage classes at a rate of 10%.
4. To develop the programmes and tools to measure children's preparedness for the pre school stage.
5. To develop a personnel preparation and qualification programme at the kindergarten stage (MoE, 2005a).

The Ninth Development Plan 2010-2014 calls for the creation of a comprehensive system of education, imparted by highly-qualified professionals to develop students' capabilities and help them acquire cognitive and innovative skills (Ministry of Economy and Planning, 2010).

The King Abdullah bin Abdul-Aziz Public Education Development Project (2007), commonly known by its Arabic acronym Tatweer, has the following stated objectives: to improve learning standards based on international best practice; to develop a high-quality national assessment system to raise achievement; to provide effective feedback to students and other stakeholders regarding student performance; and to inform curriculum design, instruction and professional development (Tatweer, 2012). The project encompasses several initiatives, including the National School Development Programme, Preschool Development Programme, ESL English language programmes, 21st Century Skills, Arabic language development and Mathematics and Science teacher development programmes (*ibid.*).

A national strategy for ECE called 'the Saudi National Strategy for Education in Early Childhood' was implemented in 2010. It addresses a range of child needs, covering five central aspects:

- Education
- Health
- Social Protection
- Safety and Security in the Surrounding Environment
- Media and Culture

The first element of this strategy is a programme that involves expanding the number of preschools and the number of children at preschool. A committee, established in 2010, was charged with implementing this programme, headed by a deputy Minister for Education for Girls' Affairs. Its principal and ambitious aim was to open 13,000 public preschools by 2012. So far, 1172 nurseries have been opened, 5,967 teachers employed and 47,726 children registered (MoE, 2011). In 2009 ECE also became an independent stage of education for the first time; it was provided with its own budget and administrative buildings.

2.2.2. The Organisation and structure of preschool education

General education in Saudi Arabia is currently divided into 4 stages:

- **Preschool** education is available to children aged 3-6, over 3 years.
- **Primary** education begins at the age of 6; this stage lasts for six years (grades 1-6).
- **Intermediate** education begins at age of 12; and it spans three years (grades 7-9).
- **Secondary** education is also three years in length (grades 10-12).

Of these stages, the Primary and Intermediate levels are compulsory for all children, while Preschool and Secondary education are optional.

The academic year begins in September and ends in June. At the preschool level, for children aged 3-6 years, it is divided into two 18-week semesters.

The Saudi education system is centrally organised, based around unified national curricula and syllabi, developed by the MoE, for each educational stage. The syllabus is based around standard textbooks developed for each subject at each grade. The Supreme Commission on Educational Policy is the highest educational authority in the country, responsible for developing policy at a national level for primary and secondary education, higher education and technical and vocational courses. There are three principal institutions with responsibility for implementing these policies in distinct educational contexts. These are the Ministry of Education (MoE), the Ministry of Higher Education (MoHE) and the Technical and Vocational Training Corporation.

The MoE is the principal educational agency in the country. Until 2002, its remit was restricted to the education of male children, but the General Presidency for Girls' Education (GPGE) was then merged with the Ministry to create a unified organisation. Today, the Ministry holds responsibility for the administration of preschool and all levels of schooling, as well as special education and adult education and literacy. It is also responsible for the construction, provision and maintenance of buildings for educational purposes, and for the supply of materials and textbooks at all levels. In addition, the Ministry is charged with the training of teaching staff, and the development of educational policy and curricula.

The Saudi National Commission for Childhood is responsible for coordination and integration of all national agencies and institutions concerned with children, formulation of a national childhood strategy, recording data on children's affairs and providing this to relevant organisations, monitoring the implementation of Supreme Council initiatives and recommendations, and promoting research into children's affairs (UNESCO, 2011).

There are two types of preschool institution in Saudi Arabia, described in equivalent English terms as crèches and kindergartens. This section will focus on the latter of these, as it is an institution with an educational remit, rather than a purely social one, and is thus more directly related to the subject of Early Childhood Education.

ECE centres (known as Kindergartens) are preschool institutions that offer three years of education and care to children prior to their beginning elementary school (Al-Hariri, 2002). They are run according to an educational methodology with a focus on multiple developmental goals: linguistic, physical, social, psychological, cognitive, and emotional. The pedagogical programme is designed to include an effective balance between play and education (Samadi & Marwa, 1991; MoE, 2005b).

There are three levels of ECE for different age groups: KG1 (for under-4s); KG2 (4- and 5-year-olds); KG3 (5- and 6-year-olds). Children's attendance of any or all of these groups is optional, and does not constitute a prerequisite to entering elementary education. Children commonly attend only the final year (KG3). According to Madini (2005), one possible reason for this is that Saudi families prefer to look after their children prior to this age, and see one year of preschool education as being sufficient to prepare a child for primary school. As of 2007, 191,246 children were enrolled at ECE institutions (MoE, 2008).

2.2.3. The preschool curriculum in Saudi Arabia

ECE is becoming an important educational stage in Saudi Arabia. The first document specifically relating to ECE, the 'Kindergarten Teacher Guide', was developed in 1984 by the General Presidency for Girls' Education (GPGE). This document contained guidance covering the fundamentals of working with preschool children, but both teachers and heads were granted wide scope for individual discretion and interpretation.

In 1988, a project to develop ECE was initiated in Saudi Arabia. The GPGE in conjunction with the Arabian Gulf Programme for United Nations Development (AGFUND) and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) initiated a project to produce a formal preschool curriculum for the public and private sectors, along with training facilities and equipment required for its implementation. This is called the Developed Curriculum of Early Childhood Education (DCECE). The curriculum was developed in several phases, and the first edition of the finalised curriculum was published in 1991, with a second updated edition appearing in 2005 with further modifications and additions to the content of the detailed units (Samadi & Marwa, 1991; MoE, 2005b). A teacher training guide was also published in 1997 to complement the DCECE (GPGE, 1997).

The aims of this curriculum were: to improve the standard of preschool education facilities and the capacity for training new staff; to train existing preschool staff to higher level; and to develop a practical and theoretical framework for ECE in order to effectively coordinate teaching at this level (Samadi & Marwa, 1991; MoE, 2005b). The aims of the DCECE were derived from the general educational policy of the Kingdom of Saudi Arabia (1985), which is based on the values and the principles of the Saudi society. These values and principles are based on Islamic beliefs, culture and tradition as well as socio-economic factors. These policies consider the child's development and the basic needs of the child at this age (Al-Sunbul et al., 1998).

Attributes of the developed curriculum for early childhood education

The theoretical perspective of the first and second edition of the DCECE is based around a concept of ‘Individual Learning’, defined as ‘learning that depends on the child’s own activity, where s/he interacts with various educational materials and toys that are available in the educational environment, which assists him/her to discover his/her own abilities and improve them according to his/her growth model’ (Samadi & Marwa, 1991; MoE, 2005b: 16). This individual learning is further defined according to four stated learning objectives: (a) learning through continuous training on skills; (b) learning through discovery and investigation; (c) learning according to individual growth and development; and (d) learning through receiving knowledge from different sources, such as books, adults and peers (*ibid.*: 45). The role of the teacher within this framework is as a facilitator for the child’s own interactions with the environment, experimentation and discovery (*ibid.*: 157).

According to these objectives, the DCECE clearly adopts the play-based, discovery-oriented approach, supported by earlier interpretations of the Developmentally Appropriate Practice (DAP) and the child-centred approach in its intense form. These interpretations, which emerged from the work of Piaget (1954), do not clearly consider the influence of broader socio-cultural factors on children’s development and learning, putting much emphasis on children’s own activity in the environment, following the developmental stages as a determinant for their capabilities and readiness to learn specific skills and concepts.

Fortunately, in current practice, these views are not readily apparent, since a number of practitioners have slightly altered a mixed form of the developmental and socio-cultural perspectives, and are calling for this modified perspective on early education according to their experience in the field. This approach is noticeable in the produced professional development training guide (GPGD, 1997), in which teachers were provided with key steps and examples for scaffolding learning in general. However, most practitioners are still very much influenced by the developmental perspective, which considers stages and readiness as determinants of children's abilities. The appearance of these two challenging perspectives in the field has constituted a source of confusion and consequently some tensions in the implementation of the DCECE. This is a problem not only restricted to Saudi Arabia but one which has had pedagogical implications for practitioners in many different locations (Plowman and Stephen 2005, Stephen and Plowman 2008, Stephen 2010, Roberts-Holmes 2013). In-depth discussions are ongoing among practitioners in the field in an attempt to reach agreement about this pedagogical issue. Here, it is discussed further in chapter three (see section 3.5.3).

The DCECE structure and components

The DCECE is divided into six educational units based on different subjects/themes, and includes one further unit as a teacher's guide which relates these six learning units to the educational framework; it also contains practical advice regarding factors such as children's behaviour (Samadi & Marwa, 1991; MoE, 2005b). These explanation and description methods are designed to fulfil the ECE teachers' need for detailed instructions. The curriculum takes into account the needs of both those qualified and unqualified in the field of ECE. As such, the curriculum provides detailed, step-by-step guidance for preparing activities, as well as practical examples for both experienced teachers and ECE students. It also explains theoretical, educational and job requirements and links these to the general educational policies of Saudi Arabia. Furthermore, it provides instructions for the practical part of the curriculum.

The DCECE is considered to be a complete source for kindergarten teachers and trainers as well as students in the field of ECE. It considers the practical aspects of ECE and the needs of society, and seeks to encapsulate the ideology of ECE in Saudi Arabia. It is a source of detailed instruction in different aspects of ECE, to assist teachers in maximising the potential for discovery and exploration within the educational environment of the classroom, and is an important reference for preschool teachers (Al-Hariri, 2002).

Preschool environment layout

The DCECE calls for the division of the playroom into several distinct learning centres corresponding to different activities. Accordingly, the learning environment in both public and private preschools is organised into small learning centres called ‘self-learning environments’ (Samadi & Marwa, 1991; MoE, 2005b). Such organisation relies on the ‘choice concept’. This allows the child to learn according to preference because he/she has the freedom to choose what he/she learns (Al-Shoaiby, 2010). Teachers prepare the learning centre according to the educational goals of a particular theme, child development and growth and child preference, to allow the child to choose which tools to use, which centre to use and for how long before moving on to another centre.

The ‘choice concept’ encourages the child towards better and more useful learning, opens the door to discovery and exploration, provides the child with opportunities to problem-solve, helps the children to learn how to communicate with one another, and helps them learn values, such as sharing, cooperation and harmony (Samadi & Marwa, 1991; MoE, 2005b). This kind of environment reinforces the family atmosphere because these learning centres resemble a home environment.

The learning centres are prepared according to the amount of space available for children to experiment and engage in activities, and are based on a family atmosphere. When preparing the learning centres the teachers also consider practical aspects such as whether the sizes of the objects are appropriate for the size of the child. Specific information about the installation and organisation of these areas is included in the teacher’s guide. Therefore when introducing technology into the classroom environment of ECE, all of these factors need to be considered. Al-Shoaiby (2010:30), argues that ‘It is possible that concepts upon which the learning centres are based will also work with technology’.

The daily programme

In the DCECE there is a balanced approach between different types of activities. The daily programme is divided into five sessions, with a balanced variation between free and teacher-led activities (Samadi & Marwa, 1991; MoE, 2005b). An alternative pattern is group activities followed by individual activities or quiet activities followed by noisy activities. The programme is organised using these patterns according to the child's growth and development (Al-Hariri, 2002). The role of the teacher in these activities is clearly defined within the curriculum, with explanatory material available in the teacher's book with regard to techniques, materials and objectives.

A typical day consists of the following: a teacher-led morning activity of 30 minutes duration; outdoor free play for 45-60 minutes; a 30-minute meal period; free indoor play in the learning centres; and finally a 30-minute end-of-day session, featuring a review of the day's activities along with relaxation, stories, music and games.

2.2.4. Challenges facing Saudi preschool education

Notwithstanding the fact that preschool education in Saudi Arabia has greatly progressed since its inception, and has developed and modernised significantly, it continues to face obstacles and difficulties. A number of studies (Al-Hawwaas, 1998; Al-Khatheelah et al., 1999; Al-Shoaiby, 2010; Gahwaji, 2006; Madini, 2005; Meamaar, 1998; Sabear, 1996; Sulimaan, 1998; Zamzami, 2000) were concerned with evaluating the conditions and the quality of ECE in Saudi preschool settings, the problems that face practitioners in the field, and the obstacles that hinder good quality services. All of these studies reported a number of problems and practical concerns such as infrastructure and funding; issues with numbers and qualification of the workforce; capabilities and attitudes of management in preschool settings; and attendance issues, with lack of support from parents, low registration and high dropout rates, in which they were compared to the international standards. They called attention to the necessity to improve the quality of ECE services, and they emphasised the need for professional development courses in order to improve teachers' competencies to manage preschool classes and to plan and prepare appropriate environment, and activities for children.

Some other studies were concentrating on evaluating the national curriculum and drew attention to the content of the DCECE and its adopted learning strategies (Al-Ameel, 2002; Meamer, 1998; Saber, 1995). All of these studies found that DCECE manual book is not explicit enough and does not explain the individual-learning strategy clearly to teachers. Furthermore, they highlighted the need to evaluate and improve ECE services, including the curriculum guidelines, the implemented pedagogies, teachers' education, and professional development.

More recently, outcomes from ‘The Early Childhood Education National Conference’ held in Riyadh in November 2012 pointed out that there are still a number of obstacles and barriers to improving ECE initiatives worldwide and, specifically, in the Saudi sector. There is a lack of awareness in Saudi society, as well as amongst decision makers, with regard to the importance of this critical stage of education and its impact on the future child’s mental, physical and social development. There is also no specific sole body that is responsible for the planning and the implementation of any initiatives or programmes. This has led to a lack of collaboration and cooperation among the different stakeholder bodies. It has also affected parallel programmes in terms of there being no overarching consideration of how these initiatives may interact, differ or overlap.

Recommendations coming out of the conference included benefiting and learning from international initiatives in ECE and care services worldwide. These examples could help inform national policy in Saudi. A further recommendation was to open new training services and academic departments in universities to increase the number of professional who can specialise in addressing the needs and issues of ECE.

Similarly, the ECE Department and Jeddah LEA at the MoE in their recent Annual Report on the Status of Academic Affairs in Learning and Education Management Department ‘The Annual Improvement Plan 2011/2012’ (MoE, 2011) identified three principal obstacles facing the Early Childhood Education Department of the Ministry of Education, and proposed suggested solutions. These were categorised as issues in three areas: qualified workforce, infrastructure and facilities, and funding, as detailed below.

Qualified workforce

A key finding of the report was the lack of specialised practitioners in ECE, and in particular the need for new practitioners to enter the profession. In addition to the number of playroom practitioners themselves, a lack of staff at other levels was identified; concerns were raised that an increase was also required in numbers of HTs, deputies, administrative assistants and inspectors. According to the ECE Department (2011/ 2012) annual report, the reasons for this are twofold: an increase in retirement of experienced ECE staff creating an imbalance, exacerbate by a recent expansion national strategy in the number of preschool education sites administered by the Early Childhood Education Department. This second factor involves further responsibility for the department not only due to an increase in public sector sites, but also in the private and international sectors, and for crèches belonging to government institutions. The staffing shortfall was highlighted as an issue to be addressed, by promoting the entry of ‘fresh blood’ into the profession, and by facilitating increased specialisation.

Among the proposals made in the report is the formation of a team of experienced practitioners, who would be released from their day-to-day duties in order to support ECE improvement and development, and to promote a culture of excellence in the ECE field. This team would then be able to offer in-house and external training to ECE practitioners. This would potentially assist with the specialisation issues raised in the concerns about the nature of the ECE workforce. Another suggestion is the encouragement of greater collaboration between public and private nurseries, to facilitate the sharing of ideas and to promote a culture of competition, in order to foster improvements in the quality of ECE provision within both sectors.

Infrastructure and facilities

Concerns were raised with respect to preschool infrastructure and facilities. Specifically, it was suggested that the buildings allocated to ECE are not built to the specifications of ECE, and are therefore not fit for purpose. Problems mentioned in the report included the size of buildings, the available space, and the level of maintenance. The report stated the need for the Ministry to provide more suitable buildings, adequate to the ECE stage, supported with infrastructure, tools and equipment, and appropriate facilities, and for the balance between the availability of indoor and outdoor spaces to be taken into consideration. This is in line with earlier studies (e.g. Madini, 2005; Meamaar, 1998; Sabear, 1996; Sulimaan, 1998; Zamzami, 2000) which found that some spaces used for both public private preschool services were rented, lacked essential infrastructure and were unable to provide minimum standards, such as playground spaces, or sufficient lighting or ventilation.

Funding

The third issue raised was the need for further funding. This is required to support improvement plans approved by the MoE, such as quality improvement in the ECE programme, as well as emergency and contingency plans. Financial issues were also highlighted in the study by Madini (2005), who referred to a lack of funding for preschool sites themselves. This was a vicious cycle, in which revenue was not received in a timely fashion by the providers from registration fees, in the case of private institutions, or from funds from supervising authorities. This led in turn to difficulties recruiting qualified practitioners and providing adequate resources for children, which meant that attracting children to the sites, and thus assuring future registration revenue, became more difficult.

The report stated that the department strongly supports the Quality Improvement Programme for ECE Services founded in 2010, but that there is a requirement for further funding from the MoE to allow this to continue.

It can be seen from the previous studies cited earlier, the ECE Department latest report (2011), and outcomes from the ECE national conference (2012) that many of the issues and obstacles that face practitioners in the field are long-standing and deeply ingrained in the ECE context in Saudi Arabia. However, as the points raised in the Early Childhood Education Department report and the conference recommendations demonstrate, these obstacles to effective ECE delivery and management have been identified by the MoE as warranting prompt action, and solutions are being sought in order to improve the management, appropriacy, funding and level of service provided by these sites.

As discussed above, initiatives such as the Ten Year Plan 2004-2014, the Ninth Development Plan 2010-2014 and the Saudi National Strategy for education in early childhood, as well as the Tatweer Project, are focused on improvements throughout the Saudi Arabian education system. Initiatives to promote the development of infrastructure for preschool education and enhance training of teaching professionals are among the stated aims of these programmes (UNESCO, 2011). UNESCO data also shows a significant increase in preschool teaching and administrative staff over the 10 years from 1999-2009, from 8,789 teachers and 871 administrative staff to 10,337 teachers and 2,047 administrative staff (UNESCO, 2011).

2.3. ICT in early childhood education in Saudi Arabia

ICT in Saudi Schools: Policy and strategies

The ultimate aim of educational policy in Saudi Arabia is ‘to ensure that education becomes more efficient, to meet the religious, economic and social needs of the country and to eradicate illiteracy among Saudi adults’ (MoE, 2012). No specific mention is made within this broad mission statement with regard to ICT use. In order to formally address the need for specific policy regarding ICT integration into the education system, a National Project ‘Tatweer’ was launched in 2007, based on six stated objectives:

1) To develop students’ skills by exploiting and using information technology (IT) in education, and thereby prepare students in an effective manner for the future;
2) To improve teachers’ potential by employing IT in all educational activities;
3) To provide an information-rich environment, scientific content, and direct educational sources for students and teachers;
4) To improve the outcome of the educational process by allowing the graduation of future generations of outstanding students who have mastered the use of IT;
5) To partake in the creation of a nucleus of an advanced IT industry in the Kingdom; and
6) To create a comprehensive awareness of the benefits of employing IT in education and disseminating knowledge of IT throughout the society at large.

These objectives form the basis of the national ICT educational policy, although some stakeholders are not in full possession of this information. Oyaid (2009), in her study on the impact of the Saudi national ICT policy on secondary teachers ICT use, found that teachers’ ICT use in education was not influenced by the MoE policy, either due to lack of awareness or lack of understanding caused by difficulties in implementation.

In 1991, the MoE integrated ICT studies into the compulsory curriculum for boys’ secondary schools, and in 2003 this was extended into schools for girls. In addition to ICT as a subject, computers have been integrated into the study of many other subjects in the curriculum (General Directorate for Planning, 2005). A number of initiatives have been developed by the MoE for ICT installation in educational contexts, including Learning

Resource Centres (LRCs) and Digital Technical Centres (DTCs), allowing access to information through a wider range of sources, rather than solely through print media (MoE, 2008). Furthermore, the Jehazi Project (2006) gives teachers the opportunity to obtain laptop computers under favourable purchase schemes, alongside other benefits.

In addition to the provision of ICT resources and education to students through MoE resource centres, the Ministry has established ICT clubs open to members of the wider community. Since 2006, these have been run from the existing computer labs of schools outside of school hours, but are open to members of the public. In addition, these clubs offer ICT training courses for teachers and an opportunity for the pupils themselves to extend their opportunities for ICT learning outside of the school day.

The introduction of ICT in Saudi ECE settings

Many preschool activity rooms in Saudi Arabia contain ICT devices used by teachers and children; nevertheless, there is a lack of a developed pedagogy for the use of ICT in these contexts. Al-Dayel (2009), in a study of preschool teachers in Riyadh, tried to identify the barriers to teachers' use of ICT in ECE. He found that there is a general dissatisfaction at the teacher level with the training courses provided. Furthermore, there is no prior and clear planning for the integration of ICT in ECE which require adequate infrastructure and ICT skilled and qualified workforce. Although the general national ICT policy encourages the use of technology in education, no specific mention is made within this policy or the DCECE with regard to ICT integration into ECE.

In addition, there are conflicts and tensions between practitioners about the effective approach to integrate technology in the ECE learning environment. A number of studies have discussed the need for revision of preschool practitioners' application of the DCECE objectives. Khomais (2007) highlighted a need to examine the compatibility of existing learning objectives with DCECE pedagogies. Al-Fadel (2000) and Al-Ameel (2002) also identified issues with practitioners' understanding and supervision of learning zones, due to lack of training. Furthermore, as identified by Al-Ameel (2002), parents' attitudes toward ECE differ from those of professionals and researchers, as they prefer a more academically-focused approach.

The introduction of ICT as a learning zone within the playroom began formally in 2010. The MoE and Jeddah LEA took the decision to integrate ICT into the preschool learning environment in response to a Quality Improvement Programme for ECE services launched by the Early Childhood Education Department in 2010. This programme is based on the Early Childhood Environmental Rating Scales-Saudi Arabia version (ECERS-SA). According to Sylva et al. (2006), the Environment Rating Scales are a set of standardised tools for measuring and improving the quality of Early Years Provision. They are used nationally and internationally by many authorities at both setting and LEA level to improve the quality of Early Years Provision, guided by the findings of the Effective Provision of Pre-school Education (EPPE) Project (Sylva et al., 2004) which indicates a strong correlation between quality Early Years Provision and long-lasting positive outcomes for children. They offer a structured approach to quality assurance and assessment.

Despite several attempts to encourage the use of ICT in ECE, issues remain with its integration into the ECE context. In Saudi Arabia the use of ICT in ECE is still largely unexplored. International research evidence provides a picture on ICT integration in ECE; however, there is a lack of studies examining the effects of using technology in ECE in Saudi Arabia and as a result, it is unclear what the appropriate and meaningful use of technology with children to practitioners. The current study aims to fill this gap by providing a current profile of ICT use in ECE in Saudi Arabia, including information on the factors influencing practitioners ICT use.

2.4. ICT in the Scottish preschool settings

Although the extent of the presence and predominance within the curriculum varies between different countries, ICT as an educational tool is used throughout developed nations in preschool settings (as well as at school and beyond), as there is widespread recognition of the importance of the benefits of developing young children's technological literacy (O'Hara, 2008; Stephen & Plowman, 2008).

In Scotland, the early learning strategy document 'Early *Learning, Forward Thinking: The Policy Framework for Early Years*' (Learning and Teaching Scotland, 2003) seeks to regulate the pedagogical practices employed to integrate ICT into ECE institutions. It is partly based upon the guidelines and principles found in the ‘Curriculum Framework for Children 3 to 5’ (Scottish Consultative Council on the Curriculum, 1999). The framework seeks to reflect on the relevance of ICT in ECE, provide a training programme in ICT use in ECE for practitioners, make available a range of learning guides and support materials for early years’ staff, as well as evaluate and monitor the impact of policy on practice. A fundamental aim of the strategy is to ‘redress the balance’ where it finds any discontinuity in the integration of ICT into early years’ playrooms in Scotland.

While on the one hand monitoring ICT integration, the framework also seeks to provide ‘a secure foundation’ upon which teachers’ can promote ICT use to ‘enhance and support the development and learning of children aged 3-5 years’ (*ibid.*, 2003: p.2). The framework, ‘informs the planning and delivery of professional development in relation to the potential uses of ICT, for all those involved in the implementation of early years services’ (*ibid.*). The central perspective proposed is that this planning and delivery of ICT skills is essential in a world where children are surrounded by ICT in their everyday lives. The framework’s aim is to get pupils ‘learning *with* and *through* ICT’ so as to provide them with a range of essential, standardised skills that are useful and relevant to living in the society around them. The *Forward Thinking* policy, the only amendment to curriculum guidance in Scotland in a decade (Plowman et al., 2010), is clearly based on and draws from the observational findings of Stephen & Plowman (2002a; 2003a). The Scottish approach to integration is therefore to firstly conduct observational research that informs policy, before going on to enforce that policy in a manner that influences practice.

The Curriculum for Excellence – the Scottish curriculum framework covering preschool up to the end of secondary education – makes specific reference to a need for learning with and about technology (Learning and Teaching Scotland, 2009a). Within this curriculum, the Early Level (3-6 years) outcomes relating to technology (Learning and Teaching Scotland, 2009b: 2-6) are defined as follows:

- I enjoy playing with and exploring technologies to discover what they can do and how they can help us
- I enjoy exploring and using technologies to communicate with others within and beyond my place of learning

- I enjoy taking photographs or recording sound and images to represent my experiences and the world around me
- I explore software and use what I learn to solve problems and present my ideas, thoughts or information
- I am developing problem solving strategies, navigation and co-ordination skills, as I play and learn with electronic games, remote control or programmable toys

Within the field of ICT in ECE, a distinction was made between, on one hand, the use of ICT to develop children's familiarity with technology, and on the other as a tool for learning to be used throughout other areas of the curriculum. Stephen & Plowman (2003a; 2003b) stressed the need for appropriate implementation in order for ICT to be used effectively in preschool contexts, and called on individual practitioners to utilise their knowledge of individual children in order to tailor classroom activities to suit them.

2.4.1. Issues relating to ICT integration in preschools in Scotland

In the Scottish setting, ICT is endorsed by policymakers and included in playrooms, and is viewed as a valuable educational resource, as well as an important area of knowledge for learners in the 21st Century (Learning and Teaching Scotland, 2003; 2009b). However, some obstacles have been identified in research conducted by Plowman et al. (2010) and Stephen & Plowman (2003a; 2002b; 2003b).

Difficulties in supporting and monitoring children's ICT use

In a study by Plowman et al. (2010) Scottish ECE practitioners highlighted the difficulty of making time to dedicate to individual children for ICT experiences. They recognised that children need assistance with new devices, due to factors such as unfamiliar operation features, as well as the need for adult prompting for exploration and problem-solving, and reassurance. This is typical of children's initial encounters with many other learning tools and situations.

In the same study, issues were raised by practitioners about the practicality of monitoring children's general ICT use in comparison with other types of activities. The presence of ICT in the playroom simply represents one more of the many resources available in the preschool environment, and if a child finds an encounter with this technology to be unrewarding, he or she will simply move to a different activity. This may be missed if practitioners are not able to offer adequate monitoring.

Lack of confidence on the part of practitioners

ICT appears to be seen by practitioners as being particularly problematic in comparison with other learning tools. Possible reasons for this are that childcare practitioners feel doubts about their competency with these technologies due to limited training routes into the field, the historically poor record of CPD or the traditionally low status associated with ECE (Plowman et al. 2010). Practitioners described feeling uncomfortable when supporting children with ICT in the classroom setting, or when trying to repair or resolve problems with hardware or software; they felt that they needed more support when purchasing appropriate equipment, and more time to learn how to use new technologies themselves.

Some ECE practitioners appear to be unconvinced by the value of ICT, despite the existence of policies encouraging its use. At the beginning of the Stephen & Plowman's study (2003a, 2003a), most playrooms provided computers and CD-ROM activities, but were less comfortable using DVDs, cameras, etc., alongside these. Practitioners made little use of computers to support their own practice, for example to create new materials, make records or send emails.

Practical concerns

Another reported issue was the cost of ICT devices and materials. In the case of digital cameras, the costs both of cameras themselves and of printing were seen to be potential problems (Plowman et al., 2010). Similar issues were reported with computers – again, the machines themselves and printing of work conducted on the computers were deemed in some cases to be excessively expensive. Concerns were raised also about the appropriacy of desktop computers for young children, as they are designed for adult use, and can therefore present challenges, due to issues including ergonomics, dexterity, and attention span.

Concerns about teaching role regarding ICT

Reluctance was noted on practitioners' behalf to take a more didactic instructor role in ICT. This is at odds with the general focus of ECE practitioners as facilitators of children's play and exploration, and they were not always comfortable in this role.

Despite identification of these above issues as obstacles to integration of ICT in ECE, Plowman et al. (2010) reported promising trends in attitudes. Practitioners displayed markedly more confidence and independence when using computers. Use of digital and video cameras had also markedly increased. In general, practitioners demonstrated a greater awareness of the possibilities of ICT.

The development and integration of ICT into the ECE curriculum in Scotland has been both a gradual and a recent process. Internationally, different countries are at different stages to Scotland in terms of this embedding of ICT into an ECE curriculum but it is clear that Scotland has advanced relatively far down this road in comparison to its international counterparts. There remains, however, a general lack of literature concerning preschools' ICT use in comparison to that of primary and secondary schools. It is not possible simply to appropriate this vast amount of literature on schools and technology for use in understanding the practice of preschools, as there are a number of distinct, important differences between ECE and the rest of the curriculum levels. For example, the ECE curriculum is less rigid and emphasises learning through play and exploration. Notwithstanding this caveat, the triad of research -> policy -> practice discussed earlier in this section is a schematic that may be adopted by other countries that still need to address the lack of research into ICT integration into ECE.

Chapter 3

ICT Integration into Early Childhood Education

Chapter outline

Chapter Three

ICT Integration into Early Childhood Education

3.0. Introduction

There is little doubt that ICT plays an increasingly significant role in the everyday lives of people and its use is essential in the 'Information Age'. As Yelland (2006:12) notes, 'the very nature of our work and leisure time has been transformed due to the presence of ICT'. Yet the presence of ICT has not necessarily gone unquestioned. This is particularly true within the ECE community where the place and potential of ICT in teaching and learning has proved to be an ongoing, and at times contentious, site for discussion and debate (Brown, 2006; Brown & Murray, 2006; Gibbons, 2006; Williams et al., 2000; Lindsay 2006; Stephen & Plowman; 2008; Somekh, 2007; Yelland, 2007).

This chapter considers research studies in the field of ICT integration into ECE, focusing on the theories, models, and factors associated with 'ICT integration'. In the first section the key issues arising from the literature in relation to the use of ICT with young children are outlined, including its potential advantages and disadvantages. In the second part, the different models that highlight the factors that influence ICT integration in teaching and learning are reviewed to understand how to integrate ICT effectively.

The literature review that follows informs this research's focus and questions. Further, it provides a starting point and a structure through which to understand ecological theory, a theoretical lens that will be adapted for the purposes of this research (see elaborations in the following chapter - theoretical framework).

3.1. The rationales for ICT integration into ECE

One major anxiety for the education sector is that they do not fall behind society's use of ICT as a communicative and societal tool (Boody, 2001). There are also other economic and educational rationales in the equation to consider. These will now be sketched out in order to get a holistic sense of the stakeholders involved in ICT use in education. ICT's strength is that it can render, either online or in software form, situations for learners that mirror real life circumstances and problems.

In 2001, Prensky coined the phrase 'digital natives' to describe the confidence that young learners show in their use of ICT, a result of them being surrounded and immersed in it in their daily lives (Prensky, 2001), and other researchers agree that children have a natural inclination to use ICT (Rideout & Hammel, 2006; Rideout et al., 2005; Veen & Vrakking, 2006; Fisher & Baird, 2009; Tapscott & Williams, 2007; Palfrey & Gasser, 2008). From an educational viewpoint, these are the 'new millennial learners' that ECE must nurture and cater for (Vandewater et al., 2007; Pedro, 2007).

The clear imperatives that suggest ICT should be an important curriculum component in education are both internal and external to the educator sector itself (Selwyn, 2011). Such imperatives are often referred to in the literature as rationales for ICT use (Kozma, 2008; Robertson et al., 2007; Hawkridge, 1989). The internal rationales are those elements of ICT use that can reform or improve educational practice, while the external rationales are societal pressures coming from outside the education sector which necessitate that young learners learn with and through ICT. The rationales reflect the priorities of ICT use, as well as bringing a set of pressures for integration (Selwyn et al., 2010). The priorities include keeping up with children in the digital age and meeting public expectations over the 'how and why' of ICT use in education, as well as the priorities of educational policy. There are further pressures to use ICT to engage young learners' attention and to make sure that ICT is used safely by teachers and learners alike (Selwyn et al., 2010).

3.1.1. External rationales

External rationales encompass societal and economic reasons for ICT use. The economic rationale implores governments to support the use of ICT in education through the provision of resources, funding and policy, as these help to prepare a future workforce that is technology literate and ready to work in the 'Information Age' (Kozma, 2008). Indeed, many developed countries are seeing manufacturing go into decline and in its place there is a growing emphasis on a creative ‘knowledge economy’ driven by technology (Selwyn, 2011a).

Nearly all developed (and indeed many developing) countries now have a detailed ‘educational ICT strategy’ based around the broad aim of getting schools to use ICT in their teaching and learning. There are national policies for ICT in the USA, Singapore, South Korea, Europe and the UK relating to education as a whole. Policy is also beginning to appear for the use of ICT in ECE, as has been mentioned, in Scotland and New Zealand. There are also policies in developing Arabic countries such as Jordan and a plan in Saudi Arabia that excludes ECE. Young learners, however, have to be provided with a learning that encompasses ICT use so that they can ‘keep up’ with this demand for technology-able learners who are the workers of the future (Holloway & Valentine, 2003). The use of ICT in ECE can be seen as an initial step in preparing young learners for the economic climate they will face as they get older, by providing them with a skill set which can be developed by later educational levels.

ICT tools have reshaped the way people think and act in their daily lives, as well as dictating a change in mainstream habits (Robertson et al., 2007). There is a rationale to ICT use to familiarise young learners with the social aspects of technology. This play with ICT at an early stage will harbour sharing knowledge, encourage creativity, make democratic action simpler and create social cohesion as the pupils get older (Kozma, 2008). Taking this focus, young learners are viewed as ‘becoming’ adults (Lee, 2002, cited in Plowman et al., 2010). Technology also promotes more autonomy for socialising over long distances while developing continuously. Early learners are exposed to these developing technologies in their home environments (Stephen et al., 2010) and, in turn, ECE institutions need to invest in ICT to keep up with society’s ever changing use of communicative and social technologies (Selwyn, 2011b).

3.1.2. Internal rationales

There are internal pedagogical rationales (Selwyn, 2011a) for the use of ICT in the playroom and further benefits for practitioner preparation and administrative work. The two main internal imperatives can be classified as reform and management rationales

(Kozma, 2008). The former of these relates to practices surrounding playroom practice, such as written administrative work, reports on the children's progress and data management. As will be more fully outlined below (section 3.2.3), ICT can prove an effective resource for educational management in supporting decision making and promoting accountability (*ibid*.).

ICT can also have powerful, reforming effects on the ways in which young children learn and develop (Selwyn, 2011b). The imperative for such changes may come from educators who, taking a constructivist approach, believe that ICT can benefit children's cognitive development by using it as a social tool in an active learning that deals with real-world problems (Selwyn, 2011a). Alternatively, practitioners, parental stakeholders, and even the learners themselves may demand the types of dynamic and collaborative problem-solving tasks that ICT can offer in the educative environment (Robertson et al., 2007).

There is, though, a distinction to be made between rationales of use, which, whether external or internal, come from outside of the teacher, and teachers' personal reasons for using ICT in ECE: a use that is influenced by pedagogical knowledge, attitudes and understanding. These rationales, while pointing to the wider reasons as to why ICT use by young learners is important, do not consider in what ways we may ensure an in-depth integration of ICT into ECE.

3.1.3. Role of ICT in ECE

There have been a number of attempts at ICT integration for pedagogical purposes that classify the types of learning and educational practices that it can benefit. For example, ICT use in primary schools has led to the tripartite classification of 'basic computer skills' (developing learners' technical abilities), 'the use of computers and information tools' (the research and processing of information) and 'the use of computers as a learning tool' (the practice of skills and knowledge) (see Tondeur, 2007; Tondeur et al., 2007). A number of justifications for the use of ICT have also been classified into eleven non-mutually exclusive purposes by Newhouse & Clarkson (2008). These are concerned with education in general but prove apt also for learning in ECE. Newhouse & Clarkson (2008) suggest that even though technology may be virtual it is suitable for investigating reality through collecting data, facilitating problem solving and presenting data in a clear way. This is part of the ability of ICT to build knowledge as well as transfer and receive feedback on such knowledge.

Gaining knowledge may be an active process for the learner, and ICT can promote active learning that can be more authentically assessed through peer feedback using technology. Also, due to the processing speed of technologies, children may achieve an increase in productivity. It is not just productivity of learning that is important but also its quality, and ICT can provide scaffolding to support high-level thinking and independent learning should be mixed with collaboration and cooperation. The intelligence of certain ICT tools may also assist learners with physical disabilities. These justifications overlap with some of the ideas put forward in Plowman et al.'s (2010) understanding of the benefits of guided interaction. Namely, ICT may extend existing knowledge of the world, help in acquiring operational skills and develop dispositions to learn. Table 3.1 presents a range of practices.

Table 3.1 Possible roles for ICT in ECE (Source: Bolstad, 2004)

Roles for ICT	
Children using ICT in their play or learning (alone, with peers, or with adults)	▪ Children using computers to play games, listen to stories, or draw pictures. ▪ Children using ICT equipment in games or role-play activities.
Children and practitioners using ICT together to scaffold children's learning	▪ Using the Internet to locate information or resources, sparked by children's interest in a particular topic or idea.
Children and practitioners using ICT together to document and reflect on children's learning or to share children's learning with parents, or other practitioners	▪ Taking digital photos, videos, or audio recordings of activities in the early childhood education setting and reviewing these together or sharing them with parents. ▪ Practitioners and children using ICT to build portfolios of children's work, to use for evaluating progress in children's learning and development.
Practitioners using ICT for planning, administration, and information management	▪ Teachers developing individual learning plans for children, or using computer based templates to plan or document children's learning (e.g. using learning stories templates, or inserting relevant concepts from *Te Whãriki* into children's learning records). ▪ Creating databases to keep track of important information about children and their families.

Teachers or teachers-in-training learning to use ICT, or learning *through* ICT	▪ Teachers-in-training learning to use ICT in their initial teacher education courses. ▪ Distance-learning teachers-in-training using ICT to learn to become early childhood teachers. ▪ Teachers-in-training learning to use technology with children in their practicum placements. ▪ Teachers using ICT to document and reflect on their practice, or using ICT as part of a professional development programme.
Children and practitioners using ICT to communicate or exchange ideas or information with other practitioners, parents, or researchers.	▪ Using videoconferencing, online discussion communities, or email, to communicate with other practitioners, parents, or researchers, or to share news and information about what's happening in the early childhood education centre. ▪ Children and practitioners using telephones, email, or fax to keep in touch with parents who are not able to come to the early childhood education centre (e.g. parents who are at work during the day). ▪ Using telephones, email, or fax to keep in touch with children and their families in distant or rural communities (e.g. Correspondence School early childhood education programme).

The table above depicts a range of practices that may be evident in the playroom and involve using a number of different ICT tools. These practices are placed alongside the theoretical roles for ICT use in the playroom, or for preschool activities in general, which they fulfil.

3.2. ICT in Early Childhood Education: The Ongoing Debate

There has been fierce debate in the field of ECE regarding the role of technology in learning and teaching. Researchers, educators and parents alike have concerns about the possible detrimental effect that ICT use in ECE in particular may have upon children in preschools (Laverick et al., 2008, Lynch & Warner, 2004). Some detractors argue that introducing technology into ECE playrooms is time-consuming, expensive, and takes away from childhood itself by speeding up learning; according to some researchers, this focus upon technology has lead to traditional childhood experiences being overlooked (e.g. Henry, 2010; Palmer, 2007, Cordes & Miller, 2000; Healy, 1998). On the other hand, those in favour of technology argue that pupils should be allowed to benefit from what it can bring to the learning environment (e.g. Marsh et al., 2005; Saracho & Spodek, 2008a, Clements & Samara, 2003; Pearman & Lefever-Davis, 2006).

Both critics and proponents agree on the importance of the early years in a child's physical, social, emotional, linguistic and cognitive development. Much of the controversy revolves around the specific needs of young children, and whether ICT can support those needs, or will take away from important developmental experiences. Plowman et al. (2010) suggest that the common concerns raised in the literature fall into three main categories: cognitive, wellbeing or socio-cultural. Cognitive concerns, among other things, focus on the potential negative effects of technology on children's normal cognitive development. Alternatively, wellbeing concerns issues like the physical harm a child can come to by using computer games for an extended period or the potential for children to become obese due to a lack of exercise; it is believed that technological activities replace more productive learning or play activities. Also, there are worries about children being exposed to crude content, such as violence, sex, racism and gender stereotypes. While, socio-cultural concerns focus on children's ability to take part in society. They, for example, highlight the potential lack of social interaction as a result of the digital age, because children are believed to use technologies in isolation, something which has been argued to be detrimental to social development (Palmer, 2007).

Whilst these debates still appear on the landscape and certainly have served to dominate the discourse surrounding ICT in ECE over the past two or three decades, these dissident voices are becoming rare. Both the New Zealand Council for Educational Research (2004) and Stephen & Plowman (2003a) have observed that there is little clear evidence about the degree to which ICT may assume a real risk to children. More recently, Plowman et al. (2010) have noted that assertions are made on the basis of anecdotal evidence or personal experience and, in turn, are presented in the literature as having a stronger evidence base than in actuality. They also suggest that the debate is so polarized regarding ICT use in early education as those strongly for ICT tend to romanticise the future and those so strongly against it romanticise the past as a golden childhood. Furthermore, Byron (2008) notes that the debate is often played out on highly emotional (rather than evidential) terms.

Since this research aims to arrive at a better understanding of ICT integration into ECE, these controversial views are worthy of discussion. ECE practitioners need to be aware of the debate surrounding ICT integration into ECE in order to ensure young children's wellbeing and development, particularly regarding the use of desktop computers since they are the most common ICT tool in preschools (Stephen & Plowman, 2003a; 2003b). Therefore, a brief account of both sides of the argument about the effect of ICT on children's cognitive development, wellbeing and social development is provided next. But it will do so (as much as the literature will allow) from a more neutral position, illustrating both advantages and disadvantages of technology.

3.2.1. The arguments against ICT use in early years

As computers began to be employed in the playroom, there was a general debate about whether this integration was suitable for early learners (Edwards, 2005; Elkind, 1996; Haughland, 2000; Stephen & Plowman, 2003a; Stephen & Plowman 2003b). Although ICT encompasses a wide range of technological products and applications, the most significant for many of us in recent years has been the computer (Blatchford & Whitebread, 2003, Edwards, 2005). The majority of educators' arguments have ensued over children's use of computers and computer games. Early contestations in the literature came from Elkind (1996) about the isolating nature of computer use, from the Alliance for Childhood (2000) who believed computers to be dangerous for emotional, physical or intellectual development, and from Healy (1998) who had similar issues and was also concerned by the influence of sponsorship by private technology companies.

These critics of ICT often believe that young children are vulnerable to adverse influences, and they claim that their cognitive, emotional, and social development is threatened by technology. Based on the common concerns raised (Bolstad, 2004; Byron, 2008; UNESCO, 2010; Plowman et al., 2010) there are a few recurring issues in the literature:

- The physical harm a child can come to by using computer games for an extended period;
- Problems related to children's social interaction if they use computers too often (e.g. anti-social behaviour such as becoming isolated or aggressive);
- A concern that computer-use actually infringes upon a child's normal cognitive development;
- Worries about children being exposed to crude content, such as violence, sex, racism and gender stereotypes; and
- The worry that computer-use will replace more productive learning or play activities

Plowman et al. (2010) note the centrality of screen–based media (e.g. television, games consoles and computers) in children's lives and the possibility of isolation and lack of exercise. One further concern is presented by Miller (2005), who claims that educators' reports about those children who are adept at using computers also show that they may lack imagination. Miller has urged scholars for a wide-ranging debate about technology (2005). The literature on whether computer games may cause violence is ambiguous (Griffiths, 2000; Sakamato, 2000, cited in Linderoth et al., 2002). As a consequence, there seems to be an emphasis upon practitioners to consider what games may or may not be suitable for children's development.

Miller follows David Elkind by suggesting that there is a lack of evidence that ICT can enhance basic skills of regulating emotions, problem solving and being imaginative. Time has proved Miller's worries to be largely unfounded and this is the case too for the issues put forward in *Fool's Gold* (Cordes & Miller, 2000). It is one of the most combative arguments against young children's exposure to technology, calling for an immediate moratorium on any future introduction of computer use in ECE environments. Instead, they argue that children should be exposed to spontaneous play, music and the arts, and gardening (2000). Their stance has been subject to a number of criticisms, and even complete rejections. Critics label this approach as an odd mixture of panic and reminiscence (Buckingham, 2000, cited in Stephen & Plowman, 2003a). Practitioners have been known to mimic these over-reactions that have appeared whenever technology advances – from the invention of alphabetic print to television and video games (Tudge, 2008; Linderoth et al., 2002; Luke, 1999).

Another major concern is the time children spend on computers as it is feared that they will lose interest in traditional play materials. However, the literature suggests that this concern is unwarranted. Shields & Behrman (2000), for example, cite national survey data which shows that children from 2 to 5 years of age spend approximately just under half an hour a day on computers at home, with use increasing with age. It has been found that using computers at home can actually assist and make more efficient academic use of computers in the classroom (Yelland, 2005).

Followers of Steiner Waldorf education take the position that children should play only with ‘natural, non-manufactured materials’, and so not only exclude the full range of new ICT but also any item made of plastic, such as Lego. The objection to ‘manufactured’ and ‘mechanical’ artefacts is more a reaction against the perceived dehumanising aspects of nineteenth-century industrialisation than it is a reasoned assessment of twenty-first century children’s needs (Siraj-Blatchford & Whitebread, 2003). Siraj-Blatchford & Whitebread (2003) argue that this position is not incompatible with the use of ICT; indeed, ICT applications themselves vary markedly in the opportunities they offer for imagination and creativity.

Siraj-Blatchford & Whitebread (2003) suggest that the ‘ideological’ detraction of integrating ICT into ECE is based upon a fear that children will become isolated and pacified in the learning process and that learning is not suited to technological methods. Many of the objections of early educators to the introduction of ICT into ECE are founded on the belief that it encourages children to be passive recipients and that young children cannot learn effectively from this kind of experience. However, there is evidence that contradicts such concerns.

3.2.2. The Educational advantages of ICT use in ECE

Even early studies in the literature argued that technologies can be extraordinarily powerful tools with the capacity to encourage young children to learn in dynamic ways (Clements et al., 1993; Yelland, 1999). Several studies find that ICT use in the ECE playroom can aid the social development of early learners (Fischer & Gillespie, 2003; Hertzog & Klein, 2005; Mouza, 2005; Kumtepe, 2006; Weiss et al., 2006). Technology can also assist a child’s ability for exploration, self-guided instruction, creativity and problem solving (Clements, 1999; Clements & Samara, 2003). A series of studies carried out by the International Society for Technology in Education (ISTE) further advocate using computer technology in meaningful ways with young children to build their technological skill and comfort level (Pearman & Lefever-Davis, 2006).

Contemporary literature indicates a changing perception of ICT in ECE and this is attributed, in part, to the growing number of ECE settings engaging with technologies, and not just computers (Edward, 2005; Colbert, 2006). Practitioners now understand that ICT integration has to be monitored and thoughtful (Visser, 2000; Ramsey et al., 2006). Intriguingly, many technologies familiar to ECE practitioners have been overlooked as ICT tools. These include fax machines, overhead projectors and tape recorders. They join more modern ICT tools, such as video cameras and interactive whiteboards, in being utilized in the early years' learning environment (Erb, 2008; Ramsey et al., 2006; Tringham, 2006).

This shift in perspective has evolved due to a global body of research. These studies highlight the way in which ICT can enhance the learning of young children. In the early literature, Cochran-Smith et al. (1988) argued that technology improves children's writing ability. Hess & McGarvey (1987) observed also that technology can enhance children's mathematics, problem solving, and scientific skills. Furthermore Weir et al. (1982) have posited that technology can effectively aid the learning of children with disabilities.

A specific example of ICT enriching playroom practice has been witnessed in storytelling where pupils use software to illustrate their stories and then compose simple musical accompaniment (Colbert, 2006). The new technologies are intimately bound up in language, drawing, art, and stories. In fact, as many commentators have noted (see, for example, Sefton-Green, 1999), one of the more exciting aspects of the emergence of the new technologies is the plethora of tools that are available which allow children and adults to construct new forms of representation through artistic and creative expression.

The majority of existing literature clearly indicates that today there is not simply an imaginative and pervasive interest in integrating ICT into ECE; there is a more general valuing and appreciation of the work carried out in the early years' sector as a whole and of the working staff pupils (Hayes & Whitebread, 2006; Haughland, 2000). The preschool learning stage is crucial in shaping how children interact and engage with the world around them; it is a stage which also impacts upon future adult life (Reed & Canning, 2010). As Adams & Brindley (cited in Hayes & Whitebread, 2006) further note it is nursery teachers who are confronted by the difficulties and intricacies of integrating ICT into ECE and they often aim to solve these problems with enthusiasm and educative rigour for their. All practitioners and stakeholders have to work together to for ICT to fulfil its potential (Colbert, 2006; Jordan, 2006; Ramsey et al., 2006).

The socio-constructivist Lev Vygotsky contends that there are two different types of learning tool: psychological tools such as language, art or diagrams, and tangible technical tools that are external, alter the environment, and can be integrated with psychological tools (Vygotsky, 1930). ICT is a technical tool that can be incorporated with the psychological. This integration or incorporation into ECE should be done, according to Siraj-Blatchford & Siraj-Blatchford (2006), so as to encourage positive dispositions to learning. As the UNESCO (2010) policy reports, children should be allowed to explore ICT tools so as to tailor them to their own learning.

UNESCO follows the example of Siraj-Blatchford & Siraj-Blatchford (2006) who set out the four key areas of learning with ICT: communication and collaboration; creativity; socio-dramatic play; and learning to learn. These are categories through which we can understand how ICT can support child development. The first category concerns children assisting each other during their learning with a range of technology, such as programmable toys or drawing programs; the second stipulation of ‘creativity’ involves using technology to adapt the contexts in which early learners follow their learning schemes. The third category of ‘socio-dramatic play’ involves using software and touch-screen technologies to promote social role plays; finally, the process of ‘learning to learn’ involves using ICT programs to allow even very young pupils to reflect on learning and support their meta-cognitive development.

Again, following UNESCO, Hayes & Whitebread (2006) consider the use of ICT tools in depth in the playroom, in terms of how they may support child development, while taking a more holistic approach to studying the surrounding environment. They add more categories of learning: ICT and literacy; ICT and mathematical understanding; ICT and science; creativity; problem solving and playful uses of technology (games and simulations); visual literacy and painting; media education (digital animation); and learning music. The emphasis that Hayes & Whitebread put on learning is on helping children to gain confidence to learn creatively through ICT.

The use of ICT in promoting literacy among early learners is a common theme in the literature. Literacy is no longer constricted to reading and writing but also to becoming literate in the full range of communication mediums that surround young learners (UNESCO, 2010). Technologies in society are changing the way that we communicate, and children need to be literate in them. Software now develops literacy not solely for formal reading and writing but in order for the child to nurture their understanding, thinking and creativity. In this sense, as the UNESCO report agrees, the supposed gap between speech and writing that Vygotsky stressed, as well as the difficulty of motivating children to learn to write, can be bridged in part through the use of technology in the playroom.

Clements (2002a, 2002b) suggests that learning with and through ICT can enhance the learning of mathematics. This finding does assume, though, that practitioners are skilled in the proper software and aware of the ideal outcomes for learning. He suggests that children can organise and scaffold their high-order thinking through exploring ICT scenarios. We need to investigate teachers' actual skills with ICT and problematise such assumptions; the current study assists in complicating such assumptions by given teachers a voice through which to express their abilities with and attitudes towards ICT. Compounding this issue is that preschool teachers need to both engage and challenge individual learners in a complex manner in just one playroom session (Siraj-Blatchford & Whitebread, 2003). ICT tools can help alleviate such issues in teaching maths problems to young children but only if teachers are confident with software and have the appropriate ICT skills (Clements & Sarama, 2007).

The unique quality of ICT is the richness of the worlds that it may render. Reality can be rendered symbolically in both electronic toys and in computer programs that replicate real-time scenarios. This involves planning that is closely linked to mathematical skills and, in turn, the ability for pupils to nurture these skills is called 'algorithmic literacy' (UNESO, 2010). Programs that promote this literacy include software that attempts to mirror everyday events or use imaginative scenarios to enhance and sharpen planning skills. For example, the early Russian program PictoWorld from the 1980s, developed by Moscow State University, challenged users to navigate a robot safely out of a digitally rendered maze. For children who practised on the program, using symbols to control the robot began to become intuitive, and so suggested a cognitive development in controlling.

Also, research by Cohen (1988; 1994) and Brooker & Siraj-Blatchford (2002) supports the idea that using animation and visual ICT aids can bring together learners from different backgrounds and with different first languages. It is ICT's status as supporting cognitive processes in an integrated curriculum that is most appealing to practitioners as it nurtures abilities to learn, create, think, communicate and collaborate.

3.3. Contemporary learning in ECE

Learning can encompass a range of developments in children's skill, confidence or knowledge (Plowman et al., 2010). In theories of contemporary education there is a clear understanding that learners in the twenty-first century have a unique set of needs that curricula must adapt to in order to properly prepare learners for working in the digital age. In 2008, Kalantzis & Cope suggested the tenets of a 'new learning' that, while not being structured into a set curriculum in their model, could offer a basic set of open-ended criteria to guide learning. The key ideals of 'new learning' put forward by Kalantzis & Cope (2008) are that:

- Education should be at the centre of the knowledge economy and be socially significant
- The idea of educational institutions should be broadened
- The tools for learning should reflect contemporary technologies
- Learning outcomes should be more dynamic, collaborative and capability based
- Learners and participants should share control in learning
- Pupils who do not fit easily into societal norms should be justly educated
- Old pedagogical practices should be updated
- The teacher should no longer be only a purveyor of knowledge but have more independence to design learning scenarios and research tasks.

The aim of these criteria is to get teachers to interrogate the received curriculum they deliver.

A number of elements need to be in place before this high level of integration may be achieved. Young children should be familiar with new ICT tools and be able to learn both with and through them (Yelland et al., 2008). Yelland et al. (2008) argue for the use of fresh technologies, as well as collaborative learning and problem solving carried out in dynamic ways. Such learning practices may be demonstrated in listening and feedback skills in brainstorming sessions or through creating drawings on ICT tools. Mirroring Kalantzis & Cope (2008), Yelland et al. (2008) argue that 'new learning' surpasses traditional and individually-focused educative practice. The role of the teacher is therefore radically altered from a purveyor of knowledge to a stakeholder who is more interested in thinking through ways of communicating, pedagogical reflection and team work. ICT can be a central tool in this transformation of learning as it allows children to make sense of concepts and ideas in a myriad of ways that can reinforce the tenets of 'new learning'. In turn ICT is a significant and powerful tool that can meet the complex needs of the twenty-first century learner.

This engagement promotes a pedagogy in which children are driven to actively construct meaning in learning; in turn, its use can be aligned with a number of renowned theoretical approaches that prioritise such construction of meaning (e.g. Piaget, 1972; Bruner, 1977; Vygotsky, 1978).

3.3.1. Theories of learning and child development

ICT's role in education is to support learning either as an information tool or as a learning tool (Selwyn, 2011; Tondeur, 2007; Tondeur et al., 2007). To inform an understanding of the possibilities of ICT use in ECE it is necessary to consider the dominant learning theories that have had a major bearing on both the form and content of how we think about children's learning in ECE. The theories of Piaget (1972), Vygotsky (1978), and Bruner (1977) are most important to initially consider in this research.

Based on Ertmer & Newby (1993), Driscoll (2005) and Dabbagh (2006), Dede has summarised the main tenets of each of the three dominant schools in educational thought: Behaviourism, Cognitivism, and Constructivism (2008). It is the principles of learning in each of these theories that inform playroom practice in ECE and each position conceives differently of both the child's position in the learning process.

1. Behaviourism argues that reality is external and objective, while knowledge can be gleaned through experience. Since learning occurs through experience, it is posited that playroom zones mould the environment to stage instruction-based learning that nurtures and changes the child's learning faculties.
2. Cognitivism argues that the world is mediated through cognitive representation; knowledge is therefore a negotiation between thinking and experience. Since learning is both experience- and thinking-dependent, playroom zones assist children to develop, through collaboration, symbolic constructs in the mind that underpin their knowledge and skills.
3. Constructivism argues that reality and knowledge are distinct, where the former is internal, and the latter is constructed. Constructivists posit that learning is an individual experience, constructed by the child, and in turn playroom zones assist learners to create meaning that is both individual and gained through experience.

Considering the most dominant of these theories, it is thought that ICT can be introduced into learning environments to support one of constructivism's main tenets: proximal learning (Vygotsky, 1978). However, such introduction relies heavily upon the pedagogical philosophy of teachers and the set-up of the physical and psycho-social context in the learning environment (Yelland et al., 2008a).

Learning theories do not absolutely provide 'a simple recipe for designing effective learning environments; similarly, physics constrains but does not dictate how to build a bridge' (Brasford et al., 2000: 131). Thus, what follows is a consideration of the theory as is relevant to the context of playroom practice, considering the needs and desires of the many stakeholders involved, and their interrelations, as well as the resources they call upon. Indeed, ICT can be a connective tool in creating and sustaining these relationships between peers and stakeholders. In socio-cultural theories this leads to considering how learning can be supported by more-knowledgeable peers or teachers through scaffolding and guided participation.

In order for ICT integration in the playroom to enhance contemporary learning in a way that is modern and relevant it is necessary also to consider the wider contexts of learning.

A reflection upon environmental and ecological factors acknowledges their influence upon practice; it also highlights the manner in which such an investigation's findings should influence the decision-making process of how best to learn with and through ICT (Rosen et al., 2009).

Practitioners carry out their work within the influential wider context of the ecological environments that surround them. These consist of a number of layers, from the micro, to the meso, to the macro. As such, and as discussed more fully in the next chapter, Bronfenbrenner's ecological theory (Bronfenbrenner, 1995) is useful for articulating the factors influencing practice that have been studied in the cases here; indeed, it is the influence of such factors that suggests that ICT cannot be studied in isolation. While a teacher's philosophy and their relationship with learners is central, the influence of holistic factors upon this relationship cannot be overlooked, particularly if we take the playroom to be the micro environment of a child's learning, the meso level to be the wider context of the preschool, and the macro level to be the ideologies and policies surrounding ICT use in ECE in a certain country.

Debates or practices at each of these contextual levels influence both the practice of ICT use in the playroom, and the philosophy of the teachers who facilitate this practice. It is now the case in early years' learning that technology has a dual role as a contextual element that surrounds children on a daily basis and as a cultural tool that they can learn through and with (Plowman et al., 2010). The focus here is on how ICT can be used most effectively to enhance ECE learning in the contemporary age and what holistic factors influence practitioners' use.

3.3.2. Limitations of learning and child development theories

In general, the learning theories previously explored in this section provide a number of useful concepts for understanding learning with and through ICT in ECE. This section has, in particular, emphasised certain socio-cultural theories as they serve to highlight the importance of an adult presence, as well as others with expertise, which can scaffold a child's learning. An idea of why and when to use ICT has been formed in this literature review but it is still necessary to consider *how* to integrate ICT in such situations in ECE.

The main focus in all of the learning theories, from behaviourism to social constructivism, has been fundamentally on cognitive development (Trawick-Smith, 2010). These theories are propounded from the particular point of view of the psychologist and educationalists have to take a more holistic view (Luckin, 2010). While a teacher's philosophy and their relationship with learners is central, the influence of holistic factors upon this relationship cannot be overlooked, particularly if we take the playroom to be the micro environment of a child's learning, the meso level to be the wider context of the preschool, and the macro level to be the ideologies and policies surrounding ICT use in ECE in a certain country. Indeed, teachers carry out their work within the influential wider context of the ecological that surround them (these environmental and ecological factors are discussed in depth later in this chapter). Debates or practices at each of these contextual levels influence both the practice of ICT use in the playroom, and the philosophy of the teachers who facilitate this practice, to varying degrees. Hence, in order for ICT integration in the playroom to enhance contemporary learning in a way that is modern and relevant it is necessary also to consider the wider contexts of learning (Siegler, 2004, 2007a; 2007b).

Furthermore, everyday pedagogical practices work more on the whole child than simply cognitive development (Lohnston & Nahmad-Williams, 2009), for example drawing is not only cognitive but is also a physical activity. There are other areas of child development that are important to consider when it comes to ICT integration in ECE, especially as, in this thesis, we categorise ICT use as play (see Figure 3.1). Play involves exercising the four key elements of the child: cognitive, emotional, social and physical (Vickerius & Sandberg, 2006). With regard to the second of these elements, it is the work of Susan Isaacs in the 1920s that empirically highlighted an emotional or affective aspect to learners (O'Hara, 2004). Children also have to be able to show choice and responsibility to develop socially; as well as gain a sense of self and autonomy (Pramling Samuelsson & Asplund Carlsson, 2008). It has been found in the literature (e.g. Howard, 2011; Pramling Samuelsson & Johansson 2006; Wood, 2013) that early years' institutions have a significant role to play in nurturing these social skills and also in developing early learners physically through play and exercise.

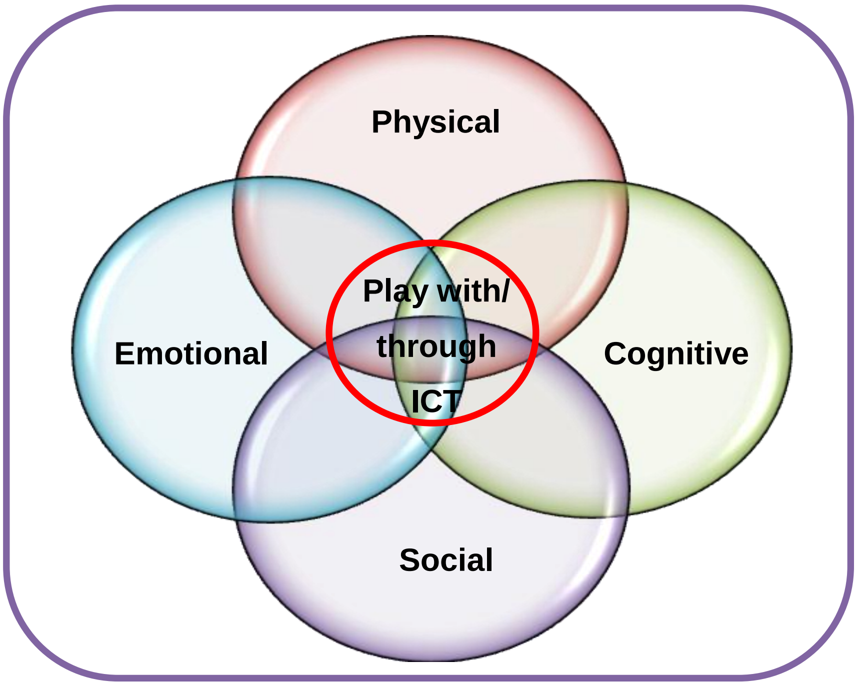


Figure 3.1 The inter-relationship of development

These categories overlap and impact upon one another. For example, the process of acquiring language involves a development of cognitive skills through understanding and learning language. The process of learning language in turn promotes social and emotional growth (Cooper, 2005; Forcier and Descy, 2008; Stephen and Plowman, 2008). Developmentally appropriate practice pays attention to all such factors and the National Association for the Education of Young Children (NAEYC) guidelines suggest how to optimise nurture across all of these issues (NAEYC, 2009). ICT therefore has to be integrated into ECE in a manner that respects this range of needs and diverse experiences that the child brings with them (Can-Yasar et al., 2012; Celebi-Oncu, 2010; Jonassen et al., 2008). In other words, it has to be integrated in a way that is 'developmentally appropriate' for the child. This integration has to respect both the diversity of learners and the influence of environmental factors.

Next, issues surrounding the influence of the wider context and how pre-school teachers can effectively integrate or implement the use of ICT within the early childhood education environment are discussed in further depth.

3.4. Ecological systems theory: The influence of the wider context

Research that solely focuses upon issues at the level of the classroom tends to produce a literature focused on ‘individual responsibility’ as opposed to ‘system responsibility’. To produce ‘system responsibility’ involves conducting research that focuses on national (macro) authority issues that influence the integration of a consistent ICT infrastructure into schools. There are three distinct levels to consider: the national level is described as macro; the school level is meso; and the classroom level is micro. It is important that research exposes and investigates the differences between ICT strategy on a macro level, the practices at the meso level of the preschool, and the use of ICT at the micro level of the playroom.

Socio-constructivism may be said to have a narrow view of culture, and this outlook can limit its application as it does not fully consider the wider environment in which the individual is situated. In order to fully conceive of this wider context we need to employ a powerful and established theoretical framework using Bronfenbrenner’s ecological theory (1995; 1998). Ecological systems theory is here favoured over recourse to just one of these theorists, and also over Cole’s (1995) ‘garden metaphor’, which asserts that the most effective use of the environment must be made in order to grow the object, i.e. nurture the learner, under consideration. While Cole’s metaphor provides a strong framework for contextualising learning and is closest to ecological theory in terms of taking an overall, holistic approach, Bronfenbrenner considers the child-teacher interaction at a much earlier age, thus being more suitable to ECE; his model is also more dynamic and considers more than just the child’s cognitive development, which is a limitation of some purely constructivist theories.

3.4.1. The Ecological System Metaphor: Overall Structure

In general, ecology concerns the study of places and the interactions of the species that live with other living and non-living entities. The etymology of ‘ecology’ stems from the Greek for ‘household’ (oikos), with the addition of “logy” which denotes a study of an area of knowledge or a particular species (Zhao & Frank, 2003). Thus, ecology in general is literally the study of households and environments. The characteristic of such ecosystems which enables a study of both their separate parts and their entireties is the graded arrangement of their influential elements into a contextual hierarchy; this approach fits with the overall aim of the current research to take a holistic approach to investigating ICT integration within ECE settings.

Viewing human institutions as ecosystems and using an ecological conceptual framework is not a unique move, and there are several precedents for it in the literature (for example Hassan, 2010; Johnson & Puplampu, 2008; Murphy & Beggs, 2003; Sandvig, 2003; Zaho & Frank, 2003; Kerawalla & Crook, 2002; Nardi & O'Day, 1999; Bruce & Hogan, 1998; Lemke, 1994). Furthermore, in the literature on childhood use of technology there have already been ecological investigations into context (Murphy & Beggs, 2003; Sandvig, 2003; Fabian & Dunlop, 2002; Kerawalla & Crook, 2002). The most famous innovator of this metaphor for study in education, however, remains Bronfenbrenner (1979; 1993; 1995; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 1998).

Bronfenbrenner's ecological system theory (1979; 1995) is concerned with differentiating and extrapolating a series of contextual relationships that surround the individual child (e.g. with a teacher). The individual (the teacher or the child) is surrounded by complex social systems affected by multiple levels of environments and relationships. As a result the individual develops at the centre of a complex series of contextual levels. As discussed in chapter three, at least some of these levels are missed by DATU and by the theories of Piaget, Vygotsky and Bruner. The conceptual model for understanding these multi-layered relationships was first expanded upon by Bronfenbrenner (1989) in a bi-directional system of five nested, environmental layers; a set of influences that can be visualised as a series of circles that surround the central individual. These layers are the micro-system, the meso-system, the exo-system, the macro-system, and the chrono-system, respectively (see figure 3.2). The layers in Bronfenbrenner's ecological framework can be briefly described as follows (Johnson & Puplampu 2008):

- Micro-system: the heart of the system containing the teacher and immediate playroom environment.
- Meso-system: the immediate ecosystem in which the teacher is situated, e.g. the wider preschool environment and the relationships within it.

- Exo-system: indirect environments that have a secondary effect upon learners, e.g. a parent or guardian's place of work.
- Macro-system: the realm of overarching social values, laws, opinions and ideologies that affect the child and the teacher in the micro-system, .g. the legal rights of children, or educational policies.
- Chrono-system: the overarching effect of time upon all systems and developments, e.g. life transitions.

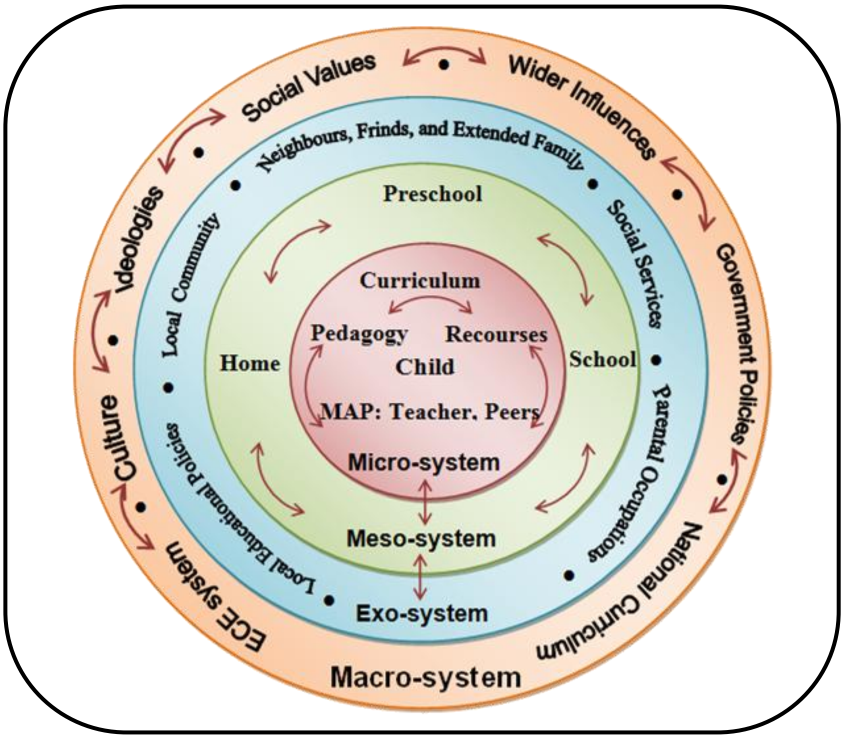


Figure 3.2 Pedagogy in Micro-system (Source: Bronfenbrenner, 1995)

In more contemporary adjustments to his theory Bronfenbrenner also adds bio-ecology or the child's own biology as a dimension to the system (2005). The system as a whole provides a multifaceted way of describing the complex interactions and influences that shape a child's development. Within the micro-system there is further scope to include the immediate technologies that may influence or nurture development. In turn, these ICT tools can be seen as a subset of the micro-system (see Figure 3.3) (Johnson & Puplampu, 2008).

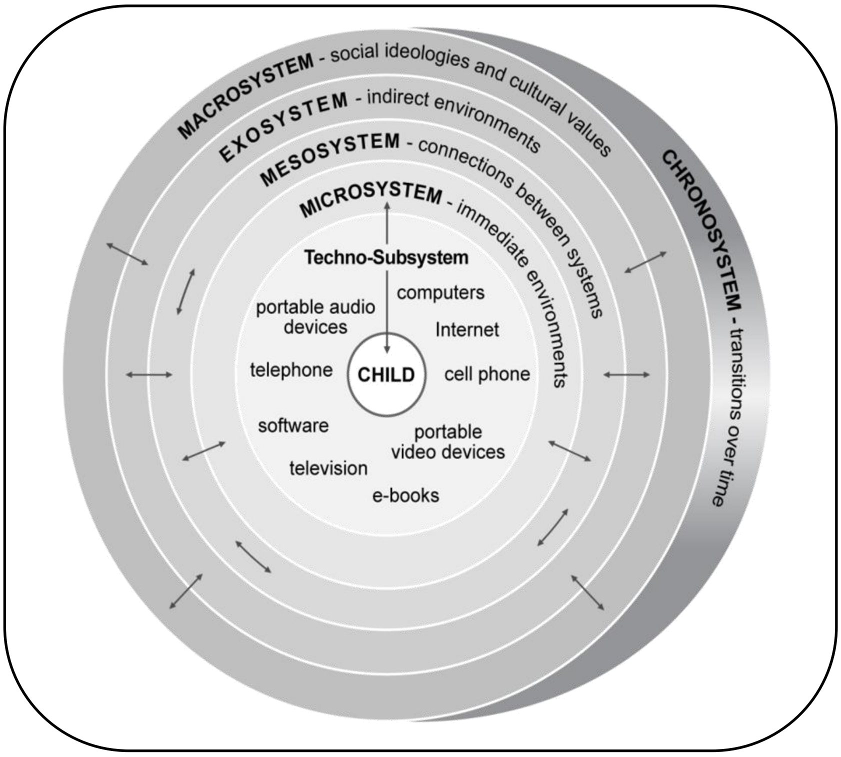


Figure 3.3 The ecological Techno-subsystem (Source: Johnson & Puplampu, 2008: 3)

Recourse to the theory of ecological systems provides a conceptual framework through which to view and articulate how the techno-subsystem of ICT use is both influenced by the systems around it and how these relationships in turn influence that between the teacher, the ICT tool and the meso-level environment of the preschool setting. Further, the macro-system of ideology and school policy impacts how often and in which ways children encounter ICT. An awareness of how the macro-system impacts upon the meso-level of the preschool, as well as the micro-level at which the teacher is situated, helps achieve a holistic understanding.

Johnson & Puplampu's (2008) appropriation of Bronfenbrenner is useful here as it not only articulates a techno-subsystem within the micro-system but also highlights the importance of connections and relationships at the meso-level of the preschool. The micro-system is dependent on the larger ecological system within which it is embedded. Studying the micro-system suggests that a change of culture in the broader context, a switch of institutional setting, or a change in focus to a different activity in the learning environment is likely to change the learning skills displayed by the individual child. This approach therefore suits the contextual and holistic focus of the case studies carried out in this research. Knowledge of the operations and interdependence of the cultures, at various levels of context, will empower this study to provide a better understanding of where and how ICT is situated in the playroom micro-system and how teacher characteristics, as well as their reactions to the pressures for ICT use, influence the process of integration. Applying Bronfenbrenner's theory to the study of ICT will provide a more adequate and detailed account of the contextual layers involved.

3.4.2. ECE elements in ecological systems theory

In the 'concentric' model adapted from ecological theory, the successive circles represent the nested systems that are involved in the research (see Figure 3.4). The layers inherent to this ecosystem metaphor fall into broad categories: the internal factors which are within the meso-system and micro-system, and the external factors which are within the meso-system. External forces are subsumed in the macro-system and exo-system.

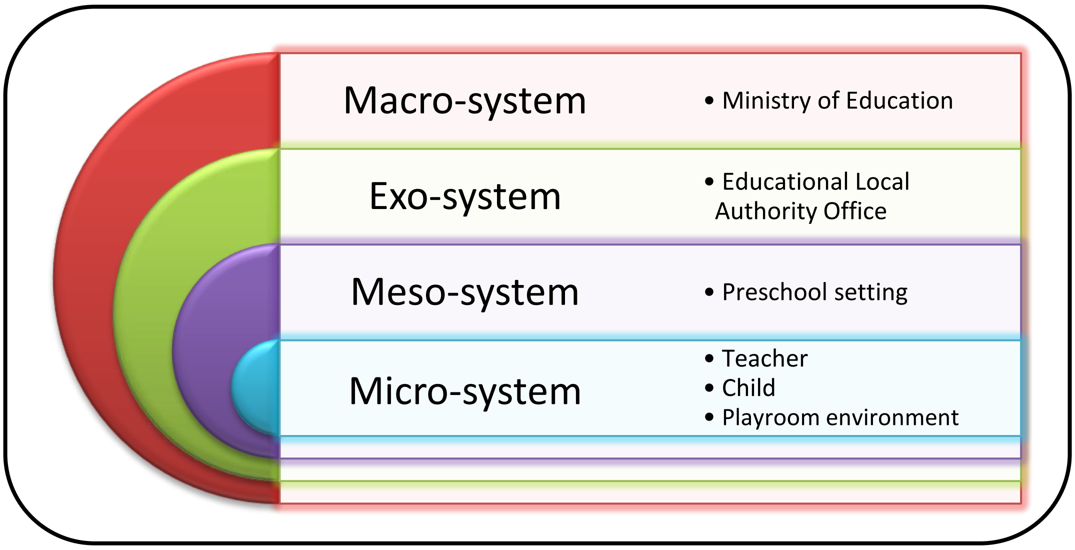


Figure 3.4 Concentric model adapted from ecological theory representing the nested systems that are involved in the research

At the level of the internal factors, the child's play and the teacher are situated in the innermost circle, alongside the toys with which it is interacting in the playroom, and with important elements such as the layout of the playroom and ICT rooms, and the general learning roles of children and teachers. The next higher level of context or meso-system is the preschool setting in which the programme is situated, as well as the relationships within the preschool that affect and influence the practitioner. Elements to consider include the type, location, layout and ethos of the nursery school (rules and community), ICT facilities (tools), time-tabling of ICT and non-ICT activities (rules), and the roles of different practitioners of the preschool (division of labour and community).

Moving to the external factors, the macro-system is characterised by national education policies on the use of ICT (rules), regulatory bodies (tools and community), the recruitment, training and retention of teachers (community and roles), and the division of labour among major stakeholders of the ECE sector (Lim, 2008). It also includes society at large, in the relevant country, and consists of elements such as ECE software developers, publishers (community and division of labour), and public perceptions of ECE schools. Exo-systems represent environments that the child does not directly come into contact with but which may affect their immediate environment (e.g. a parent being made redundant from work). Nothing is unidirectional in this interactive system. Changes that are initiated by any of the components within a system have an impact on the components of other contextual layers.

Given the eco-systems' consideration of both the singular and the whole, the actors and their interactions within a set environment with living and inanimate things, Bronfenbrenner's ecological systems theory is applied in this research to address the different educational stakeholders and factors influencing the two main concerns of the current study within these multiple levels: (a) preschool teachers' integration of ICT in teaching and learning, and (b) the influence of the preschool environment around them. In order to consider the hierarchical influences over preschool teacher use of ICT in the ecosystem of the preschool playroom, an ecological metaphor is used to describe the complexity that exists in relation to the factors that influence change, as well as to the relationships between them. The meso-level here is the wider preschool context and the micro-system is situated at the level of the playroom.

3.4.3. The individual within the ecosystem

An ecological framework allows for a study to be conducted in a holistic manner so that the understanding gained of ICT use by teachers is not one of separation or isolation. In this model we can understand ICT tools as unique, complex objects that, through their introduction into the ecosystem of the playroom, change and impact upon the very equilibrium of that system and act as an internal factor. Playrooms become the ecosystem under study and teachers the key participants that influence ICT integration. Bronfenbrenner situates the teacher at the micro-level (the playroom level) and s/he is surrounded by a number of complex social and educational systems. The child learner, too, is in the middle of a complex series of contextual levels and the teacher’s role as a MAP becomes central. At the internal level of the micro-system, the teacher has a role in guiding the learning of the child, and has further relationships with objects such as ICT, as well as to the physical spaces of the playroom.

By understanding the teacher’s environment as an ecosystem it is recognised as a space that is characterised by a number of complex internal and external relationships that operate within and around it. For the teacher, at the meso level of internal factors, important interpersonal relationships are formed with other stakeholders in the preschool setting, including administrators, colleague teachers, deputy and HTs, children and their parents. At the external macro- and exo-system levels there are relationships with rules and curricula. The teacher is subject to the drives and imperatives for ICT use that come from a larger macro-system that the ecosystem is situated within. At the external level, the preschool itself is part of the wider ecosystem of the social and educational community (Zhao & Frank, 2003).

Ultimately, this research adapts and employs Bronfenbrenner’s (1979; 1995) multisystem as an overall structure from macro-system to micro-systems; to encourage a holistic investigation of how all the relevant ICT tools may be most efficiently integrated into the meso- and macro-system of the pre-school environment (this will be explained in greater detail later in the theoretical framework chapter). Naturally, in considering teacher characteristics in more detail than previous ecological studies, the influence of relationships between practitioners, parents and other stakeholders at the meso-system level will not be overlooked. These contextual relationships are part of an ever-changing process that consistently produces new conditions that affect the teacher’s embedding of ICT into learning practices.

Using Bronfenbrenner's ecological systems theory (1979; 1995) is clearly advantageous in focusing on ICT practice and contexts in ECE. Several researchers such as Hassan (2010) and Zhao & Frank (2003) have pointed out that Bronfenbrenner's (1979; 1995) multisystem or 'super-ecology' has helped in describing the complexity that exists in relation to the factors that influence ICT integration process in schools and the associations between them. Bronfenbrenner's ecology (1979; 1995), system and nested characteristics, explain how an individual (e.g. a teacher) is affected by the environment they are in (e.g. school, curriculum) and how the connections of that individual (e.g. a teacher's relationship with HT and colleagues) within the environment, play a role in affecting ICT integration and changes in teaching and learning. In this research, Bronfenbrenner ecological systems theory influenced the initial thinking about contextual factors and the multiple levels of educational stakeholders that influence practitioners' integration of ICT in teaching and learning.

3.4.4. The Limitation of Using Only Bronfenbrenner's Ecological Systems Theory

Limitations arise from drawing solely from Bronfenbrenner, even if his ecological systems theory provides a step towards a holistic approach. Bronfenbrenner (1979; 1995) suggests a range of factors in both practice and contexts that clearly influence a child's learning in the playroom. However, a major issue is that social, cultural, economic and biological factors are not fully considered. For instance, his theory does not elucidate the attributes of the teacher in terms of their skills, knowledge, values or demographics. Also, such an approach would not consider closely the contextual elements at the meso-level that a preschool should possess, or pedagogical ideas it should pursue, in order to provide a context for ICT integration into the learning environment.

Bronfenbrenner's ecological model, however, can be adapted to suit the needs specifically of research into ICT into the early years. The important contextual elements are clarified in the next part of this chapter. Literature relating to models of ICT integration in teaching and learning are considered in more depth as the recognised factors that influence practitioners' ICT integration into the ECE playroom are made clear.

3.5. Effective Integration of ICT in Early Childhood Education

As outlined in section 3.2, one reaction to ICT integration in education suggests that it is not at all appropriate for learners' overall well-being and development. Detractors of ICT integration into the ECE environment have argued that ICT use makes learners passive, isolates them, and that it promotes ineffective learning for children (Siraj-Blatchford & Whitebread, 2003). However, many other authors consider that ICT holds potential benefits for young children's learning and development. Most supporters of ICT in the literature believe that the effect that ICT can have on ECE depends on how thoughtfully it is integrated. Van Scooter & Boss (2002) argue that ICT can complement teaching through other tools and activities. Additionally, Siraj-Blatchford and Whitebread (2003) state that ICT use can be active, intellectually stimulating, social and liberating.

Nevertheless, dynamic and educative integration of ICT into ECE will not necessarily happen of its own accord. Research indicates that the effectiveness of ICT integration depends upon three major considerations that are essential for technology to have a significant effect in ECE. These considerations include: developmental appropriateness of the technologies for the children; incorporation of ICT activities within a play-centred and responsive environment; and practitioners' skills, understanding and knowledge in overseeing appropriate uses of ICT with young children (Siraj-Blatchford & Whitebread 2003). Each element will be discussed in the following section.

3.5.1. Developmentally appropriate technology use in ECE

Dynamic and educative integration of ICT into ECE will not necessarily happen of its own accord. Research indicates that the effectiveness of ICT integration depends upon the skills, understanding and knowledge of the practitioner overseeing the integration (NAEYC & Fred Rogers Centre, 2012; McManis & Gunnewing, 2012; Siraj-Blatchford & Whitebread, 2003). It is the practitioner's responsibility to appraise proper forms of ICT and employ them to support creative play and expression. This is not only through the selective and supported use of particular software applications, including computer games, but also through the use of a range of different forms of ICT.

A significant proportion of the literature on ICT integration into ECE is underpinned by the concept of developmental appropriateness. The original concept of Developmentally Appropriate Practice (DAP) is the culmination of many decades of theoretical and research-based work in education studies and has been influenced by a wide range of theoretical perspectives, including those of Piaget, Vygotsky, Dewey, and Erikson, as well as being revised a number of times by the NAEYC (Bredekamp, 1987; Bredekamp & Copple, 1997; Copple & Bredekamp, 2009; NAEYC, 2009). As such, DAP forms the backbone of many early years' curricula and its general focus on encouraging children towards explorative learning in their social, physical and cultural environments best characterises its pedagogical approach. The form of such encouragement by practitioners also depends upon the needs, interests, age, developmental characteristics and cultural context of learners.

The phrase 'developmental appropriateness' has many meanings. In one sense, children's development can be considered a step-by-step process (Luke, 1999). As such, overly complicated play or activities for a child's cognitive capabilities are considered not to be developmentally appropriate. O'Rourke and Harrison (2004) suggest that hard-line developmental programs concentrate upon what child learners lack. Downes et al. (2001) state that fresher approaches to developmental appropriateness come from a Vygotskian perspective as ICT can be considered as a cultural tool itself that fits in with the social constructivist theory. Also key is focusing on testing and supporting child learners through scaffolding.

Developmentally appropriate ICT use is an extension of the original and dominant concept of DAP. There are two sets of often quoted guidelines that focus on developmental appropriateness: the Developmentally Appropriate Technology in Early Childhood (DATEC) project in the UK (Siraj-Blatchford & Siraj-Blatchford, 2006; Siraj-Blatchford & Whitebread, 2003); and in the USA the National Association for the Education of Young Children (NAEYC) position statement on technology use with children who are between 3 and 8 years old (NAEYC, 1996). The DATEC's eight general principles about what constitutes developmentally appropriate use of ICT in ECE provide a useful general framework for practitioners and decision-makers to develop their skill in recognising and applying the most appropriate ICT tools (hardware or software). Parents and practitioners have been encouraged to use these points to engage in a discussion about each area and how it might fit into the general philosophy and practice of the particular setting (Siraj-Blatchford & Whitebread, 2003). These principles are listed in table 3.2 and they are useful in structuring what the observations in this research will consider (see Chapter 5). These headings are also similar to the principles of the Saudi ECE curriculum (see Chapter 2).

Table 3.2 The DATEC project principles of developmental appropriateness of ICT
(Based on Siraj-Blatchford & Siraj-Blatchford, 2006; Siraj-Blatchford & Whitebread, 2003)

The ICT tool should…	
The ICT tool should be educational	Applications (tools) employed in the early years should be educational in nature, and this effectively excludes all applications where clear learning aims cannot be identified.
The ICT tool should encourage collaboration	In the early years, we know that activities that provide contexts for collaboration are especially important. Working alone as well as in collaboration and in a range of other ways in interacting with technology is important too. However, '*joint attention*' and '*children learning to share´* and/or '*engage jointly*' provides a better cognitive challenge for young children.
The ICT tool should support integration	ICT applications should be integrated as far as possible with other established ECE practices (play, project work) which make the curriculum relevant to children. Another important reason for employing an integrated approach to ICT is the recognition that this is more consistent with the notion of ICT products as tools. Tools are designed to be applied for particular purposes when required; they are not usually designed for continuous use for their own sake. Equally inappropriate is the common practice of providing access to ICT as a reward.
The ICT tool should support play	Play is considered a 'leading activity' for young children; and it is widely considered to be a driving force in the child's development of new forms of motivation. Play and imitation are primary contexts for representational and symbolic behaviour, and role-play is therefore central to the process of learning in the early years. Artefacts, such as toys and other 'manipulables' (functioning or pretend), are important because they provide a means by which children may engage and interact with a much wider range of 'virtual' artefacts and environments than would otherwise be possible.
The ICT tool should leave the child in control	Generally, applications should be controlled by the child; they should not control the child's interactions through programmed learning or any other behaviourist device. While the evidence suggests that applications of this kind may be effective in developing a range of skills including children's alphabet and phonic skills, counting and early number concepts, the approach is contrary to popular conceptions of good educational practice.
The ICT tool should be transparent and intuitive	As far as possible, we should choose only such applications which are 'transparent' – their functions should be clearly defined and intuitive. What this normally means in practice is that the application completes each clearly defined task in a single operation. The intuitive nature of the 'drag-and-drop' facility on a computer screen is a good example.

The ICT tool should avoid violence or stereotyping	Where applications fail to meet these criteria, it would be difficult to justify their use in any educational context.
The integration of ICT should support the development of awareness of health and safety issues	Where the use of a computer is integrated with other activities, e.g., in socio-dramatic play, modelling, painting, etc., children benefit from greater movement and exercise away from the computer. DATEC argues that the time spent using any desktop computer application by a child should be comparatively short, normally not extending beyond 10-20 minutes at a time in the case of 3 year-olds. DATEC suggests that this might be extended to a maximum of 40 minutes by the age of 8.
The integration of ICT should support the involvement of parents	Studies have shown that when parents, teachers and children collaborate toward the same goals it leads to improved academic performance. ECE centres report that children show a more positive attitude toward learning, and are better behaved. Home-centre links, or parent involvement, are, therefore, the components of effective early childhood education centres that merit special consideration.

More recently, Rosen et al. (2009) have put forward the criteria of Developmentally Appropriate Technology Use (DATU). DATU assumes that children actively learn and that ICT (software and hardware) should be created so as to provide a nurturing, interactive form of learning for pre-schoolers. Rosen (2006; 2009) comments that DATU exists as teachers have integrated their knowledge and views on pedagogy to provide resources for young children that are rich in technology. Accordingly, once again like many socio-cultural theorists and other contemporary educators, DATU emphasises the role of the knowledgeable and skilled practitioner.

Firstly, DATU considers what the most developmentally appropriate teaching methods are for integrating ICT into a child's learning (Rosen et al., 2009). Secondly, it highlights the different environmental aspects that should be included around children learning through technology. Emphasis is placed on the practitioner examining their own experiences and attributes, but there is also a concern for the specific situation of learners. DATU is focused on encouraging children to build and construct their own knowledge through a series of encounters with social, cultural and physical environments. Moreover, teachers make educational decisions by considering pupils' age, cultural context, and situation. In short, DATU is an approach that encourages the use of technology so as to build upon an individual pupil's innate inclinations to build up knowledge through interacting with the surrounding environment (NAEYC, 1996). It is to this playroom context that the chapter now turns.

3.5.2. Describing the Preschool Context: A Play-Based Setting

In the playroom setting, there is a large open-plan room which is used for a variety of play activities and which is populated by a number of materials and resources. Specific 'learning centres' are created (Prochner *et al*., 2008), for example a role-play area (Petrakos & Howe, 1996), an art area or a construction zone (Pellegrini, 1984). Children may move between resources freely and take part in a range of play scenarios (McEvoy *et al*., 1991). The aim of these activities and zones is to encourage Sustained Shared Thinking. This occurs when at least two people collaborate intellectually to solve a problem, clarify a concept or evaluate an activity. Both individuals have to be active and extend their mutual understandings for their thinking to be sustained (Sylva et al., 2004: vi).

This approach resonates with Vygotsky's work because it encourages learners to mutually explore (Brock *et al*., 2008). Children work together with practitioners or peers, and any achieved learning is reliant upon the fundamental characteristics of a preschool environment. Sustained shared thinking happens as part of the preschools established culture. Self-directed play is central as it may aid collaboration and diminish aggression (Broadhead, 2006), improve problem solving (Can-Yasar et al., 2012), encourage self-exploration (Broadhead, 2004) and improve creativity (May, 2007).

This approach to preschool provision moves forward work by early years pioneers such as Froebel (1782-1852), the creator of the first kindergarten (Smith & Connolly, 1980), and Susan Isaacs, who advocated free play in learning (Stephen *et al*., 2010). Thus, preschool practices are 'inherited' (Bennett *et al*., 2000) and socially constructed (Rivlin & Weinstein, 1984), based on existing and historical views of childhood.

The endorsement of play has not been universal. Bennett, Wood and Rogers (2000) argue that the assumption of play as innately beneficial is purely theoretical and not supported by empirical evidence. While play may add value to child development (Singer, 1994), from a socio-cultural perspective it is difficult to discern whether it is the play itself, the instructive teacher or some other social experience which has lead the child to develop (Rogoff, 1993a; Rogoff, 1993b; Sawyer, 2002). Nevertheless, play takes up a considerable proportion of children’s time in preschool and it provides an opportunity to explore children’s interactions with peers and preschool artefacts.

ICT and children’s play

Having provided an understanding of the typical preschool environment it is now possible to explore this context in relation to ICT integration. There is widespread belief in the benefit of play with ICT and the enthusiasm of practitioners and parents for children having early access to new technologies, and computers in particular (Stephen & Plowman, 2003a; Marsh et al., 2005). One such idea is that children should learn about technology (in terms of how it functions and the impact it has on their own lives and those of others) and also learn through using it directly. Play can contribute to a child’s learning experiences in both these areas.

Children can learn and be playful and creative with ICT in a variety of ways. However, young children need opportunities to explore technology and interactive media in playful and creative ways. Appropriate experiences with technology and media allow children to control the medium and the outcome of the experience, to explore the functionality of these tools, and to pretend how they might be used in real life (NAEYC and the Fred Rogers Center, 2012). Symbolic play and socio-dramatic play, in particular, are well established as important modes of learning for young children (Wood & Attfield, 1996). ICT research conducted as part of the Children’s Awareness of Technology (CHAT) project (1999) has shown that children consider the manipulation of symbolic play as every bit as ‘concrete’ as the manipulation of any alternative blocks and small-world toys.

O’Hara (2004) describes a range of examples from English ECE settings of ICT featured in children’s play, including socio-dramatic role play. The examples O’Hara describes include:

- an imaginative role-play about being “in the office”, in which a child used a functional PC, photocopier, and printer;
- a spontaneous indoor/outdoor game which evolved when an adult introduced six children to a pair of walkie-talkies;

- a small group of children and a teacher sitting in a circle and learning how to operate a Pixie programmable vehicle, with each child having a turn to program the vehicle to travel across the carpet to another child; and
- a whole-class “karaoke concert” using a CD player, microphone, amplifier, video camera, and television monitor.

The joint position statement of the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children’s Media (2012) stresses that interaction with technology should be playful and support creativity; it should also encourage exploration, pretend play, active play, and outdoor activities. O’Hara’s examples highlight some important themes of high-quality practice in ICT use with young children: ranging from a small group of children to whole class activity. These include: children using ICT in “realistic” and imaginative socio-dramatic role-play; children learning to use the correct vocabulary to describe different technologies and activities associated with them (for example, children talking about “typing”, “printing”, or “looking up flight times” using the computer); and children using different forms of ICT, both indoors and outdoors.

Moreover, many of O’Hara’s examples show children being trusted and assisted to be in control of the technologies (for example, children being helped to operate a video camera, CD player, computer, or programmable toy themselves and experiment with new opportunities and possibilities). Play choice and inner control are important features of play during the early childhood years (Brooker and Edwards, 2010). ICT centres can be arranged as one of the play centres in early childhood playroom where children can choose freely their own play centre; meanwhile, the ICT centre should be supplied with a variety of developmentally appropriate resources which children can freely choose according to their interest. Plowman et al. 2010 notice that although preschool practitioners talk about children playing with the computer, only a few computer activities were found to invite exploration and playfulness, whereas many others are drill-and practice based software. Even though this kind of activity can lead to learning, it may not provide a joyful learning environment for children to freely explore and interact with technology. For effective uses of technology and media it should be active, hands-on, engaging, and empowering (NAEYC and the Fred Rogers Center, 2012).

To analyze further the significance of play, Morgan and Kennewell (2005) conducted a self-directed study to test children's confidence level, feelings, and ability to use new technologies. Eventually, they found that even though young children are not confident in the use of personal computers, the fact that most of them were exposed to the use of mobile phones and e-games made them more confident and successfully increased their competency in the use of unfamiliar software. As a result, allowing young children to engage themselves in play through the use of ICT could increase their positive attitude towards technology and make them become self-efficient in the long-run.

In another study, Siraj-Blatchford (2004) observed a number of 3 year-old children using a software program that required them to enter their names. He noticed that children were interested to see what their name looked like on the computer screen, and rather thrilled that they could change the size, font, and colour, but they were overjoyed to discover that if you hold your finger on a key the computer produces an endless stream of letters. He also observed children deliberately pressing the wrong button, or giving the wrong answer, to see what will happen. This playful approach of allowing children to experiment is to be encouraged where children's attention concentrates on satisfaction and benefits of the activity itself instead of on the goals of the activity. The flexibility of play provides children with opportunity for experimentation and exploration in a risk free environment.

To understand how a child can increase their knowledge and experinces, Piaget's theory of genetic epistemology is composed of four cognitive structures or stages known as: (1) the sensorimotor stage (0-2 years); (2) the pre-operational stage (3-7 years); (3) the concrete operational stage (8-11 years); and (4) the formal operational stage (12-15 years) (Bruce, 2010). In line with this, children between the ages of 0 to 2 are expected to gain knowledge based on "motor actions" whereas children.between the ages of 3 to 7 are expected to gain knowledge through "intuition" (Instructional Design, 2013; Bruce, 2010, p. 85). It means that toddlers or pre-schoolers can learn to adopt to the use of ICT by visually and physically exposing them to the use of technology (Can-Yasar et al., 2012).

Piaget's theory is almost the same as constructivists' idea of learning. When it comes to the integration and implementation of ICT in early childhood educational learning environment, it is important to consider Piaget's idea that effective learning takes place through "adaptation", "assimilation", "accomodation", and "equilibration" processes (Rathus, 2011). Basically, "adaptation" refers to the child's interaction with the environment; "assimilation" is concerned with the need to incorporate new ideas in the existing schemes; "accommodation" is about the need to modify the existing schemes; whereas "equilibration" concerns creating a balance between assimilation or accomodation (Rathus, 2011; Bruce, 2010). In most cases, "adaptation" can happen either through assimilation or accomodation (Rathus, 2011, p. 17).

Bruner (1972), in a famous article entitled 'The Nature and Uses of Immaturity', has argued that play is one of the key experiences through which young animals learn, and also the means by which their intellectual abilities are developed. The human being, of course, has a much greater length of childhood than any other animal, plays more and for longer, and is superior in flexibility of thought. Mirroring Piaget, Bruner identifies three modes of cognitive action that assist the learner's mind in creating and storing meaning (1966).

1. The first stage of enactive development involves learning through action where motor responses primarily store knowledge.
2. The second stage of iconic representation where learning is stored in the form of images.
3. The third stage of symbolic representation is the most problematic and complex, where arbitrary symbol systems (made up for example of words or mathematical symbols) make up the forms that store information (Bruner, 1966).

During the 1970s, Bruner suggested that children were capable of intellectual achievements at an earlier point than predicted by Piaget as a result of instruction and carefully structured environments. Play is significant in this, Bruner argues, because it provides opportunities to try out possibilities, to put different elements of a situation together in various ways, and to look at problems from different viewpoints with minimum concern for the outcome. In particular, Bruner (1996) puts forward four approaches to learning that acknowledge the child as being innately intelligent, able to:

- Learn by imitating an example or a model of how to solve a problem
- Take in instructions from a practitioner where knowledge is transmitted directly
- Learn through dialogue with adults and individual thought

- Acquire a personal knowledge that may need to be transferred into social or cultural knowledge; this may require the assistance of the practitioner.

In terms of preschool learning it is the first, third and fourth of these approaches that take precedence (Plowman et al., 2010). As a consequence of the freedom it provides to try out scenarios, ICT offers particularly powerful opportunities to be playful in the way that Bruner has described. Yet, it is the responsibility of the preschool practitioner to judge which ICT tools may be appropriate for each approach bearing in mind the tools selected to assist the scaffolding of learning. In the modern environment children will have different levels of skill with ICT depending upon their proficiency and access to resources in their own home. Moreover, for Vygotsky and Bruner, working collaboratively and cooperatively constitutes an important learning mechanism (O'Hara, 2004). For example, with ICT, this could include one child teaching another child how a piece of technology works, or adult intervention may happen to guide and challenge children's thinking as well as extending their ICT capabilities.

It is clear that theorists themselves, particularly Vygotsky, saw the early potential for ICT to facilitate both interpersonal and intrapersonal learning (Vygotsky & Kozulin, 1996; Vygotsky & Vygotsky, 1980). One of the aims here is to see if this potential is being met in actual practice. The potential for enhanced cognitive development is certainly there in learning with and through ICT but there is a need to move away from skill-and-drill ICT practice to a more playful, explorative form of learning. Particularly in early years it is necessary to structure a pedagogical approach that underpins socio-cultural learning (Plowman et al., 2010). From a Vygotskian perspective, it has already been noted that ICT is most suitable for collaborative learning and problem solving in the educational environment (UNESCO, 2010).

Pre-schoolers learn by doing, and so practitioners should allow children to explore the use of ICT in playroom by taking the advantage of the opportunities for learning presented by 'spontaneous play' and 'planned, purposeful play' (Lake and Jones, 2012). Stephen et al. (2008) found when they asked children what activities they enjoyed that their answers were dominated by activities that they described as playing. These activities were characterized by an element of choice, opportunities to have some control over time and space, a lack of predetermined outcomes and a degree of authenticity, or at least an obvious link to authentic experiences (Stephen et al., 2008). Thus, to engage children in play that supports learning, with or with out technology, educators need not only to pay attention to the kind of play opportunities offered, but also need to take into considration the preferences and expectations of the young learners. Howard et al. (2010) indicate that children who are exposed to ICT activities in a play-based learning environment are more able to develop beginning attributes of cooperative play: negotiating, communicating and engaging in play.

Accordingly, for practitioners to take advantage of the value that ICT can add to young children's learning and development the stage must be carefully set within the playroom and with all the individuales involved (Plowman et al., 2012). As with any educational resource, new technologies can be used well or badly (Siraj-Blatchford & Whitebread, 2003). Preparation of the learning environment is essential to the overall success of ICT integration in ECE and clearly depends on the choices that practitioners make about which tools to select and when and how to use these; as well as their understanding of how these tools can support children's learning, development, participation, or play. The role of the early childhood education practitioner will be discussed further in the next section.

3.5.3. The Role of Practitioner in Scaffolding Children Play with ICT

The success of technology in educational settings does not rely totally on having the latest hardware, graphic software, multiple peripherals and a colour laser printer (The alliance for technology Access, 1996: 8). It is well recognised that the practitioner is central to the successful integration of ICT usage into the ECE playroom (NAEYC & Fred Rogers Centre, 2012; McManis & Gunnewing, 2012; Siraj-Blatchford & Whitebread, 2003). Practitioners have a critical role in making decisions and supporting children in their use of technology. Later this chapter will discuss, in more detail, factors at the teacher level and how they influence ICT integration. It will also consider the influential factors at the school level. In the first instance, though, the discussion in this section considers the important role practitioners have in scaffolding child learning in the playroom.

The position statement of the National Assosiation for the Education of Young Children (NAEYC) regarding Technology and Young Children stresses that the practitioner should determine if a specific use of technology or media is age appropriate, individually appropriate, and culturally and linguistically appropriate (NAEYC, 2012). Teachers are responsible for choosing appropriate hardware, software and websites as well as facilitating integrated ICT environments for children. This can be ensured by knowing about child development and learning, individual children's interests and readiness, and the social and cultural contexts in which children live. Furthermore, Haugland (1997) has stressed that learning with technology was markedely influnced by appropriate technology selection. Shade (1996) has stated that the teacher was held responsible for selecting proper tool and determining if ICT were to be used as add-ons or integrated into the curriculum. It is the practitioner's responsibility to appraise proper forms of ICT critically and employ them to support creative play and expression, not only through the selective and supported use of particular software applications including computer games, but also through the use of a range of different forms of ICT.

Teachers are also encourged to pay attention to children's physical and erognomic safety; and prevent them from exposure to violence (AAP, 2009). The adult's role is critical in making certain that thoughtful planning, careful implementation, reflection, and evaluation all guide decision making about how to introduce and integrate any form of technology or media into the classroom experience. Selecting appropriate technology and media for the classroom is similar to choosing any other learning material. Teachers must constantly make reflective, responsive, and intentional judgments to promote positive outcomes for each child (NAEYC, 2009).

Preschoolers have varying levels of ability to control technology and media and leaving them completely alone at the technology is considered developmentally inappropriate and may result in absence of benefits that ICT could provide for children. Copple & Bredekamp (2009) urge teachers to observe children at work to help them acquire new skills or understandings. Practitioners should select from a range of strategies (asking questions, offering cues or suggestions) and even demonstrate skills, add suitably complex materials, or encourage collaboration with peers.

Teachers' strategies have a tremendous influence on the integration process (Chang, 2001). According to Chang (2001) through teacher's scaffolding children effectively learn with technology. Stephen and Plowman (2008) indicate that with adult mediation children can demonstrate mastery of simple digital devices and are often seen using the tools as part of their pretend play. Additionally, it has been found that adult mediation in preschool learning environments facilitates informed use of ICT and has positive effects on children's performance (Stephen and Plowman, 2008). Teachers are in need of strategies or techniques to both judge and reflect upon their practice in the playroom when children are learning with and through ICT. In Scotland, in particular, there have been studies carried out that show an awareness of not only the practice of using ICT in ECE but which are also theoretically astute. In particular, in the ECE environment, the emphasis in these studies is that, when it comes to technology, the preschool teacher takes on the role of the more-able peer (MAP) in the pedagogical dynamic.

Stephen & Plowman's model of 'guided interaction' is useful here (Plowman & Stephen, 2006; Stephen & Plowman, 2007; 2008; Stephen et al., 2010). Guided interaction is a framework in the Vygotskian tradition; it is a coherent system through which to crystallise the types of supports that teachers can give both in and outside of the playroom. While it relies upon Vygotsky's understanding of the child learner's Zone of Proximal Development (ZPD) and the teacher's role in assisting learning, guided interaction is designed to provide a fuller understanding of technology use in the playroom specifically. Further differentiating it from traditional Vygotskian approaches is that it focuses on encouraging free play, guidance can be enacted not just through language but through multimodal interactions such as gesture or touch, and, finally, it encompasses both assistance in the playroom by the practitioner and their preparations before playroom activity begins (Plowman et al., 2010).

Thus, guided interaction has both a proximal (the guidance in the playroom from the teacher) and a distal dimension (the preparation of setting up the playroom before play begins). The former of these dimensions denotes face-to-face interaction between teachers and learners, which is visible in the playroom, and such interactions have an immediate effect upon the learning dynamic. As table 3.3 demonstrates, there is a range of categories of proximal guided interaction in Stephen & Plowman's model and these are carried out in multi-modal ways. The latter category of distal guided interaction is concerned with the ways in which the playroom has been laid out so as to purposefully facilitate children learning with and through ICT in an *indirect* manner.

Table 3.3 Proximal (direct) guided interactions (adapted from Stephen & Plowman, 2008)

Forms of guided interaction	Example	Mode	Learning
Demonstrating	How to use a tool such as the paintbrush or eraser Placing hand over child's hand as he/she moves cursor or clicks on icon How to frame a picture in viewfinder How to plug in electronic keyboard Turning over pages of story as children listen on audio tape Waving hand in front of eye toy	Physical action; oral Touch Touch; oral Physical action; oral Physical action Physical action	Operational
Enjoying	Sharing pleasure in features such as animation Moving to the music on a CD player	Oral; laughter Physical action	Learning dispositions Extending knowledge; learning dispositions
Explaining	What is on slides for the computer microscope	Oral	Extending knowledge
Instructing	Reading dialogue box on screen Tell child how to use digital camera Tell child to push button on tape player	Oral Oral, gesture Oral	
Managing	Tell child how to use digital camera	Oral; facial expression	Learning dispositions
Modelling	Tell child to push button on tape player	Physical action; oral Physical action; oral	Operational Extending knowledge
Prompting	Suggesting a child tries something new Helping with typing in names (typically to start a new game)	Oral Oral; typing	Learning dispositions Operational
Providing feedback	Giving encouragement for efforts Smiling as the child types name on keyboard Saying 'That's beautiful' when child shows picture on camera	Oral Facial expression Oral	Learning dispositions
Supporting	Staying close to child using video camera for safety and emotional support	Physical presence	Learning dispositions; operational

Once again, as outlined in table 3.4 below, there are a number of forms of indirect guided participation which this time fall within the modal, overlapping categories of overarching policy and/or professional practice.

Table 3.4 Distal (indirect) guided interaction (adapted from Stephen & Plowman, 2008)

Forms of guided interaction	Example	Mode	Learning
Arranging access to ICT	Using sand timer to structure turn-taking Recording patterns of use	Practice Policy	Learning dispositions
Ensuring access to help	Making adult (or peer) help available Checking on levels of engagement	Practice Practice	Learning dispositions
Modelling	Using technology for a purpose (e.g. making video to show at parents' evening)	Practice	Extending knowledge
Monitoring	Planning child's return to activity	Policy; practice	Extending knowledge, learning dispositions or operational
Planning	Ensuring balance across the curriculum Ensuring range of activities for each child Indentifying learning needs	Policy Policy Policy; practice	Extending knowledge, learning dispositions
Providing resources	Making broader range of ICT available Including disposable camera in story sacks for taking home	Policy Practice	Extending knowledge, learning dispositions, operational Extending knowledge, learning dispositions
Setting-up activities	Changing location and presentation of listening centre	Practice	Learning dispositions

In both proximal and distal guided interaction, activities are conceived of as falling within three types of learning: extending the knowledge and understanding of learners; learners acquiring operational skills; and learners developing dispositions to learning. These categories, which are visible in the 'Learning' columns of the above two tables, can also be applied to teachers reflecting upon and increasing their competencies with ICT (Stephen & Plowman, 2008). The focus here will be on how the knowledge, skills and attitudes of teachers affects their playroom practice with technology and how this stands up to some of the tenets of guided participation as teachers attempt to promote best practice integration of ICT into playroom practices.

Teacher's positive attitudes, familiarity, confidence and skills with ICT significantly affect the quality and the quantity of technology used in their classrooms (Pierce, 1994). Hall and Higgins (2002) point out that belief and attitudes about ICT had a direct effect on the way computers were used in ECE settings. According to Hall and Higgins, a negative attitude would ultimately result in many children having an unenthusiastic view of technolgy.

In a study of eight preschool settings in Scotland, Plowman et al. (2010) found that most preschool practitioners introduced technologies into the playrooms as a new resource to be added to existing provision or as an alternative tool. Only in some cases technology was used to stimulate children's interest and imagination. They suggested that some practitioners remain ambivalent about the value of ICT for their practice, despite its use being endorsed by policy, lack confidence and often doubt their competence when trying to extend children's learning with ICT or using ICT to enhance practice.

Based on their findings, it can be concluded that teachers' dedication and attitudes towards ICT play an important role in effective ICT integration. Some early childhood practitioners might feel discomfort as a result of their own lack of skills in using ICT (Morgan and Shade, 1994). Teachers' philosophical resistance to using ICT can be an important issue for not integrating ICT into their classrooms. Therefore, in order to make ICT integration successful, teachers need to believe that when used appropriately, technology is a valuable resource, enriching children's learning and development (Haugland, 2000; Hohmann, 1994). It is critically important that teachers carefully evaluate the role ICT in the learning environment is determined by teachers (Bredekamp & Rosegrant, 1994). The ICT integration process may create a special burden for teachers (Hohmann, 1990).

It has been repeatedly suggested that effective integration of ICT in teaching and learning depends on the teachers' ability to change their pedagogy or teaching practices (Burniske, 2002; Crawford, 1999; Loveless, 2003; Loveless, Devoogd, & Bohlin, 2001; Somekh, 2008). There is a wealth of discussion in literature that suggests a certain type of pedagogical change is appropriate for ICT and constructivist practices or approaches (ACOT, 1995; Newhouse, 2002; Ringstaff et al., 1996; Somekh, 2008). Sandholtz et al. (1997) suggest that teachers who integrate ICT should alter the traditional role of teacher-as-knowledge-provider to teacher-as-organiser, diagnostician and guide, learning partner, helper and mediator of technology-assisted learning at all ages, including ECE (Clements et al, 1993; Samaras, 1996).

Studies suggest that many practitioners lack awareness of the general issues around young children’s ICT use (Bain, 2000), or do not see how ICT can be included in a curriculum focusing on play and creativity (Downes et al., 2001). In particular, the literature suggests that the goal of attaining high-level integration of ICT into the playroom presents practitioners with a pedagogical tension; this is between encouraging practices with technology that are influenced either by the thought of Piaget or Vygotsky, respectively (Roberts-Holmes 2013).

Piagetian-derived learning theories tend to emphasise the free play of the child in an environment that has been structured and designed by the practitioner or teacher. In this model the teacher allows the child to explore and encounter ICT of their own accord during play. It is the Vygotskian cultural-historical learning approach, however, that calls for teachers to take a more active role, one in which they are able to use their professional expertise to scaffold the learning of preschoolers with technology. It has been observed in the literature, even in somewhere as far down the road of ICT integration into the early years as Scotland, that when technology is the object of play practitioners take a step back from scaffolding children's learning as their MAPs.

Suggestively, this is not the case when technology is not involved. It is predominantly with ICT that practitioners misrecognise that providing a resource-rich environment (following the Piagetian model) is sufficient for encouraging rewarding and challenging play. Teachers struggle to articulate their pedagogical understandings when it comes to play with ICT and this is reflected in the hands-off approach that they often take with children exploring it in the playroom. Practitioners' understanding of ICT pedagogy, their aptitude with technology, and their ICT training all need to be developed to include the cultural-historical models of supporting and scaffolding child play with ICT.

Teachers should therefore understand the role and value of integrating ICT in teaching and learning to assist in their attempts to integrate it into the learning environment (Ertmer, 2005; Judson, 2006; Riel & Becker, 2000). Integration of ICT requires teachers to change their teaching practices. Perraton & Creed (2001) suggest the need for teachers to understand teaching (approaches) before technology, as pedagogy precedes technology. From this perspective, teachers should be first taught to understand the different teaching practices or pedagogical approaches that are appropriate when integrating ICT in teaching and learning. Studies suggest constructivist approaches as an essential part of the teachers' repertoire (Judson, 2006; Somekh, 2008).

However, Orlando (2009) observes disapprovingly that research literature suggests often that constructivist practices are *the only* 'desirable' practices in ICT. According to Orlando (2009), there is an implicit assumption that teacher practices do not change when ICT is adopted. Loveless (2003), too, suggests that teachers' ICT adoption is a complex process that includes social and cultural factors which go beyond changes in teaching practices and class organisation. Orlando (2009) asserts that social, cultural, and institutional factors, as well as other perspectives within the school and outside, should be sought in understanding any change in teachers' practices in ICT.

The Physical Preschool Environment and ICT Integration: Knowing when and how to use ICT with children

Research suggests that ICT can be integrated into the ECE to enhance child learning in the form of additional resources in both the home and the preschool learning environment (Van Scooter & Boss, 2002). One of the important influences upon how well an ICT tool is integrated into ECE is the learning environment itself and how it is structured. The physical and technical arrangements such as children's access to computers and other ICT, the placement of computers and other ICT in the room and the type of software available determine the quality of learning environment. It also means taking care of the educational and social features of the learning environment, such as: the nature and quality of children's interactions with, and in the context of, ICT; the role of adults in supporting and encouraging children's technology use; the degree to which ICT-related activities connect with other activities in the centre; and the practitioner's broader learning goals. Also important is the careful choice of software for using with children as only good software can allow children to engage in self-directed exploration, and can be tailored to children's individual needs.

Medvin et al. (2003) have argued that how a classroom is designed can either promote integration or isolation. The exemplar for Medvin et al.'s (2003) argument is a preschool which took part in their *American Head Start* programme, which aimed to make the computer a 'social centre' in the teaching environment. This goal aligned itself with the general socio-cultural outlook of the preschool that promoted pupil interaction in order to further cognitive and social skills. There were three rules which pupils were asked to stick to in the creation of this 'social centre': the 'find a friend' rule, the 'help a friend' rule and the 'share the mouse' rule. They concluded that children only initially needed help in keeping to these rules and that they began to enjoy sharing and working together, often in spontaneous ways (Medvin et al, 2003). In another example, this time from Labbo et al. (2000), an American preschool has reported the problem of "mouse wars", where children fight over control of the computer. They argue that this behaviour results from the general problem of poor integration of the computer into the ECE learning environment. They suggest this problem can be addressed by aligning computer use with other preschool activities, such as story and reading time, in order to promote curriculum integration rather than separation. The children overwhelmingly responded with enthusiasm to the possibilities of well-chosen new technologies.

A well known early study by Davis & Shade (1994), called *Integrate, don't isolate!*, further argues that no matter how much creativity software can possibly inspire, the key to its use lies in how ECE practitioners widely integrate it into the existing curriculum. For technology to have a positive effect on social development, however, teachers must use it in a developmentally appropriate manner (Fischer and Gillespie, 2003). This approach is endorsed across the literature but there remains evidence that technology use in the educational environment is often isolated from the rest of curriculum activity (Learning and Teaching Scotland, 2003a). The literature suggests that practitioners should deeply consider how best to integrate ICT effectively into the curriculum and that there should be guidance available to them in this area.

Most authors suggest that technology can play a role in young children's early childhood education experiences alongside many other kinds of activities. ICT should not be seen as a way of superseding or displacing these kinds of experiences. For instance, ICT use should not detract from activities that can lead to improved gross motor skills like running, climbing and jumping (Siraj-Blatchford and Siraj-Blatchford, 2006). Some contributors to the literature suggest that ICT may not be workable alongside open-ended, creative play. This is most common when ICT is associated with drill-and-practice software. However, other authors put forward productive ways of using ICT to assist the child learner's creative play and expression, not simply by complementary use of supporting software, but also by a number of productive ICT tools (such as walkie-talkies, digital cameras and programmable toys). Other early-years educators suggest a wider scope of activity with more sensory-based experiences and practical activities that young children could benefit from. Young children are physically active and can indeed learn most effectively in multi-sensory ways. A sophisticated and varied level of integration is therefore required.

An example of such an innovative approach to integrating ICT into the ECE environment, so that it enhances teaching and pupil performance, can be seen in a New York Elementary school program that introduced kindergarten, first and second grade pupils to computer technology in 2000. The *100 Days of School* (Mouza, 2005) program set four different types of tasks for children at each of the learning levels which were all linked to the number 100. Each of the tasks was altered slightly, depending on the learning level of the child. This task allowed early learners access to tape recording equipment and computer charting software. The overall aim was to enhance pupils' skill in the areas of language and visual arts, writing and technology. The computer skills, in areas such as word processing and spreadsheet learning, were more advanced than those normally taught to children of the same age but teachers reported they were proud of pupil achievement (Mouza, 2005). The achievement of children suggests that their learning was scaffolded with respect to their ZPD. This outcome suggests an educational reward for integrating ICT into education in a thoughtful way.

The affect ICT has in the ECE learning environment very much depends upon the choice of tools used by practitioners, as well as learners, and how and when they use them; it is also affected by the effect they believe this usage has upon child development, participation, learning or play. Many of the objections practitioners have to ICT integration into ECE disappear when they see the joy and enthusiasm with which young children interact with a programmable toy, a working intercom or telephone link between classes, a digital camera and associated computer graphics package, or an interactive whiteboard. If learning with and through ICT is scaffolded, by knowledgeable practitioners and with respect to learners' ZPD, ICT can enhance ECE learning. The role of the ECE practitioner will be next discussed further.

Guidelines for judging the level of quality of ICT use in the ECE literature suggest different levels or forms of ICT use; for example Brooker (2003) suggests computer use could be classified along a continuum of three points, from "isolation" to "integration" to "immersion"; while, Sheridan and Pramling-Samuelson (2003) consider what ICT use in an early childhood setting would look like at three levels of quality: "low quality"; "good quality"; and "high quality". What these comparative scales of quality of ICT use might look like in an early childhood education setting are visualised in table 3.5.

An advanced form of integration or 'good quality' use would see a computer centrally located and a wide range of ICT tools (e.g. cameras, IWBs) used for a range of curricula purposes. Children would explore and communicate whilst using the ICT tools and there would be collaboration. For the playroom to be immersed at a 'good' quality level, ICT use would take on a more dynamic, integral and multipurpose role for a number of curricula activities. Children would document their learning through ICT-captured images, become more technology literature on mobile phones, and also create digital audio/visual projects that parents can view at any time to see how their child is progressing. In such a situation, teachers are there to assist and scaffold creative pupil-led learning that is based on exploration.

Table 3.5 Levels of quality of ICT use in an ECE setting (taken from Bolstad, 2004; adapted from Brooker, 2003 and Sheridan & Pramling Samuelsson, 2003)

	What this might look like in an early childhood setting		
	Physical and technical arrangements	**Roles of children and adults**	**Scaffolding of children's learning**
A low level of quality ('isolation')	Only one computer is available for children to use, at the teacher's discretion. Only a few software programs are available, the software is unconnected with the current classroom themes and topics. The child operating the computer has his or her back to the other children and is not involved in the activities.	Children seldom use the computer, nor do teachers encourage its use. Teachers often take a controlling and instructing role, partly to ensure that all children have equal opportunities to use the computer.	Teachers stop engaging themselves once children are self-sufficient and have learned basic ICT skills.
A good level of quality ('integration')	The computer is relocated into a more central position among other classroom activities. Computers and other ICT equipment (such as digital cameras) are available for children to use. A range of software programs is available, including pedagogical programs, creativity/multimedia programs, and games.	Sitting together in front of a computer, children help each other, negotiate turn-taking, collaborate and tutor each other. Children communicate, discuss strategies, solve problems, and have fun together while they use games and educational programs. Children develop different strategies while learning to handle the computer and/or different programs. They ask friends, experiment, guess, move the mouse aimlessly, use help functions, and explore by themselves or with friends. Teachers encourage children to send email, use the Internet for information, and write or illustrate, or lay down soundtracks and narration for their own stories on the computer.	The computer is still not an integrated part of other activities in the preschool. Its uses can be described as learning by doing various activities on the computer, compared to learning through the computer.
A high level of quality ('immersion')	Children use computers and ICT equipment throughout the day as a multifunctional tool that is integrated with other activities and themes. Children learn through the computer and from each other while using a variety of programs or creating their own.	Children explore new topics, are creative in their search for information, ask questions, and express their reflections and feelings. Practitioners and children use computers to document children's activities, make labels and signs as needed, and send messages.	Teachers interact with and guide the children. They create possibilities in which ICT can be used to support children in developing new experiences and to expand their world.

In addressing the question of what kind of learning environment would assist 'high quality' ICT immersion into playroom practice Downes et al.'s (2001) systemic review has put forward six possibilities:

1. Continuity is necessary between ideas and practice: philosophical and pedagogical notions surrounding technology should be made compatible. A key focus is that children have different learning needs.
2. Learning with ICT should be related to learning outcomes; these could be relevant to critical thinking, learning about learning and problem solving.
3. For ICT to be immersed in an environment it needs to be used in a timely manner, as well being varied and flexible. ICT should be dynamic and integrated with a number of different learning zones.
4. Using ICT should be collaborative.
5. ICT should support self-directed learning so children can participate in explorative learning.
6. Explorative learning should be open-ended to allow learners to explore different complexities across a range of resources.

The above frameworks for understanding levels of ICT integration are useful for reading what is happening in practice and should not be taken as rigid, absolute models. Such frameworks consider the physicality of the learning environment and, in a more holistic sense, the social dynamics surrounding it. There remain though, in both the scholarly literature on ICT integration and the theoretical understandings of educating young children, certain limitations and blind-spots. It is necessary to articulate these in order to show why a focus on the characteristics of teachers and preschools is so important in providing a holistic perspective to ICT integration into ECE.

What are the elements that a preschool should possess, or what pedagogical ideas should it pursue, in order to provide a context for ICT learning? It is these attributes that are going to be clarified in the following section in order to begin to produce 'usable' knowledge or guidelines for best practice ICT integration into ECE.

3.6. Review of models of ICT adoption in education

From reviewing the literature, there are a significant number of models that are used to conceive of how ICT is integrated into teaching and learning. For example, there is Concerns-Based Adoption Model or CBAM model (1987, 2010), Technology Acceptance Model or TAM model (1989, 2001, 2007), and Rogers Diffusion of Innovation Model or DoI model (1995, 2003). Newhouse (2002) thoroughly reviewed and classified a number of models of ICT adoption in education according to two characteristics: the scope of the target group they address, and the relevance of an individual’s learning. Four classifications, namely the Population Models, System/School Models, ICT-Oriented Micro Models and the Learning Micro Models evolved (see table 3.6). However, each model has strengths and limitations. In terms of the choice of models, Newhouse (2001) rightly suggests that no model is going to describe perfectly the circumstances of teachers. Hassan (2010) argues that these models are complementary and interrelated. For example, in his study he found that the Milken Exchange (Lemke & Coughlin, 1998) model is useful to describe ICT adoption at the policy level, whereas he uses the ACOT model to describe stages of instructional technology and CBAM for pedagogical development with ICT.

Hassan (2010) has updated Newhouse’s classifications of models of ICT adoption in education and characterises these models as belonging to different ecological levels of ICT adoption: the micro (e.g. individual, classroom), meso (school) and macro (external) contexts that surround the learner and practitioner. Table 3.6 presents Hassan’s updated classification of the models of ICT adoption in view of recent models of ICT adoption in teaching and learning that take into account complexity thinking: namely Nardi & O'Day's (1999) Information Ecology Theory (IET), Zhao & Cziko's (2001) Perceptual Control Theory (PCT), and Zhao & Frank's (2003) Ecological Perspective (EP). Hassan has included these as alternative models for ICT adoption, in that they provide a more organic and granular perspective or approach to ICT adoption in teaching and learning.

Table 3.6 Classification of the Models of ICT adoption (updated and adapted from Hassan (2010: 42)

Category	Model
Population models	Diffusion of Innovation model (DOI) *Examples*: Rogers (1995) & Geroski (2000)
System/ School models	Milken's 7 dimensions for gauging progress, National Education Technology Standards (NETS) and Technology Maturity Model (TMM) *Examples*: International Society for Technology Education (2000)
ICT-oriented micro models	These models are the Instructional Technology model, the ACOT model, and the Levels of Technology implementation (LoTi) model *Examples*: Moersch (1997) & Dwyer et al. (1991)
Learning/micro models	CBAM (Concerns-Based Adoption Model), the Typology of Uptake (TIU) model, and the Stages of Concern ICT model *Examples*: Fuller (1986), Rutherford (1977) & Carter (1986)
Ecological/ Cybernetic models	Perceptual Control Theory (PCT), Information Ecology Theory (IET), and Ecological Perspectives. *Examples*: Zhao & Cziko(2001), Nardi and O'Day (1999), Zhao & Frank (2003)

This present research follows Hassan (2010) in this regard by using Bronfenbrenner's ecological model as an overall structure. Further, within this wider framework, it calls upon a number of models/theories and considerable literature to provide a more organic and holistic conceptualisation of ICT integration into the educational environment. For example, Tearle's whole-school approach, Zhao & Frank's (2003) ecological perspective are found useful to describe ICT integration at the school level, whereas the Technology Acceptance Model (TAM) is used extensively in describing the issues and factors related to the integration of ICT at the teacher level. These adopted models will be explained in greater detail later in the theoretical framework chapter (see section 4.1). As is made clear in chapter 4, the novelty of this study's theoretical framework is that this it is the first in the ECE environment to adopt and adapt an ecological and complexity model.

Stages of ICT adoption in teaching and learning

There is extensive literature which indicates that teachers proceed to adopt ICT in teaching and learning in stages (ACOT, 1995; Lemke & Coughlin, 1998; H. Sandholtz, Ringstaff, &

Dwyer, 1992b; Somekh, 2008; Somekh & Davis, 1997). Newhouse (2002), for example, in a review of the literature on teachers' ICT adoption and change (focusing on the integration of ICT in learning and teaching processes) has suggested teachers integrate or adopt ICT in stages. Even though the literature is extensive on the stages teachers go through in adopting ICT, Dall'Alba & Sandberg (2006) and Orlando (2009) remind us and state that teachers do not follow a fixed sequence of stages. Schibeci et al. (2008) concur with Dall'Alba & Sandberg and add that teachers' 'progression' may move forwards or backwards depending on individual and contextual factors.

The Apple Classrooms of Tomorrow (ACOT, 1995) research is one of the most influential in illustrating the stages teachers go through in ICT adoption. This Model proposes a hierarchy for the successful application of technology to education. This hierarchy involves the following five stages (a) (Entry) representing baseline exposure to technology; (b) (Adoption) occurring when teachers try the technology; (c) (Adaption) beginning the appropriate use of ICT; (d) (Appropriation) where ICT becomes a part of the learning context and evolution or revolution and (e) (Invention) where there is a change in methods and media to facilitate learning (Newhouse, 2002: 21). These stages are confirmed in long-term projects like the Apple Classrooms of Tomorrow (ACOT, 1995) studies which show that teachers at the micro-level must travel through a number of stages to integrate ICT fully into their classrooms and their teaching programs and teachers must progress through all five phases, otherwise, the technology will likely be misused or discarded (Rieber & Welliver, 1989; Marcinkiewicz, 1994). These stages are described in Table 3.7.

Table Table 3.7 The ACOT five-stage model of development in the use of ICT
(*Source: Rieber & Welliver (1989) and ACOT Research (ACOT, 1995, p. 16)*)

Stage	Example of what teachers do
Entry	Learn the basics of using the new technology
Adoption	Use new technology to support traditional instruction
Adaption	Integrates new technology into traditional classroom practice. Here they often focus on increased student productivity and engagement by using word processors, spreadsheets and graphics tools
Appropriation	Focus on cooperative, project-based and interdisciplinary work incorporating the technology as needed as one of the many tools
Invention	Discover new uses for technology tools, for example, developing spreadsheet micros for teaching algebra or designing projects that combine multiple technologies

The ACOT five-stage model of teacher change and progression provides the descriptions and examples to gauge individual teachers' progression in ICT adoption, specifically in relation to pedagogy. Teachers change their teaching practices from traditional instruction (instructive approaches) to knowledge construction (constructive approaches). This five-stage model informs my theoretical framework by providing an approach towards understanding how teachers adopt ICT in teaching and learning. This ACOT model provides a basis to determine where teachers are in their adoption of ICT in teaching and learning.

However, the ACOT (1995) five-stage development model is limited in its focus as it concentrates solely on teacher's adoption of ICT and its (simple) stages, and does not explore the factors beyond teachers, at school or external level. It is a descriptive model of adoption and change rather than exploratory one. Furthermore, the model does not address certain issues that may arise which influence teachers' progression in ICT adoption in teaching and learning, neither does it describe the complexities of influences, the progression of teachers in a non-linear path or the socio-cultural context of the school that may affect teachers, as suggested by Somekh (2008). Also, the ACOT model does not describe how a teacher arrives at a certain level of progression in adopting ICT in teaching and learning, i.e., the individual route teachers take from one stage to the next, or the regression to a previous stage.

The purpose, here, is to understand the change in preschool practitioners' practices in ICT. It is important that inhibiting factors are identified and eased, something which the literature advocates across the field (Drent & Meelissen, 2008; Eteokleous, 2008; Lowther et al., 2008). The remainder of the literature review will consider the individual, social, cultural, and institutional factors that are said to influence the adoption of ICT in ECE at their appropriate ecological levels.

3.7. Factors influencing ICT integration into the ECE learning environment

Research by Drent & Meelissen (2008), Tearle (2003), and Mumtaz (2000). Brummelhuis & Kuiper (2008), Plomp et al. (2007), Tondeur et al. (2008a; b; c) and Willem et al. (2009) suggest that there are number of influences upon teachers' adoption of ICT in schools. These studies, consequently, attempt to view ICT integration at multiple levels, considering both international and local influences in a holistic praxis. According to Bronfenbrenner’s (1979; 1995) multisystem levels, these factors may be split across three levels: at the macro and exo levels are the external forces of policies from the Ministry of Education or the relevant governmental authorities at the macro level; at the meso level are the school factors that encompasses the culture of the setting; and, at the micro level are the teacher factors that includes the practitioner’s background and attributes. At these levels a range of factors may be said to help or hinder ICT integration into ECE.

A caveat here is that most of the literature is Western centric and, in terms of the Middle Eastern environment, there is only a small number of studies. For example, there is a Jordanian study by Ihmeidh (2008). In Saudi, too, examples of recent research include studies by Al-Dayel (2009) and Oyaid (2009). However, these are focused on ICT integration in schools rather than into ECE. Al-Dayel (2009) (quantitative) and Oyaid (2009) (mixed-method) use Ely's conditions (1990) as a theoretical frame. These studies are limited in scope and do not consider wider holistic issues, choosing instead to focus only on some of Ely’s key points (such as leadership), rather than taking a more holistic approach.

3.7.1. Teacher or individual factors at the micro-level

Teachers are rightly often seen as key agents for delivering ICT integration (Bate, 2010; Williams et al., 2000). However, teacher factors are complex and wide-ranging and ICT adoption varies from teacher to another and context to context (Kennewell et al., 2000; Tondeur et al., 2008a; b; c). In conceiving of factors that influence teachers’ integration of ICT it is important to move beyond a laundry list of factors and instead to interrelate them and provide a holistic perspective.

Studies by the Apple Classroom of Tomorrow (ACOT) (1995) and British educational communications and technology Agency (Becta) (2005),) suggest these teacher factors as influencing teachers' integration of ICT: background and level of education age, gender, professional development, ICT ownership, and experience with ICT or computers. Importantly, BECTA suggests that ICT ownership influences directly teachers' ICT adoption. However, it has been found that age, gender, and teaching experience are less influential on ICT adoption than perhaps the 2005 BECTA support suggests (Christensen & Knezek, 2008; Demetriadis et al., 2003; Mueller et al., 2008; Tondeur et al., 2008a; b; c).

Further, general teaching experience is not always found to be an important factor (Mueller et al., 2008). It is specifically the teacher's experience of and with ICT in terms of confidence, ICT training (skills), and frequency of use, which are more central (Mueller et al., 2008). The ACOT report suggests that teachers' education and training affects ICT adoption. Wozney et al. (2006) note, too, that teacher training is one central factor. Teachers need to have positive experiences with ICT if they are to become more confident. As such, anxiety is often a barrier to ICT adoption. Christensen & Knezek have found that teachers who feel nervous about ICT create negative attitudes to ICT (2008, p. 353). Mueller et al. (2008, p. 1533) argue that teachers' perceptions of the usefulness of ICT motivate their ICT use. Mueller et al. suggest that intrinsic motivation is more important than extrinsic motivation. Wozney et al. (2006) highlight the importance of personal ICT use and its influence upon pedagogical uses. It clear, from the literature, that important elements at the micro-level are teacher confidence, frequency of use, and perceptions of the usefulness of ICT.

3.7.2. Preschool level factors at the meso-level

Environmental barriers are considered in this research to be school level factors that influence ICT provision: covering ICT hardware, software, and network (connectivity), amongst a range of issues. Sandholtz et al. (1997), Becker (2000), and Cuban (2001) all see ICT provision, or the lack of infrastructure, as a central barrier to ICT integration. If computers are restricted to central lab access, for instance, this may cause issues relating to accessibility and planning. Mueller et al. (2008) have suggested that issues relating to provision become less central as technology advances. However, in ECE, provision remains of central import.

At the school level, leadership is seen as central to facilitating teachers' use of ICT (Dexter, 2008; Kennewell et al., 2000; Riel & Becker, 2008). Leadership is concerned both with the running of the school in general and, also, specifically in terms of ICT use, which may be supervised by a practitioner, as well as by the HT. Kennewell et al. and Tearle (2003) have found that HTs’ influence on ICT adoption affects how the whole school views ICT. For example, the HT’s appointment of an ICT coordinator indicates their perspective on how ICT should be adopted in the preschool (Tearle, 2003). Leadership in ICT has a general sense: the HT helps the ICT coordinator, the teacher and other stakeholders to act out ICT adoption (Dexter, 2008; Kennewell et al., 2000; Miller et al., 2003). Teachers and leaders need to define, extend, and create shared goals for ICT use in preschools. Teachers need to be able to provide feedback to leaders, and vice-versa, ICT integration to meaningfully progress.

ICT training refers is often carried out on a national scale and teachers are obliged or encouraged to participate (Galanouli et al., 2004). Alternatively, professional development courses are school-based and through which teachers actively improve their skills (Clarke & Hollingsworth, 2002). Galanouli et al. (2004) suggest that ICT training can add to ICT adoption. These ICT training and PD courses need to no longer just teach certain basic ICT skills but instruct on a range of integrative practices for ICT in learning (Boshuizen & Wopereis, 2003; Burniske, 2002; John & Sutherland, 2004).

Other school factors include collaboration, in terms of shared knowledge and practices, and communities of practice (Kennewell et al., 2000; Trinidad, Newhouse, & Clarkson, 2006). The school culture needs to be bold and encourage teachers to collaborate widely in order for integration to work across the preschoool (Fullan, 2001; Guhn, 2008). Further, schools are encouraged to collaborate between each other.

3.7.3. External factors (outside preschools at the macro level)

External factors include educational policies and community issues. Mooij & Smeets (2001) and Tondeur et al. (2008) have found that ICT policies, enacted by bodies like the MoE, clearly influence ICT integration at the school level. At the ministry level, policies do not cover ICT in isolation, as they also consider curricula and economic rationale. Tearle (2003) suggests that policy has a certain duality: policies affect schools directly but practitioners indirectly; and also are enforced rather than voluntary. Policies from the MoE often suffer from being contradictory and or from being too cluttered (Fullan 2001). Unlike Cyprus (Eteokleous, 2008) and the Netherlands (Tondeur et al., 2008), Saudi Arabia has a central unified policy on ICT, and this does not include ECE.

According to Wozney et al. (2006), policy can help ICT integration from the system level. It needs to consider curriculum issues as well as technological ones. Fullan (2000, 2001) has argued that parents and other organisations contribute to creating the school learning environment. They have 'reciprocity', or a collaborative and interlinking role with the school. Community and social values therefore play a role in situating the way in which ICT is used (Somekh, 2008). They may affect how the school operates as well as the teachers’ beliefs and attitudes, and their confidence with ICT. For example, if the school is rural, there may be a lack of support from parents as they are unable to contribute to the development of the school in ICT. The local community may have an indirect influence on ICT adoption in a school.

McGrath (2001) has linked these cultural elements to ecological anthropology, especially the ways in which they influence educational issues. In turn, ecological concepts, such as the ones adopted in this research, can incorporate cultural elements. Cultural factors, as external influences, influence an ecology (internal), but this relationship is bidirectional. BECTA (2005) has discussed socio-cultural factors that are important factors to be considered in an adoption, these are barriers to change, and BECTA cites Rogers' *compatibility* as a way of negating some of these issues.

In summary, there are a number of theories and models that explain teachers' ICT adoption in teaching and learning. Further, the literature review has shown that researchers have identified a number of factors that affect teachers' ICT adoption at different levels, ranging from the individual, the school, and the system.

3.8. Summary

In this chapter, the researcher reviewed the relevant literature on ICT in ECE and the ICT adoption in education. From this literature review, there are a number of factors that can influence practitioners' integration of ICT at different levels (from individual factors to system factors). These factors do not, however, indicate the complex relationship within the school (and beyond) that occurs in practitioners' integration in teaching and learning. Teachers, overall, remain uncertain about how literature can inform their practice.

Another key element in teachers' ICT integration in this literature review is the focus on pedagogy as an element in the change process, i.e., teachers' ICT integration is indicated by their change in teaching practices (and consequent change in child learning). In this research, pedagogy is the component which distinguishes teachers' technical use of ICT from teachers' ICT integration in teaching and learning (the integration of ICT in teaching and learning).

The models and theories in this chapter provide a useful 'list' of factors and a number of perspectives in understanding teachers' ICT adoption in teaching and learning. However, these models and theories are basically linear and compartmentalised, and do not provide an understanding of the whole as well as the parts that influence teachers' ICT adoption in teaching and learning. The models and theories in this chapter provide an underlying structure for the researcher to construct a theoretical framework for her research. In the next chapter, the research theoretical framework is discussed, which outlines the use of the ecological perspectives, complexity, and change.

Chapter 4

Theoretical Framework

Chapter outline

Chapter Four

Research Theoretical Framework

4.0. Introduction

This chapter describes the theoretical framework of the research in two sections. The first section discusses the main models and theories within a multi-level ecology, and the second section integrates complexity theory and educational change concepts within the ecological perspective.

According to Anfara & Mertz (2006: 189-190), a theoretical framework plays an important role in providing links between theory and research in that the theoretical framework directs the research approach and process. The theoretical framework used in this research is derived from several fields in education, ICT, business and innovation. A number of models and theories were considered and reflected upon; from them a selection was made to create a theoretical framework that fit, made sense, and resonated with the researcher own thinking (p. 191). Furthermore, Anfara & Mertz (p. 192) contend that a theoretical framework should be able to: (a) focus a study; (b) reveal and conceal meaning and understanding; (c) situate the research in a scholarly conversation and provide a vernacular; and (d) reveal its strengths and weaknesses.

4.1. Blended theories within the ecological framework

As has been argued earlier in chapter three, Bronfenbrenner's (1979; 1995) ecological systems theory is wide-ranging and holistic: it presents a number of different ecological layers to describe the different contexts that surround the individual in the learning environment. As such, in this research ecological theory is used as an overall structure or framework into which relevant theories of integration or change are placed at their most suitable ecological level. In this research Bronfenbrenner's ecological systems theory (1995) is used as an overall structure or framework into which relevant theories of integration or change are placed at their most suitable ecological level.

In this blended theoretical approach each of Bronfenbrenner's (1979; 1995) ecosystems encompasses either a theory or several theories at each layer that interact in complex, bi-directional ways. A range of theories within the ecological framework are categorised as falling into three broad areas that reflect the immediacy of their relationship to the individual teacher. The first of these is the *internal* factors that are characterised by the teacher's inner world of knowledge, skills and attitudes about ICT integration and change (micro-system). The second area of focus is the *external* factors that surround the teacher within their pre-school setting (meso-system). The third and final category is the *external forces* for ICT integration and change that come from outside of the pre-school environment from policy makers, parents and society in general (exo-system and macro-system). Each of these categories of factor may be said to influence teachers' use of ICT, as well as the process of ICT integration into the ECE learning environment and subsequent change in teacher practice. Figure 4.1 presents the relevant theories, models and their respective positions in the suitable systems.

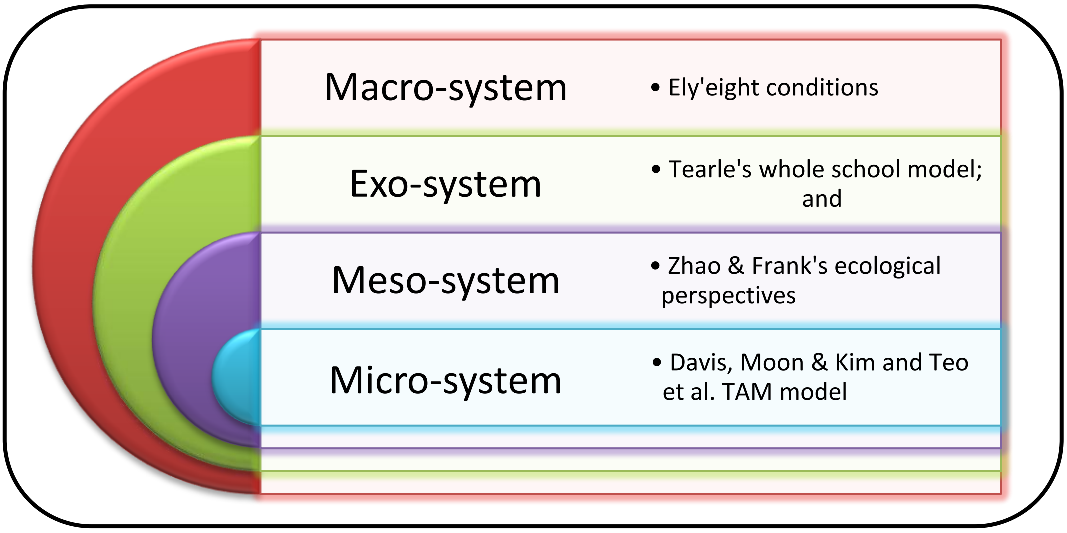


Figure 4.1 Theories and models within the ecological framework

The following section will discuss in more depth each of these theories and models at the different levels of Bronfenbrenner's ecological systems.

4.1.1. Theories and models into the micro-system level

In terms of a model that predicts how teachers' attitudes affect levels of ICT integration in the classroom, the most commonly called upon for technology is Davis' Technology Acceptance Model (TAM). This is based upon Ajzen and Fishbein's (1980) more general Theory of Reason Action (TRA). The TRA provides a causal chain showing how the beliefs that teachers have toward teaching tools may affect the attitude which they from regarding them. In turn, this attitude influences how the tool is used in practice.

In the TRA model, teachers' believe that their actions will have a certain set of consequences and they judge their decision about how to use a tool depending on these perceived results. In terms of technology, Davis' TAM adapts the TRA and identifies two teacher variables related to teacher beliefs that are postulated to affect ICT integration. These two belief factors are the *perceived usefulness* of the technology and its *perceived ease* of use. As such, if a teacher perceives both that a technology is useful and that it is easy to use then they will form a positive attitude toward it (Davis 1989). Perceived usefulness is judged by how an ICT tool will make a teachers' performance more efficient or benefit the institution in which they work (Phillips et al. 1994). Perceived ease of use is judged by how simple the tool will be to *put* into practice and influences, not only the attitude of the teacher, but also their enthusiasm for its perceived usefulness (Moon & Kim 2001). Moon & Kim (2001) suggest in the TAM that it is also "external factors" that influence attitudes and here we can relate these factor to external imperatives for change from the macro-system that influence teachers' micro- and meso-environments, as well the previously discussed "internal" rationales. Also Teo et al. (2008), noted that external variables such as 'subjective Norm' and 'facilitating Conditions' affect the two core variables in the TAM, perceived of usefulness and perceived ease of use. Davis (1989), Moon & Kim (2001) and Teo et al. (2008) TAM model is used in this research to describe teachers' use and adoption of innovative ICT tools in the learning environment.

4.1.2. Blending theories into the macro-system, exo-system and meso-system levels

There are three theoretical models that are commonly embedded at the macro-, exo- and meso-levels to identify the factors that influence ICT integration. These are:

- Ely's (1999) eight conditions that facilitate the implementation of educational technology innovations, which may impact upon innovation at all three of these system levels.
- Tearle's whole-school characteristics model (2003; 2004) which extends Ely's conditions and further details the factors that influence the implementation of ICT by teachers within the school structure. Tearle's whole-school model is useful here to further understand the meso-system of the pre-school setting.
- Zhao & Frank's (2003) ecological perspective is a multi-level model that takes into account different factors that influence an intervention, such as the adoption of new ICT within an ecosystem Their ecological perspective differs from Tearle's whole-school characteristics because it focuses on the innovation within the context of ICT and its impact on teachers. Zhao & Frank's ecological concept is relevant to this research to understand adoption of ICT in an ecology.

4.1.2.1. Ely's eight conditions that facilitate the implementation of educational technology innovations

According to Ely, change is not a simplistic process (1976; 1999). It has a number of aspects and dimensions that are evidently variable between contexts and that encompass both the external forces for change (macro-system and exo-system) and the reception of change in the setting under study (meso-system). There are a number of stages of implementation, decision making processes, resistances, and alterations to be made after initial trials; moreover, unique individuals are bound to be involved with their own distinctive characteristics.

In order to disentangle some of the problems that the multifaceted nature of change presents to researchers, Ely (1976) argued for a taxonomy of the conditions for change. After a careful review of the literature on educational change in general, and specifically the research and evaluation of technological change processes in education, Ely noted a number of observations in the research environment that assist and aid the implementation of technological innovations in education. Accordingly, he identified eight conditions that facilitate the implementation of educational technology and these were first directed toward libraries before being made relevant to education (Ely, 1976; 1990; 1999). The conditions he proposed are dissatisfaction with the status quo, the existence of knowledge and skills, availability of resources, availability of time, rewards or incentives present, participation, commitment, and leadership (Ely, 1999). These conditions are explained further in the following pages (see table 4.1).

Ely's work is founded upon a number of studies that seek to elaborate upon the inhibiting factors to technology integration. These factors, in particular, are found to resist implementation efforts (Esiminger et al., 2004; Kotter, 1996; Fullan, 1982). The aim of these early explorations was to facilitate implementation strategies that are intrinsically aware of such restrictions or obstacles to integration. Ely's early work on conditions that facilitate new educational technology implementation has been a powerful tool, and a widely used framework (Wan Ali, 2009; Turcotte & Hamel, 2008; Surry et al., 2005; Esiminger et al., 2004; Surry & Esiminger, 2003). Early studies concerning educational technology implementation in a variety of education related contexts validated his conditional framework, and this once more suggests and supports the use of this model in the current research.

More specifically, in the literature on ICT in ECE that was discussed earlier in chapter two, some of Ely's eight conditions have been observed in the ECE environment, such as teachers' knowledge and skills, alongside other conditions. In view of the fact that the current research is also concerned with the obstacles or hindrances that restrict ECE practitioners from moving forward in implementing ICT, Ely's eight conditions are a powerful guide and useful framework to support this research to explain ICT integration in pre-school settings. ICT integration into ECE involves what Ely terms a 'routine' change: one that involves only minor redefinitions of roles and procedures that, while complex, do not stretch to Ely's understanding of the significant alterations needed to cope with 'radical' change (1976: 159). In theory, a 'routine' change has the potential to be studied through research and, as such, also allows for Ely's general conditions to be used to disentangle its complexities. Slightly adapted for the present context, these conditions for change are presented in the following table.

Table 4.1 Ely's eight conditions that facilitate the implementation of educational technologies innovations

Necessary Condition	Description	Key Factors	Relevance to ICT in ECE
Some dissatisfaction with the status quo	There is an existing impetus for change	Leadership	The feeling that ICT may improve current teaching practice
Knowledge and Skills	Practitioners need to have the skills necessary to put the innovation into practice and need to be aware of possible innovations	Experience, skills, intuition and knowledge	Practitioners need skills in using ICT tools for pedagogical purposes and need to be aware of the range of pedagogical ICT tools available
Participation	There should be shared decision-making and communication amongst all parties or at least a representation of all thoughts on the process of change	Time, commitment, knowledge, skills and incentives	Teachers must feel that they are having an input into change, not only Head Teachers and external stakeholders
Commitment	There must be a commitment by all the stakeholders and practitioners involved to making the innovation possible. A sole innovator is likely to fail but if they are joined by another respected practitioner their chances increase and if they have the backing of more senior practitioners or stakeholders then the plan is more likely to succeed	Teamwork, leadership and knowledge	The Head Teacher should ensure that her staff are equally committed to ICT integration
Resources	Suitable human and material resources should be provided that can support the implementation process	Funding, incentives and knowledge	The Local Authority needs to financially support the integration process and the teachers need the knowledge and skills to use such resources.
Time	Time should be emphasised as a separate resource and its importance cannot be overestimated. The time put aside for implementation should not be the leisure time of practitioners but allocated as part of their professional day	Leadership, knowledge, funding and commitment	Training time should be provided for teachers during timetabled hours.
Incentives	The innovation must provide some reward for the practitioners involved, e.g. it may increase their job's efficiency in the long term and free up some of their professional time	Incentives, knowledge and skills	ICT should be proven to be time efficient.
Leadership	There must be strong leadership by a practitioner that exudes qualities of charisma, vision, authority and persistence. Strong leadership, however, requires that all the previous stages concerned with practitioners and resources be in place.	Leadership, knowledge, skills and resources	The Head Teacher must be knowledgeable of ICT, have the resources to hand and have motivated practitioners under her control.

Adapted from Ely, 1999: 300

The final column of the above table shows how Ely's general conditions may be interpreted for the current context of ECE. It is clear that it is not only the individual teacher at the micro-level that is important for Ely but also influences from the meso-system (e.g. the leadership of the HT and participation of colleagues), exo-system (e.g. resources provided by the LEA) and macro-system (e.g. societal pressure to modernise teaching and innovate). This interpretation of Ely's conditions seeks to achieve a closer, more practical and context-specific understanding of the factors that influence the innovation of ICT integration into ECE.

However, a weakness in Ely's model is that it does not consider the interactions between these conditions in great depth at the level of the school. Pre-schools are multifaceted settings that have unique aims and values. In their use of ICT teachers become involved in a bidirectional connection with the preschool around them. Thus, when it comes to developing a closer understanding of the meso-system of the pre-school setting it is necessary to call upon models which are more immersed in the specific complexities of the school environment (the ecosystem at large).

The next section discusses both Tearle's whole school model (2003; 2004) and Zhao & Frank's ecological multi-level model, which differ from Ely's conditions as they examine factors within a school's ecological environment (meso-system).

4.1.2.2. Tearle's whole-school characteristics approach at the meso-system level

Tearle has specifically investigated ICT integration into a UK secondary school (2002; 2003; 2004). In her case study research, she focused on many elements that influenced ICT use by teachers, including the 'whole school' elements that enhanced the level of integration. Although Tearle uses Wilson et al.'s (2001) eight conditions as a theoretical basis, these are very similar to Ely's (1999), and are interchangeable. She concentres her investigations on the teachers' practices in the school, as well as considering the elements internal to the school that are immediately external to the teacher, and that influence their ICT practice. Tearle also focuses upon the connections and links between the teacher and the elements in their environment that affect their pedagogical practices with technology.

This is an approach that is cognate with the current thesis' focus upon teachers' integration of ICT into the pre-school playroom. Also, Tearle is similarly concerned with considering the conditions of change and school characteristics *as a whole* rather than studying each in isolation. It is only by taking this holistic approach that the complexities of the integration process may be captured (Tearle, 2003).

Tearle also does not ignore the wider-picture beyond the individual and school level; she takes into account the outside *forces/drives* for ICT use at the macro- and exo-system levels and their influence upon pre-school settings and teachers' ICT integration. This influence is conceived of in terms of the influence it has over teachers and the pre-school setting in general (2003). This is why following Tearle is not entirely useful for considering the exo- and macro-systems. Even when she shows an awareness of these contextual layers, she does so in terms of their influence upon the meso-level, rather than in a bi-directional manner. Her scaling, however, of exo- and macro-system influences, from ones over which the practitioner has 'no choice' (e.g. mandatory curriculum elements) to more free 'choices' (e.g. playroom layout) is a useful evaluative tool in conceptualising the pressures upon teachers as a continuum; particularly, when it comes to influences or *forces*/*drives* outside of the preschool setting that press for ICT integration.

Tearle (2003), too, does not entirely focus on the teacher as an individual and instead her research is most thorough at the meso-level of the school as an organisation (Hassan, 2010). Within this meso-system she suggests that for ICT integration to be successful or worthwhile the following factors should be in place:

- Confident leadership with high standards of practice expected from staff and pupils, as well as from the school itself.
- It is not just ICT use that is considered 'excellent' but also all other pedagogical activities.
- Collaboration and a pervasive positive outlook towards learning.
- Staff who are suitably motivated and thoughtful towards learners.

These factors suggest the importance of school leadership, the preschool as a whole (the meso level and the relationships within it), preschool culture and the motivations of practitioners. Such elements should be considered as equally influential, given Tearle's findings that extrinsic motivations, perhaps coming from the HT, have as great an influence as external drives coming from outside the preschool.

For Tearle, it is the quality of practitioner, resources, training and support that are key elements. The role of the ICT co-ordinator is also highlighted as important for schools. Availability of hardware is further given central importance and is linked directly to how often resources were used. Interestingly, training was found to enact a smaller influence upon the level of integration although it was important from the teacher's perspective. However, Tearle's whole school perspective fails to investigate the micro-level (e.g. playroom) and instead looks at the external elements within the preschool, and beyond, which influence teachers.

4.1.2.3. Zhao & Frank's ecological perspective of ICT integration into schools

Zhao & Frank (2003) argue that an ecological framework is the most powerful tool for understanding the complex processes that underpin and influence ICT integration into education. For Zhao & Frank, the barriers to a high level of ICT integration are present in pedagogical practices and school cultures. The technology itself may also be a barrier to overcome. For example, the speed at which technology evolves may cause teacher ICT skills to become continually outdated. They also contest the structure of findings in the literature as they suggest that these are often no more than lists of isolated problems to be contended. Their model, on the contrary, is multi-level, holistic and sensitive to the ecology surrounding ICT use in educational contexts.

Hassan (2010) adopts four concepts from Zhao & Frank (2003), as well as another from Hargreaves (1994), to suggest five key ecological concepts:

- The pre-school is an ecosystem with hierarchies. At the core of this ecosystem is an internal equilibrium that is governed by a number of different species.

- There are organic (e.g., teachers, Head Teachers) and inorganic (e.g., ICT devices) groups or sets.
- The dominant species in the ecology are teachers given their position and number; less numerous species such as the HTs are keystone species.
- Each species has its own roles and responsibilities; this is referred to as its niche.
- ICT, given its status as an innovation, is an invading species that is both newly introduced and disruptive (as put forward by Hargreaves (1994)).

As point one suggests, in Zhao & Frank's (2003) understanding of the school in an ecological environment, it is an ecosystem nested in a wider community, perhaps a local education authority, which is also a smaller system within the national curriculum structure as a whole. While, the ecosystem is considered to be stable, it is nested within a wider range of contextual factors.

The diversity that exists within a school occurs given the sheer range of stakeholders that have an interest or participation in the school. In organic communities teachers, the dominant species, interact with the keystone species (preschool HT), as well as other organic communities, alongside inorganic communities, for example ICT tools. Teachers form the dominant species in the ecosystem; this is due both to their number and their unique characteristics. Teachers can create and interact with others and be individualistic or cooperative. The HTs are a keystone species as they have influence and power over the other species and the characteristics of the ecosystem. The niche that teachers and HTs have is defined by the roles and the responsibilities that they take on. The role of the teacher is to educate by facilitating children's learning. The relationships between teachers are complex and subject to change.

In these criteria, innovations are regarded as invading species that are disruptive to the status quo (Hargreaves, 1994). This is the case when ICT is introduced into ECE where it may disrupt practitioners. The teacher has the ultimate choice in accepting or rejecting ICT use as they are the ones who practice it. However, such a choice is influenced by the preschool context in which that choice takes place and influential elements may include support or leadership provided in the preschool ecosystem (Ertmer, 2005; Tearle, 2005). External influences such as policy may also be a factor (Fullan, 2001).

An ecological perspective considers such complex factors in terms of how change agents are received, understood and put to use by practitioners in the preschool ecosystem. To understand this more closely we need to draw from complexity theory to understand what it means for such a system to be complex.

4.2. Ecological perspectives and complexity theory

Ecological theory and complexity often go hand in hand. As discussed earlier in this chapter, ecological systems take into account the relationships and interactions between the different micro, meso and macro-systems that surround the ecosystem under study, and these relationships are often described as ‘complex’ and in constant change. It is complexity theory (or complexity science) that describes, in an organic, bottom-up process, how and why these relationships are complex and changeable. Its aim is to study dynamic, living systems; as well as drawing from the ecological systems approach, it has evolved from fields as diverse as maths, physics, artificial intelligence, and from a number of modern and post-modern concepts and ideas that came to prominence in the 20th century. Its use in the humanities also spreads beyond education to social, political and economic phenomena (Ramalingam & Jones, 2008).

What typifies complexity theory’s post-modern characteristics is that it is sceptical of the linear cause and effect chains that once typified Newtonian science, as well as of top-down ‘grand narratives’ that explain away unique phenomena and relationships (Morrison, 2008). It is often the small or overlooked parts of an environment, and the sometimes hidden relationships that they have with other parts of the ecosystem, which complexity theorists focus upon (Phelps et al., 2011).

Complexity theory is cognate with ecological systems theory as researchers who use it seek to understand ecosystems, establishments, or networks that are complicated in terms of scale, the number of active agents, influential elements, or dynamic relationships

(Mason, 2008). The consistencies are not the elements or relationships within the system but instead that these criteria will be forever changing and subject to flux as the system continually evolves or adapts to change. To understand the nature of such changes it is necessary to investigate each open-ended context closely and individually (Byrne, 1998). Each context should be treated as a unique ecosystem. Thus, the ecological framework is a particularly useful lens in which to embed complexity theory. For Colucci-Gray et al. (2006) this relationship includes understanding complexity as an idea: (1) the specific and general elements to complex interaction, as well as understanding complexity's epistemology, and (2) the consequences for education given the different levels of complexity (see figure 4.2).

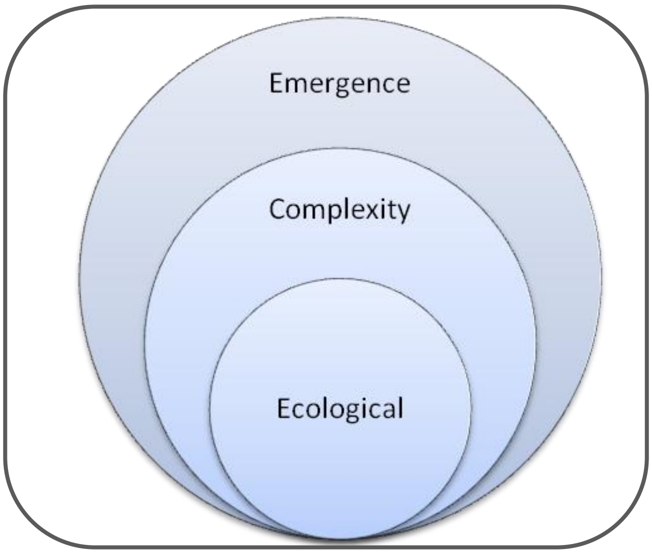


Figure 4.2 The interrelationships between ecological perspectives, Complexity thinking and emergence in this research

In addition, Davis & Sumara (2006) contend that complexity theory only comes to light in situations that cannot be looked at in isolation; it is a necessary tool in order to understand the frameworks and relationships that govern a multidimensional setting. As Tatnall & Davey (2003) point out, conceiving of this complexity in a technological environment is necessary to understand how ICT is adopted as an innovation. Another possible benefit of complexity theory, given that it is based in grounded theory, is that it is a lens that can create new categories and models to conceptualise multifaceted environments (Hassan, 2010). Combining complexity and ecological theories in this research, as well as drawing from Fullan's concepts of educational change, ensures a broad and holistic approach to conceiving of the change characterised by ICT's introduction into ECE. Along these lines, Fullan (2000) has already suggested that complexity theory is a useful tool for understanding the process of change in schools, in particular for gauging appearing themes.

As such, the focus of studies that use complexity theory in education is on the relationships that organically form in an ecosystem rather than only focusing on the stakeholders in isolation (Youngblood, 1997; Wheatley, 1999). These relationships naturally form themselves and contribute towards the 'autocatalysis' of the complex ecosystem; in other words, 'the ability of a system to evolve itself, from within' (Morrison, 2008: 17). This autocatalysis leads to an important stage of complexity theory: that of '*emergence*'. Emergence is characterised as a moment of visible change which grows from a number of internally generated conditions. At a certain moment these changes or conditions reach a point of critical mass that leads to the visible emergence of a more discernable, clearer condition. For example, the choice to integrate ICT emerges due to a number of previously smaller and discrete factors.

There is a certain link between emergence as it is articulated in complexity theory and the changes that are described by ecological systems theory in that change is an organic and dynamic process (Corning, 2002). There is a danger of defining emergence too loosely in this comparison, as has occurred at times in the literature (Corning, 2002; Davis & Sumara, 2006; Goldstein et al., 2007). The focus here is on the emergence of practices relating to ICT integration by focusing on the pedagogical choices that are made, as well as the discrete factors and relationships that influence teachers to make such choices. The aim is to create a better understanding of the existing factors that supports the emergence of ICT integration and the different ecological levels.

From the perspective of complexity theory, change begins at the micro-level and only becomes visible at the meso or macro-levels once emergence has taken place. Each change or condition that leads to emergence is given absolute respect and regarded as *sine qua non* or absolutely essential to its emergence (Morrison, 2008). The constituency and amount of change suggests that the ecosystem is at a position on the edge of chaos; a natural consequence of avoiding top-down stagnation. Table 4.2 summarises the main features of complexity theory as it is understood here.

Table 4.2 Complexity theory central features

Features of Complexity Theory	Explanation
Self-organisation	The constituents of the system arrange themselves in an organic, ‘bottom-up’ process which demonstrates autocatalysis and autopoeisis.
Adaptability	The system must be able to morph and change in order to survive changes to its external environment through its self-organisation.
Open Systems	The system has to be open to change and in a perpetual state of disequilibrium in order to survive. A stagnant, closed-system will fail and die.
Learning	As in education, a complex system has to learn, adapt and change to survive.
Feedback	Feedback loops may be negative or positive. Negative feedback helps to regulate the system whereas positive feedback promotes growth.
Communication/Connectedness	These are the links and bonds between agents that characterise a complex system.
Emergence	Given a certain amount of complexity within an environment, new and unexpected choices or developments begin to form and these are recognised as emergences.

Adapted from Morrison, 2008

Emergence comes from a slow build up of elements that eventually reach a critical mass or a tipping point. It is at this point, where the environment is primed for creating a new situation or elements, that even a small alteration in the constituent elements may cause emergence to occur. This sensitivity can be understood as a moment in the system’s evolution where the effect of even the slightest of changes may be a significant emergence. Such internal reactions may be due to external changes that the system is able to scan and be alert to (Waldrop, 1992) or they may be part of an organic, internal evolutionary process.

A blended approach involving complexity theory is likely to involve some ambiguity (Smith & Graetz, 2006). From the perspective of ICT integration into ECE, the complexity approach remains helpful to explaining relationships and interactions between systems and stakeholders, as well as in conceiving of the barriers and enabling elements in the ecosystem for the dominant species of teachers integrating technology. One caveat to this approach is that I will not adopt the purely ‘bottom-up’ descriptors of complexity theory and instead use the bi-directional movements of power and influence between systems that ecological theory puts forward.

The main tensions that the researcher will use complexity theory to describe are

1. The tension between adoption and non-adoption.
2. Stability and instability.
3. Negative and positive feedback loops.

This approach is cognate with Tearle's (2003) continuum and it allows us to conceive of the characteristics that remain uncertain and changeable in the introduction of a new species into an existing ecosystem. The benefits of using complexity theory in conjunction with ecological systems are in summary:

- Barriers or supporting elements to ICT integration can be articulated.
- The influence such factors have upon teachers may be conceived of in a holistic manner.
- It is useful in conceiving of the multi-level relationships and non-linear processes through which the integration of ICT into ECE occurs.

4.3. Complexity theory and educational change

Preschools are complex settings: they are dynamic, non-linear organisations operating in volatile external environments. In order to survive and be efficient, preschools have to be sensitive to changes outside the preschool at the exo- and macro-levels; they have to sense and respond to changes at LEA level or to wider societal imperatives. The lesson here is that ICT integration into ECE is a complex process and it cannot be studied in isolation without considering all stakeholders taking part in this process, as well as the imperatives for use coming from out the micro- and meso-levels of the preschool itself. In order to tackle the issues surrounding this integration from a more holistic perspective, as well as to understand the complexities of such issues, literature from the field of educational change can be blended into ecological systems theory, in a theoretical move that accentuates its tenets that are particularly cognate with complexity theory.

Both complexity theory and educational change perspectives move away from understanding education as a closed and entirely controllable system. Instead the impulse to understand pedagogical practice becomes an uncertain process of discovery that privileges inter-disciplinary processes and conceives of education as a form of change itself (Morrison, 2008). The exactly produced and proscribed curriculum is regarded with scepticism; preschools as complex environment means that they are open systems where often small or overlooked phenomena can lead to the emergence of more recognisable practices or decisions. The nature of change in such preschools is complex and interactive; there is a necessity for positive and negative feedback loops to regulate it. However, there also needs to be an awareness that research into innovation has to be sensitive to context-specific minutiae in order to understand the complexities at work in the ecosystem. Distinctions between boundaries become blurred and there is a bidirectional exchange between stakeholders and system elements. This sensitive, holistic and bottom-up approach is where educational change philosophy and complexity theory overlap.

Associating complexity theory with educational principles for meaningful change in education allows a link to be drawn between the ecological systems theory and educational change principles. Both overlap with complexity theory in certain ways: be it ecological theory's focus on the relationships and not only the parts of a holistic system or educational change's understanding of change as a complex, dynamic and on-going series of innovations. The significant connections between the ecological perspective, complexity theory, and change have encouraged me to consider literature from the field of educational change to complement the literature review that has already been carried out in chapter three concerning ICT and learning in ECE.

In spite of the extensive amount of research on educational change and innovation such as the work of Hargreaves, Hall & Horde, Ely, and Tearle, it is the work of Fullan (2000; 2001; 2003a; 2003b) that has a particular resonance with complexity theory and the ecological metaphor. Fullan is predominantly concerned with educational institutions and his approach is to consider change within an institution in individual, collective, and systemic terms. Further, he notes that the educational environment, which is in a constant process of flux, is saturated with the introduction of new innovations. Four central points of Fullan's are important here where this research will adopt and extend this idea, applying it to change in relation to ICT integration in ECE.

Fullan's central thesis is that all learning is a continual process of 'making meaning'. Fullan (1989) remarks that change equals learning; learning is a central element in both complexity theory and education. All complex phenomena and systems have to learn, adapt and change in order to survive. Meaningful change cannot take place in the absence of comprehensive understanding which requires bold thinking and creative solutions to grasp the multiple interests and complexity of education stakeholders' needs within the climate of twenty-first century change. This requires all stakeholders to negotiate and agree on shared visions, goals and objectives.

Fullan also insists that there is no one element or simple answer that can guarantee a positive outcome for change (as he says, 'no silver bullet'); the specificity of the situated contexts is crucial. All approaches are necessarily designed in a context-specific manner. Therefore, no one approach can be applied to all educational contexts (Robertson et al., 2007: 21-23). Every school environment is unique. However, as Morrison puts it, there is a certain tension between the stability of the preschool and being malleable to contemporary needs:

> In a climate of uncertainty it is unclear what values a school should espouse, yet the same climate requires schools to have their own identity, values and autopoeisis in order to survive. How can schools live in this situation- caught between the Scylla of constant change and the Charybdis of having to remain resolute and holding fast to their values? It is an echo of the postmodernist's dilemma of proscribing fixity and firmness yet holding such proscriptions fixedly and firmly (Morrison, 2008: 21)

In striking this balance, every internal stakeholder brings with them a unique set of experiences, preconceptions and opinions. Thus, a blend of theories is the most useful way forward to try to capture as many of these nuances as possible. Even with the adoption of this strategy, it is necessary to understand that individual schools will still vary and the one fixed blended theory may not be most suitable to understanding all the preschools involved in the case studies here. Fullan (2001) insists that we cannot simply transpose; imitation is in itself inadvisable and ineffectual. Taking what is known (without 'reinventing the wheel') and transcribing it into situated learning is the best approach (Robertson et al., 2007: 33); critical here is the challenge of reinterpreting/reimagining the blended theory that is employed to benefit each case.

Fullan’s (2001) third point is that innovation has a unique and polymorphous character. In the school sector there are different levels of change, recalling but not exactly mirroring ecological theory, and these range from LEAs to individual schools, as well as from teachers to learners. Those who should be involved in the educational change process are divided into two groups according to Fullan (2001): internal and external. The teacher is a local or internal stakeholder, so too are the school Head Teacher, pupils, administrators, consultants, parents and the community. The external stakeholders Fullan identifies are mostly governmental.

Fullan advocates a tri-level system (2003a) which is not quite as complex as ecological systems theory. Stakeholders at each level engage dynamically to exert an influence over the ongoing innovations. Importantly, Fullan suggests that multi-level change is a complex and complicated process and that change merely at one level will only ever bring about partial change overall. Therefore, it is imperative that all those involved in educational contexts must become active participants who are authentic, collegial, and collaborative (Bush, 2007). Fullan’s model is, in part, a constructivist approach. This involves an emphasis on improving relationships and developing mutual trust and acceptance of each other’s strengths and weaknesses among all those with an interest in education and this should be achieved in a collaborative or constructivist manner.

Fullan emphasises that all the stakeholders in an educational environment, including teachers and pupils, have to be involved in any improvement to that environment representing a more democratic approach, rather than relying on older ‘top down’ models where change is ordered or forced down from the top. This ties into the concept of collaboration: the vision Fullan feels is worth fighting for is to transform the conservative system of teachers and schools, who are the moral agents of change, into a more collaborative, more autonomous system; in turn, representing a cultural shift from isolation to integration. It therefore represents a move, as Fullan terms it, away from structural change towards the goal of changing the culture of schools and learning environments via values and relationships. The focus here is on the learning environments and in particular how both pupils and teachers can contribute to constructing a more effective learning environment. In essence, Fullan argues that this change can happen through the principle working towards creating a freer ideology of learning in a school that encourages input from all parties and this is the ‘capacity’ of organisations and individuals to learn. If any one party of those involved in the change process is either excluded, or overlooked, or perhaps working in a counter-direction, then the implementation may not be completed.

Fullan draws from complexity theory to emphasise that his model of change is one of dynamism and intricacy, where emergence may change and alter the environment around it; in this changeable environment, or ecosystem as I understand it here, the individual is part of a series of bidirectional relationships that characterise and shape their ability to integrate ICT as an innovation in the preschool. There is a further contingent element where even the smallest detail or change may lead to an emergence of a new factor in the ecosystem.

The final tenet of Fullan’s thought that is of interest here is that, despite the move away from the trickle-down approach, the principal retains the key role in the process of educational change. However, it is in terms of facilitating, not ordering, teachers to develop their teaching techniques and shape their environments: the HT is the key player to develop this capacity in schools. HTs also have to interact openly with local communities and encourage pupils to be participants in this dynamic change towards more effective and open teaching.

The abovementioned aspects of Fullan’s approach are principally relevant to the researcher’s interest in ICT integration as an agent for change; these features can be adapted for this study’s purpose in the field of ECE where all organisational and individuals parties such as principals, preschool teachers, and children, involved in the process of change and improvement process are considered. The primary focus, however, remains the teacher’s characteristics and their opinions and feelings regarding those stakeholders around them.

According to Fullan the characteristics of change are need, clarity, complexity and quality: Briefly, *need* corresponds to a preschool’s perceived need to adopt the innovation (e.g. ICT integration), not only whether the ICT integration is important to ECE, but ICT’s relative importance to other practices that take place within the playroom.

Clarity relates to the identification of the essential features of the innovation. The lack of clarity in an innovation represents a problem, as does false clarity in which change is interpreted in an over-simplified way, i.e. when individuals perceive that they have changed (superficial change). Clarity on how to use an ICT tool is paramount and this information should be relayed to teachers promptly and succinctly.

Complexity is related to the difficulty that the individual experiences in the change process or the adoption of an innovation. The type of change required, such as a change in teaching practices that is of relevance to my research, in other words how ICT is being integrated into the playroom environment, has an influence on the adoption of the innovation. Teachers need to understand the change that is required of them as well as the overall change (in the preschool ecosystem) that is necessary. The first level of ICT integration is entry level where the ICT tools are simply acquired and used by the preschool. The desired level of integration is more complex, however; this is the 'invention' level where ICT is integrated in the curriculum and children are allowed to play in an explorative and collaborative manner, learning with and through ICT.

The *quality and practicality* of an innovation also further influences how it is adopted and implemented. Fullan equates quality to materials and resources for change and points out that those politically driven projects often have short time lines, which affect the materials and resources necessary for implementation. HTs and Local Authorities have to make informed choices regarding which ICT tools can assist a learner's cognitive development.

In conclusion, in order for ICT integration to be implemented into ECE effectively, or to learn lessons that may benefit existing integration practices, this thesis will call upon Fullan's insistence on a shared meaning to change, as well as using collaborative integration practices, where all stakeholders have an input into the process of change. Moreover, I will follow Fullan's argument against a top down approach; in its place should be a democracy in which all stakeholders are respected. This thesis in particular begins this project through its case study focus on teachers in the ECE preschool. The opinions of stakeholders have to be respected and they have to be involved through collaboration in the changes that are taking place.

In Fullan’s model, the HT remains the key agent of change, however, and the case studies will investigate how their opinions and attitudes to innovation impact upon teachers’ integration of ICT. Stakeholders have to work together to change the preschool environment so that it is hospitable to the innovation that is being introduced (Fullan, 2001). For each different context it is also necessary to reinterpret and re-imagine existing theories; to bring the nuances of each context to the fore. The purpose behind the comparison in this research is not to only describe the hospitability to ICT of both contexts (preschools in Scotland and Saudi) but also to suggest lessons that may be learnt reflecting upon current standards of integration. The aim behind this research is to uncover each context and suggest how certain factors may be used as a basis for methods to improve the ICT integration level in ECE settings. Given the case study approach, there will be a focus on the internal stakeholders of the ECE setting, who are the HT, the teachers and the children. Primarily, teachers and HTs will be studied as the key agents for change.

Overall, the use of complexity theory, as well as considering the characteristics of educational change, allows the research to move away from prescriptive, top-down approaches. Fullan encourages a pragmatic, practical, collaborative, context-specific approach that is particularly suited to a close case study of changes and the lessons we can learn from it; while, complexity theory allows for the description of the contingent, open-ended nature of the preschool ecosystem.

4.4. Summary: Ecological framework

Given the eco-systems’ consideration of both the singular and the whole, the actors and their interactions within a set environment with living and inanimate things, Bronfenbrenner’s ecological systems theory is applied in this research as an overall structure to address factors influencing ICT integration in ECE and the different educational stakeholders within these multiple levels: (a) preschool teachers’ integration of ICT in teaching and learning, and (b) the influence of the preschool environment around them. In order to consider the hierarchical influences over preschool teacher use of ICT in the ecosystem of the preschool playroom, an ecological metaphor is used to describe the complexity that exists in relation to the factors that influence change, as well as to the relationships between them.

The adapted ecological framework is developed with multiple theories and models rather than relying on a single theory. In this chapter and earlier in chapter three the sum of the parts and the whole that constitute the theoretical framework have been described and explained, from the micro-models that explain teacher-level factors, to the overall theory that structures the research framework. To achieve a holistic sense of ICT integration into ECE it is necessary to use a blended theoretical framework. This theoretical framework includes theories and models that describe multi-level processes and interactions from a combination of ecological concepts, factors that influence technology introduction, complexity theory, and educational change.

From an ecological perspective it is pertinent to follow Hassan (2010), by combining Zhao and Frank's (2003) four ecological perspective with Hargreaves' (1994) final concept of ICT as an invading species into the preschool system. This involves an ecological understanding where:

- The preschool is an ecosystem with hierarchies. At the core of this ecosystem is an internal equilibrium that is governed by a number of different species or practitioners.
- There are organic (e.g., teachers, Head Teachers) and inorganic (e.g., ICT devices) groups or sets.
- The dominant species in the ecology are teachers given their position and number; the less numerous species of HTs are keystone species.
- Each species has its own roles and responsibilities; this is referred to as its niche.
- ICT, given its status as an innovation, is an invading species that disruptive (drawing from Hargreaves (1994)).

Considering the adapted theoretical framework, factors that support or hider practitioners' ICT integration within the ecosystem multiple levels are explored. Specifically the structural framework helps consider (a) the teachers' ecosystem where the adoption of ICT takes place; (b) teachers as the dominant species in the ecosystem; (c) HTs as keystone species to lead integration; and (d) ICT as an outside 'alien' species being introduced into the ecosystem. Within the adapted ecological framework factors that influence ICT use are embedded: (a) Ely's eight conditions (b) Tearle's Whole School Model and (c) Davis' TAM model.

In terms of educational change, the ecological framework incorporates five of Fullan's principles: need, clarity, complexity, practicality and quality. The ecological perspective puts into perspective the bi-direction interactions of Fullan's factors. Finally, complexity theory also proves useful here as it facilitates a discussion of the dynamic, organic and complex nature of interaction, which can help describe the following tensions:

- The tension between adoption or non-adoption.
- The tension between stability and clarity.
- The tension between negative and positive feedback loops.

The following figure (Figure 4.3) provides an overview of the integration of perspectives, conditions, concepts, and models within the theoretical framework used to understand ICT integration into ECE for learning and teaching. The meso-level here is the wider preschool context and the micro-system is situated at the level of the playroom. The ecological framework assumes that factors and processes are dynamic, as well as that the adoption and change are not static end points. It considers that teachers and schools have different pathways to adoption and these pathways intersect and interact at different levels. Adoption emerges from these complex factors, processes, intersections, and interactions rather than as a result of a range of linear causal factors.

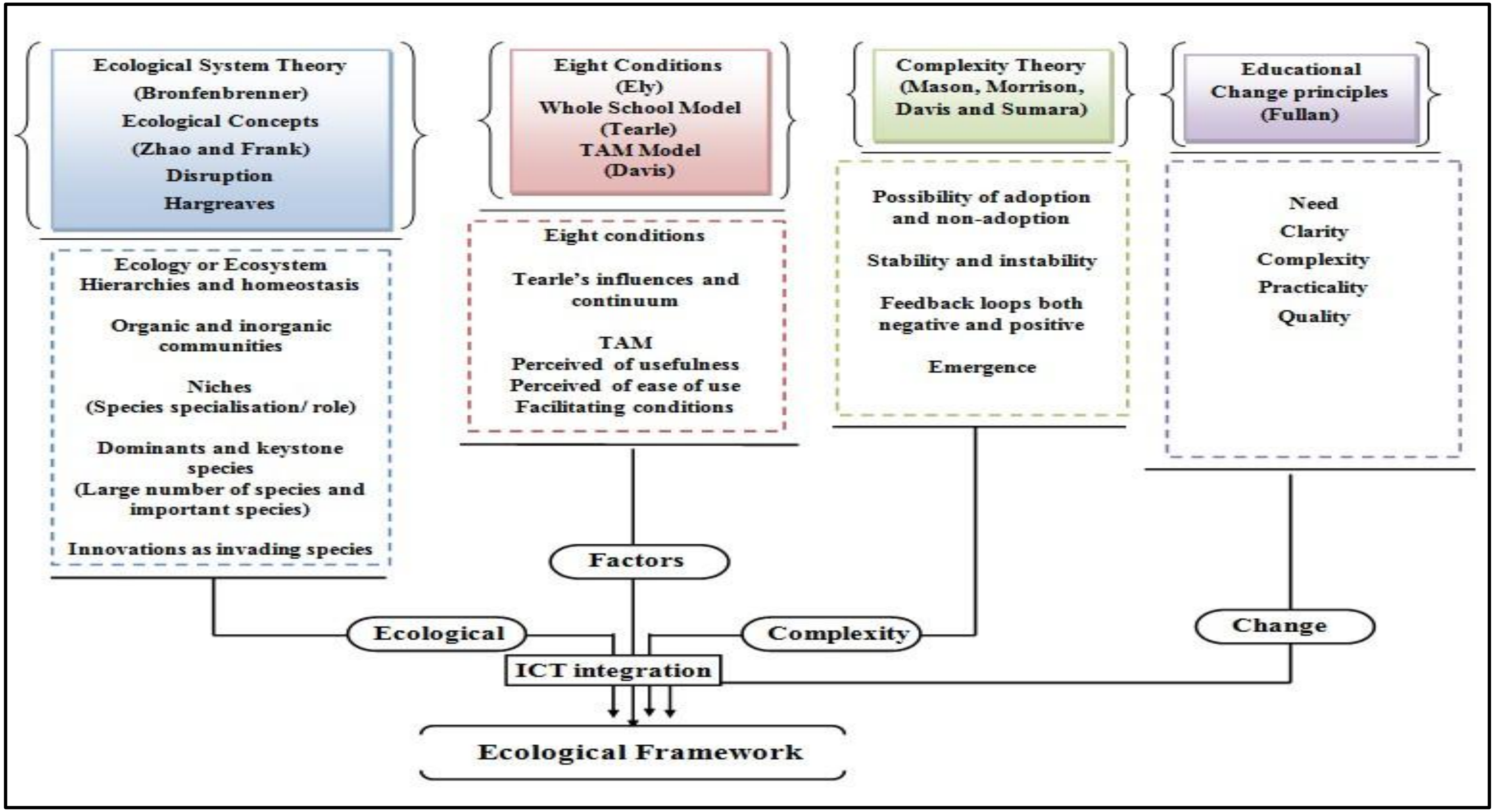


Figure 4.3 An overview of the ecological framework

Using this theoretical framework the study aims to gain a deeper insight of the actual use of ICT in ECE settings, as well as investigate the central factors that influence such use. The related research objectives and sub-research questions are:

RO1. To explore how ICT is integrated into ECE settings in both Saudi Arabia and Scotland.

RQ1. What ICT resources are available in preschool settings?

RQ2. How do practitioners use available ICT resources?

RO2. To identify the factors that help or hinder ECE practitioners to integrate ICT into ECE in Saudi Arabia.

RQ3. What are important preschool characteristics?

RQ4. What are the important teacher characteristics that influence ICT integration?

RO3. To put forward a framework that integrates the teacher and preschool characteristics that are associated with ICT integration.

RQ5. How can we move forward with ICT integration in ECE on both a local and international scale?

The next chapter discusses the design of the multiple case studies, and the methods and processes used to gather and analyse data.

Chapter 5

Research Methodology

Chapter outline

Chapter Five

Research Methodology

5.0. Introduction

This chapter provides an account of the research design, the methods used and the research instruments and techniques employed for data collection and analysis. The first section (5.1) briefly discusses the intersection between theory, design and data. Then section 5.2 examines the paradigm, the approach adopted and the rationale for this choice to address the research questions. This is followed by a discussion, in section 5.3, on the case study as a research approach and the collective case study chosen. Section 5.4 presents a detailed account of the selection process for cases in this research while also examining the methods used for data collection and the manner in which they were implemented. Section 5.5 considers the approaches to handling and analysing the assembled data. Next, section 5.6 explains how ethical issues were addressed in the research. The chapter ends with sections 5.7, 5.8 and 5.9, which consider the respective research instruments' validity and reliability, role of the researcher and provide a short summary to the chapter.

5.1. Theoretical basis

In discussing possible definitions of methods, research design and methodology, Van Wynsberghe and Khan (2007) have described methodology as the link between theory, research and data (p.3).

The use of an ecological metaphor to construct the ecological framework for the research is discussed in the previous theoretical framework chapter. According to Fleckenstein, et al. (2008), using such metaphors in research moulds 'our conceptualisation of a phenomenon of study and the methods by which we might plan a project to better understand that phenomena' (p.390). The ecological framework is a model that assists in conceptualising the complexity of factors and themes that influence ICT integration into ECE preschools. As such, the ecological framework has influenced the research methods of the current study. The ecological framework, as is discussed in this coming chapter, serves also to clarify and refine the data analysis.

The next section describes and justifies the design of the study. Further, it discusses the factors considered in selecting research methods and research techniques in relation to the questions being investigated.

5.2. Research paradigm and approach

The research followed a naturalistic inquiry procedure and took place within an interpretive research paradigm. The purpose of this approach is to explore and understand a specific situation in depth to illuminate factors for consideration of the general case (Bryman, 2001). The naturalistic inquiry is simply an inquiry conducted in natural settings, using natural methods in natural ways by people who have a natural interest in what they are studying. As Cohen et al. have phrased it, for a naturalistic researcher, 'the central endeavour is to understand the subjective world of human experience. To retain the integrity of the phenomena being investigated, efforts are made to get inside and to understand from within' (2003, p.22). Merriam also explains that 'there is no single observable reality. Rather, there are multiple realities, or interpretations, of a single event' (2009, p.8). Situations therefore should be examined through the eyes of participants rather than the researcher (Creswell, 2003).

Narrowing down the methodology employed in this research from the general, i.e. naturalistic, inquiry to the more specific leads to a recognition of the importance of the interpretive paradigm; an approach 'that is sensitive to context, uses various methods to get inside the ways others see the world and is more concerned with achieving an empathic understanding than with testing laws of human behaviour' (Neuman, 2003, p.80). It also emphasises the importance of understanding the social world by examining its interpretation from the participants' perspective and how they construct meaning in natural settings (Bryman, 2001; Neuman, 2003). In this case, this research with its interpretive position does not test theory or measure using a positivist approach, but instead seeks to understand the experience of ICT integration into teaching and learning in ECE from the perspective of preschool practitioners. There is a desire to understand how ICT is being integrated into ECE in everyday pedagogical practice and to discover which factors influence practitioners to fully or superficially integrate ICT - any interference from the researcher would skew this picture.

The interpretive perspective also fits with the theoretical framework adopted in this research. For Kilbourn and Alvarez (2008, p.1363), this ecological-complexity perspective 'actively searches for meaning and understanding in terms of the interconnections and coherence among things, events, and processes'. Furthermore, the adapted ecological framework encompasses both the macro and the micro and seeks to understand how hierarchies affect each other (with an inherent power relationship). Kilbourn and Alvarez (2008, p.1363) suggest that this way of thinking is commonly linked to fields like ecology and education. The adapted ecological-complexity perspective helps frame ICT as a social and complex phenomenon in relation to this research; it has influenced the research methods, participants and analysis.

Many researchers have employed naturalist inquiry in the field of education (Lincoln and Guba, 1985; Robson, 1993; Creswell, 2003b), and there are well-established parameters for conducting such research. This study is similar in the following ways: the research occurs in a natural setting, that is, preschools and playrooms; it is people (practitioners) who are the main object of study; it employs mainly qualitative methods and it grounds the theory in the data through constantly comparing emerging patterns and interpreting them.

Since the particular situations under examination in this research, i.e. the use of ICT by practitioners and the multilevel factors influencing their actual practice, are tied closely to their context, a case study approach is adopted here in order to provide detailed examinations, understand the situation and try to establish some guidance for further exploration. According to Yin (2003, p.1), 'the case study is the preferred empirical research method' when research contains a 'focus on a contemporary phenomenon within some real-life context'; with an aim to contribute to the collective understanding of individuals and related phenomenon. Merriam (1991, p.41) also notes that 'The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon'.

A case study design allows the researcher to investigate the research problem within a tightly defined context and across a range of teaching contexts. It provides an opportunity for an intensive study of processes and interactions within a well-defined and bounded context; further, it has advantages in terms of the scope (i.e. offers conditional generalisations) and the precision (i.e. offers specific cases for illumination) to understand the research problem. In case study literature, generalisability is often an issue, especially in the interpretive paradigm. Van Wynsberghe and Khan (2007, p.8) argue that generalisability is limited and contingent on aspects of the study that may be generalisable to other events or to a larger case. In sum, a case study approach matches the interpretive perspective selected for this research, which assumes that reality is a social construct that emerges from the way in which individuals and groups interact and experience the world.

The researcher plays a crucial role in the interpretive case study approach. S/he goes through a detailed examination of a text that could be an oral conversation, written words or even a picture in order to discover embedded meaning and to interpret the findings. The researcher is not only an interpreter but experiences the cases and can share a 'standpoint' with the practitioners taking part in the research (Mason 1996, cited in Gahwaji 2006, 97). The researcher, in turn, is both an insider and an outsider to the research.

Even though this interpretative role is important, to provide balance the emergent theory should be also grounded on data generated from the research (Cohen et al., 2003). However, it is worth mentioning here that in this approach, no particular technique is specified for analysing data that arises out of the case study (Creswell, 2009). Any one situation may generate multiple interpretations that should be accepted and appreciated (Cohen et al., 2003). Thus, given the research aim to add a dimension of understanding to the subject and to move current thinking in the field forward via thorough academic research, the researcher here borrows some of the elements from the pragmatic approach, namely grounded theory, to compare and interpret themes arising from the case study data.

In particular, the data analysis here relies upon grounded theory, a paradigm that 'is related to, emerges out of, is created through and grounded on empirical data' (Sarantakos 1998a, p.200). Grounded theory is not just a research method; it is also a paradigm that allows for the formulation of a pragmatic theory of action and, as in this research, its outcomes are a series of insights for practitioners in the field. Grounded theory is therefore a way of conducting analysis of qualitative data (Strauss and Corbin, 1998b) that leads to the creation of a series of pragmatic recommendations. In this study, therefore, the dominant naturalist and interpretive paradigm is supplemented by this use of pragmatic (grounded) theory.

It is generally accepted in many areas of research that decisions about research methods should be informed by the nature of the research questions, aims and objectives, and that they will indicate what approach and methods should be used. This study has two aims: to explore practitioners' current use of ICT in the playroom and to investigate which factors influence practitioners to fully or superficially integrate ICT. Hence, this research intends to look in depth at the beliefs, attitudes, views, influences and empowerments of various stakeholders at different levels of an ecosystem to build a holistic picture of a particular situation. Such intention requires an understanding of how people construct meaning of situations, and this meaning is naturally conveyed via a discussion or interaction with people.

An interpretive case study approach was thought to be a suitable choice in this research because it is best for when the researcher wants to investigate an issue in depth and provide an explanation that can cope with the complexity and subtlety of real life situations (Yin, 2003, p.2). In particular, it lends itself to research that attempts to understand complex processes and relationships within a setting that are difficult to measure using pure quantitative methods or with experimental methodology (Silverman, 2006).

5.3. The case study approach

There are a number of scholarly perspectives on the epistemology of the case study. Yin views it as 'a research method' (2003, p.1). Stake (2005) argues that the case study is not a methodological approach, but simply a choice about what to study and is more commonly regarded as a comprehensive research strategy. Creswell (2007) views it as a strategy of inquiry for conducting research in a natural way that enables the researcher to construct a reliable picture of the phenomenon of interest. Merriam is somewhat unusual in that her definition of case study has evolved over the years - she initially focused on the end product of the case study. Ten years and much research later, she revised her definition:

'case study can be defined as the process used, the case or bounded unit or the end product and that all may be appropriate definitions' (1998, p.34).

In light of these many perspectives, Hamilton and Corbett-Whittier (2013) have noted that the term 'case study research' is one that is debated heavily in the literature. They discuss at some length whether case study is a method, methodology or research design. As they highlight, work by Van Wynsberghe and Khan (2007) points out that the case study is not 'prescriptive in its structure, content and data collection tools and so cannot be defined in these terms' (Hamilton and Corbett-Whittier 2013, p.10). In response, Hamilton and Corbett-Whittier argue that 'case study should be seen as an approach to research or . . . as a genre that aims to capture the complexity of relationships, beliefs and attitudes within a bonded unit using different forms of data collection and is likely to explore more one than perspective' (p.10).

The current research concurs with this contemporary perspective, which is that case study is the broad approach taken and is done within an interpretive paradigm. Within this framework, the current researcher makes choices about the nature of the case study approach and the range of research methods for data collection that will be used. Three main considerations are pertinent is discussing the case study approach:

(1) The nature of the case study approach.
(2) The number of cases required.
(3) Which methods of inquiry may be suitable under the umbrella of this approach?

5.3.1. The nature of the case study approach

As Yin (1994) puts it, a research aim can be 'theory testing' or 'theory building'. According to Denscombe (2007, p.38), 'predominantly, case study has been used in relation to the discovery of information, following an inductive logic to either: (a) describe what is happening in a case study setting (e.g. events, processes and relationships); (b) explore the key issues affecting those in a case study setting (e.g. problems or opportunities); or (c) compare settings to learn from the similarities and differences between them.'. The current research is a discovery-led, theory building practice that follows an inductive logic (Denscombe, 2007, p.38). In this study, the researcher wants to investigate in depth how ICT is integrated and to capture the subtleties that occur in preschool practices, events and relationships.

Moreover, Merriam (1998, pp.27-29) argues that case studies can be described by the nature of the final product or the intent of the research. They can be (a) descriptive, which is a detailed account of the phenomenon under study; (b) interpretative, which is used to develop conceptual categories or to illustrate, support or challenge theoretical assumptions held prior to the data gathering or (c) evaluative, which involves description, explanation and judgment. In this research, the intention was to undertake descriptive case studies to provide a rich description of teachers' ICT integration into teaching and learning in ECE and to explore the factors influencing their current practices. This approach will yield up-to-date information in this field for future research, policy and curriculum development aimed at improving ICT integration in ECE settings.

The case study can be seen as bridging the gap between grounded theory, phenomenology and ethnography. The key advantage of the case study is the detail that it allows (Merriam, 1998). It is because of this depth of research that the case study is suited to a social environment; such situations can be complex and have many overlapping factors. Thus, the case study provides a holistic view of social practices, whereas other qualitative methods study isolated phenomena.

In order to discover the data that is useful for an international community of readers interested in ICT integration into ECE, it is necessary to look at both contexts in considerable depth. A nomothetic approach was adopted because the small case nature of the research means that this is more suitable than ideographic approaches (Denscombe, 2007, p.35). As Denscombe puts it, 'what a case study can do . . . is to study small things in detail' (p. 36), and the nomothetic case study approach allows for a depth of data that unravels the complexities of a certain situation in a way that is not achievable in a simple survey (one that is likely to produce surface-based data (Ibid.)). Cases, therefore, tend to be holistic rather than study one phenomenon in isolation. In this research, ICT is not studied as a separate or isolated variable, and case studies further allow us the 'opportunity to explore why certain outcomes might happen rather than just what those outcomes are' (Ibid.).

The case study approach suits this project as it seeks to describe the use of ICT in a particular context and focuses on the ICT learning environment and its socio-cultural context. In ECE, ICT does not exist in isolation; it 'weaves itself into learning in many more ways than its original promoters could possibly have anticipated' (Papert, 1993, p.53). Its introduction can cause a change to activities, curriculum and interpersonal relationships in the learning environment and, in turn, it is influenced by the changes it effects.

In these terms, ICT is a mediating tool integrated into early learning environments with the aim of improving the experience and effectiveness of teaching. Therefore, the approach adopted in this study is to systematically describe the use of ICT in Saudi and Scottish preschools, in addition to identifying the factors that influence practitioners' use of ICT in ECE. The outcomes of such an approach offer an opportunity both to inform the wider academic community and to understand these influences from a more holistic perspective.

5.3.2. Collective case study

Various researchers have suggested several types of case study (Merriam, 1998, 2009; Stake, 1995; Yin, 2009; Hamilton and Corbett-Whittier, 2013). Multiple case studies or collective case studies (Stake, 2003), as opposed to a single case study, involve 'collecting and analysing data from several cases and can be distinguished from the single case study that may have subunits or sub cases within' (Merriam, 1998, p.40). Further, using multiple case studies strengthens the 'precision, the validity and stability of the findings' (Miles and Huberman, 1994, p.29) by looking at a range of similar and contrasting cases. Stake (1995) identifies three types of case study: intrinsic, instrumental and collective. The case study approach adopted in this research can be described as an instrumental collective case study, as defined by Stake (1995). This study is collective because the researcher aims to describe how ICT is integrated in ECE settings. In this situation, the collective case study approach is instrumental to the understanding of a situation, rather than the fact that there is an intrinsic interest in the case itself. Furthermore, it was felt that taking this approach was the best means to achieve ‘some degree of robustness’ in the results.

This research incorporated six preschool settings. According to Stake (2003, p.138), the study of several cases is called a collective case study. Hamilton and Corbett-Whittier (2013, p.60) noted ‘A multi-case study may begin as a single case and then be expanded to two or more cases’. The researcher decided to work with ‘multiple cases’ in order to understand how there are variations in different contexts and to provide a greater range of observations. A collective case study design offers better understanding and theorising due to the specific collection of cases. In sum, an instrumental collective case study provides this research a way of understanding the complexities between participating cases. By using a collective case study, the researcher is able to study how teachers’ integration of ICT in teaching and learning occurs in preschools and how various factors influence teachers in different preschools.

Strengths and limitations of using a collective case study

Methodologists of the case study research approach, such as Stake (1995), Yin (2009) and Merriam (1991, 2009), have highlighted four key components of case study design: (i) unit of analysis, (ii) multiple perspectives (representation), (iii) triangulation (for accuracy and alternative explanations) and (iv) boundaries in each case (spatial or temporal).

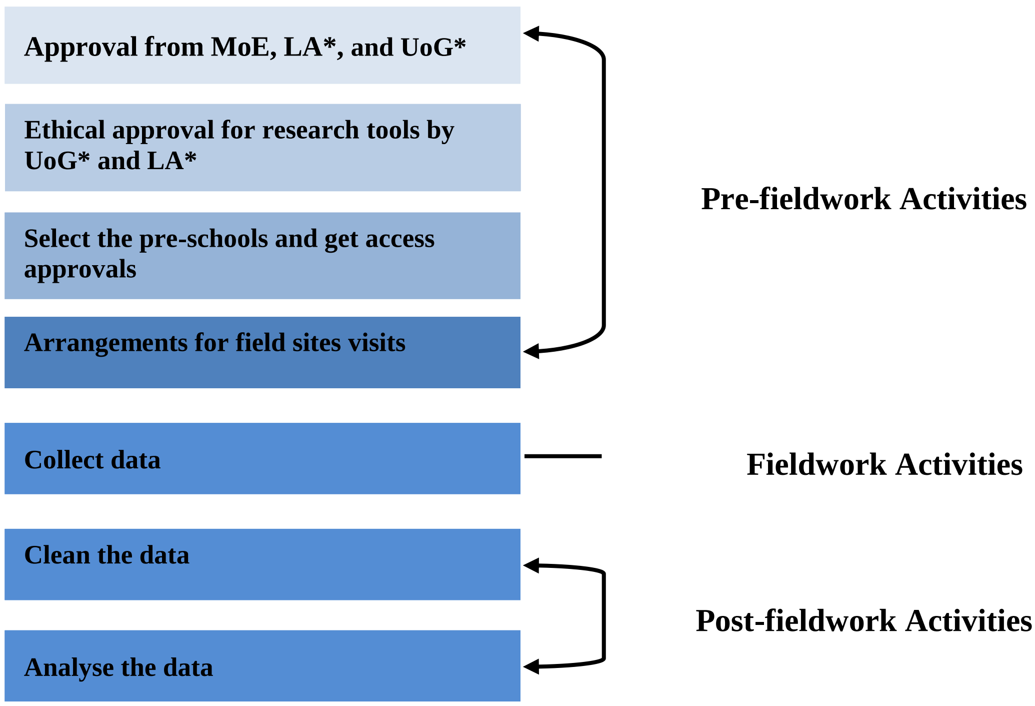
In the case study detailed in this thesis, the teachers represented the unit of analysis (component i), while the additional input of other stakeholders (e.g. preschool HTs) was sought to ensure that viewpoints were represented from multiple sources (component ii). A variety of methods were employed to accomplish triangulation (component iii), including: a) questionnaires, b) interviews and focus groups, c) documentary evidence and d) observations. Additionally, this data was derived from diverse sources within each case, for example from multiple teachers within each school. The final element (component iv) defines the precise boundaries of the case study, both spatially and temporally, and establishes what will be and will not be included. In this case study, the preschool and designated period of research demarcates the boundary.

The study is limited by the temporal nature of the phenomenon being studied; it focuses on how ICT is integrated in preschool at the present time. ICT integration and learning and teaching are evolving processes; thus, by the time conclusions are drawn from this study, the situation in preschools using ICT is likely to have changed.

The next section discusses the selection process for cases in this research; also, it examines the methods used for data collection and the manner in which they were implemented.

5.4. Data collection procedures

The fieldwork research process in both contexts of Saudi Arabia and Scotland was conducted in three different stages. Figure 5.1 depicts this process.



* MoE: Ministry of Education; UoG: University of Glasgow; LA: Local Authority

Figure 5.1 Steps in Fieldwork Research Process

5.4.1. Pre-fieldwork Activities Stage: Pre-school case study selection procedure

In keeping with the research approach discussed in section 5.1, a small number of preschools were to be selected. This figure was not fixed, but it was felt that a range between two to four preschools from each context would be sufficient to provide the necessary breadth, but also be manageable in terms of the availability of time and resources. The process of selecting the preschools for the case studies was undertaken in two main stages which are referred to as case selection and case screening.

This section describes the criteria for selection, the selection process used and final outcomes.

The selection frame

No sampling took place and so there was some reservation about using the more common term ‘sampling frame’; it was felt ‘selection frame’ was a more appropriate term. The broad frame from which a case study preschool could be selected was:

> **Preschools located in Jeddah and Greater Glasgow who were actively promoting and supporting the use of ICT for teaching and learning in ECE.**

Case studies were identified based on the following criteria:

- An equal number to be selected from the private and public sector.
- They had to serve children aged from 3-6 years in Saudi cases and 3-5 years in Scottish cases.
- They had to have ICT resources available.
- Saudi preschools were to be located in Jeddah City and Scottish preschools in Greater Glasgow.

The ICT aspect of this statement is central to the research, and will be addressed in detail in the next section.

Selection criteria and process

Section 5.2.1 noted that this study needed to identify preschool cases that had a good reputation for integrating ICT for teaching and learning. Otherwise, it was felt it was not possible to learn from the preschools for the purpose of this research. Denscombe notes that 'all case studies need to be chosen on the basis of their relevance to the practical problems or theoretical issue being addressed' (2007: 40). Preschools were selected based upon a number of known attributes, as well as living up to the 'good practice' criteria. This purposive sampling suggests that the cases here, while not 'extreme', have been regarded as notable achievers within the 'normal' parameters of ICT use. A number of conveniently located, interesting (*ibid*.: 41) 'good practice' preschools were selected, but of course it was in the end the choice of the preschools whether they were able to accommodate my research and some did decline.

Geographical location

In Saudi, preschools were selected strategically based on geographical location, covering preschools in urban and suburban areas of Jeddah. In terms of Scotland, the researcher became aware that greater Glasgow was divided up into different Local Authorities (LAs). The number of possible preschools to research was far greater than the number necessary for the case studies. It was decided to limit the preschools chosen to be within Glasgow City Council and East Dunbartonshire.

There were two central reasons for this restriction. Firstly, it was easier to obtain professional advice from a range of experts and practitioners, such as academics and HTs through research contacts, on selecting nurseries from the two LAs that had an intrinsic value in the field, i.e. a good record for ICT integration and were recommended for good practice. Denscombe notes that 'there are even some experts in the field who would go as far as to argue that selection on the basis of being intrinsically interesting is a sufficient justification in its own right' (2007:,41). While certainly a number of possible case studies in the Scottish context were talked of by both researchers and professionals, some particularly interesting cases were said to be found in these LAs and those preschools were pursued when possible.

Secondly, matters of convenience were also considered. For example, high transportation costs and lengthy journeys to case study preschools were not seen as a sensible use of resources. It was also considered important to be able to spend whole days researching a case, arriving for the preschool proceedings at 8:30 am when appropriate, and similarly retaining the flexibility of remaining on site after the preschool had finished the daily working hours. It was felt that excessive journey times may lead to unsatisfactory compromises and that imposing these geographical criteria need not compromise the requirement, but would make the research more manageable. Consequently, conveniently located, interesting ‘good practice’ preschools were selected to take part in the research.

ICT integration

This research process began by searching for practice that promoted and supported ICT use for teaching and learning in ECE. There was considerable caution in laying down very specific criteria, as it was felt this might pre-empt possible outcomes of the research. It was also noted that it was extremely difficult to access detailed information about such a large number of preschools, and then apply the selection criteria in a fair and rigorous way. In view of this it was decided to make the decision in two stages. The first was to draw up a long list of possible preschools and then look more closely at these to develop a short list.

Long list of possible preschools

Creating the long list was undertaken by seeking advice from two sets of experts in the field. Full details of the process are discussed below.

In Saudi Arabia, the arrangements to select the preschools were made through the Early Childhood Education Department at the Saudi MoE in January 2009. After considering the ethical approach of the study, as is standard practice, in addition to the research case study criteria, the MoE contacted the Jeddah Early Childhood Department to inform them of the aims and objectives of the study, asking for cooperation in assisting the researcher in her fieldwork activities, namely: interviews and questionnaires, administration, and data collection. Accordingly, a list of contact details for all licensed preschools (private and public) that met the case study selection criteria was provided (this list included 16 public and 34 private preschools). In turn, to refine the long list, advice from the head of the ECE department at Jeddah LEA helped to orientate the initial choices.

In Scotland, arrangements to select case study preschools were made by approaching the education services department at both the relevant LAs (Glasgow City Council Local Authority (GCCLA) and East Dunbartonshire Local Authority (EDLA)). After contacting both LAs, EDLA responded to the criteria by providing the researcher with a list of contact details for private, public and voluntary preschools that met the research criteria (this list included ten public preschools, six private and two from the voluntary sector). Those from the voluntary sector were excluded as they are beyond the research scope. GCCLA responded by simply giving the researcher permission to contact preschools and HTs directly. Alphabetical lists for all the public and private preschools were obtained from the GCCLA website. In choosing from these lists the following process was followed:

- An email was sent to ICT advisors from the LA, attached with a copy of the permission letter received from GCCLA and the research PLS, inviting the recipients to nominate preschools that they felt fitted the ICT requirement for a case study preschool. The ICT advisors work closely with the preschools, and they were well placed to help nominate establishments to work with. It was emphasised to the advisors that that there was no need for the chosen preschools to be exceptional, but they would need to be at a stage in their development of ICT use which was reasonably well advanced. This allowed for the preschool's current practice, ICT integration process, management structure, resource development and plans for professional development to be studied.

- Advice and recommendations from academics at the University of Glasgow, School of Education was sought. Advisors came from specific subject disciplines and worked with a large number of preschools in Glasgow. It was felt that it would be helpful to obtain working knowledge of the use of ICT for teaching and learning in ECE. Each person approached helped in introducing the researcher to a range of preschools and contacts who were known as contributors to integrating ICT in Glasgow City Council preschools. A group of the preschools were mutually nominated by both academics and ICT advisors. This was a snowball sampling technique (as well as purposive).

This technique was applied within the geographical boundary to give a long list of preschools to follow up more closely.

Short list of possible preschools

The next step in the case selection was to refine the long list of preschools. In terms of the Saudi cases, this was undertaken by seeking advice from the ECE inspectors at the ECE department at Jeddah LEA. In turn, ten public preschools which had been part of an Evaluation Programme for the Quality of Early Childhood Education and Care Services were nominated. Those preschools were identified for their high quality in ICT. Four of the ten public nurseries were situated in the Presidency of National Guard, the Ministry of the Interior and the Ministry of Defence residences and these were excluded as the researcher would have had to have gained further permission from the relevant Ministries to access these. Six preschools in the public sector therefore remained: two were used for piloting and four were shortlisted for the main study. A larger number of private preschools met the research criteria. In choosing from this list, once again, recommendations from inspectors were sought, in addition to looking at preschool websites when available. Accordingly, the list was refined, and six preschools were selected at random: two formed the pilot study and four were shortlisted for the main study.

In terms of the Scottish cases, the next level of case selection was achieved through studying the most recent HMIE inspection reports and preschools websites, if available, for all the public and private preschools on the long list to identify any reference to ICT use. This process resulted in six public and four private preschools being identified as possibilities.

Final decisions

Once approval was gained from the LAs in both contexts, identified preschools were then contacted directly to get access approvals and to make arrangements for visits. Since the final decision over participation was taken by the respective HTs, initial contact with the HTs was, in some cases, done by an introductory email, sent with a copy of the research detailed PLS and information sheet (see Appendix 1). In turn, some HTs replied by suggesting a meeting, while other HTs indicated they could not participate, and some of these recommended other preschools.

Outcomes of the selection process

In Saudi, only ten of the twelve preschools approached initially responded positively, the other two expressed good wishes for the research but felt unable to participate due to other commitments with the Childhood Studies Department at King Abdul-Aziz University in hosting pre-service teachers training. Consequently, four preschools from both the public and private sectors were used for the pilot study and six were selected for the main study (three private and three public). However, when the data collection for the main study commenced it became clear that data was being replicated within each sector and the study was consequently limited to four case studies in total: two from the private sector and two from the public.

One of the Saudi preschools was selected specifically because it has a strong trend towards the provision of ICT. The other three Saudi settings are selected not because of any specific ICT use or provision of ICT but rather as examples, across both public and private sectors, of pre-school provisions that were reported by the LEA to be of good overall quality for innovation in learning.

In Scotland, only six of the ten preschools contacted prior to the data collection stage answered positively: two felt unable to participate due to other pressures both were preparing for the HMIE inspection, and two preschools did not respond. After piloting in one private and one public preschool, once more due to replicating data, as well as collaborating data already found in the literature, the researcher narrowed the range to only two preschools for the final study (one private and one public). These two Scottish preschools were chosen, as they were identified as field leaders, based on their most recent HMIE reports.

It was felt necessary to select more cases from the Saudi ECE environment than Scotland as the literature in this field is, at present, particularly deficient.

Overview of the selected case study preschools

For the final study, six case study pre-schools were selected, four preschools from Jeddah, Saudi Arabia and two preschools from Glasgow, Scotland.

- Two public nursery schools (A$_1$ and A$_2$)
- Two private nursery schools (A$_3$ and A$_4$)

Jeddah city /Saudi Arabia

- One public nursery school (B$_1$)
- One private nursery school (B$_2$)

Greater Glasgow/Scotland

The six cases, which are the focus of this research, are designated as Preschools A$_1$, A$_2$, A$_3$, A$_4$, B$_1$, and B$_2$ which may be characterised by the preschool sector (public - private) and context (Saudi - Scottish) to ensure anonymity. Next section presents a short summary of the general features of the participating case study preschools.

Preschools profile: General features for the case study preschools

The four Saudi cases, two from the public sector (A$_1$ and A$_3$) and two from the private sector (A$_2$ and A$_4$), are located in residential areas of Jeddah City. These preschools are all authorised by the Ministry of Education (MoE) and operate under the supervision of the Early Childhood Education Department for the Local Authority of Jeddah. They follow the approved academic calendar, in accordance with the MoE, which regulates the entire school sector in terms of semester times and holidays. Preschools run for thirty-six working weeks, five days per week (Saturday to Wednesday) annually in the academic year.

The preschools in the Saudi context are of varying size. Some nurseries may be considered medium-sized (a capacity of up to 50 children per year) and large-sized (a capacity for teaching a maximum of 150 children per year). Some of the preschools are also attached to primary or extended schools, while some other nurseries are stand-alone settings. Table 5.1 depicts the demographic variables of the preschools of the study.

Table 5.1 Preschools' Demographic Features

Preschool	Location	Sector	Type	Size*	Age group	Operating hours
A1	Jeddah/SA	Public	Attached to primary school	Medium	3-6 years	7:00am-1:00pm
A2	Jeddah/SA	Private	Attached to extended school	Large	3-6 years	7:00am-4:00pm
A3	Jeddah/SA	Public	Detached nursery school	Large	3-6 years	7:00am-12:00pm
A4	Jeddah/SA	Private	Attached to extended school	Medium	3-6 years	7:00am-4:00pm
B1	Glasgow/Scot	Public	Attached to primary school	Large	2-5 years	8:45am-6:00pm
B2	Glasgow/Scot	Private	Attached to primary school	Medium	2-5 years	8:30am-6:00pm

* Nursery size indicates its capacity to cater for a number of children per session or academic year. Medium <50. Large >50.

In Scotland the two nursery schools are open 5 days a week for fifty two working weeks, from 8.45am-6.00pm, though sessions can be booked for morning only, afternoon only or both. All cater to preschool children aged 2-5 years (See Table 5.1). The preschools are of varying size: one nursery is medium-sized (a maximum of 50 children per session) and one is large (a maximum of 80 children per session).

In all of the preschools, HTs reported that they had been investing in ICT for some time. The preschools also included and documented ICT within their annual long and short term educational plans. However, under scrutiny their level of ICT resourcing and their uses of ICT varied. The next section describes briefly the specific features of each case study.

The Participants in the study

Teachers as dominant species

Teachers, or practitioners, are the most important species in the ecology and are the main unit of analysis in this research. Those invited to participate taught at each level of their respective pre-school system. In some cases, other teaching staff members - special subject teachers - were invited to participate in the study. 95 practitioners participated in the questionnaire phase, 64 of whom worked in Saudi Arabia and 31 in Scotland.

Not all teaching staff members were interviewed in focus groups. Participants had to be both willing and have the time in their schedule for interviews. HTs recommended certain

ICT-competent teachers for interview, while HTs and ICT coordinators were interviewed, given their pivotal roles. Interviews were held also with a number of teaching staff who indicated in the survey that they did not use technologies of any kind, as well as a number who were low-level users. Interviews with "non-users" focused on their concerns about ICT, their reasons for not using ICT, their present levels of knowledge and skills, their needs and priorities for their own development, and any perceived barriers to using ICT.

Other participants

The inclusion of other species within the ecological framework provides triangulation. According to VanWynsberghe & Khan (2007: 8), other participants assist in understanding the conditions under which the concept, relationship, or event ‘got the way it is’. As a keystone species, the inclusion of HTs provides an understanding of how they support or hinder teachers’ ICT use in their respective preschools. They play an important role in determining, for example, the management of ICT infrastructure and preschool polices in teaching and learning. All HTs participated in the questionnaire and interview phases.

In some cases, other staff members such as ICT coordinators, were asked to fill out a questionnaire, given their important roles in ensuring that the preschool ICT infrastructure is maintained. Three ICT coordinators participated in both the questionnaire phase and focus group discussions.

Participant characteristics

In Saudi, 39 (61%) of the teachers were in public and 25 (39%) in private preschools. Practitioners fell into three categories: (a) practitioners with High School Certificates; (b) teachers trained in teacher colleges with Diplomas in Teaching (Dip. T.S.) or Vocational Qualifications (VQ); and, (c) teachers trained in universities with Bachelors in Science (B.Sc.). Of the 64 practitioners, 29 were college diploma holders, 28 held a B.Sc. degree, and seven had High school certificates. A majority of the practitioners specialised in ECE (39; 61%). In Scotland, 25 (81%) of the teachers were in public and six (only 19%) in private preschools. Practitioners fell into four categories: (a) practitioners with High School Certificates; (b) teachers trained in teacher colleges with Diplomas in Teaching (Dip. T.S.) or Vocational Qualifications (VQ); (c) teachers trained in universities with

Bachelors in Education (B.Ed.); and (d) teachers who have Post-Graduate Degrees in Education (M.Ed.). Of the 31 practitioners, eight were college diploma holders, two held a B.Ed. degree, 18 were vocational qualification holders, one had a High school certificate and two held an M.Ed. degree. 27 of the practitioners specialised in ECE (87%). Figure 5.2 illustrates a breakdown of teachers' professional backgrounds.

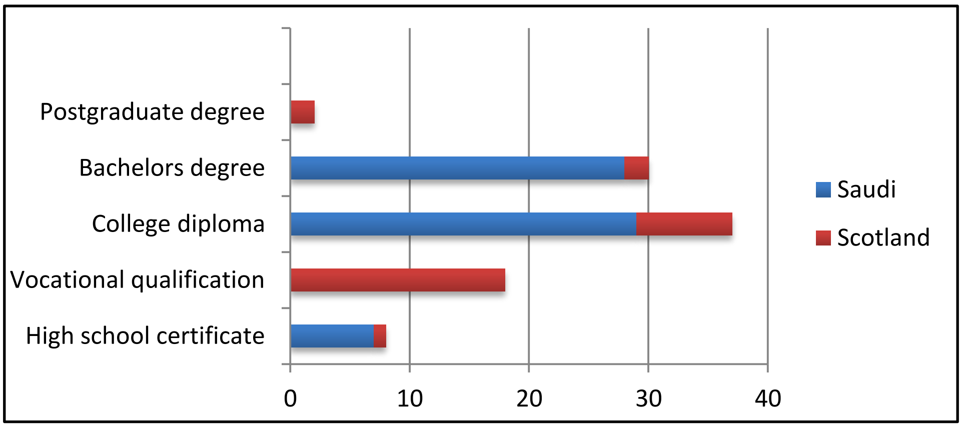


Figure 5.2 Practitioners' qualifications, frequency

As shown in figure 5.3 most of the Saudi preschool teachers had more than ten years experience (36 practitioners), while having between one and five years experience was also common (14 practitioners). In Scotland, the years of experience practitioners had was more evenly spread. 12 practitioners had one to five years experience, nine had six to 10 years, and 10 had more than 10 years.

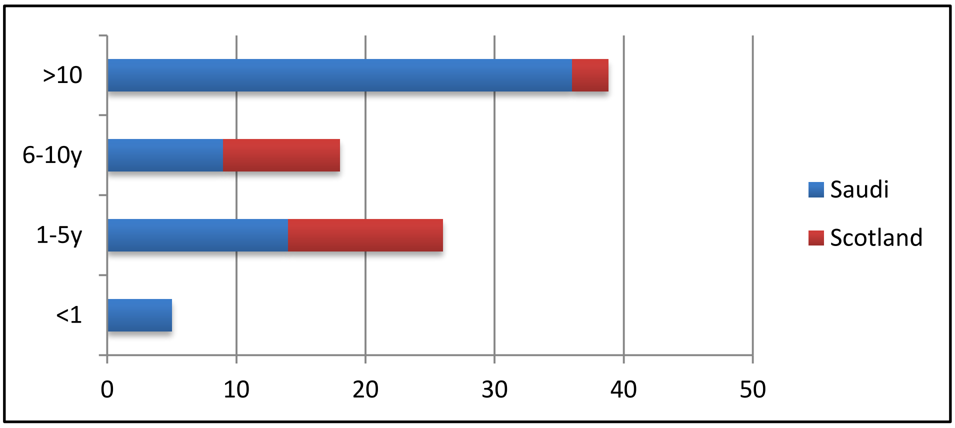


Figure 5.3 Practitioners' Years of Experience, frequency

In terms of age ranges, in Saudi 23 teachers were between 20-30 years old, 28 were between 31-40, and least common was being over 50 years old (two practitioners). In Scotland, almost half (15 practitioners) were between 20-30 years old and, once more, least common was practitioners being over 50 year olds (2 practitioners).

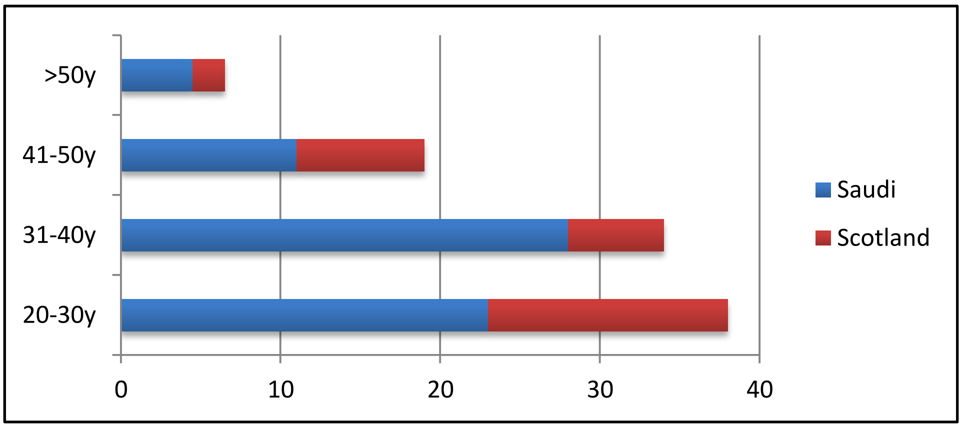


Figure 5.4 Practitioners' Age Group, frequency

Further, in Scotland, 27 practitioners (87%) had attended training in ICT use. In Saudi, 46 practitioners had attended training in ICT (72%).

Timeline for the case study

The first stage of the collection process began with the Saudi cases in September 2009 and ended in October 2010. Upon completion of the Saudi-based research, the data collection process in Scotland began in November 2010 and ended on 25th June 2011.

5.2.2. Fieldwork activities stage: Data collection approach and methods

In setting up the case studies the researcher collaborated with individual staff at the micro level; she also considered the data collectively, working both at the school (meso) and system (macro) levels, using a multi-method approach to triangulate the data. This is a well-established method that helps corroborate findings, addresses any bias and encourages the consideration of different viewpoints (Denzin, 1970; Denscombe, 2007). It provides a broad and thorough base for interpretation.

In this research, to gather accounts of different realities constructed by various groups and individuals in different learning environments, the research study was carried out in two phases:

- Phase one included documentary analysis as a research method where documents were used as a tool to select the preschools for the case studies; further, it contributed to generating a wide and rich perspective. The sample of preschools was chosen based on the degree of ICT integration reported in phase one.

- Phase two was a collective case study of preschools. In this phase data collection was carried out through: (1) self-reporting questionnaires sent out to a number of pre-schools in Jeddah and in Glasgow and East Dunbartonshire; (2) face-to-face interviews with HTs and focus group interviews with teaching staff and ICT-coordinators; (3) document analyses; and, (4) observations of ICT-based activities.

To comprehend the purpose of each method, their design, and the ways in which they interact, the research methods and instruments used within the case study framework are discussed fully in the following section. In part, figure 5.5 illustrates the ways in which the research methods interacted. For example, it suggests how documentary evidence was called upon before the study began, where such evidence was key to case selection, and for preparing the content of other tools. Further, it clarifies the bidirectional data flow between observations, interviews and questionnaires.

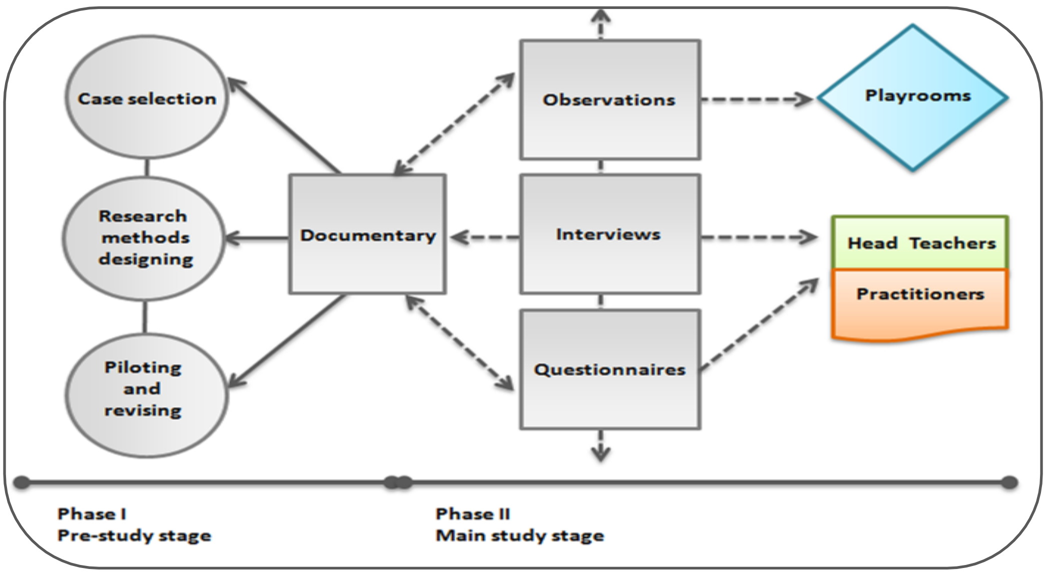


Figure 5.5 Data flow and relationship between research methods and instruments

Research methods and instruments

In this section detailed information on the methods and instruments used within the case study framework are discussed. It provides, for each of the methods (questionnaires, interview, document analysis and observation), details of purpose, the specific design features, and how they are used within the study.

Method 1: Questionnaire

Purpose and rationale

It is perhaps untypical of case study research to select a questionnaire as a research tool (Robson, 2002). The questionnaire element acted as a screening phase, producing a set of descriptive data, which could be further assessed in the subsequent stages of the research, and refined and guided the direction of the data collection stage. Indeed, the questionnaire also introduced the only quantitative elements of the study, therefore contributing to the multi-methods approach. In turn, the case studies are not purely qualitative as they also rely upon the quantitative elements of the questionnaire.

In this sense, after the questionnaire studies take place it is possible to use more standard case study data collection methods to ‘throw further light to associations found in the survey’ (Robson, 2002: 177). Such an approach adds breadth and rigour to the research scope.

Two questionnaires were required for the whole study: one for the HTs and one for the teaching staff. Using the questionnaire as a data collection method provided:

- A border perspective on the whole preschool philosophy towards ICT, as well as its plans, needs and priorities for further development.
- Basic descriptive data on the current level of ICT use in preschools, teachers’ attitudes towards ICT as a teaching and learning tool in ECE, their perceptions of their ICT knowledge and skills needs, the kind of training which will help them develop further, and the factors which tend to encourage or hinder the take-up of ICT.
- Bring to the fore specific issues to further investigate through the case study data collection tools.

Design

Both questionnaires used in this study were 'self-administrated' questionnaires. They were designed and constructed based on questionnaires from previous studies in this area (Great Britain Department for Education and Skills & Becta, 2002; Hayward et al., 2002; Tearle, 2002; Oyaid, 2009; Williams et al., 2000); and in the light of the needs of the research they were developed further to cover issues adapted from the literature review and the theoretical framework (see chapters 3 & 4). The questionnaires were carefully designed in terms of both content and style, and the aim was to produce an attractive but standardised data collection tool. In addition, great attention was paid to the questionnaire's wording since it was first developed in English and the final version had to be translated into Arabic for the Saudi component of the fieldwork (see the piloting and implementation section for further details).

The HTs' questionnaire consisted of 34 statements asking for responses on a Likert scale designed to record the level of agreement or disagreement to each statement. Additionally, a combination of close and open ended questions was also included to invite HTs to provide more detailed responses. A copy of the questionnaire is given in Appendix 2.

The preschool teacher and practitioners' questionnaire was divided into five sections covering various issues surrounding ICT integration in preschool settings (see content section for details). The sequence of sections and questions mirrored the study's research objectives/questions. The questionnaire layout also follows Cohen and Manion's suggestion to progress from 'objective facts to subjective attitudes and opinions through justifications' (2003: 257). Four of the 34 questions were open-ended. The number of open questions was limited in case these more thought-provoking questions made people feel the questionnaire would take too much time to complete. There was a concentration on closed questions because they are quick to answer and easy to analyse. For instance, the first four sections of the questionnaire contained mainly closed questions, including multiple choice questions, dichotomous questions, likert scale and rating questions. A number of open-ended questions were also included within some sections that invited more thoughtful responses. The questionnaire's last section sought factual information (age, years of experience, qualifications…. etc.) again in the form of multiple choice questions.

Cohen et al. (2007) note the importance of the appearance of the questionnaire, as do Munn & Drever (2004). Care was taken to ensure that the questionnaires looked smart and clear. Care was taken to ensure that the questionnaires looked smart and clear. Also, the layout was kept simple and unified throughout. Questions were kept short and clear instructions were given to guide participants through each question. For instance, instructions were written in bold type and adequate space was left between one question and the next. The font size was large, extending the length of the questionnaire, but it aided clarity. Sufficient space was left to answer open-ended questions.

Content

The structure and content for both questionnaires was drawn from three sources: (1) previously developed questionnaires; (2) the literature review and the theoretical framework established in both Chapters 3 and 4; and, (3) the outcomes derived from the informal visits to a number of preschools prior to the main study. Each questionnaire item was designed to answer a specific research question (see Appendices 2 and 3 for more detail).

As mentioned, questions were grouped into five sections representing the main themes of the research:

(1) Teachers' use of ICT: this elicits information to assist in establishing an understanding of teachers' current ICT use, in terms of applications, methods of teaching, reason for use, frequency, and locations of use.

(2) Motivations and barriers to ICT use: factors at the different levels of the ecosystem identified from the literature review and the theoretical framework (see Chapter 3 and 4) that potentially support or hinder teachers' ICT use.

(3) Teachers' perspectives towards ICT: feelings and attitude statements worded so as to clearly elicit teachers' attitudes and beliefs towards ICT use in education in general and in ECE specifically.

(4) Policy and ICT in ECE: teachers were asked to provide information about policies known to them and explain its influence on their school and practices. Through a list of statements worded for this purpose, teachers' knowledge and attitudes were examined.

(5) The future of ICT in ECE: examined teachers' views on the probability of future changes in the field.

The questionnaire ended with a final open question to allow teachers to provide any further comments.

Piloting and Implementation

The translation of the questionnaire was carefully done and the conceptual equivalence of words between English and Arabic was a key concern. The standardised Arabic was chosen as the model for translation.

Prior to sending the questionnaires for the main study, it was piloted to ensure its validity and reliability. Five preschool practitioners were selected from the public and private pre-schools respectively, as well as two HTs and two Deputy HTs, to complete the questionnaire. The participants were contacted by the researcher and consented to participate in the pilot (see ethical approach described in section 5.3). The HTs' questionnaire was piloted successfully, while the ECE practitioners gave the researcher constructive feedback on how to alter one enquiry (question two) to make it more easily understood. Additionally, they recommended a change in the order of the questions, such as in section D on ICT policy and ECE, and the deletion of overlapping items in section C's question 12. At the end of the pilot scheme the participants were asked to review the newly altered questionnaire and they concurred with the changes.

After the piloting phase was complete, the full implementation of the questionnaire phase began. The questionnaires were distrusted to HTs and all teaching staff in both the public and private case study pre-schools. Following attending a staff meeting in the orientation visit (see observation section for further details), the researcher sent the questionnaire—which had a two week deadline for completion—to the HTs, who in turn placed it in the staffroom. A box for responses was left there. During the following two weeks the researcher conducted phone conversations with HTs to ensure that the research was being carried out smoothly. Lastly, appointments were made with HTs for interviews and dates for focus groups were fixed.

Method 2: Interviews and focus Groups

Purpose and rationale

The second phase of the study included one-to-one interviews and focus groups. These were the central data sources for the project. Interviews and focus groups often concentrated initially on areas suggested by questionnaire responses. This was to help provide a more in-depth understanding of the issues and the contextual factors which influence teachers' responses to ICT and ICT training. In turn, some preschools focused on different issues to others.

Two types of interviews were employed: (1) Interviews in the form of an individual interview with HTs; and, (2) Focus group discussions with teaching staff.

Design

Both individual interviews and focus group discussions were semi-structured with open-ended questions, to allow more flexibility for both the researcher and the participants to expand upon issues raised in the questionnaire (Silverman, 2006). Interviews and focus group discussions were divided into three parts covering the three main themes of the study. At the start, open questions were asked. Later, the interviews and focus groups addressed pre-defined questions that were broad and open to investigate any issues that had been identified in the theoretical framework (Chapter 4). The interview and focus group discussion schedules are in Appendix 2.

Implementation

The interviews and focus group discussions began a week after phase one of the research. Interviews and focus groups were conducted within the schools themselves, HT interviews were conducted during daily duties, whereas focus groups took place after the daily teaching schedule. Prior to the interviewing process, the researcher gave the participants an overview of how the interviews would be structured before they took place. Furthermore, for ethical reasons, both brief and detailed Plain Language Statements (PLS) containing information about the research and defining the interviewees’ roles were distributed to ease any anxiety, and also to allow interviewees some time to reflect on the topics. Next, all the participants were asked to sign a consent form. For detailed information on the ethical approach described in 5.3, and for copies of the PLS and consent forms, see appendix 2.

Interviews followed a schedule and were conducted according to a set plan. Some prompting was used, when necessary, as the times were limited to 45 minutes for HT interviews and 60 minutes for the preschool practitioners' focus groups. Given the time restraints, the researcher asked interviewees to focus closely on the interview themes. Too much digression by interviewees was discouraged. Interviews and focus group discussions were tape recorded with the approval of the participants and later transcribed. In rare cases interviews were recorded by hand at the request of the interviewee.

The data generated from this part of the research was in the form of: (1) Interview notes; (2) Tape recordings; and, (3) Interview scenarios, as transcripts were made of all recordings.

Method 3: Document Analysis

Purpose and Rationale

Document analysis was used for two main purposes in aiding this research as whole. The first was to scrutinise school manifestos to judge whether a preschool met the 'good-practice of ICT' inclusion criteria that was stipulated for this purposive study. The second purpose was to analyse any written ICT policy/plan documents in the selected preschools that may guide or influence both the schools' practice of, and practitioners' perspectives on, ICT integration into ECE. This provided another angle from which to view the situation and one that informed the finer details of the questionnaire, points to pick up on in the interviews and specific items to try to observe.

Content

During the process of selecting and refining the number of preschool case studies, only publically available documents were sought, such as inspection reports and information on the Internet. For the selected cases, documents were sought which originated both from the preschools and elsewhere (e.g. school website). They were selected if they might be related to ICT strategy, policy, planning, purchase, implementation and evaluation.

Implementation

The latest inspection report had been obtained from the Internet prior to selecting the preschools. The preschool websites, if available, had also been explored. The key items of documentation considered here are: (1) the preschool prospectus; (2) the preschool educational plan; (3) the school ICT policy; (4) the school improvement plan; (5) preschool management structure; (6) recent/ planned schedules of CPD; and, (7) the daily routine schedule. These were requested from HTs and in most cases could be provided. Any further documents that might help build the whole preschool ICT picture, such as details on ICT devices and specialised software providers, or any private ICT companies that work in partnership with the preschool, were requested as appropriate.

Analysing the school prospectuses gave the researcher a sense how the preschools' ideologies may be related to ICT integration. For example, schools seemed to employ ICT as pedagogical tools in order to live up to the reputation put forward in the prospectus. This 'ideal' could regularly be considered against the documents that actually influence pedagogical practice, such as educational or school improvement plans. The researcher was careful also not to assume that the content of the documents would be reflected in actual practice in the preschools. Yin suggests that 'the most important use of documents is to corroborate and augment evidence from other sources' (1994: 81). Hence, reading documentation primarily contributes towards data triangulation and enhances trustworthiness. The data generated from this phase of the research was in the form of paper-based documents.

Method 4: Observations

Purpose and rationale

Observation was used as a supportive and exploratory data collection technique. In its supportive role its main purpose was to further illuminate comments made during interview or survey. On some occasions observation may expose differences between belief and practice, i.e. differences in what people *say* and what they *do*. Observation was used also to explore apparent differences between interview and documentary data, again to aid the researcher's interpretation of a situation. While in its exploratory role, observation often noticed unexpected situations that could be later followed up in interviews.

Design

The informal participation observation took place under natural conditions; the researcher was able to watch, listen to activity, and take notes. Only on occasion would she join in. The research fulfilled a 'participant-as-observer role' by 'shadowing' practitioners through normal/natural events (Denscombe, 2007, p.218). Both planned and opportunistic observation was undertaken.

Observations were noted on an observation worksheet. The collected data was categorised and classified according to the key areas identified on the form. The structure and content of the observation sheet was informed by previous studies in this area (Rosen et al., 2009; Plowman & Stephen, 2007; Siraj-Blatchford & Siraj-Blatchford, 2006; Siraj-Blatchford & Whitebread, 2003; Brooker, 2003, Sheridan & Pramling Samuelsson, 2003; NAEYC, 1996); and in the light of the needs of the research it was developed to cover issues adapted from the theoretical framework (see Chapter 4), as well as the outcomes derived from the informal visits prior to the main study. The observation sheet was carefully designed in terms of both content and style to produce a clear and useful data collection tool. A copy of the observation sheets is given in Appendix 2.

Content

The observation worksheet consisted of two sections: (1) a case study information sheet that was used to layout general information gathered about each site visited (number of children, staff, facilities, learning zones in the playroom, daily routines, ICT resource infrastructure); and, (2) a second sheet that was used specifically for ICT-based activity observations, which was to capture the children's and teachers' interaction and experience of ICT in the playroom (for detailed information see Appendices 2 and 3).

Implementation and recording notes

Observations were carried out in all the six preschools in two distinct ways: the first visit included some general, informal observations as part of a tactic of orientation. For example, a record was made of the physical features of the preschool. This included observations of what playroom and resource facilities, such as computer labs or media suites, were like. Informal observations, such as in the staffroom over lunch hours, allowed the staff to become familiar and feel comfortable with the researcher being in their work environment. One potential problem in such an approach is the difficultly in capturing 'natural' social interactions if those interacting are aware that they are being observed. Such a change of behaviour by participants is known as ‘the observer effect’ (Denscombe, 2007). Therefore, it was felt helpful to conduct this orientation stage before starting the data collection process to allow the staff to become familiar with the researcher and to get the opportunity to find out more fully the nature of the research, why it is conducted, and how long it would last. Throughout the initial informal observations the HTs and staff were busy performing their daily tasks. For example, in some nurseries they were busy meeting parents and guests from the local authority. Such general observations were recorded in short notes.

The second type of observation was specifically carried out in learning environments and was part of the multiple methods employed to examine the uses of ICT and the approaches to integration. In order to organise this before the visit, the HT provided the researcher with the timetables of activities. Several short periods/sessions of daily activities were observed and the researcher undertook the role of the ‘participant-as-observer’. In the second observations - those conducted specifically in the learning environments - practitioners were often happy for the researcher to sit in on their sessions, and it was only on a very few occasions that practitioners seemed uncomfortable. Nevertheless, the majority of practitioners were communicative during their teaching, providing a running description of what activities were happening and why. They would also assist in obtaining any extra requested data and would happily answer any questions.

Observations of activities took place after practitioner interviews. This allowed for triangulation of the data and for some of the issues raised in the interviews to be viewed through a different research tool. Only a small number of observations took place without prior interview, and these were used to identify any fresh potential issues relating to ICT use in the playroom. Data from observation was noted on an observation worksheet and field reports were later written based upon these sheets. On occasions an observation was recorded by video and digital camera.

Summary of data types

A summary of the different types of data collected through the four methods used is given in Table 5.2.

Table 5.2 Summary of the Data Collected

Research Instrument	Data Collected
Questionnaires	Paper-based questionnaires completed by both HTs and staff
Interviews and focus group	Tape recordings
	Transcripts
	Paper-based interviewer memos
Documentary evidence	Preschool webpage based information
	Paper-based documents
	Paper-based memos
Observation	Paper-based completed observation sheets
	Still and video images

5.5. Data analysis process

In data analysis collected data is translated into meaningful information. This can be achieved by using the appropriate procedures to address the research questions. The research questions are concerned with, first, the teachers' actual uses of ICT in ECE, and second, the factors that supported or hindered teachers' ICT integration in teaching and learning. These factors, as outlined in the theoretical framework and the literature review, gave the researcher the basis on which to structure the initial variables and draw up what Miles & Huberman (1994) describe as a 'start list' for coding. This broad priori framework for coding the data, as shown in figure 5.6, was only to be a starting point for subsequent changes or adaptations, ones that would depend on the interpretative needs and nature of the data. Giving further detail was envisaged to become necessary in the later part of the process (see sections 5.3.1 and 5.3.2).

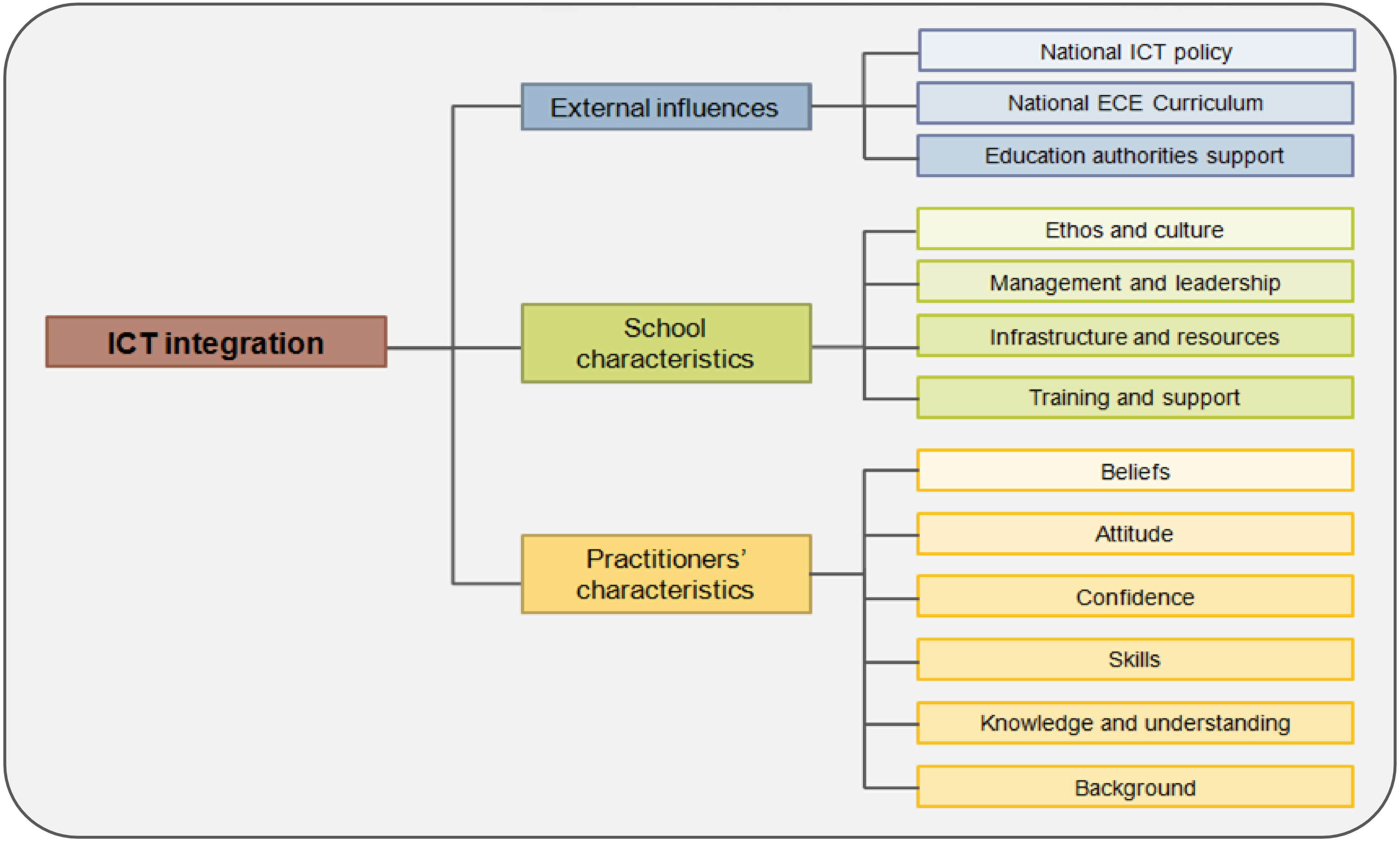


Figure 5.6 Framework for data coding derived from the literature

Data from several cases (with multiple sources in each case) was analysed in terms of how it fitted with the research context: the factors influencing teachers' actual uses of ICT in ECE settings. The six cases were analysed using cross-case analysis to examine themes and find commonalities and differences between cases.

In the analysis of the data and the findings, which follows this chapter, various references to literature are made. The literature served to highlight the similarities and differences that were present in both contexts. Glaser & Strauss (1967) state that literature needs to inform all stages of data analysis and the building of new theory, or in my case, a series of lessons and recommendations. At the coding stage, for example, literature is key for "comparing and contrasting" what is discovered in the data with theories in related literature; it is an important part of 'sense making'. In addition, according to Delamont (2007) the use of the literature is to 'sensitise' the researcher to what is in the data, as part of the process of asking questions about the patterns that emerge. This ensures that the researcher is not making ungrounded assumptions due to their biases.

The following acts as a summary of the data analysis process for the four data collection tools.

5.5.1. Questionnaire analysis

The questionnaire consisted of 32 closed questions and 4 open questions. Many of the questions use a 5-point Likert scale designed to gauge teachers' responses. The statistical package for social science (SPSS 16) was used for analysing closed questions, which started with coding the variables, then deciding procedures to be taken for missing or contradicting values, data cleaning, and data entry. The data from the closed questions was analysed descriptively using percentages and frequencies. On a few occasions mean scores were calculated to compare participants' responses.

All open question responses were typed and organised electronically in a document using Microsoft Office Word 2007. Secondly, responses were carefully examined and those similar were merged together, creating general descriptors for each group. Open questions did not have a high response rate, particularly from the Saudi respondents. Some teachers from the Saudi cases stated that the questionnaire's closed questions were comprehensive enough. Generally speaking, closed questions are preferred by respondents as they only need to tick boxes (Oyaid, 2009).

5.5.2. Interviews analysis

The analysis of qualitative data involved typically an iterative process (Creswell, 2007; Denzin & Lincoln, 2005). The main principles of analysing qualitative data are, firstly, that the analysis is rooted in the research data to 'ground' all analyses and conclusions upon gathered evidence. Secondly, the researcher articulates trends in the data through careful and scrupulous reading and, thirdly, they do not bring any undesirable preconceptions to the data. Fourthly, an iterative process of analysis is followed, one 'that constantly moves back and forth comparing the empirical data with the codes, categories and concepts that are being used' (Denscombe, 2007: 287-88).

The case study method does not specify a particular approach to analysing data (Creswell, 2009). Generally, there are five stages to follow in any analysis of qualitative data. The five stages are; preparing the data, becoming familiar with the data, interpreting the data and developing codes, categories and concepts, verifying the data, and representing the data (Figure 5.7). In this research all recorded interviews and discussions were carefully transcribed. In the case of Saudi preschools, only pertinent incidents or responses were translated instead of translating the whole interview. Translations were verified by two other Arabic native speakers to cross check their consistency. A professional translator was not used because it was felt that participant word choice and their context could only be fully understood by the researcher. This sustained the reliability and validity of the data.

Once translations were done, transcripts were typed and organised electronically in documents using Microsoft Office Word 2007. The analytical process then started by: (a) reading through the interviews transcripts several times to understand initially the experiences expressed; and (b) identifying themes in each text by highlighting 'significant statements' sentences. Also, at the coding stage, computer software was introduced to help organise and sort useful information. This depended on the researcher's preference.

Following Corbin & Strauss (2008) in their segmentation of data, this process led to the creation of an accessible referencing system for the responses and improved manageability of the large dataset.

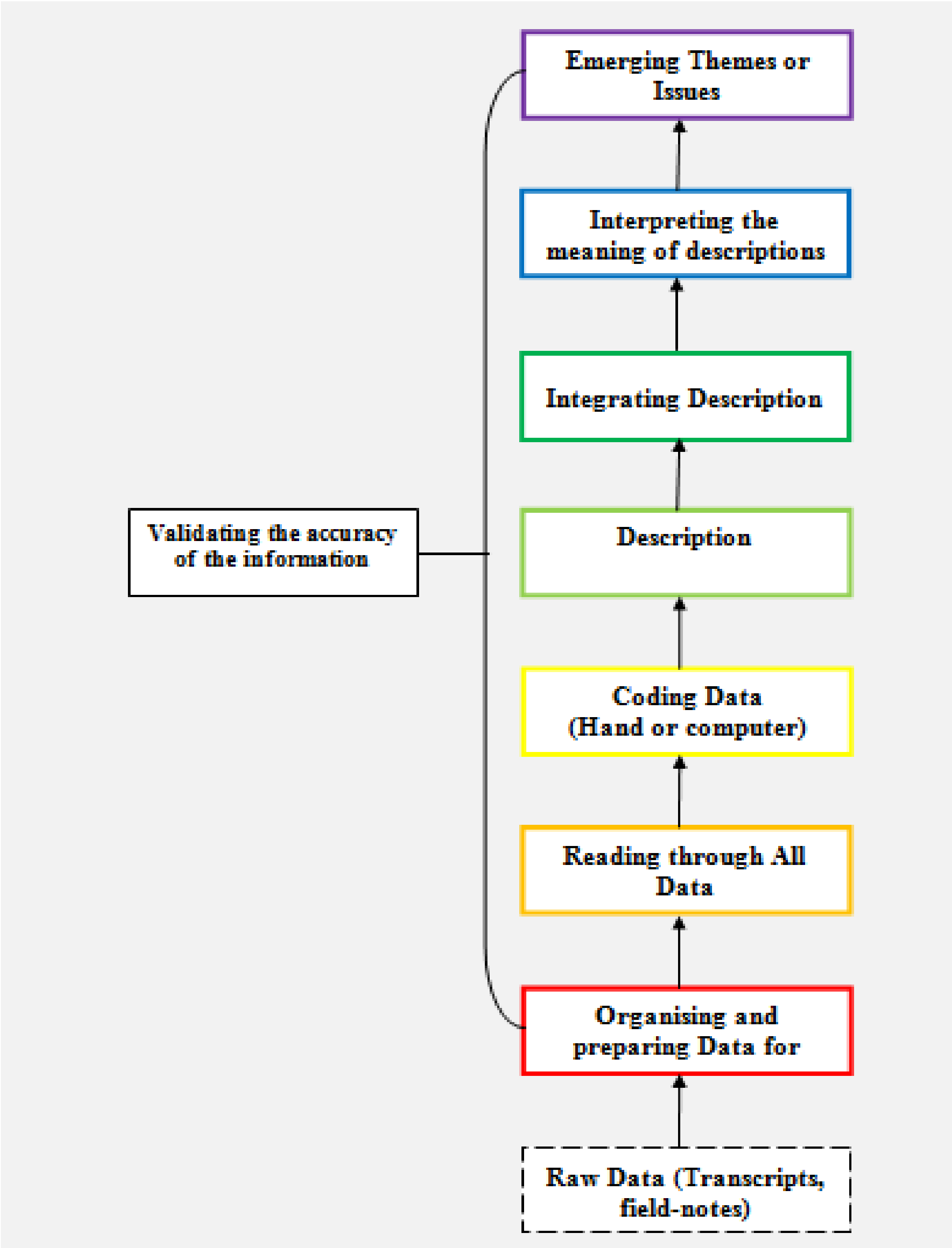


Figure 5.7 General Procedures in Qualitative Data analyses

Additional steps were applied using Microsoft Word to reference the data and to ensure participant anonymity. In this process the natural position of each statement was recorded with a unique reference number for each key point: the preschool, the teacher and the point in the interview were all part of this number. Table 5.3 presents the data references employed. These references are used to refer to the data throughout the remainder of the thesis.

Table 5.3 Research data references

Data	Refer to
A1, A2 …etc	Saudi preschool and the number stands for the case no.
B1, B2	Scottish preschool and the number stands for the case no.
HT	Preschool Head Teacher
T	Teacher
I	Interview
FG	Focus Group
O	Observation
	References Example
HT, A1, I	Head Teacher is from Saudi preschool no.1, from the interview data
T1, A1, FG	Participant no.1 is from Saudi preschool no.1, from focus group data
A1: O	Saudi preschool no.1 observation

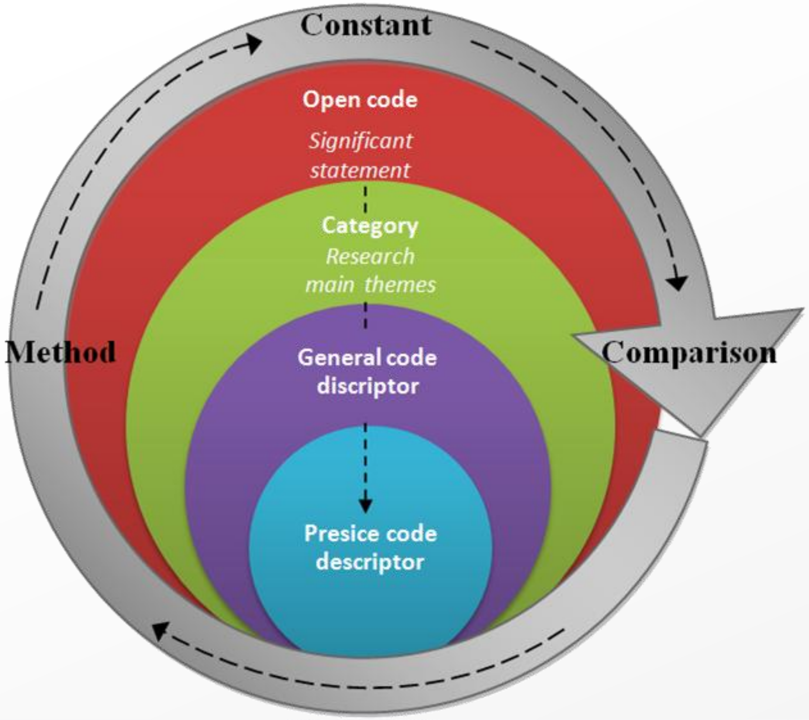
After this careful consideration, a process of coding began to reduce and interpret data. Elements from grounded theory were used here to analyse and frame the data. Based on the grounded theory principles developed by Glaser and Strauss (Glaser & Strauss, 1967; Strauss & Corbin, 1998; Corbin & Strauss; 2008), the constant comparison method was important for this research in order to produce a holistic understanding of the research situation through considering practitioners' own views on ICT integration into ECE. Taking this approach, descriptions of the settings and participants were generated and there was a consistent comparison between emerging categories and themes (Denscombe, 2007; Denzine & Lincoln, 2005). For Glaser and Strauss (1967), the constant comparative method involves four stages:

- Look at incidents within the same category in order to compare them
- Take the properties and combine them
- Ensure that the theory is delimited
- Construct a relevant theory

However, because this research is primarily exploratory, the last two stages were not adhered to. The data analysis concentrated only on incidents that could be similarly categorised for comparison. In the first stage, all transcripts were read and re-read in detail. Incidents in the same category were compared manually by highlighting data to construct a set of 'open codes'. This stage involved writing notes on the transcripts as well as referring to the field memos made earlier. The data was examined as a whole, among practitioners in all the six preschools, to highlight similarities and differences. Any competing views were cross-indexed with the rest of the data to foreground obvious or hidden relationships.

It is noteworthy here that the rationale behind analysing the data manually and through Microsoft Word, rather than using ‘Computer Assisted Qualitative Data Analysis software’ (CAQDAS), was for similar reasons as those, mentioned above, regarding self-translation. Also, analysing data by CAQDAS would not locate and take into account important situational and contextual factors. Creswell (2009:188) highlights that computer software ‘should not be a substitute for close reading of the material to obtain sense of the whole’. Denscombe (2007:305) argues that ‘there is no package that can substitute for the interpretative skills of the researcher, in which the identification of significant themes, patterns and categories still has to be done by the researcher’. The choice of manual analysis was felt strongly preferable because of the rich nature of the qualitative data. Creswell (2007) notes that ‘not all qualitative researchers see such programmes [i.e. CAQDAS] as relevant to their needs’. In this case, manual analysis was most suitable for handling the data.

Taking the approach of constant comparison allowed any new or emerging codes to be continually contextualised in terms of older codes, and for relevant conceptual links between codes to be established. On analysing the data at this early stage, a large number of codes emerged reflecting the main unit of analysis (teachers as dominant species), other units (preschool HTs and ICT coordinators) and actual uses of ICT. In order to move to the next stage of analysis, on the creation of categories the emerged codes were thematically grouped under the two main themes through a process of ‘pattern spotting’ (Miles & Huberman 1994): teachers’ ICT use and factors that support or hinder their ICT integration in teaching and learning. Within each theme a number of codes were consolidated together in two specific stages. The first stage involved placing these groupings emerged under general descriptor that concerned all the codes in a category. In the second stage, similar data entries were identified under a more precise code descriptor and any irrelevant sub-categories were discarded. The principles of grounded theory (Glaser & Strauss, 1967; Strauss & Crobin, 1998; Crobin & Strauss; 2008) were followed to enhance data compatibility. Overall, data analysis of the interviews followed four stages of categorisation and description: (a) Generation of initial codes; (b) Creation of categories; (c) Labelling with general code description; and, (d) Suggesting the more specific code descriptor. The following figure (5.8) presents an example of this process.



Example:

Code
‘The nursery does not have a specific budget to purchase ICT devices, and the financial support from the MOE does not include specific budget for ICT’. (HT, A_1)
Category
Influence of factors at macro level on the process of ICT integration
General Code Descriptor
Support
Precise Code Descriptor
Financial support/ budget for ICT purchases

Figure 5.8 Analysis descriptor and an example of the process

Emergence of factors according to the ecological framework

At the more precise code descriptor stage, the factors emerged from the data were organised according to the different levels of the ecological framework: (a) factors related to the teacher as an individual; (b) factors related to the preschool and (c) factors related to external forces. The term emergence is borrowed from grounded theory to describe a relationship between data and theory. The phrase 'the emergence of factors' is used simply to indicate factors that emerged from data. Hassan (2010) suggests that researchers integrate data and theory if they focus on the micro and macro approaches in qualitative research. Through an iterative process, figure 5.9 is used to manually draw, illustrate these factors and linked them to their respective ecological levels (at which they are conceptualised through the adopted ecological complexity framework).

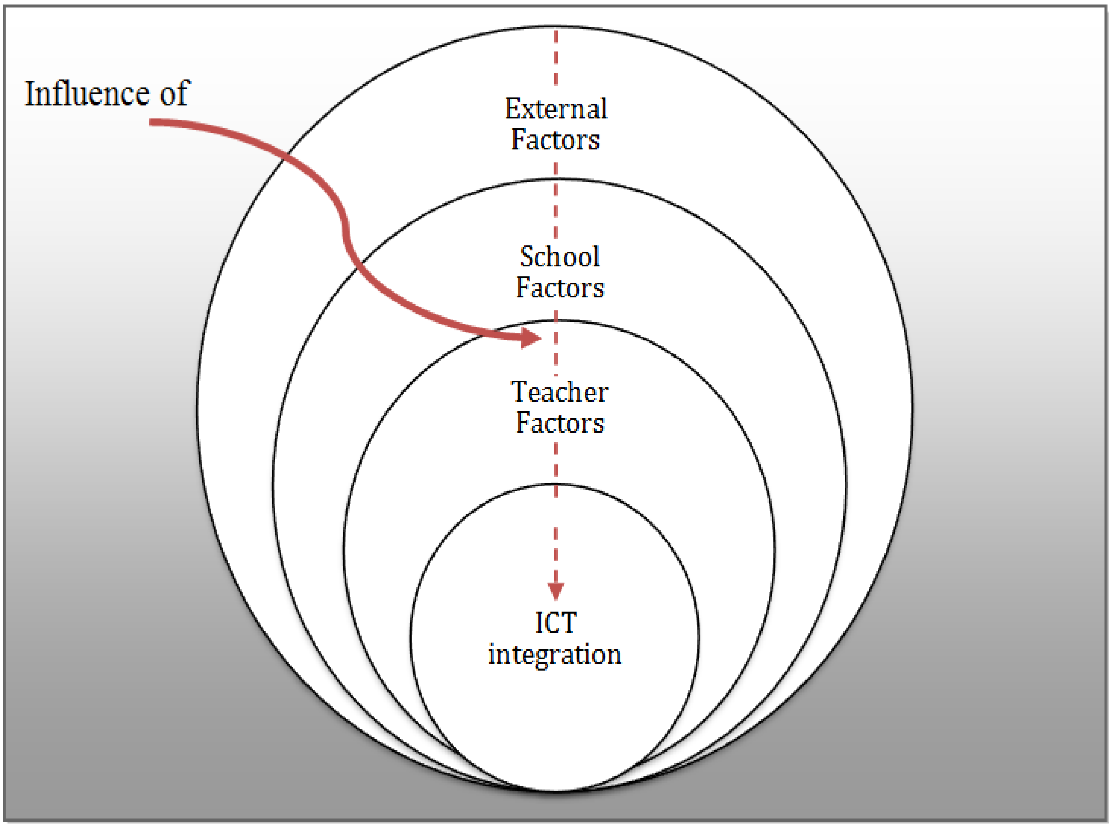


Figure 5.8 External, preschool and teacher factors that influence teachers' ICT integration in teaching and learning

Following this linear model, as a starting point, helped to develop an understanding of the ecological framework, which encompasses also complexity theory and educational change.

It provides a framework in which to place emerged factors for further analysis. This ensures that all themes which are predetermined from the theoretical framework and literature review, in addition to the factors that emerge from the data, are examined thoroughly from the point of view of the overarching theoretical perspective.

5.5.3. Secondary data analysis

For documentary evidence, all documents were read, and notes taken of key points. Those to be returned were copied, allowing for annotations to be made on the document where appropriate, and to ensure access at a later date. Key notes were highlighted and referenced in an EndNote® library used for the research. Given the main purpose of the documentary evidence, as described earlier in this chapter, no formal content analysis (e.g. Silverman, 2006) was undertaken. Sufficient data was drawn from them by reading and highlighting key points (Denscombe, 2007; Silverman, 2006). Initial careful reading and frequent return to the documents served to ensure that important documentary data were not overlooked or misused.

The majority of the documents were available before questionnaires were issued or interviews were undertaken. They were used in both proactive and reactive modes. Pro-activity involved finding points to orientate interviews or observations and get more details. Using the documents reactively assisted in triangulation with other data sources.

In terms of observation data, following each visit, the notes were entered into the observation sheet formatted in Microsoft Word to ensure clarity. These records included the date of the visit, the planned schedule for the day and notes on each activity. The features noted for each activity typically included: (a) duration; (b) a general description; and, (c) particular features related to ICT-based activities. Given the structure of the observation, as described earlier in this chapter, a formal method of analysis was not appropriate.

5.6. Ethical considerations

In conducting any research study that requires the co-operation of other individuals, efforts must be made to ensure participants are treated fairly (Bryman, 2008; Denscombe, 2007). In turn, ethical issues have to be considered. O'Hara et al. suggest that 'you [the researcher] will be expected to treat any participants with respect through the way in which your research is conducted and through the way in which outcomes are communicated' (2011: 108). In this study official permission has been gained for the research. Of course, researchers cannot assume a divine right to enter a nursery, school, collage, or factory (Cohen et al., 2007). As is standard practice, the researcher had to first apply for ethical approval from the 'School of Education Ethics Committee for non-Clinical Research Involving Human Subjects' at the University of Glasgow. This process involved filling out an EAP1 application form detailing the nature of the research, its purpose, and the data collection procedures.

In the Saudi context, the first contact with the MoE was made on the researcher's behalf by the Dean of KAAU who requested permission to conduct the research in both public and private preschool settings. After considering the ethical approach of the study, as is standard practice, the MoE approved all the research tools to be used in the research. In Saudi Arabia, universities are governmental, and so research requests are dealt with respectfully and with minimal issues. Moreover, the researcher's own professional status as a lecturer at a Saudi university was enough to persuade preschools that the research was worthy and should go ahead.

O'Hara et al. (2011) assert that 'before any empirical research involving human participants can begin those participants and/or their guardians need to have made an informed decision about whether they want to be involved or not and if so to grant their permission'. Therefore, after the MoE endorsement and Glasgow University ethical approvals were gained (see Appendix 1 for the ethics committee approval letter) contact with the LAs was made for approval to access the preschools where they were provided with a copy of the university's ethical approval and a detailed PLS. In Scotland, once LAs approval was gained, the researcher contacted HTs directly. In an exceptional case, GCCLA asked the researcher to fill out an additional research pro-forma detailing the nature of the research and its purpose; after this was complete an official letter was received approving the research from the LA. In the Saudi context, the MoE contacted directly the ECE department for the LEA of Jeddah to inform it of the aims and objectives of the study, and asking for its full cooperation in assisting the researcher in her fieldwork activities. In turn, visits to the locations were arranged through official co-ordination with the ECE department in the LEA and letters were sent to a number of preschools requesting their participation.

A second stage involved contacting the preschools and sending the PLS, along with consent forms, by email or post to them. Once the preschools agreed participation, in both contexts, participants were given a PLS to inform them about the purpose of the research participation was on a voluntary basis. They were asked to sign a consent form and were allowed to withdraw at any time without giving a reason (see appendix 1 for practitioners' PLS and consent form).

The ethics panel wished to maintain the confidentiality of participants. The anonymity and privacy of participants has to be respected (Walliman, 2006). All the information was collected on a confidential basis. The confidential nature of the data was maintained through a reversible process of de-identifying the data whereby identifiers are replaced by a code, to which the researcher retains the key in a secure location. It was made clear that participants would be referred to by a pseudonym in any resulting publications. Approval was also given to data storage, access and destruction methods.

In addition to recognising the needs of practitioners, it is also of great importance, from an ethical perspective, to consider issues relating to children (Oliver, 2003; Liamputtong, 2007). O'Hara et al. (2011) stress that if you are planning to observe or talk to children then parents will need to give their permission and the children too must have a means of agreeing to be involved or not. In Scotland it was necessary to obtain informed consent from parents. With this in mind parents were sent a package containing three documents: a letter introducing the research, a PLS, and an informed consent statement that explained the unobtrusive nature of the research (see appendix 1 for parents' PLS and consent form). They were informed that participants could withdraw at any time and for any reason they wished. Cohen et al. (2007) stress the importance of obtaining respondents' informed consent, and their right to withdraw at any stage. All of the children's parents signed and returned the consent form. Furthermore, prior to data collection all the practitioners and children were fully informed about the purpose of the research. This occurred verbally at the start of each observation session in which practitioners or children were involved. Adequate notice, too, was given that the researcher was coming to the playroom at a time that was scheduled. Roberts-Holmes (2005) recommends that even when initial consent has been granted some participants such as children need to be asked at the beginning of each session, if they want to take part.

In Saudi consent is gained directly from the MoE, LEAs, and HTs. Parents in each preschool have already signed an agreement note at the beginning of the year that children may participate in any unobtrusive research projects occurring in the context of their child's preschool. The researcher gained an official approval from the MoE and LEA in order to be allowed appropriate access to playrooms, other facilities, and official documents of the preschools. This consent acted as a gateway into the preschools and signaled also ethical approval for the project. Nevertheless, prior to each observation session all the practitioners and children were verbally informed about the purpose of the visit. Adequate notice, too, was given that the researcher was coming to the playroom at a time that was scheduled.

The next step was to plan an orientation visit to ease the path of entry for research (Creswell, 2007: 89-90).

5.7. Validity and reliability

In this research issues of validity and reliability were considered carefully for both the quantitative and qualitative research methods.

Quantitative method (Questionnaire)

Cohen et al. (2007: 117) state that 'for a research instrument to be reliable, it must demonstrate that if it were to be carried out on a similar group of respondents in a similar context (however defined), then similar results would be found’. The questionnaire’s content and face validity were confirmed as follows:

- As discussed earlier in this chapter the questionnaire was designed after an intensive search and review of the available literature and was proven to have a high level of internal validity.
- A second draft of the research questionnaire was piloted on practitioners. Participants’ remarks were addressed and taken into account when producing the final copy.
- A third and final draft of the questionnaire was handed to four Education academics that had good skills in both spoken and written Arabic and English. In what is known as a face validity check, the researcher asked them to check the Arabic translation, and the words and phrases used. They also provided valuable comments for enhancing the questionnaire’s effectiveness.

Qualitative methods (interviews, observations and documents)

The validity and reliability of qualitative research relates to trustworthiness (Lincoln and Guba 2005; 1985). Rolfe suggests that ‘Trustworthiness has been further divided into credibility, which corresponds roughly with the positivist concept of internal validity; dependability, which relates more to reliability; transferability, which is a form of external validity; and confirmability, which is largely an issue of presentation’ (2006: 305). However, a distinction has to be made between quantitative forms of maintaining reliability and validity and qualitative forms (Golafshani, 2003; Morrow, 2005). As Golafshani (2003: 601) puts it, ‘To ensure reliability in qualitative research, examination of trustworthiness is crucial’. Given this research is constructivist or interpretivist, i.e. mostly qualitative in nature, the areas that would enhance and maintain trustworthiness are found in the adequacy of interpretation and its relation to the quality and reliability of the study outcomes.

Credibility

In order to enhance trustworthiness various strategies were employed to ensure the credibility of generated data, and also to avoid bias. To encourage construct validity, multiple sources of evidence are drawn from and this follows a standard method to enhance trustworthiness (Yin, 1994: 34). According to Guba & Lincoln (2005), triangulation is essential in a qualitative study for data credibility. Triangulation is not a preordained method in itself as it ‘may include multiple methods of data collection and data analysis, but does not suggest a fixed method for all research. The methods chosen in triangulation to test the validity and reliability of a study depend on the criterion of the research’ (*ibid*.: 604). Here, the data from the formal observations interrogates the questionnaire and interview data. This is just one example, but in this triangulation method all the data collected works to test the findings of the other research tools. It encourages a constant comparative method and a critical analysis of the data that enhances validity (Silverman, 2006).

Another aspect of qualitative research is bias. Bias is also recognised in this research to ensure a reflexive process. Gibbs (2007) suggests several procedures to enhance reliability, such as checking transcripts to ensure no drift in the codes. Care also has to be taken in coding and cleaning the data for the questionnaire. With regard to the qualitative data, the interviews were transcribed extremely carefully and any phrases that the researcher was not familiar with were double-checked by other researchers – this was particularly useful for transcribing the interviews from the Glasgow and East Dunbartonshire preschools where teachers would employ a vernacular not always clear to a speaker of English as a second language.

Additionally, to determine further the accuracy of the qualitative findings, member checking technique was carried out (Creswell, 2009: 191). According to Creswell, member checking ensures that participants confirm the accuracy of the data (descriptions or themes): transcripts are sent to the participants for them to comment and amend. Member checks are essential to establishing credibility (Lincoln & Guba, 1985). In this research practitioners did not challenge or expand upon interpretations: they agreed with the researcher’s understanding.

Other techniques, such as prolonged engagement and persistent observations, were applied also. The researcher spent between twelve to eighteen weeks carrying out the field work in both contexts. This time was sufficient to communicate with a number of participants, develop relationships and build trust with the practitioners in the preschool. Furthermore, the observations enhanced credibility by considering closely the contextual factors.

Confirmability

Confirmability, according to Lincoln & Guba (1985), is another aspect to the qualitative data analysis process. In this research a cross-checking procedure, peer debriefing, was carried out to ensure confirmability and the credibility of data analysis. Following this method, the researcher locates a peer to review and ask questions about their qualitative study (Creswell 2009: 192). Peer debriefing took place with academic staff members at both King Abdul-Aziz University and Glasgow University. This engagement encouraged the researcher to analyse, discuss and defend findings. It provided also a way of discussing alternative interpretations and analysis when agreement was not met over validation or interpretations.

The reliability of a study affects the researcher's relationship to the wider research community. According to Yin (1994: 36) the goal of reliability is to 'minimize the errors and biases in a study' and this lack of bias can be made clear to other researchers through documenting a study protocol clearly showing the steps the researcher has taken in the project. The research methods of data collection and analysis must be clearly laid out, adhere to standards of academic rigor, and be repeatable and logical steps. This has been achieved in the current research by basing all procedures upon a sound understanding of the literature in both the field of case study research and ICT integration into education.

Transferability

Finally, an important aspect to consider when analysing data is the danger of generalisation. There are three questions that readers will commonly pose about generalisation. According to Denscombe these are, 'How *representative* is the case?', 'Isn't it possible that the findings, though interesting, are *unique* to the particular circumstances of the case?', and 'How can you *generalize* on the basis of the research into one instance?' (2007: 42-43). Although the happenings of a case are unique, the phenomena being studied are representative of a broader class of events and the case is representative of a certain type. For example, in this research the pre-schools being used are representative of the two contexts and the two main forms of preschool provision (public and private). The preschools also follow their national curriculum and have shared national pedagogical aims. However, the findings are based upon certain opinions and practices of practitioners at a certain point of time and these could not be replicated exactly again.

These findings come from a dense case study and this is valuable in itself. Even without generalisation a case study's data can be of significant use to practitioners in the field (Flyvberg, 2006). In terms of transferability, the criterion is satisfied, according to Lincoln and Guba (1985), by providing a 'thick description'. In the case of this research, the multiple case studies, along with triangulation of data, helped in providing a 'thick description' of the phenomenon being investigated, and maintain the possibility of generalisation (Cohen et al., 2007). Such thick descriptions help also to enhance transferability where the reader is able to decide for themselves how the specific attributes of the cases relate to the wider research community and which findings can be transferred to other contexts.

Outcomes from the public sector nurseries may benefit other nurseries in this sector, as well as the outcomes from private sector nurseries being useful to the wider private context. One has to proceed with care when generalising in this manner but the cases can be said to be representative of preschools that share their selection criteria (Denscombe, 2007: 43). Even if preschools do not share these selection criteria, the in-depth nature of the case studies and their details may still be of interest in terms of pedagogical practice when integrating ICT into ECE.

5.8. The Researcher's role

Particularly in qualitative research, the role of the researcher as the primary data collection instrument necessitates the identification of personal values, assumptions and biases at the outset of the study. It is possible that the investigator's contribution to the research setting may actually be useful and positive rather than detrimental (Creswell, 2009). The current researcher's interest in the presence of ICT in early childhood education has been shaped by personal experiences in the field of ECE, starting from as a student in the Childhood Studies Department at King Abdul-Aziz University in Saudi Arabia. The researcher's status as an ‘ECE practitioner’ and as a researcher in the MoHE, with an interest in the area of ICT integration, offers a unique perspective and understanding of the challenges and issues influencing teachers’ ICT.

During the data collection process, the researcher was perceived by practitioners to be 'neutral' in terms of power and status during the fieldwork. As such, it was easier for the researcher to negotiate and build trust with the teachers involved. In the first visit, the researcher met with the HT to discuss the research. Informal conversations were also initiated with deputy HTs, teachers and other practitioners in the preschool during this orientation stage. There were dualities and tensions between the researcher’s insider and outsider roles but these were negotiated to maintain reliability.

5.9. Summary

In summary, the case study approach works well in this research context because it is more capable than other qualitative strategies of generating sufficient details to unravel the complexities of the situation. It also approaches the research problem from a holistic perspective rather than dealing with isolated factors, with the advantage of flexibility to employ different methods depending on the specific needs of a situation. These tools help generate a comprehensive vision to explore how ICT is integrated into Saudi and Scottish ECE settings.

Chapter 6

Findings from Case Studies

Chapter outline

Chapter Six

Findings from Case Studies

6.0. Introduction

This chapter will describe the findings from the case studies so as to address the first research objective and its related questions. The first contextual section (6.1) describes the preschool and the playroom context. The second section (6.2) describes and synthesises the findings of the six cases, contextualised into the first main theme (the actual uses of ICT in case study preschools) which addresses research objective one (RO1) and its two sub-questions (RQ1 and RQ2):

RO1. To explore how ICT is integrated into ECE settings in both Saudi and Scotland.

RQ1. What ICT resources are available in preschool settings?

RQ2. What use is made of available ICT resources by practitioners?

In answering these questions the findings of the data analysis are organised under three sub-themes that address the actual use of ICT in the cases:

1. ICT resources available in the preschool settings
2. Uses of available ICT resources
   - Use of ICT as an information medium
   - Using ICT as a construction medium
3. Integrating ICT into the ECE environment
   - Who is conducting the ICT activity?
   - The location of ICT within the learning environment
   - Types of activity
   - Playroom scenarios

Before discussing the actual practices with regards to the research questions in this way, the opening of the chapter provides more detailed features of the cases. Such details are considered as they impact upon practitioners' use of ICT in the playroom.

6.1. Preschools' Profile: Detailed features

The preschools have certain mutual features but they also have distinguishing attributes. The in-take for each case study and the important characteristics that may influence ICT integration are presented next.

6.1.1.Case study A_1: Saudi public preschool

Case study A_1 is a public nursery school, which is attached to a primary school, located in a residential area in the central region of Jeddah City. The nursery accepts only Saudi Arabian children and the majority of pupils come from a middle class background. Recently, A_1 was chosen by the Jeddah LEA to take part in a programme for Evaluating the Quality of Preschool Education services, using the ECERS-SA scale (see Chapter 2, p.37). The nursery school was chosen as an example of the high quality provision of ECE services.

6.1.2.Case study A_2: Saudi private preschool

Case study A_2 is a private nursery located in a residential area in the northern region of Jeddah. Notably, since 2004, case A_2 has been investing heavily in ICT and promoting E-learning and ICT integration. In their school prospectus, A_2's vision statement is to,

> 'Use advanced technological approaches for learning and training throughout the curriculum [...]. In fact the school has a vision for e-learning which is helping to create a bright future for its pupils using unique approaches, through holistic teaching, and ensuring a top level of quality'
>
> (Preschool A_2: Prospectus)

Coherent with their outlook, A_2 has comprehensively updated their facilities within the last five years, including Media suites and computer laboratories. Wireless facilities and access to the Internet in both administrative areas and playrooms were available. A_2 could boast of additional intranet access and a website, where all staff were allocated an email address and a centralised address book was available.

The preschool also has formalised access to ICT-related staff, such as an ICT Coordinator, IT Specialist and IT Technician, provided through a relationship with its sister primary and secondary school. The nursery is known as one which provides the most in-service ICT training for its teachers. ICT co-ordinators offer extensive, certified training to teachers in related software and hardware, in cooperation with international companies. The nursery, too, works in partnership with specialised companies such as *SMART*, *Promethean* and *Techno-Kids* who provided hardware and educational programs such as *Active Primary* and *Active Inspire*. These companies trained and certified the ICT skills of the teachers in affiliated preschools.

6.1.3. Case study A_3: Saudi public preschool

Case study A_3 is a stand-alone public preschool located in the northern region of Jeddah City. A_3 is a recognised preschool in Jeddah where practical experiences are exchanged between practitioners from both public and private preschools. The nursery HT acts as an ECE trainer, not just in her own preschool, but in the local community. It is known as a historically progressive educational role model that provides support to practitioners and promotes best practice. A_3 is described as a nursery which is 'a regional and local training centre' for public and private preschools in Jeddah city. Since 2001 the ICT resources have been significantly improved and extended in case A_3. It has specialist rooms with in-built facilities, such as an audio-visual suite and computer lab. According to HT-A_3, the involvement of the community and support from parents had helped develop this school into an ICT leader.

Additionally, case A_3 had an ICT specialist: a part-time computing teacher who provided informal, optional in-house training to assist practitioners to meet their professional development needs. Generally speaking, none of the other Saudi public-sector nurseries had in-house ICT-related staffing. The presence of such a teacher in case A_3 reflects that ICT is seen as a priority there.

6.1.4. Case study A_4: Saudi private preschool

Case study A_4 is a private preschool, attached to an extended school, which is situated in the southern region of Jeddah City. The nursery has two educational sections: an English section and an Arabic section. The international section is endorsed by the Commission on International and Trans-regional Accreditation (CITA), meaning that international curricula can be taught in English; meanwhile, the Arabic section teaches the Saudi Arabian national curriculum.

The HT, who is also the preschool owner, has stated candidly that ICT is a priority area (HT-A_4: I). The school prospectus states:

> 'Our mission is to create a rewarding and stimulating environment for our students […]. We educate our generations to meet market needs and become able to face modern challenges'
>
> (School A_4: Prospectus)

Given this impetus, the facilities of A_4 were modern; it is well-known for its infrastructure and efforts to integrate ICT into the curriculum. There is an on-going digital library which contains all of the materials prepared by teachers: an accessible database of resources for teachers. It also included a number of DVDs documenting school events such as parties and graduations.

In this preschool ICT teaching was balanced between treating ICT as a discrete tool in the Media Suites and integrating it across the curriculum activities. Additionally, the IT services department in the preschool provided design materials, as well as support to teachers, for example, when they were searching for images to illustrate a particular theme.

6.1.5. Case study B_1: Scottish public preschool

Case study B_1 is a public nursery school, which is attached to a sister primary school, situated in the urban setting of the City of Glasgow in west-central Scotland. B_1's prospectus notes that it 'is at the forefront of local authority good practice as a centre of ICT excellence' (School B_1: Prospectus). B_1 can be regarded as a leader in the early-educational field with regard to integrating technology. The HT is an ICT trainer, not only in her own school, but in the local authority area as a whole. She was also part of the team that created the ICT national strategy in Scotland – 'Early Learning, Forward Thinking' – to promote the use of ICT in ECE settings.

Training was provided on-site by the HT as well as by an ICT co-ordinator who was one of the members of the teaching team. The ICT tools were extremely up-to-date and modern; there were, for example, both plasma screens and touch screens available to the children. There was also a plenitude of resources. The HT stated:

> 'we are quite well resourced for an establishment. We have lots of computers that staff can access. We have our own cameras, plus we have video cameras. The amount of ICT we have here is quite vast… We have everything we could need at the moment. Anything new that comes out… I think we are ahead of other nurseries and establishments in getting that.' (HT, B_1)

It is this investment, as well as the HT's renowned enthusiasm for ICT use to innovate pedagogical methods, which reinforces B_1's excellent reputation.

6.1.6. Case study B_2: Scottish private preschool

Case study B_2 is a stand-alone, private preschool in a middle-class suburban area of East Dunbartonshire in west-central Scotland. B_2's integrated inspection report notes:

> 'Children made good use of [...] ICT throughout the nursery. They controlled the direction of programmable toys and independently recorded the work of the nursery with a digital camera'
>
> (B_2: HMIE Inspection Report, 2009)

Interestingly, the HT placed a strong emphasis on connectedness between the preschool and others around it, which influences the practices of ICT integration inside the nursery itself, and provides a communicative network between preschools concerning technology. Furthermore, the HT encouraged teachers to take their pupils to public areas where ICT could be seen to be integrated, for example the local library or even to use the automated ticket machines at the train station.

6.2. Case study preschools' organisational structure

The common organisational structure observed in the preschools included an HT, a Deputy HT (DHT), at least one full/part-time administrative assistant, and teaching and support services staff.

Nevertheless, slight differences in structure were apparent. For instance, those preschools attached to primary or extended schools, as in cases A_2 and A_4, tended to have only supervisors with authority to direct the internal process within their nurseries, and report work progress to the whole school HT on a semi-annual basis. Moreover, nursery supervisors and teaching staff were supported by more than one clerical assistant and had access to all of the administrative departments and IT support services available in the adjoining primary school.

In case B_1, the DHT role is replaced by a Team Leader position: one experienced member of the teaching team. While in case B_2, the HT title is replaced by a nursery manager who reports directly to the owner and no administrative assistant is available. Table 6.1 shows the demographic variables of the preschools' staff.

Table 6.1 Preschools' Staff Demographic Features

Preschool	Administrative team			Teaching Staff		In-house ICT staff		In-house
	HT	DHT	Admin	Key T	Assistant T	ICT Coordinator	ICT specialist	Training
A1	✓	✓	✓	6	6	×	×	×
A2	Supervisor	×	✓	10	7	✓	✓	✓
A3	✓	✓	✓	10	10	×	*✓	✓
A4	Supervisor	×	✓	3	4	✓	✓	✓
B1	✓	Team leader	*✓	7	11	✓	×	✓
B2	Manager	×	×	6	7	×	×	×

*Part-time only

In terms of the teaching staff, the vast majority were full-time practitioners and allocated key roles because of their extended experience in the preschool teaching field (of the 95 practitioners, 46 had more than ten years experience). Teachers were categorised as a Key Teacher, Assistant Teacher or Term-time Teacher; this classification is according to teachers' academic qualifications and years of experience.

As shown in table 6.1, ICT-related staffing existed in most of the cases, taking several forms: (a) ICT-related staff, such as an ICT Coordinator, IT Specialist or IT Technician, available through their adjacent primary/secondary school, e.g. in case A_2 and A_4; (b) A part-time computing teacher/ICT specialist who is available as part of the teaching team as well as providing informal, optional in-house training, e.g. case A_3; and, (c) A full-time member of the teaching team designated with an ICT coordinator role responsible for technical support, in-house training, and driving integration, e.g. in case B_1. This teacher was responsible for technical support, in-house training and the main drive for ICT integration within nursery came from her.

6.3. The learning environment within the preschools

From a number of observations, this section provides descriptive information about the learning environment characteristics, the common floor plan of the playroom and the philosophy behind such designs. Only the description and layout for case A_1's playroom is discussed in detail, exemplifying the rest of the other cases, in both Saudi Arabia and Scotland. The layout for all preschools was similar. Any slight variations in layout will be discussed in section 6.5.

6.3.1. The Organisation and hierarchy of the playrooms

Two main approaches were taken to organising pupils in the playroom. One approach was to organise the playroom activity spaces in terms of different age levels. In these cases there was more than one playroom to facilitate such separation. This occurred in all of the Saudi cases, A_1, A_2, A_3 and A_4, where there was a tendency to segregate the playroom into KG1 (3-4 years), KG2 (4-5 years), and KG3 (5-6 years). In either Scottish case, B_1 and B_2, there was one playroom for 3-5 year olds.

There were two key teachers in the playroom in cases A_1 and A_4 and one key teacher and an assistant teacher in cases A_2 and A_3. In Scotland, one key teacher was allocated to a group of 15-20 children and a group of support teachers helped fill out the large teaching space. In spite of these differences in teacher organisation and number of playrooms, the physical layout of the playrooms was quite similar in all six cases.

6.3.2. Description of the preschool playroom layout (A_1: PO-1)

The impression on entering playroom A_1 is of a homely and pleasant atmosphere. Severable factors have been considered in organising the learning environment, such as the available space, furniture size, colours, and temperature. On inspection these aspects seem well-ordered and carefully prepared by teachers, who have clearly considered how each tool in the playroom may be used by the children. All items are child-sized, durable, tactile and safe for vigorous use. The furniture is arranged to establish some semi-private corners without sacrificing the visibility necessary to supervision.

The learning environment is laid out into multiple learning centres/activity zones which encourage a variety of activities designed in different interest areas. A floor plan of this is shown in figure 6.1. Teachers in Case A_1 (T2-A_1:FG) stated that learning centres such as the reading centre, the construction (blocks) centre, the art centre, the cognitive skills centre and the ICT centre, remain in the same positions throughout the academic year, so that the child feels at home and at ease in the environment. The teacher has the flexibility to add or remove materials from these learning centres given the children’s progress.

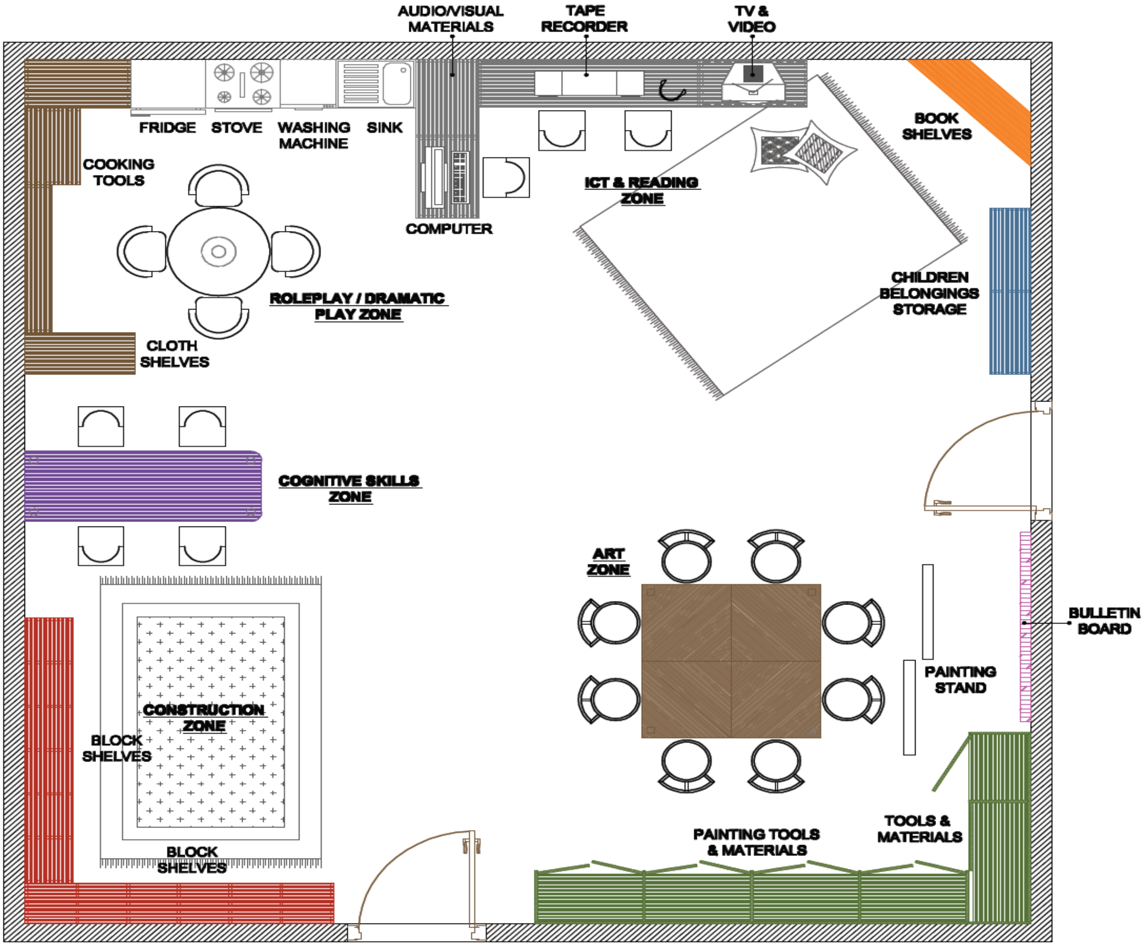


Figure 6.1 Case Study A_1playroom structure

Some learning centres are more adaptable to the selected topic area: the discovery centre, the dramatic/role-play centre and the sand and water centre, for example. Some learning centres were naturally noisy where children were working enthusiastically in groups. Other learning centres were quiet and were designed and positioned for solo activity.

The learning environment in A_1 had been carefully prepared to permit the child to learn, experiment, and discover in ways befitting his/her abilities. The environment promoted a sense of safety, a family atmosphere, which facilitates children practising a variety of skills with tools, toys, and devices; in this way the children learn to deal with everyday life outside the nursery. From observation, akin to the constructivist approach of Piaget, Bruner & Vygotsky's principles of learning, learner choice was evident, exemplified by teachers leaving it up to the child to decide which learning centre to start their activities in, as well as which sensory tool to engage with, before moving on to the next centre when they are finished.

These are the characteristics described that formed the type of playroom design that occurred in most of the preschool settings observed in both contexts. Such organisation does not occur naturally; the national curricula of both countries call for a structure of this type (Samadi & Marwa, 1991; MoE, 2005b; Scottish Consultative Council on the Curriculum, 1999). There is an international understanding of how the spaces in which preschool children learn should be structured (NAEYC, 2009; O'Hara; Bertram & Pascal, 2002; Siraj-Blatchford, 1999).

6.3.3. Daily routine and programme

Saudi nurseries follow a daily routine set by the MoE and laid out in the national DCfECE (Samadi & Marwa, 1991; MoE, 2005b) but this may be altered to meet the specific learning needs of the child. Figure 6.2 shows the different periods of the preschool day. A balance is struck between different types of activities: structured and un-structured, group and individual, entertaining and cognitive, as well as indoor and outdoor.

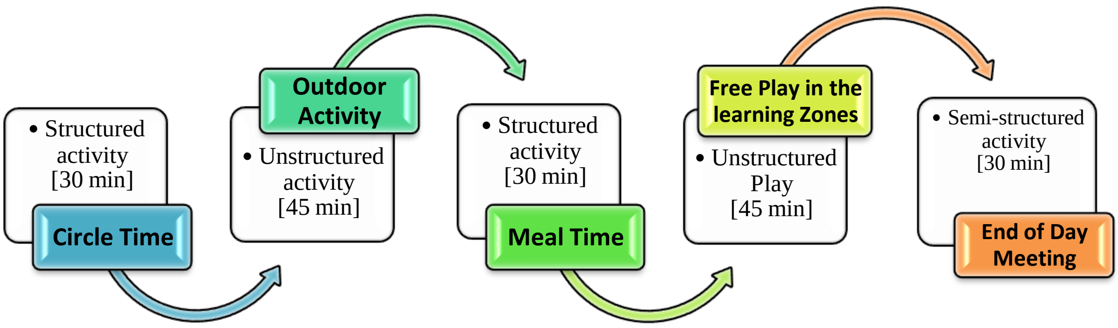


Figure 6.2 The consistency in the daily programme periods

Under observation, the Scottish context follows a similar structure, but with some alterations to the sequence of the sessions. For example, case B_2 operated in a traditional pattern similar to the Saudi nurseries as expressed by the HT:

> 'There is a daily routine as the children are in by 9 o'clock. From there they have a wee [short] story, daily registration time, [...] followed by some free play, then they have snack bar. Again, there is still structured activity going on in the room. Then they go out to the garden for half an hour and then come in and it's lunchtime. Then, again, it's free play, followed by the snack bar and then outside to the garden. (HT, B_2)

In Scotland, the shift to the recent CfE has called for a move away from any rigid time-bound approach to one that focuses on organising experiences which promote active learning, and as a consequence reflect child learning preferences (Scottish Executive, 2007). At the time of the study, this was a process in transition and a structure was still observable. The CfE forefronts child-centred learning in a documented form; even in Saudi, however, where the daily routine periods are firmly stated in the ECE national curriculum, it was still observable that teachers had the freedom to alter activities based upon the child's learning desires. Therefore, in spite of the variations in policy in this regard, both contexts shared a similar non-rigid routine for learning.

Daily routines and layout did not vary greatly between the preschools observed in Saudi and the Scottish context follows a similar structure (with some alterations as discussed earlier). As an observed example from Saudi, in case A_1, the daily routine began with a structured activity (circle time) at 8am. Teachers stimulate the children's interest by asking them to guess the class topic by considering a YouTube video: using a laptop and an LCD projector. The teacher ended the activity by setting a worksheet exercise related to the main topic. Circle time lasted thirty minutes. Afterwards there was an unstructured outdoor activity from 8.30-9.30am, followed by a structured meal time from 9.30-10am. Free play in the learning centres was then encouraged from 10-11am. Between 11 and 11.30am there was an end-of-day meeting involving story time and 11.30-12pm was for relaxation. This routine did not vary greatly in the Saudi cases.

In both contexts, there is a desire to meet the preschooler's need to find equilibrium between activity and relaxation. As mentioned above, one of the main principles of early learning in both contexts is that it relies upon self-learning. Such principles are based upon the constructivist and socio-constructivist schools of thought, as well as linking to the Developmentally Appropriate Practices for using ICT in ECE. In turn, appropriate practice does not alter between cultures. Children are emboldened to experience and discover the learning environment independently. The 'choice concept' of responsibility is also fundamental; the learning curriculum places strong emphasis on supporting children to make decisions themselves and to take responsibility for these choices.

In summary, the characteristics of the preschool environment itself and particularly the learning environment at the micro-level are introduced. The next part will build upon these descriptions of the preschool and playroom ecosystems to discuss the findings of the data analysis. Findings from the data analysis are categorised into two main themes: (a) the 'actual use of ICT in the case studies'; and, (b) the 'factors affecting ICT use in the case studies'. Here the focus will be on theme (a) and Chapter 7 will go on to consider theme (b) more fully.

6.4. Actual use of ICT in case study preschools

This second part of this chapter describes information and data collected from teachers' questionnaires, observational field notes, documents, and interview transcripts that will address the first of the research objectives for this study: 'To explore how ICT is integrated in the context of ECE'. There are two sub-questions to help explore this issue: 'What ICT resources are available in preschools settings?' and 'What use is made of available ICT resources by practitioners?'. In answering these questions the findings of the data analysis are organised under three sub-themes that address the actual use of ICT in the cases (see figure 6.3).

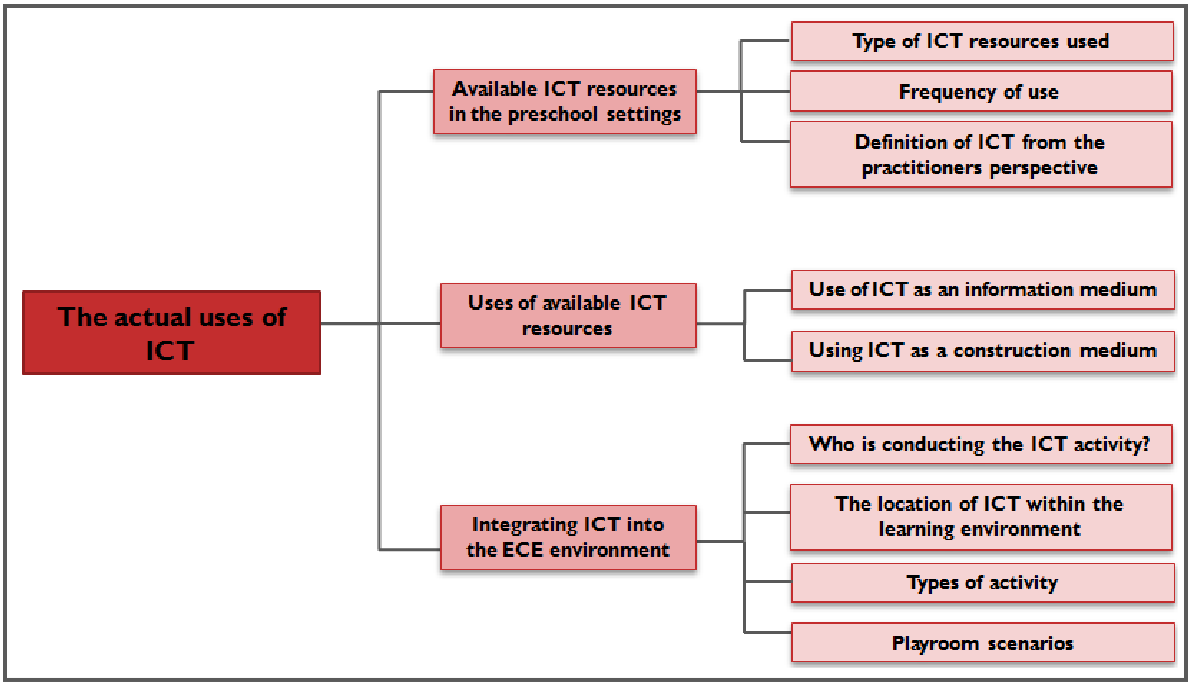


Figure 6.3 Key themes and sub-themes emerged in relation to RQ1: Actual uses of ICT in preschool cases

6.4.1. ICT resources available in the preschool settings

An array of ICT tools were observed under the remits of the six cases. Similarly, both HTs and practitioners reported a range of ICT resources available in their preschools. Table 6.2 shows teachers' responses in the questionnaire regarding which resources in the preschool environment teachers use. The results cover the range of ICT resources used by teachers for education (e.g. playroom practices) and support (e.g. professional, personal and administrative) purposes in the context of ECE.

Table 6.2 ICT resources used generally by teachers, number and percentage (n=95)

Resource	Number	Percentage
Computer and Computer based resources	**93**	**97.9**
Digital Camera	**80**	**84.2**
Video Camera	**65**	**68.4**
TV & Videos	**85**	**89.5**
Telephone, mobile, fax	**81**	**85.3**
LCD projector	**62**	**65.3**
Overhead projector	**58**	**61.1**
Electronic Whiteboard	**33**	**34.7**
Video Conferencing	**13**	**13.7**
Programmable toys	**44**	**46.3**
Software	**79**	**83.2**

Almost all of the practitioners (98%) said that they make use of a computer and some computer-based resources such as the Internet. As may be expected, the use of television and video (90%) and telephones (85%), including mobiles, was also very high. Reflecting the practice of recording learning, digital camera use (84%) was cited by the vast majority. Given the centrality of the PC to offices and playrooms in the preschools, some form of computer software use (e.g. generic word processing and specific educational software packages) was also significantly high (83%).

Resources such as the Electronic or Interactive Whiteboard (IWB; 34.7%) and video conferencing (13.7%) were rarely used by practitioners. The rare use of video conferencing is understandable given the preschool context.

In the questionnaire, practitioners were asked to indicate the contexts in which they used ICT resources, specifically: playroom practices, professional development, personal use or administrative work. In terms of frequency of responses to each area, the responses of teachers from both Saudi and Scottish cases were identically ordered (see figure 6.4) and ICT use occurs most often in the playroom, less often for both personal use and professional development, and least often for administrative work.

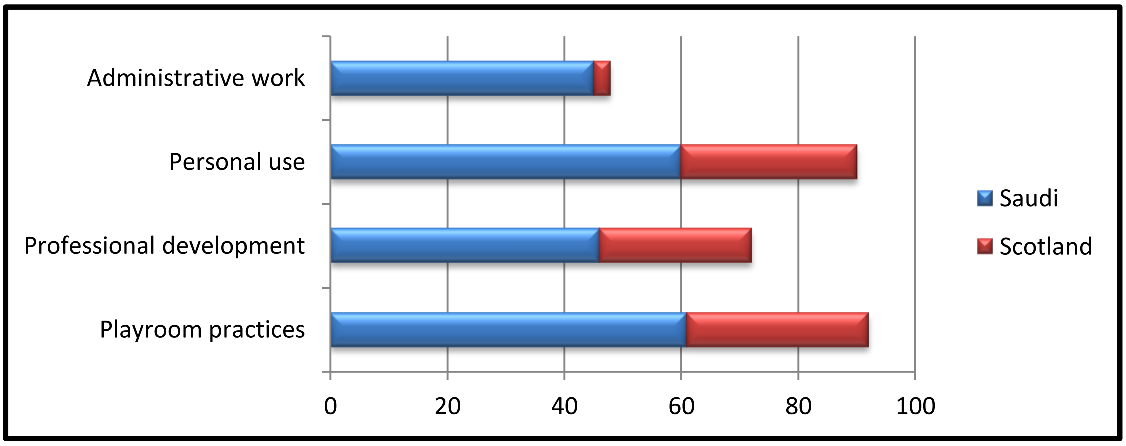


Figure 6.4 Purposes at ICT use was reported among practitioners of Saudi Arabia and Scotland

Practitioners from both contexts were asked to indicate their frequency of use for each of 18 chosen ICT resources in the context of playroom practice. The responses were rated on a scale: (daily=4), (weekly=3), (monthly=2), (termly=1) and (never=0); non-responses were also rated as ('never'). The average score (mode) for each tool was calculated and expressed in the same manner as the question's options: daily, weekly, monthly, termly or never used. The mode was the chosen average as it measures the most occurring data of a data set. It is the most suitable average, in turn, with which to express the resources used most frequently by practitioners. Table 6.3 presents practitioners different frequencies of use for the 18 types of ICT resources (as percentages). The average median score for each of the resources is presented in the final column.

In the Saudi context, the most popular ICT resources used by most teachers were computer (96%), data projector (86%) and slide shows (82%). Also, at least three-quarter of the teachers had at on time or the other made use of a tape recorder (77%), TV & Videos (75%) and digital cameras (75%). The frequency of use among these popular resources differs depending on need for effective teaching and communication, teachers' ICT knowledge and versatility. The most frequently called upon ICT tools were the computer and some computer-based resources such as the Internet, online information sources, word processing and slide-show programs. About 89% of the teachers used computer either daily or at least once a week. The LCD projector and tape recorder were on average also used at least once a week.

Table 6.3 ICT resources used frequently for playroom practices, number and percentage, Saudi (n=64)

	Responses from Saudi Arabian cases n (%)					
ICT Resources	**Daily**	**Weekly**	**Monthly**	**Termly**	**Never**	**Mode***
Computers	20 (31)	37 (58)	6 (9)	0 (0)	1 (2)	3=W
Internet	24 (38)	14 (22)	1 (2)	0 (0)	25 (39)	0=N
E-mail	10 (16)	8 (12)	3 (3)	0 (0)	44 (69)	0=N
Digital cameras	10 (16)	21 (33)	12 (19)	5 (8)	16 (25)	0=N
Video cameras	4 (6)	13 (20)	14 (22)	9 (14)	24 (38)	0=N
TV's & Videos	16 (25)	14 (22)	16 (25)	2 (3)	16 (25)	4=D/2=M
Tape recorder	19 (30)	22 (34)	6 (9)	2 (3)	15 (23)	3=W
Telephone, mobile, fax	18 (28)	7 (11)	1 (2)	0 (0)	38 (59)	0=N
Data projector	24 (38)	17 (27)	9 (14)	5 (8)	9 (14)	3=W
IWB	9 (14)	2 (3)	0 (0)	1 (2)	52 (81)	0=N
Video conferencing	1 (2)	2 (3)	1 (2)	2 (3)	58 (90)	0=N
Educational software	11 (17)	8 (12)	12 (19)	9 (14)	24 (38)	0=N
CD-ROM	8 (12)	20 (31)	14 (22)	2 (3)	20 (31)	3=W
Online information	19 (30)	14 (22)	3 (5)	2 (3)	26 (41)	0=N
Programmable toys	6 (9)	2 (3)	3 (5)	0 (0)	53 (83)	0=N
Word processing	26 (41)	14 (22)	3 (5)	1 (2)	20 (31)	0=N
Spreadsheets	3 (5)	8 (12)	3 (5)	3 (5)	47 (73)	0=N
Slideshow programmes	17 (27)	24 (38)	11 (17)	1 (2)	11 (17)	3=W

*D=Daily, W=Weekly, M=Monthly, T=Termly, N=Never

Table 6.3 indicates that the frequency of use is approximately the same for data projector, tape recorder and slide show. For each of these three resources, the same proportion (41/64) of teachers (64%) used the resource either on daily basis or at least once a week on average. Closely related to these three ICT tools is word processing where (40/64 or 63%) of the teachers processed word document daily or at least once weekly. This is as expected. The use of projector and slide show is expected to be related and both could be related to word processing as the processed words could serve as materials to for the slides. Similarly, the frequency of use of digital camera (48%) and TV and videos (47%) were closely equal. The rarely used ICT tools, on average used either termly or less frequently, were the video camera and educational software packages. Programmable toys, video conferencing and spreadsheets, too, were used on average less than once term.

In all four Saudi cases there was a preference for simpler tools that do not radically alter the existing practices of the ecosystems under study. This may be due to more investment into these more familiar ICT tools, as well as teachers using computers often to perform relatively simple tasks, like checking email or searching for information sources. More complex ICT tools such as the IWB and programmable toys were often overlooked and used rarely in favour of more traditional choices such as the PC or LCD projector. Another reason could be due to lack of trained teachers to handle these more complex tools in most schools.

Table 6.4 shows that in the Scottish context, all the practitioners (100%) had used computer and digital cameras in the course of their teaching at least once within the term. Programmable toys and internet was also popular among the Scottish practitioners - about 83% of them had used these tools at least once within a term. Also, almost 8 out of 10 practitioners (77%) had used education software and TV & videos and more than two-third (67%) had used IWB for teaching. Computers were the most frequently used on daily basis. Almost 8 in 10 (77%) Scottish practitioners used computer on daily basis and about 7% of them used computer at least once weekly. Daily usage of digital cameras was also high among the teachers. More than two-third (67%) used digital cameras daily while 87% of them used the cameras at least once in a week. More than half (57%) of the practitioners used an education software at least once weekly.

Table 6.4 ICT resources used frequently for playroom practices, number and percentage, Scotland (n=31)

	Responses from Scottish cases n (%)					
ICT Resources	**Daily**	**Weekly**	**Monthly**	**Termly**	**Never**	**Mode***
Computers	24 (77)	6 (19)	1 (3)	0 (0)	0 (0)	4=D
Internet	11 (36)	6 (19)	7 (23)	1 (3)	5 (16)	4=D
E-mail	4 (13)	2 (7)	0 (0)	0 (0)	24 (77)	0=N
Digital cameras	20 (65)	7 (23)	3 (10)	1 (3)	0 (0)	4=D
Video cameras	3 (10)	3 (10)	2 (7)	6 (19)	16 (52)	0=N
TV's & Videos	10 (32)	4 (13)	3 (10)	6 (19)	7 (23)	4=D
Tape recorder	7 (23)	5 (16)	1 (3)	0 (0)	17 (55)	0=N
Telephone, mobile, fax	3 (10)	0 (0)	0 (0)	1 (3)	26 (84)	0=N
Data projector	1 (3)	2 (7)	0 (0)	0 (0)	27 (87)	0=N
IWB	7 (23)	6 (19)	4 (13)	3 (10)	10 (32)	0=N
Video conferencing	0 (0)	0 (0)	0 (0)	1 (3)	29 (94)	0=N
Educational software	11 (36)	6 (19)	3 (10)	3 (10)	7 (23)	4=D
CD-ROM	7 (23)	2 (7)	4 (13)	2 (7)	15 (48)	0=N
Online information	4 (13)	5 (16)	6 (19)	1 (3)	14 (45)	0=N
Programmable toys	2 (7)	13 (42)	10 (32)	0 (0)	5 (16)	3=W
Word processing	2 (6)	3 (10)	1 (3)	1 (3)	23 (74)	0=N
Spreadsheets	1 (3)	1 (3)	0 (0)	0 (0)	28 (90)	0=N
Slideshow programmes	2 (7)	3 (10)	1 (3)	5 (16)	19 (61)	0=N

*D=Daily, W=Weekly, M=Monthly, T=Termly, N=Never

Some other computer-based resources were used on average less frequently, such as online information sources; the IWBs were also used on average less often. Those ICT tools used infrequently (on average termly or less), were the LCD projectors, and spreadsheet and slide-show programs. Interestingly, although the IWB was available in the majority of preschools its use was relatively low.

From observation supported by the data from the questionnaire it was evident that a narrow range of tools was used in the case study nurseries. Notably, the digital camera and programmable toys were used more often in Scottish cases. In Saudi, information led activities such as using PowerPoint and the Internet were used more frequently on average. This situation invites an exploration of the ways in which tools were used pedagogically.

ICT: More than Computers

In interviews, it became clear that practitioners had different understandings of what constitutes an ICT tool. This impacted on the types of tools used and the ways in which they were integrated. There were some teachers who clearly had a broader vision of ICT than others. For instance, one teacher stated:

> 'We are also looking at ICT in a much wider way than the computers, or cameras […] look at all the different technologies, all the different things that might be used for children to get experience of.' (T_4-B_1: FG)

Another HT demonstrated an informed, inclusive ICT definition:

> 'We obviously have a range of computers which are used by staff, in terms of researching work, preparing work, etc. – we have a bank of computers that children use freely on a daily basis, cameras (video and still), programmable toys, music, SMART board, basically anything that's available if we think it will be useful in terms of supporting learning, motivating children, sustaining and engaging learning' (HT, B_1)

However, some misinterpretation of the term ICT echoed other research findings by Siraj-Blatchford & Siraj-Blatchford and Hayes & Whitebread (2006) who emphasise the danger of ICT being understood to be 'PC operating skills' (*ibid*.: 153); Price (2009: 5) reports that ICT may even be reduced to such an understanding as improving 'hand-eye co-ordination' or 'mouse control'. Such a reductionist understanding is echoed in the current study, where ICT was thought to be:

> 'good for their hand-eye coordination with the mouse and the little muscles in their fingers, their fine motor skills, I think [...] it's quite a difficult skill to learn to use the mouse'. (T_1-A_3: FG)

Further, even one HT reflected that ICT is primarily an information tool:

> 'Access to information through the Internet and computers is available to children and such technologies are surrounding children in their environment at home and everywhere.' (HT, A_1)

This is worrying as it is evident that the misuse of ICT equipment itself, as the UNESCO report suggests, can become a barrier to integration of ICT (2010: 56), especially if its use is limited (Price, 2009).

Various definitions of ICT unsurprisingly reflect different rationales for ICT use. For instance, one teacher clarified the vision in B_1, where ICT is embedded into a range of activities:

> 'Just like numeracy is embedded, literacy is embedded, health is embedded, ICT is embedded across the curriculum in different ways […]. So it's there within all the curricula areas rather than a separate point'. (T_2-B_1: FG)

An HT stresses that the purpose of ICT is to act as a communication and learning tool that supports lifelong learning and the development of the whole person:

> 'As I say, for me, the positives are what engages, what motivates, what helps a child to learn and sometimes that learning isn't just about a body of knowledge, it's about themselves, their inner confidence, their communication with others. So, the outcomes might not be knowledge and skills about ICT but it must just be about developing that whole child'. (HT, B_1)

This HT viewpoint resonates with teachers' perspectives:

> 'I think it (ICT) can really stimulate the children's interest in other areas of the curriculum.' (T_1-$B_{1:}$ FG)

> 'It can enhance the children's learning' (T_2-B_1: FG)

Such broad-minded perspectives, however, are not shared by all HTs, with some still viewing the purpose of ICT in a narrow, administrative context:

> 'ICT is really very beneficial because nowadays we type our daily routine schedules, yearly and monthly plans in an organised manner and they can be presented in an attractive way by adding pictures and clip-art.' (HT, A_1)

Three teachers (T_1, T_2 and T_4) in A_1 endorse the narrow view of their HT:

> 'Access to information through the Internet and computers is available to children and such technologies are surrounding children in their environment at home and everywhere. For us as teachers ICT is a good tool to get information.' (T_1-A_1: FG)

And,

> 'ICT contributes to helping teachers to get access to information in comparison with the amount of time needed to search for information using a book. Therefore, it is very important to present both tools (traditional and new) and give the children the opportunity to chose between both based on their needs and preference.'
> (T_2-A_1: FG)

What becomes apparent is that the differing definitions of ICT are reflected in its use. Within the Scottish case study scenarios it appeared to be valued as an integral means of learning curricula wide; meanwhile, in Saudi, it was viewed as an informational tool (e.g. A_1).

6.4.2. Uses of Available ICT Resources

Aside from a standard viewpoint (UNESCO, 2010), the 'viewpoint of purpose' categorises resources purposively, so as to reflect the context of use, and not just frequency. ICT can be used, recalling Papert's terminology (1999), as an informational medium or as a constructional medium. The next stage is to consider not just the frequency of use but *how* ICT is being used from a purposive perspective.

6.4.2.1. Use of ICT as an Information Medium

The vast majority of practitioners from both contexts responded in the questionnaire that they use ICT resources. Three rationales were prominent: (1) 90% used ICT as a method for improving and developing teaching, (2) 86% as it is an effective method to convey information and (3) 81% as it is a method to change the activity routine and maintain child interest.

The same thought was reflected in practitioners' answers during the focus groups. Rationales fell into three main themes: the first is that ICT is being used as a facilitating tool; the second is that ICT is being used to reinforce and support them as practitioners; and the third is that ICT is being used as a tool to supplement other teaching methods.

ICT as a Facilitating Tool

The use of the Internet and online information sources was often what practitioners valued the most. The Internet was used, on average, at least weekly in both contexts, while online information sources were used weekly on average in Saudi cases and monthly on average in Scottish cases:

> 'I see that technology assists the teacher a lot as she can gain access to the Internet through the computer at anytime and get the information she needs' (HT, A_4)

> 'We were doing children of the world, we researched population, which country the children came from, the colour of the flag, so Internet helped with that topic.' (T3-B_1: FG)

> 'I think the fact that you can, if they're [children] interested in something, you can go straight away to the Internet and get a picture up of it. For instance, the flags' (T4-B_1: FG)

Some practitioners report that ICT is most appealing because of the wide expanse of information it provides and its ease of use:

> 'ICT is easy to use and it facilitates teachers' work. [...] Now by pressing one button we can get all the information we want.' (T1-A_1: FG)

> 'ICT is faster and easier to get the most updated information.' (HT, A_1)

> 'ICT is a tool that allows the opportunity to get information from a variety of resources.' (T3-A_2: FG)

Such informational use confirms findings that preschool teachers limit their use of technology mostly to downloading images (PBS & Grunwald associations, 2011; McManice & Gunnewig, 2012). From observation, particularly of the Saudi cases, these were utilised predominantly by teachers in information-based and teacher-centred activities.

There were also examples reported of child-led uses of ICT. These were given by teachers from cases B_1 and B_2, demonstrating ICT use as an informational tool in a child-led approach:

> 'Computer for the Internet benefits the children to use for information searching, that's the quickest source to go into the room and find out anything that they're interested in and that benefits because they are finding it straight away.' (T3-B_1: FG)

Another teacher from case B_2 suggested accessing the Internet with children to search for information:

> '[the children] might say well how long a frog's tongue is? So you could take them straight over to the computer to research some information and print it off. That would be an advantage, a major advantage, because you're acting on their interest.' (T1-B_2: FG)

Nevertheless, very few practitioners from the two Scottish cases were observed using the computer and the Internet to support their own practice by seeking out materials or downloading recourses.

ICT as Reinforcing and Supporting Practice

Teachers from the four Saudi cases reported particular ICT resources as being beneficial (e.g. software packages like Word processing). They highlighted the fact that they make use of word processing to prepare activity worksheets, their daily educational and activity plans, and for record keeping and administration work:

> '[T]he HT encourages us to always submit word processed activity plans. This can be quite handy as they can be easily edited for future classes.' (T4-A_2: FG)

> 'In the past it was optional to type our lesson or activity plans using word processing. However, recently the HT is encouraging all teachers to submit word processed plans. Having an electronic copy of our activity plan is beneficial and useful as it can be easily reworked for future classes.'(FG1, T1, A_1)

A Saudi HT stated:

> 'ICT is really very beneficial because nowadays we type our daily routine schedules, yearly and monthly plans in an organised manner and they can be presented in an attractive way by adding pictures and clip-art. Also, it is quite handy to return to these and modify them in the future rather than have to start from scratch again.' (HT, A_1)

Sometimes practitioners also use it to report children's development or progress:

> 'The child progress e-portfolio is another good example of the benefits we can get as pre-school teachers from using such software in reporting children's developments and achievements in an attractive manner.' (T3-A_4: FG)

In the two Scottish cases, it was only a minority who reported that they were using ICT for administrative work, recording their observations of children and building profiles; this research finding is in line with findings from Plowman et al. (2010).

Furthermore, teachers emphasised that ICT allows children to view and/or access contemporary and attractive information:

> 'Technology reinforces and supports information and makes certain that the child is exposed to the information through the use of different tools.'
> (T2-A_2: FG)

The most common reported opinion was that ICT facilitates delivered information in a clear and enjoyable way:

> 'It gives an opportunity for new and attractive methods of teaching' (FG1, T3, A_1)
> 'The teachers in our nursery are creating stories using PowerPoint presentations and they embed audio effects, or record their voices and include it in the presentation itself. All this is done to present the story to the child using more attractive methods.' (HT, A_4)

A similar approach was observed in A_1 when a practitioner, using LCD projectors, gave presentations based on research. The LCD projector was a popular tool in the Saudi context; Saudi teachers reported using it on average on a weekly basis:

> 'The LCD projector visibly enlarges and displays pictures especially at story time also it is beneficial in playing video clips; it brings to life topics for the children.' (T2-A_1: FG)

And,

> 'When stories are presented through PowerPoint presentations, children become more excited and they enjoy it more than when a story is presented using an OHP. This is because changing the slides on an OHP can interrupt the children's enjoyment, while PowerPoint allows continuity in presenting the story and doesn't interrupt the children's viewing.' (T4-A_1: FG)

ICT tools can also break down complex information into more digestible ideas:

> 'ICT helps in introducing new, complicated and dense information to children through presenting it in an attractive manner using audio-visual effects and animations.' (T4-A_3: FG)

Informational activity was most evident when teachers gave presentations to children to enhance the presentation, make abstract ideas clearer or to grab the children's attention. For instance, during circle time in case A_3, using PowerPoint in combination with the LCD projector, the teacher showed a 3D picture of a bee hive, as well as of a bee collecting pollen, and different types of honey. At the end of the activity the teacher brought in a tray with a selection of honey that children were encouraged to taste. Another teacher in case A_2 even used the IWB in a French vocabulary and speaking lesson where children watched an authentic French You-Tube video clip and sang along with a French nursery rhyme. However, this simplistic use of the IWB does not fulfil the tool's potential.

In A_4, ICT was a powerful tool for in-class discussion of critical events:

> 'There is […] a structured activity taking place regarding natural phenomena (storms, hurricanes, floods, etc). In this case ICT played an effective role in presenting the information to the children by using real images, video clips from YouTube, and searching for information with the children through the Internet.' (T_3-A_4: FG)

Using recent YouTube clips of flooding in Jeddah, the children were able to bring this knowledge and understanding to inform their own personal experience of the floods. They were able to reflect on their own and other family members' behaviour during this time, to give expression to their feelings and process the emotional events. This exploring and labelling of their fears was a therapeutic process for the children. Here, ICT tools are being used in exceptional cases to promote reflective practice.

ICT as a Tool to Supplement Other Teaching Methods

Teachers also reflected upon ICT as a multifaceted teaching tool to complement traditional teaching aids:

> 'There are a lot of traditional tools that attract a child, but when there is a need for ICT to convey information more forcefully, such as using a PowerPoint presentation or audio-visual effects, then here technology can have a stronger impact.' (T4-A_4: FG)

Saudi teachers also suggested that when more general traditional teaching methods become problematic, ICT may be useful:

> 'On some occasions using abstract pictures or images doesn't help to deliver the topic or the concept and won't deliver the full experience of the topic to the children. However, for a topic that concerns the sun, the planets and the movements of the solar system, if we enlarge the images using a PowerPoint presentation and projector, it may help in presenting a live experience to the pupils and break the scientific concept up.' (T4-A_1: FG)

In both contexts there was a merging of traditional tools with ICT. As part of the same focus group discussion, Scottish practitioners noted:

> 'We were doing caterpillars and [...] showing them [...] a picture. I know it's not real life […] but it's instant.' (T4)
>
> 'I can show them what [the caterpillars] can turn into [...] to show them the stages we had the pictures printed out for them.' (T1)
>
> 'It was on a SMART board presentation as well. So they did the research on […] the caterpillars.' (T_7-B_1: FG)

However, more commonly observed was the use of the Internet to carry out web searches by practitioners in informational gathering activities where children were presented information on the screen or through the use of the IWB.

Other observations revealed that teachers in Saudi favoured the use of LCD and overhead projectors. There was an extensive use of PCs, LCDs and Internet searches, i.e. using ICT as an informational tool. Two public nurseries included in this study were participating in the pilot project ECERS-SA (See chapter 2), which recommends that a computer be placed in KG3 level playrooms (5-6 year olds). Despite the recent nature of this development the Saudi nurseries were observed using the LCD, the Internet, generic software (e.g. word-processing), and presentation software (i.e. slideshow programmes) in more structured teacher-led activities. Notably, none of the Scottish nurseries used LCD projectors.

In turn, in Saudi clear importance was given to the role of the teacher as educator. Teachers emphasised the help that ICT gave to them:

> 'It meets teachers' desire and taste for changing or modifying teaching according to what is appropriate for children's needs and the teaching context.' (T3-A_2: FG)

There was an underlying belief that children need to be informed what to learn, rather than explore and discover and make meaning themselves: a focus on the teaching rather than the learning process. This is not a socio-constructivist approach which encourages explorative play through using ICT as a constructional tool. The informational activities reflect a teacher-centred model where the child is a relatively passive participant in the learning process.

6.4.2.2. Use of ICT as a Construction Medium

In contrast to the informational use of ICT, in some nurseries children were actively engaged in the learning process; the tools in these playrooms were used in a constructional manner: processes of observing, discovering, constructing, recording, communicating or role-playing. Morgan & Siraj-Blatchford (2009) state that such play empowers the children, placing importance on the child's active experiential learning, and moves away from the more traditional teacher-centered approach which allocates a more passive role to the learner.

There is a range of constructional uses of ICT but constructional tools can be categorised into five main types of ICT (UNESCO, 2010; Hayes & Whitebread, 2006; and Siraj-Blatchford & Siraj-Blatchford, 2006):

- Tools for recording (e.g. digital cameras)
- Tools for constructing and controlling (e.g. educational robotics)
- Tools for observing and discovering (e.g. digital microscopes)
- Tools for communicating (e.g. email and the internet)
- Tools for role-playing (e.g. range of everyday technologies such as microwaves, blenders, etc.)

Tools for Recording

In this study, practitioners' responses in the questionnaire showed that the digital camera was the most commonly used tool in the Scottish context (65% of teachers reported use and importantly such use was, on average, on a daily basis – see table 6.6). This finding is supported by the literature (Plowman et al., 2010; Stephen & Plowman, 2003a) and by observation of the cases. In Saudi, the use of digital cameras is reported much less often (on average on a monthly basis – see table 6.5).

From the HT and focus group interviews it was clear also that the camera was valued highly in Scotland:

> 'That's our most valuable resource, our cameras. You don't really need the computer for that because you can use the small docking station for printing.' (HT, B_1)
>
> '[We] use the camera for everything.' (T_4-B_1: FG)
>
> 'The main resource of ICT we use is a camera**.**' (T_1-B_2: FG)

They were reported as used commonly for supporting and documenting learning by teachers:

> 'Photography and the use of photographs for supporting learning, for communicating with parents and so on, for providing evidence of learning, is probably the highest and most common used of ICT across the city.' (HT, B_1)

Primarily, digital cameras are used to collate evidence of achieved learning outcomes rather than for observation or discovery:

> 'It's the main resource for evidence.' (T_1-B_2: FG)
>
> 'It helps with your evidence as well, taking photographs, evidence for what you've carried out throughout the playroom.' (T_2-B_1: FG)

A central benefit of using digital cameras is for monitoring child development and playroom practices, as well as for documenting the children's progress or special achievements:

> 'We use the digital camera in our observations of the children so that if they have an achievement, like they build a unique construction using the blocks available in the construction zone, then we can get a photograph straight away and we can use it in their record, to show that they have achieved this.'
>
> (T_4- A_1: FG)

> '[W]e've got big books and that's our record of what all the children have done. And so we need the photos everyday for everything we do and we just [put] them in.' (T_1-B_1: FG)

In the Scottish context, alongside these 'big books' or theme portfolios, there was also the child's overall profile folder to chart progress:

> 'The digital camera for evidence; I mean, it's brilliant for evidence in their profiles.' (T_2-B_2: FG)

In Saudi, preschool teachers in cases such as A_1 and A_4 reported using cameras to take photographs of educational trips or social events, where presentations could be made of a child's work for parents:

> 'Here in the nursery we are encouraged always to display photos which were taken of children's achievements, any special events like trips, nursery visitors and so on […]. It is truly helpful in conveying the general atmosphere of the nursery to parents visiting the nursery.' (T_3-A_1: FG)

> 'Yearly, as part of graduation celebrations, parents are provided with a CD of pictures documenting how their child has progressed throughout the academic year.' (T_1-A_4: FG)

It was evident from observing all preschool layouts that pictures of the pupils were on notice boards and spread all over the settings. One example was provided in Scotland where digital cameras and digi-screens were used together to provide real-time documentation of learning for the children and their parents:

> 'One of the things we've invested in are digi-screens where we can put in a pen-drive and display photographs in real time. So that what happens in the day in the nursery we can put on show for the parents when they come back for their children so that they can see what their child has been doing that day.' (HT, B_1)

Another benefit of staff use of not just digital cameras, but also other recording tools such as a Dictaphone, is that recorded learning achievements may be written-up and documented at a later stage:

> 'with traditional methods, the staff just take lots and lots of hand-written observations of children in their everyday practice, but certainly taking photographs, video snaps, recording what children say in conversations with the children [helps]. So for example in the home corner children could be having a

> wee conversation and that is missed because the staff can't write quick enough. Whereas if you had a wee Dictaphone or a wee video camera for the staff to record this crucial information of the children playing, the staff can then set a situation with the children or change the role-play area to develop those children's needs or take the next step to develop the level they're at, at the moment.' (HT, B_2)

However, cameras are predominantly used to support the role of practitioners rather than children learning through these tools themselves. Aligning with findings by Plowman et al. (2010), the use of digital cameras was valued by teachers but their status as an expensive tool meant that practitioners were reluctant to encourage children to use them proactively.

Along these lines, Scottish practitioners highlighted the pressure to build the evidence required by inspectorates:

> 'We are always evidence gathering here at the nursery all the time for the profiles and for governing bodies like the Care Commission and HMIE – they are always asking us how we challenge the children and how we are taking the learning forward – where is the evidence? Can you prove it?' (HT, B_2)

The drive or rationale to use digital cameras comes from the expectation that children's achievement should be documented for both parents and the LEA.

In all the Saudi cases, there is no such evidence-based approach to curriculum required and no expectation of teachers or learners to produce such evidence in the yearly *ad hoc* MoE inspectorate or in the annual report submitted to the MoE by HTs. Thus, preschools were reported to use them only to take photographs of child achievements, extra-curricular activities and special events. In both contexts, though, the digital camera tended to be used as an informational tool and at a low level of integration.

Through discussion with practitioners it became apparent that the camera was often not essential to the learning process but a communication tool. One HT acknowledged:

> 'The camera is used daily but more so by the staff taking pictures of evidence of children for their profiles or planning and that sort of thing, more than the children using it themselves. But I would like the opportunity for the children to have their own camera to just randomly use when they want to just take it away. But certainly we don't have that facility; we have the one camera throughout the whole nursery. And the Digi-Blue, as I said, we share with another nursery where it is at the moment.' (HT, B_2)

It is the value of digital cameras as a commodity that often stands in the way of children using them as learning tools. Where child use does occur it is done under supervision:

> ‘Certainly, the pieces of equipment like the camera and the Digi-blue, they’re under the supervision of an adult because obviously they are precious to use for other things in the nursery. [If they] get broken they’re expensive to replace so those things are under supervision’ (HT, B_2)

This lack of resources was keenly felt by the HT:

> ‘If we had the facilities the children would excel by the time they got to primary school and be very capable of using these resources without the support of an adult.’ (HT, B_2)

This point resonates with one made in Saudi case A_1:

> ‘We would love to have a video camera to take videos of the activities and the children on different occasions. It would be good to have the ability to put this on the screen and discuss it with children or we could use it in activities as live situations from the daily routine and encourage the children to talk about it. This would be an amazing learning opportunity.’ (T_3-A_1: FG)

This lack of resources was keenly felt by the HT:

> ‘If we had the facilities the children would excel by the time they got to primary school and be very capable of using these resources without the support of an adult. They could go off confidently and use the technology they had been given and it wouldn’t be alien to them by the time they reached primary schools because obviously the schools have those facilities when they get there.’ (HT, B_2)

This point resonates with one made in Saudi case A_1, where one teacher referred to a need for more resources:

> ‘We would love to have a video camera to take videos of the activities and the children on different occasions. It would be good to have the ability to put this on the screen and discuss it with children or we could use it in activities as live situations from the daily routine and encourage the children to talk about it. This would be an amazing learning opportunity.’ (T_3-A_1: FG)

In all instances observed in the Saudi context, the digital cameras had been provided by individual teachers and not the preschools themselves. This contrasts with the Scottish cases where at least B_1 had a strong supply of these ICT tools and where documenting learning was a way of consolidating and clarifying the process and achievements.

In the Scottish context, in spite of the majority of use being made by practitioners, there were a few examples observed where digital cameras and similar technologies were used by children as a learning tool. The children in case B_2, for instance, were observed to provide photographic and video evidence of other children's artwork and role-play, while exploring how to use the zoom facility and change camera angles and perspective. In nursery B_1 children were observed collecting evidence of their peers baking.

Digital cameras have to be considered as learning tools; the camera 'has to have a relevance to the child and it has to make a difference' to their learning (HT, B_1). As the HT teacher expressed further:

> 'the aim was to enable the children to be so adept with the camera to be able to take it to the card printer or to be able to take it to the computer in order to source the photograph on there and be able to print it.' (HT, B_1)

Taking this idea further, ICT recording equipment can be a tool for children to document their own learning in a way that also encourages them to be explorative and selective in terms of what they capture:

> 'I see it as very much a supportive tool, I suppose it is a discrete entity which is an enabler for reprographics, most importantly for the children to evidence their own successes and achievements in a day […]. [O]n a daily basis, throughout their play, without even thinking about it, the camera is there, they can photograph what they want to photograph – whether it be the construction they've created or whether it be photographs for their passports.' (HT, B_1)

Apart from the digital camera there was limited use of any other recording ICT tool. B_1 preschool HT stated that they had 'talking pens now to support dual language learning' but they were not observed in use and the nursery teachers in B_1 themselves made no mention of these. Further, both Scottish HTs reported:

> 'We've got things like MP3 players in the shape of microphones that children can adlib into, we've got little sound recorders as well that can just take a few minutes of recording.' (HT, B_1)

> 'Things like mobile phones, these video phones, MP3 players, just a variety of recording equipment [...] for the children again [allow] us to have so many opportunities to further the children's learning and development and support the CfE.' (HT, B_2)

In spite of both HTs mentioning tools such as MP3 players their use for recording was observed to be limited.

More commonly, teachers from both Scottish cases favoured digital cameras as a tool for recording child life *outside* the nursery, and in so doing bridged the gap with the external environment and involved parents. This further taught the basics of personal responsibility, sharing, and communication to the learner:

> '[T]hey can take some photos, bring the camera back, print them out and make a learning board (you'll see a couple that are out there). It's quite good for […] all children really, and they can tell you about their life outside the nursery and bring literacy into it with the little speech bubbles. Again, it's cross-curricular.' (T_1-B_1: FG)

In the Scottish context there was a wide use of digital cameras for documentation purposes by teachers but less use by learners themselves to improve their skills and confidence with these technologies. In the four Saudi cases, digital camera use was cited to a lesser extent. Only one teacher reported that 'we use a digital camera a lot to capture photos' (T_1, A_1). When, on occasion, employed it was never observed to be used by the children themselves. In the Saudi context there is no external curriculum imperative for documenting child learning so consistently. In both contexts a small number of other recording tools were used to record child learning. As Price (2009) has noted in the literature, consensus needs to be found for concise and authentic rules for child digital camera use that balance quality of learning against anxieties about the expense and delicacy of the resource.

The dominant use of digital cameras noticed in the Scottish cases also raises questions about the 'superficial' nature of such documentation. Photographs are a starting point for broader discussions between teachers, children and parents about learning processes and achievements (Siraj-Blatchford & Whitebread, 2003) and should not be considered as the end point of documentation and communication.

Tools for Constructing and Controlling

Tools like programmable toys and educational software were used on average on a weekly basis in the Scottish context: 42% of practitioners reported using such toys this frequently (see table 6.3). HTs and teachers in the Scottish cases often reported, amongst other programmable toys, using a type of floor robot known as the 'bee-bot' that clearly grabs the children's attention:

> ‘We also have bee-bots as well, wee little mini robots that look like bumble-bees and we can set them to go backwards and forwards. It does tend to draw children to activities, it encourages learning.’ (HT, B_2)

These bee-bot toys encourage creativity and imagination as the children are able to experiment and make different characters out of them by changing the cover of the toy. Children take control of their learning:

> ‘children [...] can change their bee-bots to look like whatever character they want […] they have been spacemen, they have been characters from nursery rhymes, […] different things.’ (HT, B_1)

Practitioners also felt that the toys could enhance learning in maths, literacy and expressive art:

> ‘The bee-bots are very much for maths, [… given] the direction arrows.’
> (T1-B_1: FG)

> ‘It's giving them an added focus or an [addition] to whatever they are learning. Whether it's in maths or literacy or expressive art or any of those areas.’
> (T2- B_1: FG)

> ‘When you are talking about children directing, it's a very hard thing for young children to understand, even in early primary, direction is quite hard. The bee-bots show them very visually.’ (T4-B_1: FG)

In B_1 both the bee-boot, as well as remote controlled toys, were used outdoors in open and unstructured activities, where the only scaffolding by the teacher focused on providing directions (right, left, back, forward). Another observation witnessed programmable toys in a structured activity. In $B_{2,}$ children sitting in a circle group had to successfully direct a single bee-bot moving along a road-map. Children had to make decisions, give and follow instructions, problem-solve, troubleshoot, and collaborate (UNESCO, 2010; Siraj-Blatchford & Siraj-Blatchford, 2006).

HTs sought to improve the methods of integrating programmable toys in order to challenge child learning in new ways:

> ‘What I would hope is that staff would continue to see the possibilities of ICT for learning. Programmable toys, in terms of how they move, making them move, making them do; children [are] engaging and interacting with children - and with adults - and responding.’ (HT, B_1)

This new learning can take the form of collaboration with another ICT device to promote learning *through* ICT:

> ‘One of the things we are looking at for the bee-bots is [...] software that will allow them to use the bee-bots in conjunction with the SMART board. That's a bit of a challenge for the children because not only are they looking at the bee-bot's pathways and direction, which is supporting, obviously, their mathematical skills, as well as just using the technology itself. So they are learning in the technology but they're also learning through it.’ (HT, B_1)

This aim not only relates to the use of bee-bot toys; it is a reaction to an external curricula drive to challenge a child’s learning and expand their abilities by learning transferable skills:

> ‘It's about learning in the technology but also looking at how you learn through the eight curricula areas of the CfE and how you can support that. So we would be looking at ways: how would you support a child? How would you challenge the child, how to extend their skills through activities like how to link between technology and another technology […] and how the children are able to transfer those skills and that's very important; and how they would be able to do it as they move on into primary school.’ (HT, B_1)

In this environment, children begin to learn how to build their own robots with the aim of making them move, suggesting a strong future for programmable toys:

> ‘We’ve got a new piece of construction material in and just when I left them there just before you came they were constructing robots, and the question I heard was, “How can I make it move?” So, no I don’t think there’s any doubt that ICT is going to be a part of the future.’ (HT, B_2)

This varied use of programmable toys made it clear that Scottish teachers did not merely consider computers as ICT:

> ‘[We are] not just thinking about the computers but the remote control toys or, if the light boards are out, then children will experiment with that all day.’
> (T_2-B_1: FG)

In B_1 the bee-bots were also observed as a tool for learning literacy. A large mat was laid out with all the letters of the alphabet printed on individual cards spread out across it. The teacher then asked the pupils to program the bee-bots to travel to letter cards spelling out a set word. While the words were short (such as cat, pot, hat, or cut), this was a challenging activity, so the children collaborated: those learners who were familiar with the alphabet assisted those who were less so. The bee-bot here was being used in a complex activity but with the purpose of allowing the children to explore and assist one another's learning. Evidence in the literature suggests that young children are capable of learning the very basics of programming and, in turn, can perform reasonably advanced tasks with programmable toys (UNESCO, 2010).

Alternatively, programmable toys were of limited availability in Saudi preschools. One teacher from A_3 even responded, 'what do you mean?' when asked about these in focus group interviews, indicating a lack of knowledge and understanding. This knowledge gap was echoed by her peers:

> 'What is a programmable toy?' (T2-A_3: FG)
>
> 'What are their benefits?' (T3-A_3: FG)
>
> 'How can we use it with children?' (T4-A_3: FG)

It is clear from these responses that seeing the potential and multifaceted use of programmable toys is one of the lessons that the Saudi preschools may learn from the Scottish. Also, internationally, countries in a similar position to Saudi can look at using these resources. In particular, the benefit is that the bee-bot allows children to incorporate their own designs, to explore and take control of their playroom practice, while learning directional skills and develop problem solving skills. The way in which the programmable toys were incorporated into B_1 and B_2 demonstrated a constructivist approach where children actively learn through discovery and exploration. Children in both cases were able to become familiar with the technologies around them on their own terms, without improper adult intrusion, giving them confidence and transferable skills to use when they encounter technologies in primary schools in the future.

Another tool that may be used for constructional learning is the IWB. Only two cases in the Saudi context had IWBs (A_2 and A_4) but it was observed on multiple occasions as being used for constructive purposes. The children were often excited by the tool, as was noted by one of the teachers:

> 'I think with the SMART board it's brilliant, when you think about how much paper and paint you use when people or children are drawing pictures, with the SMART board you can do your picture, rub it out, someone else can go back and redo it, you can save it, you can print out.' (T4-A_2: FG)

One use was in a numeracy skills session for five year-old children at A_4, when pupils were asked to match counting boxes to an actual number on the IWB. Also, the nursery took a stratified approach to constructing activities, evidenced by an activity for 3 year-olds which focused on recognition and using the program software itself, promoting both giving and following instructions, turn-taking, teamwork and negotiation. The children could recognise different icons as well as understand the functions that these buttons performed: a demonstration of cognitive development.

A similar approach was witnessed in one of the Scottish preschools with an IWB used to promote collaboration. In B_1 the practitioner uploaded software on the computer that encouraged the composition of a drawing. This was then linked to the IWB so that activities could be seen on both screens simultaneously by a whole group. Children were assigned to work on one specific screen at a time in small groups, and were told to take turns giving and following instructions. They were encouraged to make decisions about which software activity to pursue. This process was initially managed with the aid of the computerised egg-timer in negotiating turn-taking, whilst peers observed and gave suggestions to the others engaged in the process. Practitioners commented:

> 'They enjoy using the SMART boards' (T3-B_1: FG)
>
> 'our SMART board [...] moves down to the children's level. And they can just walk up and touch it, and it makes them very confident. At the start of the term a lot of children weren't really interested in it, but they are quite confident with it. [...] I think it's the fact that they can just go up and touch it with their fingers and they can choose.' (T2-B_1: FG)

The use of the IWB could on occasion be a beneficial example of constructional learning.

Children, however, also need to learn to control the ICT devices that they use in everyday life in order to give them a rounded preschool education. Whether it be learning how to turn on a simple torch, or a more complex task such as learning the range of functions on a TV remote control, it is important to allow children time and support to achieve this (Siraj-Blatchford & Whitebread, 2003). For example, the children in the Scottish context were encouraged to use a printer and explore how it works:

> 'Something they are really enjoying at the moment is printing something out and then running – because the printer we use is centralised in the office area and so they are quite excited. We wait on the speech bubble coming on the screen which says "this document has been sent to the printer" and then they rush through' (T1-B_1: FG)

The HT adds:

> 'Using sort of everyday technology like radios, CDs, hi-fis, karaoke machines, microphones, so all the everyday things they are familiar with. They use things like the laminator, printers (they love being able to send their work from the computer through to the networked printer).' (HT, B_1)

The rationale for employing ICT in constructing and controlling, for example through the use of programmable toys, was often overlooked in the Saudi context. The skills that children may take from using these tools expand a range of learning facilities that are useful for education and life after preschool (Siraj-Blatchford & Whitebread, 2003). It is important, though, from an ICT perspective that children learn how to control everyday technologies around them from a young age in order to increase their ability to cope in the Information Age.

Tools for Observing and Discovering

Many ICT tools for observing and discovering were named by teachers in case B_1 and B_2 such as digital microscopes and metal detectors. Although it was observed to be a highly effective and stimulating tool for observing and discovering, a digital microscope was only available in one of the case study nurseries (B_1):

> 'We have different types of digital microscopes that the children use a lot'
> (HT, B1)

In one observed instance it was used by children to examine a range of materials found outdoors, including leaves, stones and a ladybird. Children were highly motivated to investigate, analyse and compare materials. There was an awareness of the difference between organic and inorganic matter, and variations in the size, colour, shape, and texture of materials. The class were encouraged to problem-solve how to capture the ladybird and keep it safe and then return it intact to its natural habitat. Children were able to observe the ladybirds from the digital photographs taken under the digital microscope and use these photographs as models for artwork and creative writing. This activity brought the outside environment and the natural world into the learning environment. This activity was timed so as to allow cooperation between practitioners and parents. Parents could contribute near the end of the session and possibly conduct some research-based follow up on home computers.

A more traditional approach was observed through the use of audio-visual equipment with the LCD projector to watch films, video clips and current events, and relate to issues of emotional intelligence. For instance, the week-long theme of 'Toy Story' was used in preschool (B_1) to explore core values such as friendship and its responsibilities. Children were encouraged to relate the storyline to their own life story and their own emotional responses. This disclosure promoted self-expression in the child and empathy for others. Problem-solving skills were also modelled to fit the film and work was ultimately documented in an individual portfolio.

Tools for Communicating

In both contexts ICT tools for communicating such as email, telephone, mobile and fax and video conferencing were on average never used for playroom practices (see tables 6.6 and 6.7). Communication tools were therefore used between teachers for administrative purposes outside of the playroom and also between teachers and external stakeholders such as the LEA and parents.

Only two of the preschools under study (A_2 and A_4) had their own website to communicate with parents and provide information on the school. In A_2, A_4 and B_1, there was an internal network for which staff were allocated their own email addresses. In both contexts, the use of the computer was observed to be common and teachers had staff email addresses; however, only a few of the preschools in these case studies were observed to utilise ICT as a central tool for communication purposes. All of the preschools also had access to dedicated networks for their respective LEAs through which they could access notices and announcements; they could also upload statistical reports, school improvement plans, sick leave reports or annual progress reports to a central server to share with the LEA.

Preschools A_2, A_4, B_1 and B_2 used email to communicate on occasion with parents, although it was evident that it was still embryonic in nature, as one teacher from B_1 realised:

> 'We do have parents' email addresses now so hopefully next term we can email a lot more of the children's pictures […] reducing the costs.' (T7-B_1: FG)

A number of the preschools admitted that they often use email to contact parents but that this was not the case for the children. Such a situation is symptomatic of email programs not being developed specifically for child use and not being considered as child-friendly. In turn, it would take a lot of time, support and supervision for the children to be able to use such programs (Siraj-Blatchford & Siraj-Blatchford, 2006).

There was no evidence of children using computers or laptops for email or social networks. This is despite recognition by some practitioners that the children are familiar with these tools:

> 'Some of them talk about social networks as well […] about their older siblings being on social networks, such as Bebo and Facebook, and whatever'
>
> (T_7-B_1: FG)

Additionally, teachers made mention of children recognising telephone company logos:

> 'I suppose it's environmental print as well, because a lot of them can identify mobile phone brands such as O_2, Orange or Virgin and so on, so they talk about that as well' (T_7-B_1: FG)

They also acknowledged that some learners know how to use mobile phones:

> 'the children in our playroom […] know mum's mobile phone number […] they know how to use mum's mobile phone [...]. Sometimes you can hear them talking about it and they rhyme off mobile phone numbers, so I think a lot of this is being used by 3-4 year-olds as well, the use of mobile phones'
>
> (T_1 -B_1: FG)

Even so, no actual preschool was observed to promote such communication activities as part of the learning process. This seems in part to be due to school policies where use of mobile phones may be seen to impinge on the learning process rather than add to it, as this teacher indicates:

> 'There's a policy in our nursery: we don't have mobile phones in the playroom' (T_1-B_3: FG)

There is an emphasis on technology as discrete items rather than integral to the learning process itself. Indeed, only case B_1 used an ICT tool in developing communication skills; this was through the use of walkie-talkies between children in the same nursery premises. This area showed generally low levels of ICT integration.

Tools for Role-playing

Role-play occurred in the six nurseries, such as in B_1, where a group of children were observed participating in physical activity initiated by listening to CDs, and this play took place on a weekly basis. As observed, the children were encouraged to role-play the movements of a range of characters. For example, they wore butterfly costumes and were asked to copy the teacher's flowing movements in response to the music. Through this play the children learned relaxation, self-expression and role-play. Computer games were also used in B_2 to encourage child role-play in the virtual world, such as the program 'Dora' where, taking on the role of Dora, the child 'goes into colours and languages' and which 'the children are picking […] up at a very young age' (T_5-B_2: FG). This was alongside a consistent use of everyday technologies, including radios and fridges.

Role-play was an integral part of nursery life but only a few instances were observed where it was an intrinsic part of the learning process. In an example of integrating ICT tools, one HT reported encouraging a fluid curriculum which allowed teachers to respond to children's ideas within the set learning plan. The HT said:

> 'We are trying as much as possible to make the children familiar with ICT, [so] it's part of their learning …. It's not an add on …. For instance, as part of their learning yesterday… the children [had] their role-play as a garden, and they thought maybe it would be a good idea, as one child suggested, […][to] have an entry for the garden, so they would have tickets, so the children were writing up tickets for it. […] They were writing their ticket but they thought they might tear so they brought them to be laminated, so they're very confident at the different use. The same as the snack bar – they sometimes make their own juice, so they're using juicers.' (HT, B_1)

Such as in the snack bar scenario, CAPRI electronic tills were explicitly reported by teachers in the cases as an important role-play resource (T_1-A_1: FG). For example, nursery A_3 was actually observed carrying out a role-play of a café with children playing the role of cashiers; moreover, customers and counter staff used juicers to make real fruit juice and blenders to make smoothies. Here were examples of everyday technology successfully integrated into role-play and simulations. It is integrating ICT in the playroom to this degree that was the embodiment of a central idea, one repeated time and again by practitioners, that the preschool's role is to support children who are surrounded by ICT in their daily lives.

6.4.3. Integrating ICT into the ECE Learning Environment

After identifying the most common ICT tools used in the case studies, as well as the purposes for which they were used, this section will analyse some of the previously presented examples in terms of how the children are engaging with the ICT tools and what they are achieving through such engagement. In doing so, this section will focus on the following:

- Who is conducting the ICT activity?
- Is the learning space an ICT zone or a media suite and how is it organised?
- What are the different kinds of activities?
- How can we analyse the playroom scenarios?

All of the questions are explained below in more detail and pertinent examples are drawn from the research.

6.4.3.1. Who is Conducting the ICT Activity?

In all of the case studies practitioners conducted the activities that took place within the playroom. There were three different approaches to this support. In a few cases, such as A_1 and A_3, where the playroom was supported by two teachers, both teachers took part in any organised activities using ICT. In other cases, such as B_1, where the playroom was supported by an ICT coordinator who is, as mentioned in section 6.2, one of the teaching staff, this coordinator supported the teacher in running the activities. The third approach was seen in three cases (A_2, A_3, and A_4) where preschools were partners of international companies that supplied software; in these preschools a visiting IT specialist from the firm would frequently visit to both train teachers and to assist the children in playing and learning through the software. This specialist came to visit the children and teach them classes in a computer lab.

6.4.3.2. Organising the Space: ICT zone or media suite

Two different approaches to organising ICT spaces were identified through observation in the six cases. ICT tools were located either (a) directly in the playroom, usually as an ICT zone, or (b) in a separate ICT class.

Practitioners were asked in the questionnaire where they make use of the ICT resources available to them [3]. The vast majority use ICT within the playroom with only a small proportion of teachers using ICT in other areas such as the school library or a computer lab. Table 6.5 shows teachers' responses according to context.

When ICT is used in the playroom this usually equates to a single desktop computer in a designated learning centre as observed in cases A_1, A_2, A_3, A_4, and B_2. Only in case B_1 were there multiple desktop computers in the actual learning environment, assigned to a specialised ICT learning zone, encouraging peer-to-peer learning and widespread collaboration:

> 'I know sometimes there's been the accusation that computers are very solitary etc. but in my experience we've usually got at least a couple of children around a computer or sometimes more and one child is sharing what they know so they are leading, so you've got peer-to-peer *learning* going on there as well.'
>
> (HT, B_1)

Table 6.5 Locations reported as for teachers ICT use, frequencies and percentages [Saudi Arabia (n=64)/ Scotland (n=31)]

Location[a]	Saudi Arabia n(%)*	Scotland n (%)*	Total n(%)
Playroom	58(91)	31(100)	89 (95)
Computer lab	26(41)	5(16)	31 (33)
Smart room	27(42)	1(3)	28 (30)
Library	28(44)	3(10)	31 (33)
Staff room	25(39)	13(42)	38 (40)
Home	55(86)	30(97)	85 (90)

[a.] Dichotomy group tabulated at value 1
*Number and percentage of teachers responding for each category in the form of multiple responses

A range of ICT tools were also present in the playrooms such as tape-recorders and TV and videos assigned to reading areas (A_1, and A_3). In three cases (A_2, A_4, and B_1) educative tools were also available in the playroom, normally in an ICT zone, which contained an interactive whiteboard (IWB), an LCD projector and a number of other tools, such as microphones and programmable toys related to numeracy and literacy skills. A_1, A_3 and B_2 had no IWB available, whilst B_1 had one available within the large open playrooms, utilised by multiple age ranges. Figure 6.5 show snapshots to the layouts of ICT learning zones in cases B_1 and A_3 respectively.

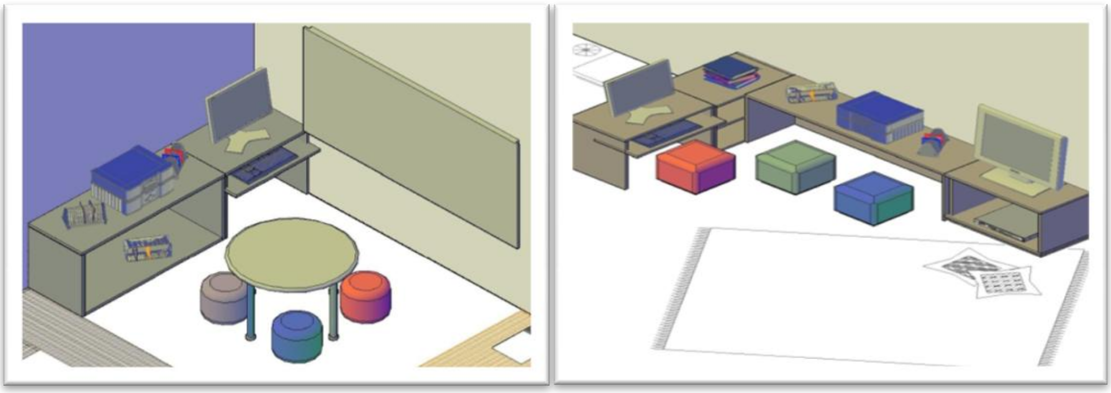


Figure 6.5 Snapshots of the ICT zone situated in the learning environment of case $B_1$and A_3

Generally speaking, most of the observed playrooms tended to have their own facilities assigned to each teaching space, reflecting greater investment and prioritisation in a range of ICT tools:

> ‘We have two or three playrooms, every playroom have their own computer, their own printer, their own SMART board. In addition to that there are a number of cameras, each playroom probably has three of four cameras on hand and there is a small card printer for each of the cameras’ (HT, B_1)

Access to separate ICT facilities in the nursery, such as computer laboratories occurred in all four Saudi pre-schools. This access to wider facilities allowed for 1 computer: 1 learner. These facilities were often well maintained in those cases that formed part of primary or extended schools and had technical support from the primary or secondary IT staff. In the two Scottish cases only B_1 had access to a Media Suite in its adjoining primary school once a week.

> ‘I'm quite happy the way it is, because we have use of the media suite on a Tuesday.’ (T2-B_1: FG)

> ‘We have good access in the school […..], and we have the media suite. So, some of them who are going to school, it will be familiar to them already.’
> (T2-B_1: FG)

There is limited research on the position of ICT tools, whether in the playroom or in a media suite (e.g. NAEYC, 1996; Davis & Shade, 1994); there is a general consensus in the literature that ICT use is most productive as an integrated tool within the playroom rather than being considered discretely. Such an approach is much easier to integrate appropriately into various activities across the curriculum. Yet, the enthusiasm from both teachers and children for the dedicated media suites was obvious through observation and in interviews. As teachers reflected:

> 'The majority of the children really enjoy it [...] there are a lot of computers there as well, and a SMART board.' (T3-B_1: FG)

> 'On the day that children have an IT class where they go to the computer lab it is like a celebratory day for them, and they are extremely happy that they are going to the computer lab.' (T3-A_4: FG)

In both contexts children often considered using the media suite as one of the highlights of the week; once there, they would learn collaboratively and impressively. Teachers would often introduce the learning topic to be covered in the suite for five minutes or so at the beginning of the class and then after this instruction it was clear that the children were in control of their learning. In most of the cases, as well as in A_2 and A_4 where the preschools were in partnership with International software companies, the computer software was pre-loaded by teachers and they would often pose literacy or numeracy problems. At times, children were given options of different pre-loaded programs to select.

The layout for the computer lab in A_2 is represented in figure 6.6. There were 24 computers in lab A_2 but between 12 and 15 desktop computers in A_4. In the latter case the computers were arranged on low tables with seats for children in mind.

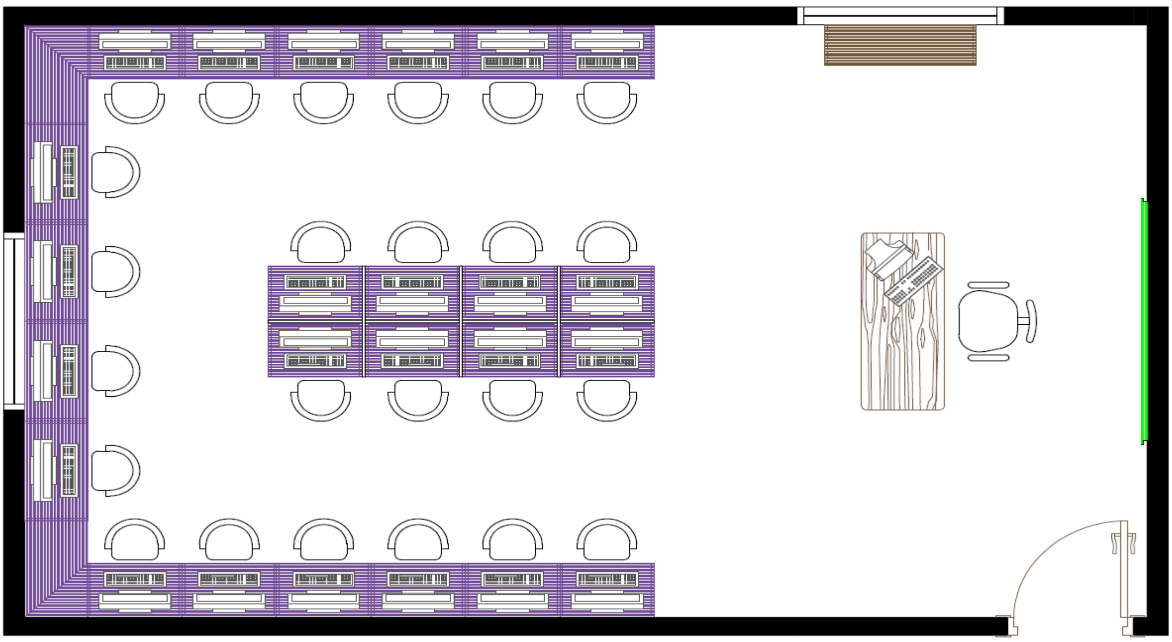


Figure 6.6 Floor plan for the computer lab observed in Case A_2

However, in A_2, A_3 and B_1 the layout was for adults in terms of the furniture size and position; children were sometimes observed to stand on the chairs and smaller children's feet often did not touch the ground. Such use may therefore carry health and safety issues. Outside of the media suites, ICT resources, such as the LCD and overhead projectors and other audio-visual equipment, were not always accessible to teachers (A_1, A_3, B_1 and B_2) as they were usually held in a central location, such as the pre-school library (A_1), and shared out between teachers, thus requiring advanced planning and coordination with peers. For example, one nursery (B_1) had only one IWB available, and it required coordination and planning from staff to access. Nursery B_2 was the least resourced out of all the cases; it had to share ICT tools with a sister nursery, requiring again substantial planning.

With regard to such issues, playroom practitioners cannot control how well their preschools are resourced; these factors are not decided at the micro-level but are the result of decisions made at the meso-, exo- or macro-ecological levels. Such factors, including playroom size and preschool philosophy, do influence ICT integration, something considered more closely in chapter 7.

Most of the examples discussed and observed in the study occurred indoors. However, on a few occasions in Scotland, in cases B_1 and B_2, ICT was used productively outdoors. Tools like digital cameras, programmable toys and metal detectors were observed examples. This was to be expected as outdoor play is one of the focuses of the Scottish curriculum and is part of the HIME standards (HMIe, 2007). In particular, children on one occasion in case B_2 were encouraged to play with and explore the use of programmable toys and remote control cars in the nursery garden and this was observed to motivate them to engage with technology enthusiastically. Providing outdoor unstructured play with ICT tools enhances a holistic approach to learning that should be encouraged in the Information Age.

Playing with ICT outdoors can be extremely motivating for learners in terms of sharing, exploring and problem solving, and it can add to learning in ways that were not previously possible (Price, 2009; Morgan & Siraj-Blatchford, 2009). For instance, in B_1 it was reported that children took cameras and video cameras with them on fieldtrips to document their journeys to Edinburgh Zoo and Hamleys Toy Shop in Glasgow. Such activity can develop child learning in various ways, starting from learning how to handle the camera safely, then becoming familiar with it. Once indoors children attached a camera to a computer, selected photos they liked, printed and displayed them, and discussed the contents. Examples such as those observed in cases B_1 and B_2 suggest that the outdoor potential of ICT is being gradually discovered.

Conversely, no reference to any use of ICT in outdoor activities was witnessed in the four Saudi preschools. As outlined in the daily routine section, there is general play outside in the Saudi curriculum; on observation, however, this did not extend to ICT. Learning technologies are often dissociated from outdoor practice given that they are electronic, some may require connection to power sources, and may not be considered robust enough to withstand the hot outdoor environment in Saudi (particularly in summer). Importantly, Saudi practitioners did not conceive of ICT as an outdoor tool at all. However, with certain tools, such as programmable toys, the benefits for explorative learning, motivated and enthusiastic play are clear if contextual circumstances allow for it (Price, 2009).

6.4.3.3. Kinds of Activities

Usually, approaching activities in ECE means choosing between *structured* or *unstructured* activities and *group* or *individual* activities, as described in the preschool daily routine section (see section 6.4.3). ICT was used in both structured and unstructured activities distributed throughout the daily routine. However, there was a significant difference in the kind of activity linked with ICT in the six case study nurseries. For instance, in cases A_1 and A_3 ICT tools were used mostly by teachers in structured activities, when child group activities occurred at circle time and at the end of day meeting (e.g. story time). Cases A_2 and A_4 followed a more balanced approach where ICT tools were used in both structured and unstructured activities (i.e. free play periods) by both teachers and children. In cases B_1 and B_2, ICT resources were used intrinsically within free play periods rather than during structured activities initiated by the practitioner such as circle time. This reflects the CfE's emphasis on active and explorative learning rather than structured activity. ICT use was observed in this study at various times throughout the day in Scottish nurseries rather than associated with a regular time slot.

Playroom scenarios

Teacher-led structured activities or free play/unstructured activities vary depending upon the size of the group being taught (individual, small or large group, whole class) and the types of ICT being used (e.g. computer software, programmable toys, or communication tools). Table

6.6 is adapted from UNESCO (2010); it describes and reflects upon the benefits and shortcomings of a range of structured scenario sizes and also provides examples from the cases.

Table 6.6 Characteristics of two types of playroom structured activities scenarios according to size of the team of children

Playroom Scenarios					
Big Team Scenarios (from six to ten children or up to half of the class)					
Type of Activity	**Category of ICT**	**Case Study**	**Advantages**	**Disadvantages**	**Observations and reported use**
Structured Activity e.g. circle time period End of day meeting e.g. Group play	Informational tool e.g. Internet Tools for constructing e.g. IWB or Programmable toys Tools for discovering and exploring e.g. digital microscope Tools for recording and communication e.g. digital camera or video camera	B_1 and B_2 A_2 and A_4 B_1 and B_2 B_1 B_1 and B_2	A high level of collaboration is presented amongst the children. Mutual supports helped to increase concentration levels although cognitive skills vary between children. A rich variety of ideas, plans and suggestions occurred on how to solve tasks. A teacher organised the class into two halves where they took turns in the work with ICT. More complex outcomes were possible when children were given enough space for self-realisation.	A large team means less time for each child to share the ICT tool. As a result they work for a short time but observe other children for longer. Complementary activities need to be designed alongside the ICT use. Two teachers are required if the large group has two tasks to carry out at once.	Children should see the results immediately after the activity they were engaged in. e.g. images downloaded from the Internet or photos they took using the camera, etc. Various forms of guided interaction occurred. Teachers helped children in finishing of the product of the activity (printing out images or downloading photos from the card printer and this was in close collaboration with the children. Teachers displayed the work for weeks or showed it to another group of children over the end of the day meeting to meet the pupils' satisfaction with the finished product. Children assist in different ways e.g. by choosing photos for the theme portfolio or recording comments and voices for a movie presentation. All options should be considered.

In free play periods in B_1 and B_2 children took turns on the equipment; queues for the ICT tools were long at times but well managed. On occasion, though, some of the tools went unused. On rare occasions, some learners avoided using technology in the playroom all together:

> ‘They maybe have it in the house, so when they come to nursery they don't want to look at it, it's not that they are not interested in it; it's that when they come to nursery they don't want to look at it’ (T2-B_1: FG)

Alternatively, one teacher commented:

> ‘I suppose, if there are things out—not just thinking about the computers but the remote control toys—or if the light boards are out then children will experiment with [them] all day’ (T3-B_1: FG)

A balance has to be kept with technology use. At times, practitioners felt children needed supervision:

> ‘They just want to sit in front of the computer and click away all day’ (T1-B_2: FG)

But one teacher continued:

> ‘We have [...] an egg timer. So they know that’s their time up’ (T2-B_2: FG)

Children at free-play, mostly, can choose what to do and when to do it, and so different patterns of children’s engagement with ICT were observed during such periods.

Section 6.5.2 contains examples of such activities: exploiting various environments and categories of ICT, and different sizes of teams for children. Table 6.6 provides short characteristics of two types of scenario according to team size.

Whole Playroom Scenarios (whole class which may be up to 20 or depending on the country and other condition					
Type of Activity	**Category of ICT**	**Case Study**	**Advantages**	**Disadvantages**	**Observations and reported use**
Structured activity e.g. Circle time period End of day meeting e.g. Rhyming and story time	Informational tool e.g. Data Projector Tools for constructing e.g. IWB Tools for discovering and exploring e.g. digital microscope	A_1, A_2, A_3 and A_4 A_2, A_4 and B_1 B_1	Whole-class approaches helped children to collaborate, take turns, share opinions, emotions and respect pre-set rules and principles. Sharing technology helped learners achieve this. Only one teacher was normally required to use the technology to show the whole class. The teacher was focused on both preparing and delivering one activity.	There were high demands on the teacher to organise an entire class in a productive and flexible way. The task was more teacher-orientated and keeping the children's attention required a high level of pedagogical skill to manage the whole group. The activities were organised around educational aims and perhaps limited child self-expression. The activities sometimes were led by the strongest learners and the teacher needed to make sure each child played a role and needed to guarantee fair sharing of ICT among all. Some teachers were not willing to do that.	Whole-class activities make it difficult to monitor each child's cognitive development and are at times hard to control. Different sub-groups form amongst the children and they join together in groups to work in parallel on the problem. The children are motivated by praise but this may cause an inadequate level of competitiveness between children that is not helpful. The child should be shown that winning is not important. The aim is collaboration, support and communication rather than just completion.

A balance has to be kept with technology use. At times, practitioners felt children needed supervision:

> 'They just want to sit in front of the computer and click away all day' (T1-B_2: FG)

But one teacher continued:

> 'We have [...] an egg timer. So they know that's their time up' (T2-B_2: FG)

Children at free-play, mostly, can choose what to do and when to do it, and so different patterns of children's engagement with ICT were observed during such periods.

Section 6.5.2 contains examples of such activities: exploiting various environments and categories of ICT, and different sizes of teams for children. Table 6.7 provides short characteristics of two types of scenario according to team size.

In free play periods in both cases B_1 and B_2, it was seen that children took turns on the equipment in a proper way, following nursery rules; queues for the ICT tools were long at times but well managed. On occasion, though, some of the tools went unused in construction, role play or outdoor activities:

> ‘You’ll find that some children shun it [ignore it] for maybe half a year, and then get interested later, because there’s lots of things about’ (HT, B_1)

On rare occasions, some learners avoided using technology in the playroom all together, perhaps due to the amount they are exposed to at home:

> ‘They maybe have it in the house, so when they come to nursery they don't want to look at it, it's not that they are not interested in it; it's that when they come to nursery they don't want to look at it’ (T2-B_1: FG)

It is difficult, however, to assign general reasons to individual choices:

> ‘It depends on the child. Some children wouldn't go near it [ICT zone]’ (T3-B_1: FG)

Another teacher continued:

> ‘I suppose, if there are things out—not just thinking about the computers but the remote control toys—or if the light boards are out then children will experiment with [them] all day’ (T3-B_1: FG)

Naturally, a balance has to be kept regarding technology use; at times practitioners felt this wasn’t the case:

> ‘Oh they might just want to sit at the computer all day; they just want to sit in front of the computer and click away all day’ (T1-B_2: FG)

One teacher continued:

> ‘But we have a timer, an egg timer. So they know that’s their time up’ (T2-B_2: FG)

Children for most of their time in the preschool, can choose what to do and when to do it, so for that reason very different patterns of children’s engagement with ICT resources were observed during the free play period. Once again, the reader is referred back to section

6.5.2 which contains many examples of all sorts of activities, exploiting various environments and categories of ICT, and different sizes of teams of children for further analysis. Table 6.9 provides short characteristics of two types of scenario according to different sizes of team of children. It describes and reflects upon the benefits and shortcomings of a range of scenario sizes and also links it to a pertinent example from the cases under consideration here.

Table 6.7 Characteristics of two types of playroom structured activities scenarios according to size of the team of children

Playroom scenarios					
Single child scenarios					
Type of Activity	**Category of ICT**	**Case Study**	**Advantages**	**Disadvantages**	**Observations and reported use**
Free-play period e.g. ICT zone within the playroom or Computer lab	Tools for constructing e.g. IWB or computer and educational software Tools for recording e.g. tape recorder or CD player	A_2, A_4 and B_1 all six cases all six cases	Individual work of a teacher and a child provided additional contribution to child's learning. Particularly beneficial when teachers used guided interaction. This approach helped teachers gain knowledge: ▪ To adapt the ICT tool to better suit the child's needs ▪ To set task difficulty levels for the child ▪ To better integrate ICT use into the child's general learning goals.	Working with a single child is problematic as teacher needs to manage all of the class simultaneously. It is a challenging task and requires more than one teacher and/or teaching assistants. Too much solo-learning in some cases e.g. A_1 and A_3 infringed a child's inclination to share tools, understand the needs of others and/or compromise. A large amount of resources was required. Limited resources were problematic in some cases such as A_1 and B_2.	Teachers became familiar with the personalities of learners. Children got used to advanced features of ICT such as painting program toolbar e.g. undo function, cleaning up, etc. Single child scenario gave teachers opportunity to closely consider the developmental appropriateness of ICT tools use.

Small team scenarios (from two to five children)					
Type of Activity	**Category of ICT**	**Case Study**	**Advantages**	**Disadvantages**	**Observations and reported use**
Free-play period	Informational tool e.g. using the Internet in a child-led activity Tools for constructing e.g. IWB or Programmable toys Tools for discovering and exploring e.g. digital microscope Tools for recording and communication e.g. digital camera or Tape recorder and CD player	B_1 and B_2 A_2, A_4 and B_1 B_1 and B_2 B_1 B_1 and B_2 All six cases	Children may learn collaborative skills and build peer and team relationships. Children were given space to self-express in comparison to big group and whole class scenarios. Children watch and learn from each other, as well as share resources. This allowed for a child-initiated and child centred approach. Teachers step back but maintain fair amounts of use between children while also getting a close send of their different levels of ICT use. Most scenarios were complex and class-wide where different groups take turns playing different roles or parts.	Short activity lengths of 20-30 minutes may not allow children sufficient time to interact properly. Activities may need to be repeated often as a result. Children are asked to learn to communicate with others as well as to learn how to play with the ICT tool. Teachers need to invest more time and be more aware of communication issues to ensure this happens.	Teachers should allow the children to present outcomes from their collaborative work so that presenters and listeners may develop meta-cognitive skills and close team bonds. Children should wear coloured badges so it is clear which team they belong to in such scenarios. Conflict may arise amongst the children about the outcomes and this can be solved in most cases by using a democratic voting system.

In the Saudi context mostly whole classroom and big scenarios were observed and this indicates that the focus in teaching and learning was a teacher centred approach; one in which ICT was seen as a teaching and supporting tool. In the Scottish context the focus was different: it was mainly on ICT integration through the curriculum. ICT was seen as another tool to encourage and stimulate child learning through play, discovery and problem solving.

6.5. Discussion

The collection of snapshots of practice presented in this chapter illustrates how various categories of ICT were exploited in the learning environment of the six case study preschools. From a broad palette of different ICT resources it was evident that a narrow range of ICT tools was used in the six case study preschools. Some challenging categories or types of tools such as the IWB and programmable toys are overlooked or ‘undiscovered’ in some of the cases.

Teachers in the Saudi cases used a narrow range of ICT resources, mainly computers and a number of computer-based tools, such as the Internet, online information sources, LCD projector and PowerPoint. These were the predominant ICT tools used in cases A_1 and A_3. However, in cases A_2 and A_4, a greater range of ICT tools was used, extending to computers with educational software applications that were often mediated by IWBs. There was an absence of programmable toys in the four Saudi preschools. Practitioners from Scottish cases B_1 and B_2 favoured using digital cameras as a tool for evidence collection; yet, noticeably, computers and educational software were more highly utilized. Studies by Howard et al. (2012) and Plowman et al. (2010) note that despite the increasingly widespread range of ICT resources available for use in preschool settings, computers remain the most significant for many practitioners.

Although practitioners in both contexts appreciate that ICT can hold great learning possibilities for themselves and the children, their observed uses of resources appeared to act as an entry-level technology for inexperienced staff. For instance, audio equipment was frequently used to play rhymes and to listen to stories; however, there was little use of these resources for recording children’s voices, and some practitioners identified the listening centre, a cassette or CD player with headphones, as a long-established but underused resource. Also, television and video players were widely observed to be available in the six preschools case studies, but they were rarely integrated into playroom activities (this occurred namely in the Scottish cases, see section 6.4.2). The limited ICT practices found in this research reflect those reported in Howard et al. (2009); Keengwe and Onchwari (2009); Mama and Hennessy (2010); Plowman et al. (2010) studies. In the focus group discussions, practitioners from both contexts talked enthusiastically about digital cameras, valuing the opportunity for immediate taking of photographs for displays, to share special events or achievements and to keep records of children's progress. More specifically, practitioners from Scottish cases B_1 and B_2 favoured using digital cameras as a tool for evidence collection and as a mechanism for recording life outside the nursery, and in so doing bridged the gap with the external environment, and involved parents (see sections 6.4.2.1 and 6.4.2.2).

While digital cameras offer considerable advantages in terms of immediacy and future use of images, observations revealed that digital cameras were still mostly used in an informational way that was not child centred. The instances where children were observed making use of this tool were limited. Practitioners in both contexts were much less likely to use DVDs, video cameras to record their observations of children, and build electronic profiles or create and edit material on the computer. Furthermore, only a minority reported that they were downloading, editing and printing photographs and playing back videos they had recorded. Plowman et al.'s (2010) findings related this limited use of cameras to the fact that they were seen by practitioners to be costly, not only for the initial purchase, but also for printing and batteries. Similar cost issues were reported in this research project regarding the use of both computers and digital cameras, as staff needed to find money in their budgets for printing costs, particularly when children were enthusiastic users of art and drawing programs. Staff also mentioned other practical drawbacks, including the facts that cameras were too heavy for young children and headphones were too large.

The findings from this research appear to support those from existing literature indicating that the use of ICT in ECE is influenced by the locations of ICT within the early childhood learning environment (O'Hara, 2008; Roberts-Holmes, 2013; NAEYC & Fred Rogers, 2012). This particular issue holds implications for how effectively ICT can be used in ECE to support children's learning and development. Through interviews and observations in the six cases it was clear that many ICT tools (e.g. computers, tape recorders, etc…) exist mainly as a part of other play materials rather than being in their daily activity or as a part of the curriculum. In most playrooms, the computers were only used during children's free playtime along with other play materials that were arranged in advance for children's play (see section 6.4.3.2). Therefore, the computers served one purpose: game playing. Simply installing a computer in a centre does not necessarily lead to an ICT culture supportive of children's learning (Fischer & Gillespie, 2003; Keengwe & Onchwari, 2009). ICT tools were placed in these playrooms as an add-on or extra resource for children to play with rather than serving as an educational tool that helps children and teachers achieve their educational and personal goals (Ramsey et al., 2006).

There is a general consensus in the literature that ICT use is most productive as an integrated tool within the playroom rather than being considered discretely (Can- Yasar et al., 2012; Davis & Shade, 1994; Kandir et al., 2010; NAEYC, 1996). Using such an approach also allows the easier integration of ICT appropriately into various activities across the curriculum. Yet, the enthusiasm from both practitioners and children for the dedicated media suites was obvious through observation and in interviews. Access to separate ICT facilities in the preschool, such as computer labs and Media suites proved to be advantageous and helped children to learn collaboratively and impressively (see section 6.4.3.2).

The integrated use of ICT in ECE playrooms is defined as using ICT in any number of ways in which technologies could support instruction in a wide variety of curriculum areas (Lake & Jones, 2012; Stephen, 2010). ICT can be meaningfully integrated into playroom projects and activities (Plowman et al., 2012). In examining ICT usage in the preschools playroom, it was clear that practitioners exhibited various instructional methods. Playroom observations revealed that practitioners in the two Scottish cases (B_1, and B_2) integrated ICT as both a teaching and learning tool in the pedagogical environment. ICT was often used in constructional, free play as a child-centred tool in the playroom, with small group or single child learning. It was very rarely used in structured activities for informational purposes or in whole-class scenarios. In very few instances practitioners were observed using computers and the Internet to support their own practice by seeking materials, downloading resources or using email. Whereas, playroom observations revealed a widespread focus on information-based and teacher-centred activities in the four Saudi cases. It was more common for ICT to be used in structured activities, involving the whole-class group, as a teacher-centred information tool.

Although the role of adult interaction is important for the development of young children learning, to enhance the benefits of ICT use for young children, cooperative use of ICT with peers is recommended (Medvin et al., 2003). Without an understanding of the varied benefits of ICT use for young children, early childhood practitioners may not realise that child-centred activities can also be used. Labbo et al. (2000) offered a variety of approaches and activities that practitioners can use to provide opportunities for child-centred activities and ICT. By providing a variety of opportunities across the day for child-centred ICT use, children learn to use ICT as a tool. They outline three kinds of engagement in which ICT could be used effectively: (1) thematically linked activities, planned to present key concepts in a variety of way; (2) spur-of-the moment activities that arose from play or conversations; (3) brief targeted moments when adult and child worked together. In terms of findings from this research's preschool cases, it is the first and third of these approaches that were observed in a small number of instances in cases A_2, A_4, B_1, and B_2. In some cases, ICT was used to add a different medium or stimulate children's interest and imagination. For example, in case B_2 one of the teachers was observed accessing the Internet with the children to search for information about frogs to meet children's interests. Elsewhere, in case A_4, extracts of downloaded YouTube videos were used to inform children's knowledge and experience of natural phenomena (e.g. storms, lightning, thunder, rain, floods, etc…) and offering opportunities to encourage children to reflect on their own personal experience, give expression to their feelings and process the emotional events.

Having a computer centre/ ICT area in the playroom and effectively integrating ICT in ECE requires more practitioner input than other learning areas such as role playing, blocks or reading (Stephen & Plowman, 2008). Sociocultural theories of learning, such as those of Vygotsky (1978) and Burner (1977) discussed in Chapter 3, point to the essential contribution made by adults. Practitioners know what interests children, understand what they can do alone and with help, and interact with them in a responsive manner. For example, in all cases the practitioners arranged the role playing area at the beginning of the semester, and they allowed children to play alone or with peers in those areas. They rearranged, added or removed some of the toys in those areas during the semester. Playroom observations in all cases showed that the role play area was the most visited area in playroom. All the practitioners treated the computer centre/ ICT area in the playroom the way that they treated any play area in their playrooms. However, the computer centre/ ICT area was quite different from traditional early childhood learning areas because it required constant practitioner time and input. In order to run a computer centre/ ICT area effectively, Lesisko et al., 2010 stress on the importance of good planning before integrating the use of ICT in ECE learning environment. Thus, practitioners need to select appropriate ICT resources, suitable software, frequently assist children and maintain devices (Keengwe & Onchwari ,2009; Mama & Hennessy, 2010).

Practitioners' role, attitude, knowledge and understanding play an important role in ICT use in ECE (Brooker & Edwards, 2010; Morgan & Kennewll, 2005). The success of technology in educational settings does not rely totally on having the latest hardware, graphic software, multiple peripherals and a colour laser printer. All the gizmos and the gadgets in the world operating in tandem cannot work miracles by themselves. 'It is people who make technology powerful' (The alliance for technology Access, 1996: 8). It is well recognised that the teacher is central to the successful integration of ICT usage into the ECE playroom (Can-Yasar et al., 2012; Jonassen et al., 2008; Stephen & Plowman, 2008). Findings show that it is teachers' various misunderstandings of what constitutes ICT and the pedagogical complexities of using ICT, that provide the first explanations as to why the Saudi teachers frequently used such a narrow range of ICT tools in information-based and teacher-centred activities. Teachers' pedagogical knowledge and culture shape their use of ICT in the classroom and they are likely to adopt practices with ICT that reflect their knowledge and beliefs about teaching and learning (Ertmer & Ottenberit-Leftwich, 2010; Hermans et al., 2008; Ruthven et al., 2004). The use of ICT as a facilitating and supporting tool was something they valued highly and this once again explains why the use of ICT tools in whole-class scenarios was the predominant type of activity observed.

According to a number of studies on the use of ICT in early years in Scotland (Plowman & Stephen, 2006; 2007; Plowman et al., 2010; Stephen & Plowman, 2003a; Stephen & Plowman, 2002a;), factors linked to such limited constructivist practices in the Scottish preschools include the training routes and the poor record of continuing professional development which affected preschool practitioners' confidence in their level of competence, particularly when engaging children in learning with ICT or using ICT to enhance practice. The factors that influence the observed practices in the Scottish cases have already been discussed in the literature review where a range of pertinent studies in the field are covered (see Chapter 2). However, as mentioned, the literature on the factors that influence Saudi teachers' ICT practices is very limited (Al-Dayel, 2009; Al-Shoaiby, 2010; Al-Showayer, 2006; Hammed, 2011).

Therefore, to address this gap in the literature, and after describing fully the current practices with ICT resources in the Saudi cases, the intent in the next chapter is to identify and examine the critical factors that influence the process of ICT integration into the four Saudi cases. Drawing from the perspective of the adopted ecological framework, the critical focus is upon (1) Factors at the meso level of the ecosystem (preschool characteristics); (2) Factors at the micro level of the ecosystem (teacher characteristics). After this closer analysis of the Saudi context, which will also draw from the Scottish context where appropriate in highlighting key factors and issues, it will be possible to present a series of insights for international practitioners, ones that are based on the experiences with ICT integration of both case countries.

Chapter 7

Factors Influencing ICT Integration into ECE

Chapter outline

Chapter Seven

Factors Influencing ICT Integration in ECE

7.0 Introduction

In the chapter that follows, factors influential to practitioners' integration of ICT into the playroom are explored based on triangulated data that has been assembled from the case study preschools. The factors were identified from a multilevel perspective to address research objective two (RO2) and its two sub questions:

RO2. To identify the factors that either help or hinder ECE practitioners integrate ICT into ECE in Saudi Arabia.

RQ3. What are the important teacher characteristics that influence ICT integration?

RQ4. What are important preschool characteristics?

The findings are presented under three key themes: (1) Teacher or individual factors at the micro-level; (2) Preschool level factors at the meso-level; and (3) External factors (outside preschools at the macro level). This arrangement, moving from micro to macro levels, is aimed at focusing first on the main unit of analysis in this research which is practitioners, i.e., the dominant species in the ecosystem.

The findings are presented in the first part of this chapter in a linear manner to prepare for the fuller discussion to come in the second part. The factors are presented throughout this chapter to align with the research questions and in a multi-level manner that reflects the adapted ecological framework. At the end of the first part of this chapter there is a brief summary of these linear factors. A discussion then ensues at the end of the chapter; one which charts the transition from considering these as linear to more complex factors; this is an argument that again is focused through the adapted ecological perspective and argues that complexity thinking is key to understanding ICT integration. The discussion therefore provides a micro (species), meso (ecosystem) and macro (system) level of understanding of the factors that influence practitioners' integration of ICT into the ECE playroom.

7.1. Teacher or Individual Factors at the Micro-level

From the data, six potential factors at the micro-level may be identified in relation to the practitioner as the dominant species in the ecosystem: (1) beliefs concerning ICT integration; (2) attitude towards ICT integration; (3) confidence in using ICT; (4) level of competence; (5) teachers' knowledge and understanding; (6) the influence of teachers' background and skills on their confidence in ICT use. Figure 7.1 depicts the factors and sub-categories emerged from the data.

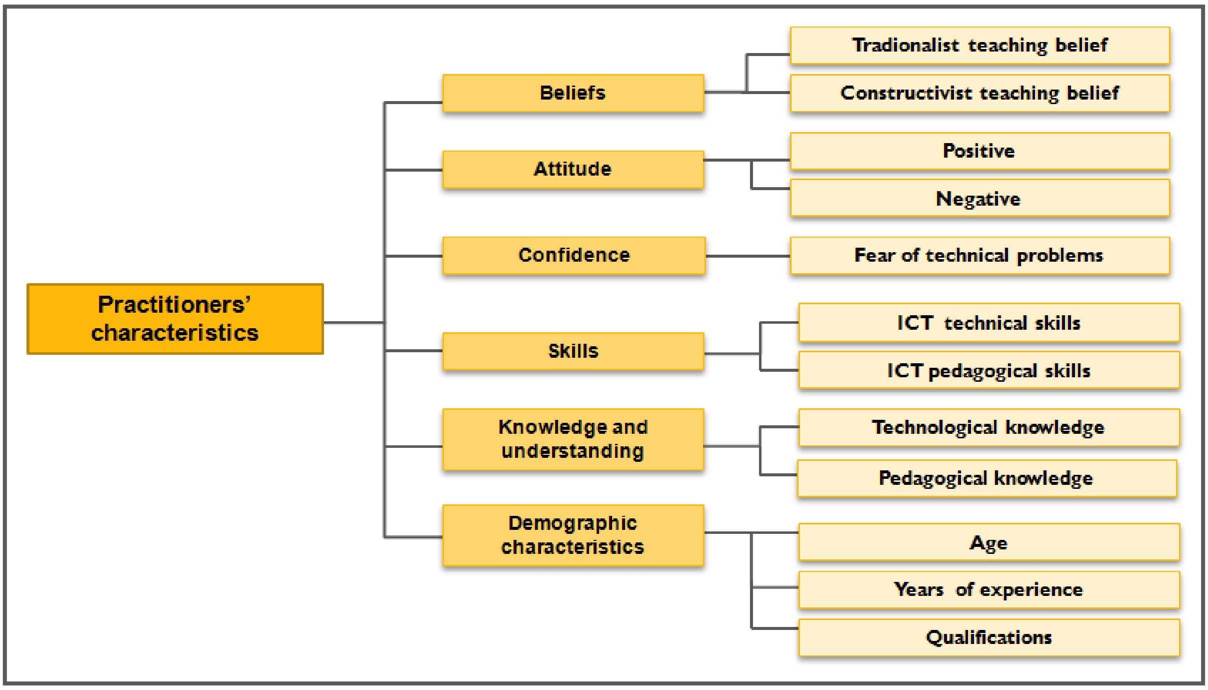


Figure 7.1 key themes and sub-themes emerged in relation to RQ3: Factors at the teacher/ individual level

7.1.1. Teachers' Beliefs Regarding ICT Integration into ECE

Teachers were driven to integrate ICT into their teaching according to two central rationales from the macro-system, exo-system and meso-system: (1) external rationales that come from society at large; and (2) internal rationales that come from within the education sector itself. Table 7.1 shows that almost all of the teachers surveyed (98%) believed they used ICT in their teaching because of internal rationales such as benefits to pupils, teachers and the teaching and learning process.

Table 7.1 Reported rationales for ICT use in teaching, frequencies and percentages, Saudi =64

Rationale For ICT use [a]	Responses*		Percent of Cases
	N	%	
To keep abreast of advancement in technology	61	11%	95%
To catch up with developed nations	53	10%	83%
Change of activity routine to maintain interest	62	12%	97%
Make use of available equipment	58	11%	91%
Method for improving and developing teaching	63	12%	98%
Its use is a symbol of modernisation	57	11%	89%
Pressures to change from pupils, teachers, and parents	7	2%	11%
Effective method to convey information	61	11%	95%
It is the era of technology use; the illiterate one is the one who does not know how to use ICT	55	10%	86%
Professional way of teaching	59	11%	92%
Other	5	1%	8%

a. Dichotomy group tabulated at value 1
*Number and percentages of teachers responding for each category in the form of multiple responses

From the table, the majority of teachers' responses on given rationales was relatively consistent. There was a belief in the equal importance of internal and external influences (Selwyn et al., 2010). The data that was extracted from questionnaires concurs with data from teachers' interviews. This was reflected in teachers' responses during the focus groups where, for example, they expressed that 'Using ICT […] can be a support to ECE, so a child can become adaptable in the technological era' (T2- A_1: FG).

Teachers also believed that ICT is already surrounding children in their everyday life, which is reflected in one teacher's comment from A_4:

> 'It is very important for the children at the early years' stage to use technology as it exists already in their surrounding environment on a daily basis […].'
> (T1- A_4: FG)

Practitioners felt that children were 'digital natives' (Prensky, 2008). There is an external rationale that technology use in preschools reflects this situation. An HT commented that,

> 'Whether we like it or not ICT is part of a child's life and environment […]. It is better to find out how to integrate it into ECE effectively'. (HT, A_1)

It is the preschool's role to support young learners' in the Information Age, to extend domestic experiences of ICT, and to link home experience with preschool activities (Stephen et al., 2010).

It was also believed that children should experience ICT in ECE in a way that prepares them for later years' schooling. Reflecting this belief, which is founded in a societal rationale for use, some teachers from case A_2 and A_3 commented:

> '[ECE] is similar to the seed you plant and start to grow and its growth should continue throughout the other educational levels. This will not happen if there is no continuity' (T4- A_2: FG)

> 'I believe that the beginning should be from preschool because ICT is available and active at other school levels, starting from primary school onwards. It is a necessity in ECE as long as it is an integral part of education in general'
> (T2- A_3: FG)

At times practitioners saw ECE as the first step towards a path that would lead eventually to working life. The early learners of today would be part of the technologically literate workforce of the future:

> 'Early preparation, child-readiness, and providing the child with the basic essential skills and background are important at this early stage […]. Those children are the adults of tomorrow' (T2- A_1: FG)

This resonates with the literature reported on ECE teachers who see nurseries as 'places where children as workers of the future are educated' (Holloway & Valentine, 2003). The external rationales coming from the meso- and macro-systems remind educators that children must be socially prepared for tomorrow.

External rationales coming from the macro-system may also have a nationalistic aspect. Technology integration into the early years is not mentioned in the Saudi national ICT policy or the national ECE curriculum (Samadi & Marwa, 1991; MoE, 2005b); however, unexpectedly, the national imperative to keep Saudi ICT use abreast with developed countries was something that the large majority of teachers felt strongly about (83%).

Global competition at the macro-level has been a driving force behind the prioritisation of ICT in Saudi preschools. Globally, nearly every developed country, and indeed many developing countries, now has a detailed 'educational ICT strategy'. However, the Saudi example suggests that other factors aside from policy, such a teacher beliefs and societal influences, have a significant influence over how ICT is integrated at the micro-level of the playroom. This is a global issue and one that affects Scotland, where 'some practitioners remain ambivalent about the value of ICT for their practice, despite its use being endorsed by policy' (Plowman et al., 2010: 62).

In terms of how internal rationales impacted teachers' beliefs in Saudi, the majority indicated that ICT had a positive impact on both **their teaching** and **pre-schoolers' learning** (80%). As shown in table 7.1, the most frequently mentioned internal rationales favoured by over 90% of the teachers were: (1) using ICT as a method for improving and developing teaching, (2) using it to change the activity routine to maintain interest, and (3) using it is an effective method to convey information.

Evidence for the numerous ICT benefits reported by practitioners is presented in chapter 6. Those snapshots of practice illustrate how practitioners used ICT for teaching and learning. The results suggest that teachers either perceived ICT as an informational tool or as a constructional method of teaching and learning.

When teachers understood ICT as a constructivist tool this influenced their practice greatly, but such examples were rarely observed. In one instance, in case A_4, a small group of children, with support from their teacher, were researching information on specific themes, such as the 'Recycle Bin Process'. This process progressed into a collaborative PowerPoint presentation. In another example, this time observed in case $A_{2,}$ children were seen searching for information on 'People around the Globe'. Pictures, figures and information generated from the search process were presented in a wall magazine, created by the children, and presented on one of the preschool bulletin boards. In another case, one teacher mentioned:

> 'We can encourage children to participate in activities through asking the child to search for specific information at home so as to bring information back into the nursery and present it to fellow pupils' (T4- A_1: FG)

The aforementioned examples show how the use of ICT resources such as the Internet can fit neatly with the constructivist view. ICT can open up education 'beyond the four walls of the classroom and link learners to other sources that can support and mediate effective learning' (Gee, 2005). A constructivist use puts the child at the centre of the learning process. This supports the ‘choice concept’ pedagogical rationale for ECE where learners are encouraged to pursue their interest and inclination (Selwyn, 2011).

The majority of teachers viewed ICT as an informational tool, believing it to be only a supporting tool:

> ‘ICT, for me as a teacher, is an assistive or supporting tool but not the core tool.’ (T1- A_4: FG)

> ‘[ICT] can become a supporting tool for specific times to support the educational situation if needed. Searching for information, expanding on an issue and encouraging children to do such things is a benefit.’ (T4- A_1: FG)

In the ecosystem of the playroom, the dominant species, teachers, had a tendency to teach *with* ICT rather than to teach the *use* of ICT; in other words, teachers did not often enough support children to learn both *with* and *through* ICT. This was symptomatic of teachers’ ‘traditionalistic belief’ regarding technology that they are the centre of the teaching and learning process:

> ‘What is principal and important is the teacher as she is the engine of the educational process, while the learning tools available in the learning environment support the teacher to deliver the vast share of the information to children’ (T1- A_4: FG)

There was a pervading idea that ICT is an ‘add-on’ and a number of teachers still considered ICT as a new addition or ‘species’ to the playroom.

The previous chapter (section 6.5.1) reported that teachers in the Saudi cases used a narrow range of ICT resources such as the LCD projector, PowerPoint and the Internet in their practices. Pedagogical beliefs provide the first explanation as to why the Saudi teachers used such a narrow range of ICT tools frequently in information based and teacher-centred activities, in particular in cases A_1 and A_3. More complex ICT tools such as the IWB, ones which are associated with student-centred, constructivist approaches, were used rarely. A number of studies have associated traditionalist beliefs with having a negative impact on practices with technology (Hermans et al., 2008); in turn, this can be associated with low-level ICT integration (Ertmer, 2005; Tondeur et al., 2008c).

7.1.2. Teachers' Attitudes towards ICT Integration into ECE

Researchers have found that beliefs determine a person's attitude (Bodur et al., 2000; Hew & Brush, 2007). Practitioners' positive beliefs influence their attitude and decision to use ICT (Sime & Priestley, 2005; Gialamas & Nikolopoulou, 2010). In the Saudi cases, too, positive beliefs informed a set of attitudes that affected practice with ICT in the ecosystem of the playroom. Beliefs have been described as 'the cognitive components of attitudes' (Gialamas & Nikolopoulou, 2010) and, as the researcher address here, teacher attitudes towards technology are another major factor affecting ICT integration (Hermans et al., 2006).

To gauge the ***attitudes*** [12] of teachers towards ICT integration into education, all the preschool teachers read through thirty attitudinal statements and then indicated, using a 5-point scale, how much they agreed, from *strongly agree* to *strongly disagree.* Percentage results are reported in table 7.2-a. In computing the data for positive attitudinal statements, strongly agree was coded 5, agree was coded 4, neutral was coded 3, disagree was coded 2 and strongly disagree was coded 1. For negative attitudinal statements, the code scale was reversed, meaning that a high average score in both types of statement reflects a positive attitude.

The vast majority of practitioners showed an interest in knowing more about ICT (97%) and expressed no fear of using it (73%). Positive statements generally achieved a high agreement percentage and the majority of the negative statements generally gained a high disagreement level. For statistical clarity, two new variables were computed: one for the median of positive statements and one for that of negative statements. The results show that Saudi teachers strongly agree with statements of positive attitude (4.5) and disagree with those showing a negative attitude (1.9), which again reveals a positive attitude towards ICT.

Table 7.2-a Teachers' Attitudes towards ICT use in ECE (Saudi Arabia, n=64)

Statements	n (%)					
	St. agree	Agree	Neutral	Disagree	St. disagree	Overall Attitude
"I'd like to know more about ICT"	43(67)	19(30)	1(1.6)	1(1.6)	0(0)	St.agree
"ICT scares me"*	2(3.1)	7(11)	8(13)	31(48)	16(25)	Disagree
"ICT is an information source for my teaching"	39(61)	24(38)	1(1.6)	0(0)	0(0)	St.agree
"I don't know what I would do without ICT"	22(34)	30(47)	7(11)	4(6.3)	1(1.6)	Agree
"I manage information more effectively due to ICT"	32(50)	29(45)	2(3.1)	1(1.6)	0(0)	St.agree
"I wish ICT had never been invented"*	0(0)	3(4.7)	1(1.6)	19(30)	41(64)	St.disagree
"I find ICT helpful for non-work related tasks"*	3(4.7)	4(6.3)	3(4.7)	23(36)	31(48)	Disagree
"I find using ICT time consuming"*	3(4.7)	2(3.1)	1(1.6)	21(33)	37(58)	St.disagree
"Some children are scared of using ICT"*	1(1.6)	2(3.1)	3(4.7)	33(52)	25(39)	Disagree
"ICT makes my work easier"	31(48)	27(42)	2(3.1)	2(3.1)	2(3.1)	Agree
"I prefer using ICT when no one can see me making mistakes"*	0(0)	6(9.4)	18(28)	26(41)	14(22)	Disagree
"ICT makes children acquire new knowledge effectively"	33(52)	28(44)	3(4.7)	0(0)	0(0)	St.agree
"ICT reduces preparation time"	37(58)	17(27)	3(4.7)	7(11)	0(0)	St.agree
"Using ICT increases workload"*	2(3.1)	10(16)	6(9.4)	30(47)	16(25)	Disagree
"I find it easy to select appropriate ICT resources for my teaching"	23(36)	28(44)	5(7.8)	4(6.3)	4(6.3)	Agree
"I feel supported in my use of ICT"	26(41)	30(47)	8(13)	0(0)	0(0)	Agree
"Children can get distracted by ICT"*	1(1.6)	1(1.6)	7(11)	36(56)	19(30)	Disagree
"ICT helps me communicate with colleagues"	40(63)	21(33)	2(3.1)	1(1.6)	0(0)	St.agree
"ICT systems are slower than using a book"*	3(4.7)	4(6.3)	5(7.8)	30(47)	22(34)	Disagree
"Sometimes I feel disoriented by the information age"*	1(1.6)	7(11)	12(19)	30(47)	14(22)	Disagree
"ICT encourages children's team work"	28(44)	33(52)	1(1.6)	2(3.1)	0(0)	Agree
"I can never find any relevant ICT tool for my pupils"*	2(3.1)	1(1.6)	4(6.3)	29(45)	28(44)	Disagree
"ICT seems to motivate children to learn"	33(52)	31(48)	0(0)	0(0)	0(0)	St.agree
"ICT can cause limitations in teacher-child interaction"*	4(6.3)	7(11)	7(11)	34(53)	12(19)	Disagree

* Coding scale has been reversed to reflect teachers' responses on negative statements

Concerned with the micro-level of the playroom, the Technology Acceptance Model (TAM; see Davis, 1989) suggests that users formulate a positive attitude towards technology when they perceive the technology to be useful (PU) and easy to use (PE). Such beliefs are primary motivational factors for accepting and using new technologies (Teo et al., 2007). Practitioners' beliefs in the benefits of ICT motivated and encouraged them to integrate ICT into their daily practices; and accordingly, this personal motivation has influenced their attitudes towards ICT. As shown in table 7.2-a, teachers' responses in the questionnaire indicated that their positive attitude towards ICT is an outcome of their belief in the usefulness, benefits and possibilities it offers.

ICT for those teachers offered an ease of access to information (99%) and, when interviewed, many clearly believed that ICT could neatly present difficult concepts to children (see section 6.5.2. for how teachers used ICT for presentation purposes). As such, the great majority claimed that they manage to use information more effectively due to ICT (95%). Also, 'ease of use' was an important factor for teachers' attitudes where ICT could save them time and make their working tasks easier to carry out. Teachers clearly believed that ICT use could save preparation time (85%) and make their tasks easier (90%).

A range of factors has been found to affect teacher attitudes to technology, including their age (Tondeur, 2008), knowledge of technology (Yuen et al., 1999; Mukti, 2000), their qualifications and experience (Potosky & Bobko, 2001; Kumar & Kumar, 2003) and their training (Tsitouridou & Vryzas, 2003). In this case, there was, a highly significant difference for the qualification levels between those expressing different attitudes (p<0001). Higher levels of qualifications were more frequently found in those holding a positive attitude.

A range of factors has been found to affect teacher attitudes to technology, including their age (Tondeur, 2008), knowledge of technology (Yuen et al., 1999; Mukti, 2000), their qualifications and experience (Potosky & Bobko, 2001; Kumar & Kumar, 2003) and their training (Tsitouridou & Vryzas, 2003). In this case, there was, a highly significant difference for the qualification levels between those expressing different attitudes (p<0001). Higher levels of qualifications were more frequently found in those holding a positive attitude.

However, other evidence from the Saudi case reports demonstrates that the attitudinal picture was not constantly positive. In a number of studies from the literature, too, teachers tend to be less positive about the *extensive* use of ICT in the playroom and far less convinced about its potential to improve teaching in general (Cox et al., 1999; Zhao &

Cziko, 2001; Russell et al., 2003). Saudi teachers were sceptical in certain of their beliefs regarding ICT. They seemed uncertain in interviews about technology *replacing* existing methods and so the interviews clarified the questionnaire data. A selection of teachers from case A_1 and A_3 privileged traditional methods:

> 'We cannot ignore traditional methods such as using books and totally replace these with new teaching tools or modern teaching tools but it can become a supporting tool.' (T4- A_1: FG)

> 'With respect to ICT replacing traditional methods, from my point of view, I am totally against that and my answer is no. Yes, ICT has its benefits such as quick and easy access to a wide range of information, but still there are other issues that have to be considered.' (T4- A_3: FG)

It is clear that while there was a focus upon ICT as positively contributing to the teaching environment or ecosystem there were still some concerns about ICT integration. For instance, teachers from cases A_1, A_3, and A_4 felt that over-use or inappropriate use of ICT could lead to health problems for young children:

> 'Of course, it is not sensible to over use those devices throughout the day as this will be boring for the child. There are a lot of traditional tools that can attract a child' (T4- A_4: FG)

> 'If the child is overly exposed to such technologies at this early stage until high school then it may cause physical health issues' (T4- A_1: FG)

> 'I don't deny the number of skills and benefits the child will gain; however, there is a negative effect on health and physical growth' (T3- A_3: FG)

Communication skills were also felt to be threatened by poor use or over-exposure to technology:

> 'Verbal communication between the children, or between the child and the teacher, becomes less and the child tends to become more isolated' (A_1, T2, FG1)
>
> 'Over-exposing the child to technology might cause damage to his social communication skills. Moreover, he will only be a passive recipient'
>
> (T3- A_2: FG)

Comments surrounding this issue of communication demonstrate some of the contradictions between the quantitative and qualitative data that was collected. In the questionnaire phase almost three quarters of teachers disagreed with the statement that *ICT can cause limitations in teacher/child interaction* (72%). In turn, practitioners were more positive in the questionnaire than in focus group discussions.

A lot of teachers' comments, including those above, demonstrated little knowledge of recent literature on ICT that has the potential to dispel their worries. Reactionary statements were expressed, too, in case A_3:

> 'Some electronic games can expose children to violence and aggressive ideas or thoughts, so continuous direction and supervision from a preschool teacher is required.' (T3- A_3: FG)

Many of the negative responses related to a number of concerns about the disadvantages that ICT use may cause for children in the long run. Such issues are considered old-fashioned responses to technology, what has been called 'romanticizing the past' in the recent literature on ICT integration (Plowman et al., 2010). There is a lot of evidence that ICT integrates into ECE alongside a range of other activities if it is organised in a developmentally appropriate way (Siraj-Blatchford & Siraj-Blatchford, 2006; Rosen, 2009; McMains & Gunnewig, 2012) (see chapter 3, section 3.5.1).

7.1.3. Teachers' Confidence in Using ICT

Given these often outdated concerns, it was clear that practitioners were projecting their own anxieties about teaching with ICT in the playroom onto the tools themselves. Anxieties are related to a lack of confidence (Wozeney et al., 2006). As in table 7.2-a, a high number of teachers responded to the questionnaire that they *do not feel scared of ICT* (over 70%); however, a considerable percentage of teachers were actually anxious and unconfident about integrating or supporting ICT use in more child centred activities (see table 7.2-b). This became more pronounced in examples of actual practices provided by interviews and observations.

Table 7.2-b Teachers' Attitudes towards ICT Use in ECE (Saudi Arabia, n=64)

Statements	n (%)					
	St. agree	**Agree**	**Neutral**	**Disagree**	**St. disagree**	**Overall Attitude**
"I know the basics of ICT, but that's it"	2(3.1)	24(38)	9(14)	23(36)	6(9.4)	Neutral
"I feel I suffer from information overload"*	5(7.8)	19(30)	9(14)	20(31)	11(17)	Neutral
"I use ICT effectively myself but I'm not sure how to teach children"	3(4.7)	18(28)	17(27)	18(28)	8(13)	Neutral
"ICT is moving too fast for me"*	6(9.4)	20(31)	10(16)	23(36)	5(7.8)	Neutral
"ICT swamps children with information"*	32(50)	30(47)	1(1.6)	1(1.6)	0(0)	Agree
"The children are way ahead of me in their use of ICT"	29(45)	33(52)	2(3.1)	0(0)	0(0)	Agree

* Coding scale has been reversed to reflect teachers' responses on negative statements

A high proportion of teachers had concern for the children as well as for themselves, agreeing that *ICT can swamp children with information* (97%). In turn, teachers seemed to prefer to remain in their ‘comfort zones’ and were unconfident about employing a high-level, constructivist strategy of integration in the ecosystem of the playroom. Their enthusiasm was counter-acted by what Becta has termed a ‘persistence of beliefs’ (2004a; Veen, 1993) that continued to influence their attitudes towards ICT integration.

One reason for teachers’ anxiety over playroom uses of technology is the ‘newness’ of ICT, as a ‘species’ entering the micro-system of the playroom, which leads to concerns about teachers’ own self-efficacy as the dominant species:

> ‘One of our major difficulties with ICT integration is the random and sudden introduction of any new system or educational programme. Everything happens suddenly and the change is absolute, it is not gradual, there is no understanding of the background and the nature of this newly implemented programme’
> (T4- A_1: FG)

Even though the majority of teachers stated that they attended training in ICT use (72%) many teachers were uncertain about their skill-levels, resulting in more neutral or ambivalent attitudes towards using ICT in the learning environment. As shown in table 7.2-b, the spread of responses to the statement *I use ICT effectively myself but I am not sure how to teach children* showed further uncertainty over playroom practice (only 41% disagreed). Teachers also answered the statement *I know the basics of ICT but that’s it* with an explicit feeling of inadequacy (41% of teachers here agreed and 14% were neutral). Almost all felt that *the children were well ahead of them in terms of ICT skills* (97%).

Teachers worried about how to react if their ICT use in the playroom somehow went wrong:

> ‘I once loved to present an activity to the children using the Internet but the network broke down, and I had to change the entire plan totally. Honestly, I panicked a little bit and then later on I replaced the activity with something else. This is the most annoying thing with technology – when any unexpected technical breakdowns happen’ (T2- A_4: FG)

This lack of knowledge and competence fed into a lack of confidence when using ICT in front of the children in the ecosystem of the playroom. Research has shown a correlation between teachers with negative attitudes towards technology and a lack of confidence with

ICT (Oyaid, 2009). In this case, it was relatively common to find teachers feeling vulnerable if the children's use of ICT began to move ahead of them. In interviews, the practitioners described feelings of inadequacy when trying to support preschoolers using ICT, as well as when trying to remedy hardware or software problems.

It is clear that both attitude and confidence are related. As covered in the literature review, in Ajzen & Fishbein's TRA model, teachers' believe that their actions will have a certain set of consequences and they judge their decision about how to use a tool depending on these perceived results, where their confidence influences this judgement. Teachers' responses in these cases indicated the benefits of ICT use in supporting their own limited practices. Teachers had misconceptions about 'ease of use' that fed into practicing ICT given the 'low-level' benefits of saving time, searching for information, preparing class plans, or presenting information. According to Davis' TAM (1989), teachers judge perceived ease of use by how simple the tool will be to put into practice at the micro-level (Moon & Kim, 2001). In Saudi, if a tool was likely to be complex to employ, or if the teachers had concerns about the support they received when technology malfunctioned, their attitude became more neutral to integrating ICT. Teachers' confidence, self-efficacy and competence in using the tools were also barriers to integration that influenced their attitude.

7.1.4. Teachers' Competence and ICT Use

In the questionnaire, a series of questions asked teachers about their ICT training and also their competence and skills with ICT. Teachers were asked ***how competent they felt in using ICT*** [13] in four distinct areas: playroom practice, professional development, personal use and administrative work. They were asked to judge if they were **very competent**, **competent**, **not competent** or **didn't know** about their ability. As figure 7.2 shows, most teachers felt either very competent (39%) or competent (41%) in using ICT for playroom practice.

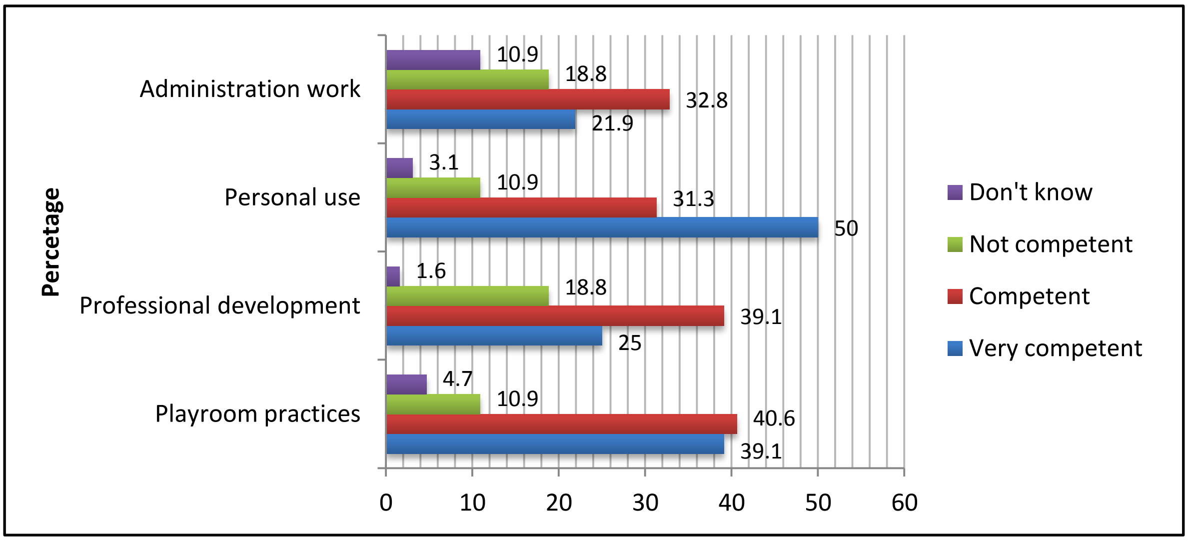


Figure 7.2 Levels of teachers' competency in ICT use in different contexts

These results suggest a contradiction with the limited, low-level integration of ICT in the playroom that was observed. Also, as laid out earlier in section 7.1.3, teachers actually were unconfident when supporting children learning about/with ICT in scaffolded scenarios.

One way to account for such a contradiction in teachers' responses is explained in the literature, particularly in the Becta (2004a) review. In the Becta report, following Fabri & Higgs (1997), they suggest that teachers' fear of ICT stems from a fear of losing their professional status or professional face. Teachers present themselves as competent with technology for fear of being unprofessional. In section B of the questionnaire, teachers were asked about *the factors that influence their use of ICT*; as part of this question, teachers were presented with three statements concerning notions of professionalism and career progress (see table 7.3).

Table 7.3 Teachers' responses on the factors related to professionalism and career progress, Saudi n=64

Response	n (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Career progress (annual assessment, appreciation letters, to keep job, promotion, and good for CV)	36(56)	23(36)	1(1.6)	0(0)	4(6.3)
Leave good impression on pupils and parents as using ICT is an indicator of teachers' proficiency	33(52)	27(42)	2(3.1)	2(3.1)	0(0)
Taking ICT courses is not beneficial salary wise	10(16)	19(30)	7(11)	21(33)	7(11)
Teachers' resistance to change	15(23)	38(59)	5(7.8)	4(6.3)	2(3.1)

Regarding these professional motivations, the vast majority of practitioners considered that they used ICT to improve *career progress (e.g. letters of commendation, or for promotions, etc.*) (94%), as well as *to leave a good impression on pupils and parents as using ICT is an indicator of teachers' proficiency* (92%). Teachers presented themselves as competent in the questionnaire to maintain a good impression of professionalism in general.

Notably, Saudi practitioners were indeed competent in using informational tools such as the Internet, Word processor, PowerPoint, and data show projectors (e.g. LCD and OHP). However, under observation in case A_1, it was noticed that a child was using a computer located in an ICT zone (at the micro-level) when it began not to function. The child was hesitant to call for help but the teacher eventually noticed and came over. Without any direct interaction and unable to resolve the issue she sent the child away. This demonstrates a lack of competence and a failure to engage and scaffold the child's learning. Such reactive supervision is not desirable and shows a lack of initiative; it also raises questions about the PC's position in the playroom and micro-level choices. In spite of teacher supervision there was still a tendency for children to leave the computer if the technology was not holding their attention. Teachers often needed to be more sensitive and knowledgeable in their supervision (Plowman et al., 2010). In Saudi, this was the result of low self-confidence and lack of competence with ICT as a construction medium.

Teachers generally proved themselves as competent preschool practitioners in many different pedagogical areas other than ICT (e.g. in posing high-level thinking questions, creating problem solving activities, encouraging exploratory play). For example, from observation of a scenario in which children were learning about the role of fire-fighters, the teacher asked many questions encouraging children to be both self-reflective and imaginative. In another case, where children were learning 'Where Rain Comes From' the teacher again demonstrated a skilful set of techniques by posing high-level questions and engaging the children. The practitioners were in their comfort zones.

In spite of high levels of competence being generally reported, around 40% of teachers agreed or strongly agreed that the *lack of appropriate skills to use ICT effectively* was a barrier to integration (see table 7.4). This is a noteworthy percentage given that very few teachers (11%) had previously described themselves as incompetent.

Table 7.4 Teachers' responses on factors influencing ICT integration in ECE, Saudi Arabia n=64

Response	n (%)				
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Lack of appropriate skills for effective ICT use	1(1.6)	24(38)	11(17)	22(34)	6(9.4)
Lack of class management skills	2(3.1)	4(6.3)	11(17)	33(52)	14(22)
Lack of awareness of ICT advantages in ECE	4(6.3)	8(13)	5(7.8)	27(42)	20(31)
I can't cope with ICT jargon	0(0)	27(42)	6(9.4)	26(41)	5(7.8)

Teachers demonstrated a lack of the additional pedagogical knowledge required to use technology constructively with children (such knowledge is provided in the TPCK framework, for example). In spite of observations to the contrary, in the questionnaire only about 9% of teachers agreed that *lack of class management skills* was a barrier to their integration. Teachers here reflected their class management skills in general and were unaware of the additional types of pedagogical knowledge required to manage ICT use:

> 'There are other things we are not aware of and would be worth knowing'
> (T4- A_2: FG)

> 'The devices were to be placed in the playroom and to be used by the children and the question here is, how will the child be attracted to using it and how can we encourage use?' (T1- A_3: FG)

Teachers, however, desired to learn more about ICT. As one HT, in their role as the keystone species, reflected:

> 'What is important is that the teacher has the skills which help her to make use of the available resources because without those skills, and the acceptance and readiness to take advantage of these, our targets cannot be met.' (HT, A_2)

In spite of a willingness to learn more about technology, teachers' lack of knowledge, along with the emphasis placed on them to lead integration which due to meso-level failures, contributed to low-level integration.

7.1.5. Teachers' Knowledge and Understanding

In observation and focus group discussions teachers tended to consider that their main role was as a playroom leader when using ICT, relying upon a form of direct interaction to guide learning. However, when it came to using ICT in small team or single-child scenarios teachers doubted their skills to deal with such playroom dynamics. Due to a lack of knowledge, teachers misconstrued their role as supervisors of technology (Plowman & Stephen, 2007; Stephen & Plowman, 2008; Plowman et al., 2010) meaning direct interaction that was not child-centred:

> 'There is a continuous need to observe and supervise the child's behaviours when they are using a computer to ensure that they are on the right track.'
> (T3-A_1: FG)

> 'ICT [...] requires continual supervision by the teacher.' (T2-A_3: FG)

There was a lack of knowledge of possible socio-constructivist learning alternatives to the one-to-one learning situation. This was compounded by a view that children only had to learn 'basic' technology skills:

> 'child readiness and preparation has to come through starting to provide children with basic skills that qualify them or enable them to deal with technology, such as opening the device, closing it, controlling the mouse, opening and closing the program.' (T2-A_2: FG)

Teachers also reported some uncertainty about '*ICT jargon*' with 42% agreeing that they could not cope with it, suggesting a lack of knowledge. As such, teachers were often unclear about the benefits of the range of software available to them. One teacher thought her poor English language skills were a hindrance to her ICT use, as the majority of good ICT resources are in English. Some also encountered hindrances to their ICT use that were of a personal nature. Another interviewee indicated that being an unconfident, inexperienced ICT user was an obstacle to her teaching. Overall, the reported high-level of competence in ICT use, in questionnaires, for playroom practices is also likely to be a consequence of the narrow vision that teachers had regarding the constructivist potential for ICT integration into the playroom. Their narrow understanding of ICT as an add-on tool is a likely explanation for teachers' feelings of competence, even though they only occasionally used ICT in constructivist ways with the children (as observed in cases A_2 and A_4).

It is clear that all the teachers who participated in questionnaires wanted to ***enhance their skills and knowledge in ICT*** (100%) [15]. However, none of the teachers answered the next question satisfactorily, in which they were asked to list the ***ways they would like to develop their skills and knowledge in ICT*** [17]. Space was provided for teachers to provide three possible skills to develop. All of the teachers were unable to answer. Some teachers indicated at the time to the researcher that they were struggling with the question. Their lack of knowledge meant that they were forced to simply indicate very general areas for improvement. 90% of the teachers desired to improve their skills and knowledge in both playroom practice and professional development, while 70% wanted to develop their skills and knowledge of ICT in their personal use, and 40% wanted to improve their administrative abilities with ICT. However, the fact that teachers, even as the dominant species in the ecosystem, were unable to independently list skills they would like to develop suggests a severe lack of knowledge.

Overall, a lack of competence and pedagogically advanced beliefs are barriers to constructivist integrations of ICT in these cases. Saudi teachers had a positive attitude, but this was towards a distinctly narrow understanding of using ICT as an add-on to their playroom practice. Their enthusiasm for their own competence in the questionnaire results masks a lack of skills to employ constructivist pedagogies (as was observed). In turn, teachers are not using ICT to the optimum level in the ecosystem and need more support to do so.

7.1.6. Teachers' background

There seems to be an association between ICT usage for playroom practice and teachers' age. More than one-third (36%) of Saudi teachers were aged 30 years or less and only two teachers were over 50 years. However, given that only two teachers were in the older age group (>50 years), the median usage here may not be representative of the age group and differences in median ICT usage between age groups were not statistically significant. The median was calculated in a similar manner to section 6.5.1 (see previous chapter).

Of the 31 Scottish teachers, almost half (48%) were aged 30 years or less and only two were over 50 years. ICT usage for playroom practice appears to increase with teachers' age. Again, given the small number in the older age group (>50 years), the median usage obtained for the group may not be representative. ANOVA test indicates that there was no statistically significant difference in the median playroom ICT usage between age groups.

In Saudi, the majority (70.3%) of the teachers had at least 6 years teaching experience. From this 56.2% had more than 10 years experience. The use of ICT for playroom practice in the micro-system increased with teachers' years of experience, ranging from an average mean of 24.6 (5 years of experience) to 32.8 for teachers (6-10 years of experience), and (>10 years of experience). However, differences between the average use of ICT for playroom practice across the levels of experience is not statistically significant.

In Scotland, a significant proportion (61.3%) of practitioners had >6 years teaching experience. The use of ICT for playroom practice changed slightly with practitioners' experience, going from an average mean of 24.6 (1-5 years of experience), to 30.4 (6-10 years of experience), and 27.7 (>10 years of experience). Differences between the average use of ICT for playroom practice across the levels of experience is not statistically significant.

In Saudi, the vast majority of teachers (89%) had either a college diploma or BSc degree. A smaller proportion of the teachers (11%) had only a high school certificate. A majority (61%) of the teachers specialised in preschool education while 39% specialised in other educational areas. Teachers whose speciality was preschool education used ICT in playroom practice on average more. However, there was no significant difference between the means.

In Scotland, a small majority of practitioners (58%) had VQ qualifications, and 26% had a college diploma, while 13% had either a B.Ed or M.Ed degree. The vast majority (87%) of practitioners specialised in preschool education. There is a sparse distribution of practitioners across the educational levels. However, ICT use for playroom practice could be associated with level of education. Practitioners with higher levels of education had higher mean usage of ICT in playroom practice. This was not statistically significant. Teachers whose speciality was preschool education used ICT in playroom practice at the micro-level, on average, more than the teachers who had other specialities. But, there was no significant difference between means.

7.2. Preschool level factors at the meso-level

At the school level, which is part of the meso-system, teachers' ICT integration was influenced by a number of factors, such as preschool culture, leadership, infrastructure, and training. In a similar fashion to the previous section, a number of related sub-factors are also identified to clarify the constituent parts of each of the central factors. Emerged factors are listed in figure (7.3).

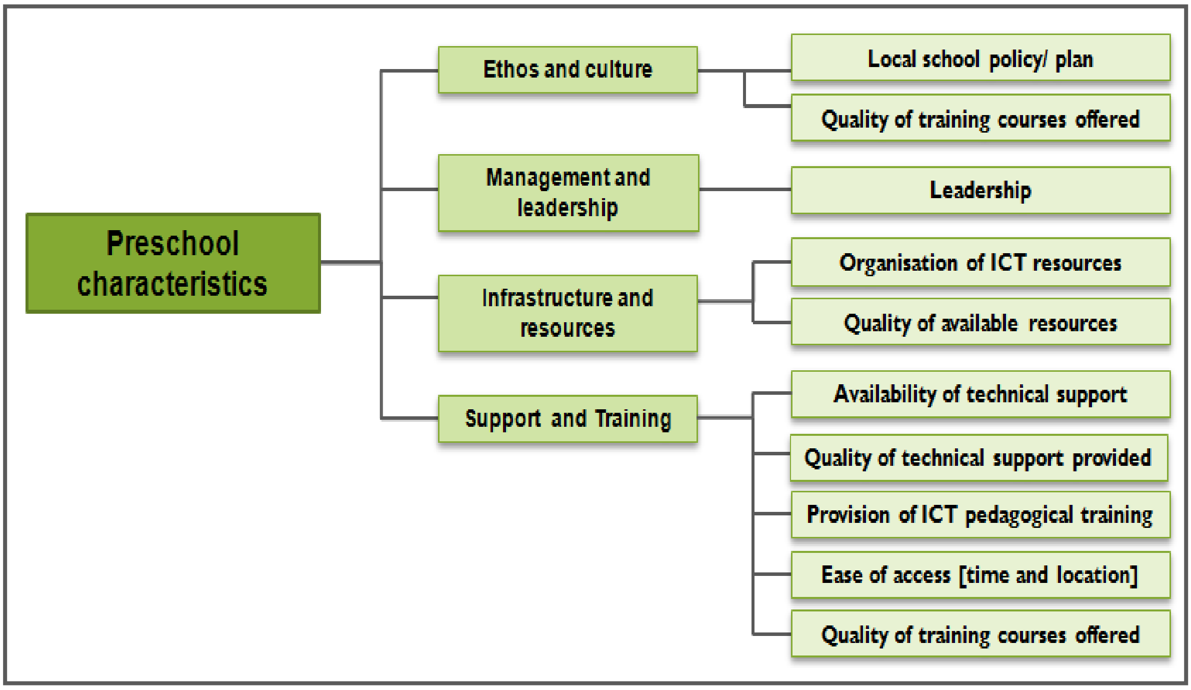


Figure 7.3 Key themes and sub-themes emerged in relation to RQ4: Factors at preschool level

7.2.1. The Preschool Culture

According to the literature, the preschool culture for integrating ICT is created by the effect of preschool policy on how internal stakeholders (HTs, teachers and children) interact to create a ‘subjective norm’ for integration.

7.2.1.1. Preschool ICT Policy/Plan

When HTs (keystone species) and teachers (dominant species) were prompted in the questionnaire [Q5, Q21] over whether their preschool had a Whole Preschool ICT policy, the four Saudi HTs responded ‘yes’, since they interpreted the question as asking whether or not a policy existed. Contrastingly, the majority of teachers responded ‘no’ (63%), as they interpreted the question as asking if the policy is actually implemented in their preschools.

In the interviews four preschool HTs produced a ‘term plan’ in which ICT was included only as a teaching tool. However, in cases A_2 and A_4, HTs also mentioned a rather limited ICT ‘plan’ that consisted of goals but no explicit strategies to achieve targets. The latter two preschools also put forward a vision for ICT in their prospectuses. In general, none of the four Saudi preschools in the survey had an explicit whole preschool policy on ICT and just A_2 and A_4 had a preschool development plan which specified targets for ICT.

Interviews revealed that there were clearly misunderstandings about the difference between a whole preschool ICT policy and an educational term plan between HTs and teachers. However, HTs began to realise that they had misunderstood what a whole-preschool ICT policy was. The HT in case A_3 now said that there was no stand-alone plan for ICT, just the general term-plan that included it (HT, A_3). Similarly, in case A_1 the HT reported that there was no preschool ICT policy, either internal or national, when teachers had begun the integration of ICT through their own efforts:

> ‘ICT integration started in our nursery due to continual pressure from teachers’ personal efforts to include ICT. From here our journey towards integrating ICT began.’ (HT, A_1)

Voluntary efforts were obviously key:

> 'The use of ICT was started as a voluntary process by preschool teachers, for example teachers began creating PowerPoint presentations using their own laptops.'(T4- A_1: FG)

Suggesting a degree of uniformity of practice, during the focus group discussions, teachers from the four Saudi cases listed some policies practised in their preschools. However, they described these as verbal rules that were part of the general ethos of implementing ICT into the playroom. In turn, these rules, although not written, were part of the preschool culture. For instance, according to teachers in all the cases, the norm was that they should have a minimum, operational level of skill with ICT. More progressively, in preschools A_2 and A_4 this ethos included the idea that using ICT was a must for all teachers, as well as that children should be encouraged and supported to use ICT and that teachers should attend in-house ICT staff development courses.

The inconsistency in both the HTs' and teachers' responses showed that they understood policy questions in two different ways: (1) the intended meaning concerning 'the existence of written ICT policy influencing the integration process in their preschool'; and (2) an unintended meaning in the form of a response to 'the extent to which any ICT policy or plan had been implemented.' There is therefore a tension between influence and implementation (see Table 7.5).

Table 7.5 Preschool policy influence on ICT integration

Level of Influence	**Preschool Position**		**Level of Implementation**
Very Much Influenced			Fully Implemented
Influenced		☑	Implemented
Not Influenced	☑		Not Implemented
Don't Know/ Unawareness	☑	☑	Uncertainty/ Hesitation

Influence is the effect of any existing policies coming from the macro-systems and whether or not they had been taken into consideration when the preschool was forming its own policies. Whereas, implementation is the next step after being influenced by any policies: that is, putting them into effect. Case A_1 HT mentioned that their nursery was not influenced by any ICT policy but that implementation was based upon a general, unwritten ethos, although they were still uncertain and facing difficulties (HT, A_1). In cases A_1 and A_3, both HTs (keystone species) and teachers (dominant species) indicated that there was an absence of a shared vision concerning the applications of ICT:

> 'Decisions were taken randomly without careful study, without clear vision or clear working objectives. This definitely causes an unsuccessful ICT integration' (T2- A_3: FG)

While, in cases A_2 and A_4, teachers complained that the issue was in the development of a vision about ICT integration that was limited to a top-down strategy, initiated by senior managers at the school or meso-level:

> 'making decisions and plans from above, and ordering us to implement them without previous notice and understanding what is going on in the field, will not help in improving integration.' (T1- A_2: FG)

It seems that the problem of planning and management reported previously in section 7.1.3 is not only an obstacle for teachers in the learning environment but that it is more widespread and encompasses a general lack of planning and clear vision for ICT integration.

This lack of a clear vision is partly a result of ICT initiatives coming from the macro and exo-levels being unclear (this is discussed further in section 7.3.1 which is concerned with factors at the external level). HTs' and teachers' interviews demonstrated that this lack of clarity was an issue. In turn, ICT policy and culture become crucial in an environment in which teachers are dissatisfied or disorientated by the assistance and imperatives coming from the macro-level. This particular barrier to implementing ICT raises questions about how external forces at the macro- and exo-levels assist preschools at the meso-level to implement clear ICT policies. From this perspective, the issue of ICT policy becomes a system responsibility to address the uncertainty.

While none of the preschool HTs saw a whole school ICT policy as potentially detrimental to a more integrated use of ICT, they did not see it is as an absolute necessity either, suggesting that such a plan was not a priority at management or meso-level. HTs, even as keystone species, did not therefore have the awareness and knowledge that a clear preschool ICT policy could enhance integration levels of technology. HTs regarded ICT as a set of stand-alone tools rather than a wholly integrated part of teaching and learning at preschool. At least in the private preschools (A_2 and A_4), HTs had clear objectives about what they wanted to achieve with technology. It was still evident, however, that they were lacking a written policy that articulated the ICT practices required for these goals to be reached.

7.2.1.2. Preschool Environment

In spite of the lack of any whole preschool ICT policy/plan being identified in most of the cases, efforts to integrate ICT still took place and were driven by the environment that internal stakeholders created for themselves through individual effort, teacher enthusiasm and HT leadership (occurring at the meso- and micro-levels). Generally speaking, discussions with teachers provided strong indicators of the importance of having a supportive environment within the preschool and even beyond (i.e. LEAs).

As a part of the teachers' questionnaire [Q10, Q11], the vast majority of teachers agreed that '*the whole preschool view of the importance of ICT in ECE*' was a key driver in the process of integrating ICT into their organisations (94%), as well as the '*encouragement and support coming from senior management*' (95%). Reinforcing this positive feeling towards ICT's importance to their preschools, a large majority also disagreed that ICT was '*not seen as a whole school priority*' (83%). Teachers' responses presented in table 7.6 indicate that the HTs were successful in leading a positive preschool environment that was open to ICT use within the ecosystem of the playroom.

Teachers from all cases valued colleague support highly. Given the lack of a policy coming from the macro-level, teachers supported, motivated and encouraged each other. From table 7.6, it was clear there was *competition amongst teachers* (66% agreed) and that *other enthusiastic teachers* positively influenced attitudes (77% agreed). Teachers were also not critical of their colleagues with the large majority disagreeing that the *bad influence of another teacher* was a barrier to integration (75% disagreed). Teachers were also observed to work together in a competitive, enthusiastic and supportive environment and this influenced the overall subjective norm at the meso- and micro-levels.

Table 7.6 Teachers' responses on factors influencing ICT integration in ECE, Saudi Arabia n=64

Response	n (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
The whole preschool view of ICT importance	40(63)	20(31)	3(4.7)	1 (1.6)	0(0)
Encouragement, from senior management	39(61)	22(34)	3(4.7)	0(0)	0(0)
ICT not seen as a whole preschool priority	2(3.1)	5(7.8)	4(6.3)	36(56)	17(27)
Competition among teachers	18(28)	24(38)	16(25)	5(7.8)	1(1.6)
Children's competence	30(47)	29(45)	4(6.3)	1(1.6)	0(0)
Another enthusiastic teacher	16(25)	33(52)	13(20)	1(1.6)	1(1.6)
Children's acceptance and support	24(38)	37(58)	3(4.7)	0(0)	0(0)
Bad influence of other teachers	1(1.6)	6(9.4)	9(14)	31(48)	17(27)

Another reason for integrating ICT that emerged from the questionnaire was that teachers felt it benefited the children as stakeholders in the preschool. Since there was no official imperative coming from the macro-level it was children who became the motivation for ICT integration. As can be seen in table 7.6, the vast majority of teachers cited improving *child competence* (95%) with ICT as a reason for integration and, once more, a very significant majority agreed that *children's acceptance and support* (96%) was an important drive for integration. Teachers relied upon one another's enthusiasm and personal interest in ICT to try and create an environment that was conducive to children experiencing technology.

7.2.1.3. Preschool Leadership

Senior management has an important influence on preschool culture and in maintaining a positive subjective norm. Teachers recognise HTs (the keystone species) as a central part of this influence, particularly in their role as sympathetic leaders, who oversee and monitor ICT integration. Given the lack of a clear ICT policy coming from the macro-system and exo-system levels (discussed in section 7.3.1), teachers looked to HTs to provide a positive, forward-thinking culture for ICT integration.

The HTs were presented with a number of questions related to whole preschool philosophy in the questionnaire. HT responses showed that they were completely in favour of the use of ICT in ECE. As can be seen from table 7.7 all HTs supported ICT use. All four agreed the following: ‘*teachers and children are encouraged to utilise ICT*’**;** ‘*ICT use is encouraged across the pre-school's curriculum*’; ‘*administrative work in this nursery is aided by the use of ICT*’; and, ‘*the nursery school's information management is made more effective by ICT*’.

Table 7.7 Attitudes of Saudi HTs for their nursery’s philosophy towards ICT

Statements	**n (%)**				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Teachers and children in this nursery are encouraged to utilise ICT	0(0)	1(5.6)	0(0)	3(17)	14(78)
Teachers are encouraged to attend ICT staff development courses	0(0)	0(0)	0(0)	8(44)	10(56)
The use of ICT is encouraged across the pre-school's curriculum	0(0)	1(5.6)	3(17)	7(39)	7(39)
This nursery keeps up to date with ICT using informal networks	0(0)	0(0)	2(11)	10(56)	6(33)

Expanding on these ideas in interviews, HTs said they were in favour of the use of ICT as a vital addition to ECE. Additionally, all HTs stressed that ICT was not a new introduction into their preschool environments as they had been investing for over ten years. Importantly, according to case A_1 and A_3 HTs, this was teacher-led integration, separate to the recently reported rush coming from exo- and macro-system impetuses for using ICT:

> ‘We decided to invest in ICT over ten years ago. This was established by bringing in PCs for administrative purposes. Later on this progressed into using desktop computers for teaching purposes based on the individual efforts of an interested group of teachers.’ (HT, A_1)

During the interviews, HTs suggested that ICT could benefit teachers and the preschool in several ways: (1) ICT could offer teachers easy and quick access to information, for example case A_4 HT enthused that ICT allowed teachers to get information from the Internet quickly and easily; (2) it presented new possible methods for teaching and practices for numeracy and literary skills, for example case A_1 HT felt that PowerPoint was great to use in structured activities to grab children’s attention; (3) ICT helped with administrative and preparatory work, for example case A_1 and A_3 HTs were observed using their own office desktop computers for administration; (4) it helped the Saudi ECE sector keep abreast of technology use in preschools worldwide, a point raised by case A_1 HT.

These external (keeping abreast of international practices) coming from the macro-level and internal rationales coming from the meso- and micro-levels (ICT as teacher-centred playroom tool; ICT as informational tool for teachers; ICT as an administrative tool) recalled those identified by their teachers (section 7.1.1). Noticeably, interviews revealed that both HTs and teachers shared the same limited pedagogical belief which reflected on the actual practices of ICT in the playroom. In turn, the HTs, in their roles as leaders of integration (and keystone species), did not have the technological pedagogical knowledge to change ‘the subjective norm’ at the heart of the preschools’ ethos regarding ICT as a teacher-centred, add-on to learning.

Discussions with HTs revealed that there was ambivalence about whether ICT could *replace* traditional teaching methods. In the questionnaire, case A_1 and A_4 HTs had said ICT could replace traditional teaching methods, while case A_3 HT said it was possible only some of the time, with case A_2 HT disagreeing entirely. Supporting the questionnaire findings, in interviews there was also a noticeable divide in the knowledge of the HTs between the public and private sectors. HTs varied in their point of view over whether ICT could replace traditional teaching methods. In A_2 and A_4 the HTs had more knowledge of technology, which helped to put forward a more nourishing ethos than their counterparts in the public preschools, in terms of embedding ICT into teaching in the playroom ecosystem. For instance A_4 HT stated:

> ‘What is actually important when using technology is purposeful use to support all the aspects of the curriculum in early years.’ (HT, A_4)

In a similar point, case A_2 HT said:

> ‘Here, ICT is embedded throughout the curriculum.’ (HT, A_2)

These discussions confirmed earlier observations which indicated that cases A_2 and A_4, the private preschools, were at the first stage of a more purposeful, constructivist use of ICT compared to their public counterparts. As a result partly of HT leadership, therefore, the ethos in the private schools at the meso-level was slightly more conducive to a higher level of integration than in the public cases. However, all HTs lacked knowledge of specific forms of constructivist integration, where the private preschool HTs were only slightly less limited in this regard.

HTs as keystone species can take on either a responsive or a facilitating role in the integration of ICT into their preschool. In these cases, this depended upon how HTs responded to a range of challenges facing them in integrating ICT, including budget issues, supporting teachers, the provision of resources and adequate training. HTs certainly considered staff development in ICT as important, with all four agreeing that '*Teachers are encouraged to attend ICT staff development courses*' (see table 7.7). This suggests that the majority of teachers were working in preschools which encouraged them to take up training opportunities. As case A_2 HT commented:

> 'What is important is that the teacher has the skills which help her to make use of the available resources because without those skills, and the acceptance and readiness to take advantage of these, our targets cannot be met.' (HT, A_4)

The response of A_4 HT, suggests limitations to the skills encouraged:

> 'Part of the nursery policy is that all teachers should attend training courses to improve their basic skills in ICT.' (HT, A_4)

Once more there is a focus mentioned on 'basic skills' and a lack of skills was something that most teachers complained of given the limited nature of training (section 7.1.3).

Given curriculum pressure, HTs also had to keep a balance where teachers maintained other teaching duties and responsibilities, such as playroom planning, preparation and looking after the young children, as well as finding training time. This was certainly a concern to all of them. Case A_1 HT said:

> 'Sending teachers for external training courses might negatively affect the daily programme in the nursery.' (HT, A_1)

Clearly, the HTs, like teachers, saw ICT as a separate entity to manage - in other words, 'a competing pressure rather than a vehicle for progression towards educational goals' (Williams et al., 2000a: 319).

HTs were aware that ICT was not even properly embedded into preparatory training for new preschool teachers in Jeddah. Case A_1 HT commented:

> 'CPD programmes provided by the EYTTC in Jeddah prepared the teachers with the principles for teaching in early years. There was a focus on preparing teachers from a pedagogical perspective, while dismissing ICT.' (HT, A_1)

Such paucity in training, something that teachers also complained about (section 7.2.3), led HTs – namely in cases A_2 and A_4, the private preschools, that had existing partnerships with software companies – to seek training from other sources than the LA for their teachers:

> 'Training in our preschool is provided through specialised companies that we are contracted to. We consider this as something that is vital and fundamental to our nursery.' (HT, A_2)

Again suggesting a lack of knowledge amongst HTs, there was a problem with IT technicians and private trainers not having a pedagogical background in early-years (see section 7.2.3). HTs did not pick up on this because they generally only demanded basic, operational skills to be provided to both their teachers and children.

As well as training, the high cost of ICT devices and software was seen as a barrier. Case A_1 and A_3 HTs revealed that ICT was partially funded through finance from the MoE, but that there was no specific budget stipulated for ICT:

> 'The nursery does not have a specific budget to purchase ICT devices, and the financial support coming from the MoE does not include a specific budget for ICT.' (HT, A_1)

As discussed in section 7.2.2, case A_1 and A_3 teachers often spoke of their frustration at lack of access to ICT and their HTs were also frustrated at being unable to provide adequate support due to lack of finance. Despite the lack of budget, both HTs and teachers seek to improve their ICT environment:

> 'We are as a whole school working continuously on providing the nursery with more facilities to ensure that all staff have adequate resources.' (HT, A_1)

Case A_3 HT said:

> 'We are investing more in ICT although we do not have a specific ICT budget; however, we as a group in this preschool are interested in ICT and so we manage our own budget to include a yearly investment in ICT.' (HT, A_3)

HTs did not just desire a budget for everyday ICT tools but also funds to provide dedicated ICT spaces in the preschool:

> 'In order to integrate ICT in ECE it is important to provide computer labs in the nursery and to have specialised ICT teachers.' (HT, A_3)

In cases A_2 and A_4, the HTs were thankful to have a private principal who owned the school, as well as the attached larger school, and who provided funding:

> 'Our Principal in this nursery very much supports us financially and emotionally.' (HT, A_4)

There was once more a gap in the potential for ICT integration between private and public preschools, on this occasion, given the economic resources available in A_2 and A_4.

In another pragmatic effort, HTs encouraged informal networks between preschools. This exchanging of experiences was an attempt to fill in the gaps in prescribed training. Teachers found these conversations and exchanging of ideas useful at the meso- and macro-levels, whether between sectors (HT, A_4), on international websites (HT, A_2) or with local schools in the community (HTs, A_1 and A_3):

> 'It is vital to encourage the exchanging of experiences between preschool settings.' (HT, A_2)

HTs wanted to improve the environment for ICT integration and suggested the need for better funding, educational software in Arabic and combining ICT training into existing preschool teacher training. For instance, case A_1 HT suggested:

> 'Further support is needed from Jeddah Local Authority in order to help us as individual settings to integrate ICT into teaching and learning.' (HT, A_1)

Case A_3 HT was keen to emphasise two issues, namely to provide better infrastructure and support for ICT in her preschool and also to give teachers the time to train more thoroughly with technology:

> 'In order to integrate ICT it is important to provide computer labs in the nursery and to have specialised ICT teachers who are not the preschool teachers themselves.' (HT, A_3)

> 'It is crucial […] to consider creating specific days when teachers are exempt from their duties so they may train with ICT.' (HT, A_3)

As discussed in section 7.2.1.1, despite the lack of local and national ICT policy, priorities related to ICT did exist in the general preschool termly plan for all cases and HTs did seek to improve ICT integration in the future.

In balancing external influences decided at the macro- and meso-levels, such as funding, with the needs and demands of teachers at the micro-level, HTs in all four cases saw themselves as catalysts and facilitators of ICT integration into their preschools. Even as keystone species, however, HTs were limited in their role as facilitators by external factors: the lack of a standard policy for ICT in ECE, financial issues, curricula pressures and their own lack of knowledge of technological pedagogical, constructivist uses of ICT for teaching.

In Scotland, the HTs had a great influence upon integration levels. While a number of high-level practices were observed in B_1, the HT in B_2 was more sceptical of ICT:

> 'I don't think at this stage it is very important […] they still want to go out and play.' (HT, B_2)

In B1, the HT was acknowledged as an expert in the field of ICT:

> 'I've organised and led ICT training in Glasgow since 1985 […]. Obviously because of my own skills it's perhaps easier for me in one sense to lead development because I know what to lead and why it's important' (HT, B_1)

Her pedagogical knowledge of ICT was also highly developed:

> 'I hate 'drill' and 'kill' software, I'm not interested in anything that teaches colours, shapes, numbers, in a very rigid, out of context way. I think that would be my worst nightmare if that's what people thought ICT was about in early years, even in child education. As I say, for me, the positives are what engages, what motivates, what helps a child to learn.' (HT, B_1)

Given that a number of high-level integrations were observed in B_1, it is clear that the HT's pedagogical knowledge was reflected in playroom practice, suggesting the importance of the HT as a keystone species.

7.2.2. Preschool ICT Infrastructure and Support

The infrastructure of a preschool and support for teachers at the meso-level are important factors in ICT integration into the playroom (Drent & Meelissen, 2008; Lowther et al., 2008). In order to determine teachers' views on the provision of ICT infrastructure and support, teachers were presented with a number of relevant statements, relating to *the factors which support or hinder teachers' use of ICT in ECE* [Q9 & Q10]. They were required to grade the extent to which they agreed or disagreed with each statement using a 5-point scale. Table 7.8 shows teachers' responses in the questionnaires.

Table 7.8 Teachers' responses on factors influencing ICT integration in ECE, Saudi Arabia n=64

Response	n (%)				
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Encouraging school environment	33(52)	23(36)	7(11)	1(1.6)	0(0)
Whole school limitation in the infrastructure	8(13)	10(16)	3(4.7)	35(55)	8(13)
Lack of technical support and maintenance	8(13)	28(44)	5(7.8)	18(28)	5(7.8)

As shown in table 7.8, a large majority (88%) of practitioners felt that in terms of school ICT infrastructure, they were in an *encouraging school environment* and many disagreed that there was any *limitation in the infrastructure* of the preschool in which they taught (68%). The *lack of technical support and maintenance* was a less clear-cut issue, with 57% of teachers agreeing that this was true. There was a broad sense that the infrastructure of their preschool was adequate to their needs apart from uncertainties over technical support.

Table 7.9 provides an overview of each case's ICT profile; it gives a brief snapshot of the observation notes with regard to ICT infrastructure and support in the four preschools (for further details see chapter 6.5.3.).

Table 7.9 Snapshot of the ICT infrastructure and the support provided in the four Saudi cases

Factor	Case A_1	Case A_2	Case A_3	Case A_4
Sector	Public preschool	Private preschool	Public preschool	Private preschool
Type	Attached to an extended school	Attached to an extended school	Attached to an extended school	Attached to an extended school
Available ICT resources within the playroom	Each playroom in the nursery had a sole PC. Also, a tape recorder was placed at one of the activity zones, which may be distributed in the learning environment	Each playroom in the preschool had its own facilities (e.g. IWB, LCD projector, and PC) assigned to each teaching space, reflecting greater investment and prioritisation	In each learning environment was a sole PC, as well as TV and video equipment and a tape-recorder	Playrooms also had ICT zones, which contained two PCs, a number of programmable toys related to numeracy and literary skills, and a tape-recorder with two-tail headphones. IWB in each playroom.
Access to ICT specialist rooms	A range of ICT tools such as LCD projectors and audio-visual equipment, including TV and video, were accessible to the teachers. ICT tools were located in a central space, e.g. the preschool library	Highly updated facilities built within the last five years: e.g. media suites and computer labs, where such facilities allowed for 1 computer: 1 learner	One specialist room with in-built facilities, such as an audio-visual tools suite. There was also a computer lab	Specialist rooms with in-built facilities, such as Media suites and computer labs, allowing for 1:1 computer use by pupils
Internet connectivity	Broadband line available at the administrative offices area only	Wireless facilities. Additional intranet access and a website	Broadband line available at the HT office	Broadband and intranet facilities
Additional facilities				On-going digital library of CDs and DVDs maintained by teachers
ICT Support	No in-house ICT-related staffing	Facilities were well-maintained due to technical support from their adjoining primary and secondary ICT staff	Part-time, visiting computing teacher provided informal, optional in-house training to assist practitioners to meet their professional development needs	Formalised access to ICT-related staff, such as an ICT Coordinator, IT Specialist and IT Technician, due to its relationship with its sister primary/secondary school
	------	None of the ICT-related staff specialised in ECE	ICT teacher not specialised in ECE	None of the ICT-related staff specialised in ECE
		Work in partnership with specialised international companies.		Work in partnership with specialised international companies

Cases A_2 and A_4, the private preschools, had better infrastructure with a range of ICT resources, 1:1 computer learning in a lab and even an IWB available in each playroom and used by both teachers and children. Support was also provided by the IT department at their sister primary/secondary schools. These meso-level factors provided an environment to encourage the few observed constructional uses of ICT in a child-centred way. There were also a number of areas of concern revealed in the focus group discussions with teachers, which confirmed findings made during the observation phase. Particularly in cases A_1 and A_3, poor accessibility and provision of ICT facilities were points raised frequently.

7.2.2.1. Dearth of Hardware in Good Condition

It was surprising to hear teachers in interviews complain about the lack of equipment in their establishments. It was once again case A_1 and A_3 teachers who mainly commented on shortages of advanced hardware, educational software, no or poor Internet connections and a general absence of enough resource rooms.

> 'The annoyance is the unavailability of a sufficient amount of facilities and resources in our nursery, such as a lack of laptops and Internet access, but hopefully providence will provide these for us.' (T-F A: FG)

In case A_1 and A_3, only PCs located in the administrative area for the HT, DHT and administrators were connected to the Internet (T2-A_1: FG). Poor access was a central reason for no observed playroom use of the Internet by either teachers or children in the ecosystem under study. There were efforts, however, to remedy this situation. According to the HT in case A_1, ADSL (Jet-stream) would be installed soon.

At times, this lack of provision in infrastructure did not restrict teachers (the dominant species) from using ICT; their reported enthusiasm and motivation drove them to bring their own laptops into the preschool. They moved them around the nursery and utilised them for both personal and professional tasks. In response to this enthusiasm, HTs allowed teachers to use their personal motivation to bring ICT tools from home. As one pre-school teacher said:

'I always bring my laptop with me to the nursery to use it in playroom activities and to prepare any activities I need while I am in the staff room. So, the lack of PCs in the nursery does not affect me.' (T4- A_3: FG)

Furthermore, some teachers from both cases discussed bringing portable broadband devices with them to work (such as a dongle). Some others remarked that the use of mobile computer resources in staff-only areas was permitted and this was helpful to them.

> 'Sometimes I use my [BlackBerry] to access the Internet and check my email or even to research for information if it is needed for one of activities I will do with children.' (T4- A_1: FG)

However, most still rely upon home Internet access:

> 'Well, due to the limitations in some facilities and resources in our nursery, such as a lack of laptops and Internet access, I tend to use the available ICT resources at home, the Internet to collect information, preparing my PowerPoint presentations, and using Word Processors to type my lesson plans. And I guess I'm not the only one who does that; I believe that most of my colleagues do the same.' (T4- A_3: FG)

Consequently, teachers expressed a need for improvements to provisions at the meso- and micro-levels.

7.2.2.2. Poor Organisation of ICT Resources

Issues relating to the poor organisation of ICT are discussed in section 6.5.3.Timetabling and the positioning of resources within the preschool in cases A_1 and A_3 were found to be barriers to integration. As one of the teachers stated:

> 'Access to ICT resources and planning are our biggest constraints.'
> (T4- A_1: FG1)

For instance, in case A_1, during the non-participant observation, most of the ICT equipment (e.g. data projectors, TV and video, and a variety of audiotapes, CDs, DVDs) available for teaching purposes was located in the nursery library, which teachers could book in advance. Additionally, other ICT resources such as printers, scanners and photocopiers were located in the administrative space and were accessible only to teaching staff to use when it was deemed necessary (detailed in section 6.5.1). Such organisation of resources promoted teacher-centred learning, through whole-class scenarios, rather than an explorative learning approach.

In case A_3 there was a similar set-up, with the addition of an audio-visual lab that was only accessible to the children again through a teacher. A reservation system was in operation but did not function adequately.

> 'The computer lab is usually fully booked. I try to bring my class into the lab as much as I can. Though I do have a set schedule to go into the computer lab, it's not enough.' (T3- A_3: FG)

The uncertainty and waiting involved in organising ICT resources in the learning environment are therefore factors that led to teacher reluctance and caused them to turn away from integrating ICT. This was frequently the case in observations and explains why in the questionnaire teachers reported using ICT far less in spaces outside of the playroom (see table 6.8, section 6.5.3).

It was clear during the observations that teachers in the public sector cases (A_1 and A_3), were divided about the positioning of ICT tools in the nursery. Some teachers from case A_1 preferred the idea of having a computer lab and a dedicated SMART room for ICT use:

> 'Providing computer labs or SMART rooms is necessary to prepare children to use such tools and devices.' (T3- A_1: FG)

Some others from case A_3 felt that this was not a large enough space to use.

> 'Not all ICT tools can be placed in the playroom environment, such as the LCD projector. Whereas, I don't mind having a computer or an audio-recorder within the playroom.' (T1- A_3: FG)

Notably, the more ICT literate of the public sector teachers held the view that supplying nursery schools with more appropriate equipment and facilities, as well as training, were the correct first step towards better ICT integration (T1- A_1: FG).

A lack of PCs in playroom areas at the micro-level had a detrimental effect upon playroom management and planning during free-play time. Having a sole computer in the playroom ecosystem was an issue:

> 'Conducting group activities with two or three children can be beneficial for children of different capabilities. However, only having one computer in the playroom can still be an issue if children have radically different skill levels.'
> (T3- A_1: FG1)

For many teachers, their need to manage and plan playroom scenarios with only limited ICT resources remained a barrier to integration. When under-provision was combined with a lack of teacher competence or skills with ICT it resulted in anxiety from teachers regarding ICT's pedagogical use in the playroom. Concerning the provision and prioritising of ICT resources in public preschools, A_1 HT said:

> 'Although the nursery doesn't have a specific budget to purchase ICT devices and the financial support from the MoE doesn't include a specific budget for ICT, providing the nursery with ICT tools is still a priority in my school. We are as a whole school working continuously on providing the nursery with more facilities to ensure all staff have adequate resources.' (HT, A_1)

The HT of A_3 articulated the same issue suggesting a commonality in the situations of the public schools.

7.2.2.3. The Provision of Technical Support

There was once again a divide between how teachers in cases A_1 and A_3 (the public sector preschools) rated their support and how those in cases A_2 and A_4 (the private sector preschools) viewed theirs. As shown in table 7.8, the majority of teachers (57%) agreed that there was a lack of technical support and maintenance in their preschool; when breaking this figure down to public and private sector preschools, a large proportion of the public sector teachers felt much more strongly that they had less technical support (see table 7.10).

Table 7.10 Teachers' responses on factors influencing ICT integration in ECE, Saudi Arabia n=64

Response	n (%)	
	Public sector cases	Private sector cases
Lack of technical support and maintenance	28(72)	8(32)

Case A_1 had no ICT-related staff on its premises suggesting a lack of provision for support at the meso-system coming from the macro- and exo-level. Case A_3, even though it was also a public preschool, was better supported, due to the individual effort of the preschool's HT. Preschool A_3 was regarded in the local teaching area as a standout exception to other public preschools when it came to ICT infrastructure and support, as articulated by the HT of A_4, who was familiar with the preschool's reputation:

> 'I would like to acknowledge [case A_3] as a public sector experience as their experience is well thought of in terms of integrating ICT into ECE' (A_4, HT).

Even given their improved infrastructure (with a specialist audio-visual room, as well as a computer lab), technical support was only provided by a part-time, visiting computer teacher who came to the preschool twice a week.

In the public nurseries, teachers had to manage their own access to ICT resources and were observed to be troubled by this, in particular with the lack of technical support given to them to use ICT tools provided by the government. One teacher commented:

> 'The MoE provided our nursery with desktop computers to be added to the learning environment for level KG3, […] when checking those computers we found that the software was not installed […]' (T4- A_1: FG)

Teachers complained about poor maintenance and technical support services, as they were forced to act upon their own limited pedagogical and technological knowledge. Once more, ICT integration primarily relied on the motivation of teachers themselves. The lack of time to prepare for the arrival of new ICT tools, as well as the lack of support, resulted in teachers being unconfident with integrating ICT as a 'new species' into the micro-system. As a result of this poor provision of ICT coordinators and technical support in cases A_1 and A_3, respondents expressed as essential the need for an ICT specialist/coordinator to be placed within the nursery as a permanent staff member:

> 'Having a specialised person, teacher or staff member, will definitely make the task more successful.' (T4- A_1: FG1)

In contrast, support in cases A_2 and A_4 was provided by an ICT coordinator and IT technician from their adjoining primary/secondary schools, and responses in the questionnaire (table 7.10) indicated that they were more positive about the technical support they received. This was also the case in interviews:

> 'Our nursery is offering all the ICT tools and facilities needed to support our use of ICT. In addition to maintenance and technical support, if anything went wrong, support is here straightaway.' (T1- A_2: FG)

> 'The provision of such a person who is responsible for teachers' support is something quite unique here.' (T3- A_4: FG)

Coming from the meso-level, provision of ICT support improved teachers' confidence and consequently their attitude towards ICT use at the micro-level. Such positive attitudes and confidence promoted a more constructivist, explorative integration of ICT into the learning environment than in the public sector cases (see chapter six for examples of actual practices). The rare constructivist/child-centred examples were more visible in cases A_2 and A_4, where permanent ICT support, including in-house training, helped teachers' confidence.

Two reasons for the limited instances of high-level integration in these cases were teachers misunderstanding their role with regard to ICT and the technology support workers not having an in-depth understanding of the ECE environment. Taking the former issue of how teachers saw their own role, there was a lack of preschool ICT policy to define this clearly for them, which is a common occurrence in the Saudi context (Tearle, 2003). As one teacher put it,

> '[The ICT support assistant] helps in the preparation and implementation of the activity since I am the teacher and I do not have enough time to prepare such things. My focus should be within the learning environment and she takes the part of preparing any required tools for the educational activities.' (T2-A_4: FG)

The teachers felt that preparing ICT tools for teaching was not part of their remit or role as educators. Even basic ICT skills were delegated to an ICT support worker. One public teacher even suggested having a specialist ICT teacher to deliver activities with children:

> 'allowing access to a specialised teacher in the area of ICT who is capable of conveying the information and to use the available ICT devices effectively would help teachers to make the most of the available ICT resources.'
>
> (T2- A_1: FG)

Often teachers delegated responsibility when it came to pedagogical choice about which tools to use and how to integrate them into the playroom to support workers. There was a confusion of roles here between an ICT coordinator, who provides technical support, and a curriculum ICT coordinator, who should focus on pedagogical issues arising from integrating ICT into playroom practice (Tondeur et al., 2010).

IT assistants were mostly from a computer sciences background and were not training teachers in particularly pedagogical or constructivist uses of ICT. Such support was not a substitute for the appropriate/ effective training of teachers to enhance their technological, pedagogical knowledge and competences. Across both public and private schools this was recognised as a barrier to high-level integration:

> 'We need an ICT coordinator specialised in early years' – this is something really very essential.' (T1- A_4: FG)

> 'A specialist technician would be more aware of children's levels, abilities and needs at this early stage. Also they would be more aware of what is new in the field of ICT in education and what may work and what may not.' (T1- A_1, FG)

In turn, in the cases where ICT support was provided, this was not by trainers with an understanding of constructional teaching practices in ECE.

In Scotland, there was a contrast between provision in the public and private preschools. In B_1, they felt that they were fortunate to be so well-resourced. In fact, they felt they were the best resourced public preschool in the LEA. As on teacher said:

> 'We are very fortunate here. I would like to see everyone have the full range of resources and support that we have in [B_1] – because it's patchy. There is no doubt about it.' (T1- B_1: FG)

In the private preschool provision was much more of an issue. The HT, as the keystone species, stressed that they needed certain tools:

> 'We are not quite at the stage at the moment of them putting [a digi-blue camera] into the computer to make mini-videos and things but that's the sort of process that the children have to do, but we're not at that stage.' (HT, B_2)

This suggests that while preschools in Scotland have been in general well resourced, there was an issue with provision in this private preschool, which was observed to have the least ICT provision of any of the six cases.

7.2.3. Training and Teachers' ICT Integration

Given the low levels of confidence and the limited competence of teachers using ICT, it is necessary to explore teachers' perceptions of how they are trained. Over two-thirds of teachers indicated that they had had some form of organised ***ICT training*** (70%) [Q12]. Moreover, the vast majority agreed that the *availability of training opportunities* encouraged them to make use of ICT (78%) [Q9]. This is surprising, since observed actual practices, particularly in cases A_1 and A_3, suggested a low-level of ICT integration. Given the contradiction between training and confidence/competence, the researcher decided to focus more than previously anticipated on the issue of training in the interview phase.

7.2.3.1. Poor Quality Training Courses

Teachers commented that most of the courses provided by the MoE were inadequate and focused on basic ICT skills. In cases A_1 and A_3 the MoE provision was the main form of training provided at the meso-level, to which teachers often suggested improvements:

> 'They have to bear in mind that not all preschool teachers are qualified and have the required skills to use ICT and that there is a large variation between individual ICT skills from teacher to teacher.' (T4- A_1: FG)

Several teachers complained that the free courses offered by the Ministry were scarce, places were limited and they were too short (between two to five days). Longer courses were not funded by either the nursery or the MoE. Respondents from A_1 and A_3 commented on the struggle to obtain cover for training attendance:

> 'To be honest last year, and the year before, they took only one teacher each year, and the year after one administrator, to join an ICT training programme for just one week. It must be taken into consideration that the normal duration of attending such a programme is approximately three months; however they condensed this into a very intensive one week course.' (T4- A_3: FG)

In cases A_1 and A_3 teachers stated that these training opportunities helped them at the beginning of their journey to acquire basic ICT skills but that they were no longer suitable.

7.2.3.2. Scarcity of Pedagogical Training

In the interviews, teachers continued that specialised training opportunities in ICT in teaching are quite rare, and if there are any such courses, they are neither directed towards the pre-school sector, nor catered to varying skill levels, as well as being after the daily working hours.

> 'Unfortunately until now there is no full preparation for the provision of appropriate training programmes to train and prepare early childhood education teachers at different levels within the daily working hours.' (T4- A_1: FG)

Interviews with teachers revealed a clear tendency for stakeholders in the macro- and exo-systems to provide only basic ICT skills training for teachers. Noticeably, the pedagogical needs of teachers for successful constructivist ICT integration were neglected in favour of behaviourist technological skills.

> 'When they obliged us to integrate ICT more fully within the playroom they didn't even think about providing us with any further training or support beyond the limited and basic courses they offered in the past.' (T4- A_3: FG)

Teachers had been promised training that was more central to their CPD in the past but had been let down:

> 'Training and facilities are the core elements on the priorities list. Well, let's be optimistic, they promised to provide us with these.' (T1- A_1: FG)

This top-down approach, coming from the macro-level and the exo-level of the ecosystem, is one reason why ICT was at the first-level of integration.

7.2.3.3. Equality in the Provision of Training

As mentioned, there was variation in the resourcing of training between preschools (private vs. public and stand alone vs. attached to a primary or secondary school). From observation, case A_2, as a private preschool attached to an extended school, had in-house training provided weekly by one of the ICT co-ordinators at the IT department of the attached primary/secondary school. These ICT co-ordinators offered extensive, certified training to teachers in related software and hardware (e.g. IWB and computer-based 'dedicated/ domain-specific software' UNESCO, 2010), often in cooperation with international companies. A_2 worked in partnerships with specialised companies such as *SMART*, *Promethean* and *Techno-Kids*, who provided hardware and educational programmes such as *Active Primary* and *Active Inspire*.

As a result of the introduction of the ECERS-SA programme by the MoE (discussed in chapter 2), which included a standard relating to ICT integration, focus was given to introducing ICT in later-years ECE. This reflects the MoE's practice at the macro-level, as well as the LA at the exo-level, to only allocate ICT devices to 5-6 year-olds who are about to embark on school. Teachers of later year groups in the nursery become the priority for training:

> 'I am afraid that this matter will be restricted to those teachers who have skills and knowledge of ICT use, specifically preschool teachers who make daily use of ICT with children, whereas those who don't have any skills will

> be asked to do tasks in other aspects and will be relegated down the list of priorities for training.' (T4- A_1: FG)

From observation, there a number of levels of pedagogical ICT use in the playroom at the micro-level, across all of the cases, and future training programmes need to be flexible enough to accommodate these.

There was a sense of training having not been provided to prepare for sudden changes in ICT provision. More support from the macro-level, as well as from the LA, was required:

> 'Introducing ICT and technology in general to children at an early stage should be carefully planed, introduced at the appropriate time and not be random.'
>
> (T3- A_1: FG)

In addition, participants signalled a need to ensure equal training opportunities for skilled and unskilled teachers alike:

> 'It is essential to consider the level of teachers' ICT proficiency and awareness. This should be followed by planning training programmes that are applicable to different needs' (T2- A_1: FG1)

These steps were thought to enhance the integration of ICT into the microcosm of the playroom. Recognising different skill-levels, as well as addressing the inequalities in the provision of training across year groups, and between the public and private sectors, could achieve this.

7.2.3.4. Paucity of Time for Training

As suggested, the issue of time scarcity for training was barrier identified from teachers' comments. Teachers from all cases felt that 'proper' training could not be provided within working hours:

> 'There is no full preparation for the provision of appropriate training programmes to train and prepare teachers during or within working hours'
>
> (T4- A_3: FG)

> 'if the teacher was interested in improving her skills, she was obliged to join an external training course which took up her personal time (outside working hours)' (T4-A_1:FG)

Teachers felt that their personal time was not considered equally valuable to preschool time:

> 'they consider time because it will be extracted from the working hours, whereas this consideration is not shown when time is taken from teachers' personal time (outside working hours)' (T4- A_1: FG)

The lack of leave allotted to attend courses was an impediment to training teachers equally in ICT. Overall, from observations and interviews, it was clear that there was a scarcity of time for training and this was also reflected in the questionnaire [Q10], with the majority of teachers (56%) in agreement that it hindered their efforts to integrate ICT.

7.2.3.5. Self-directed or Collaborative Approach to Skills Improvement

In section C of the questionnaire, teachers were prompted to tick which of a list of twelve methods they used to ***keep up-to-date with new skills and ICT developments*** [Q14]. They specified a number of informal methods of skills development (presented in table 7.11). The highest proportion of teachers suggested that *self learning* was how they maintained their skills (90%). This is consistent with the finding that a vast majority (87%) of teachers, reported in section 6.5.3.2, have access to ICT at home. The approaches of *exchanging experiences with other teachers* (91%), *exchanging experiences with family members* (75%), and using *the Internet* (68%) all scored highly too. The great majority responded that they used the Internet on a daily to weekly basis for personal use (83%); a majority (64%) also used it for professional development purposes just as frequently.

Table 7.11 Methods for updating ICT skills as chosen by teachers in Saudi Arabia (n=64)

Response [a]	Responses*		Percent of Cases
	N	%	
Self learning	59	18.1%	93.7%
Exchanging experiences with colleagues	57	17.5%	90.5%
Exchanging experiences with family members	47	14.4%	74.6%
Librarians	6	1.8%	9.5%
Technician	19	5.8%	30.2%
Inspector	11	3.4%	17.5%
In-service training courses	31	9.5%	49.2%
External training courses	27	8.3%	42.9%
Professional journals	11	3.4%	17.5%
Computing department	14	4.3%	22.2%
Internet	43	13.2%	68.3%

a. Dichotomy group tabulated at value 1
*Multiple response analysis

On the other hand, nearly half the teachers reported that they kept their skills up-to-date by attending *in-service training courses* (49%) and *external training courses* (43%). The least common responses to ways of developing ICT skills were to consult the school *technicians/educational advisers* (30%), *computing department* (22%), *professional journals* (18%) or *librarians* (10%). The low responses to using help from the school *technician* or the *computing department* can be linked to the unavailability of this type of support in the preschools, particularly in the public sector (see section 6.2).

As discussed in section 7.1.5, teachers often suggested that there was more ICT knowledge to be gained but they were uncertain what form this knowledge could take:

> 'The support we need from our management here in this nursery is more training courses – namely, in early years. Probably there are other things we are not aware of and would be worth knowing.' (T4- A_4: FG)

Teachers, the dominant species, clearly need more guidance in identifying what their priorities should be in terms of developing their use of ICT in ECE. This links to a lack of training in particular technology use in ECE and a lack of technological pedagogical knowledge that impedes teachers' ability to express their needs.

With regard to Scotland, Plowman et al. (2010, p.62) have suggested that 'practitioners often doubt their competence,' perhaps due to their diverse educational and training routes and a 'historically poor' record of CPD. The problem for CPD lies not in the availability of training but that training is not always targeted to ICT playroom practices:

> 'I think over the years we've seen an increase in staff skill development, the availability of ICT training, but part of the problem is that what's available is mainly for admin systems or for applications, such as Word or Excel.' (HT1, B_1)

There are also time constraints upon practitioners:

> '[...] there are issues in getting staff out, we have to maintain ratios in nursery, because Care Commission demand it and Consense demands it as well, so there are problems getting staff out during the day'. (HT, B_1)
>
> 'I don't think there is a lack of training opportunities. I think there is a lack of ability to get out of the building in core time to access training'. (HT, B_1)

This was particularly frustrating for the HT as she had previously organised ICT training and knew of local courses available:

> 'I've organised and led ICT training in Glasgow since 1985 […] there are courses in Govan'. (HT, B_1)

However, it was also her unique experience as a trainer that allowed her to direct effective in-house training in her preschool:

> '[…]because of my own skills it's perhaps easier for me in one sense to lead development because I know what to lead and why it's important'. (HT, B_1)

The HT also demanded that her practitioners take responsibility for their learning and are accountable for their CPD. She desired them to be proactive in using online resources and improving their technology skills whenever was feasible.

In the private sector there was a more severe lack of ICT training and this was contrasted to the provision in the public sector:

> 'Certainly the ladies I have just now haven't had any training on ICT. Training on ICT was put forward by [the LEA] four years ago and, since that training was undertaken, the staff that were there then have moved on and there hasn't been any training offered since. The training that was offered was at [a public sector preschool in the LEA]. They have fantastic facilities over there. Funding again is limited at the moment with the LEA'. (HT, B_2)

Thus, there are inequalities of training in both contexts and more direction is required from the exo- and macro-levels.

7.3. External factors (outside preschools at the macro level) external level

In spite of the methodological focus of these case studies being on the micro- and meso-levels, internal to the preschools, some external factors were naturally brought up by HTs and teachers in the interviews and under observation. The small number of naturally arising responses regarding external factors at the exo- and macro-systems came from all four cases but mostly was from cases A_1 and A_3. I attribute the smaller numbers to: (1) the 'distance' between the teacher at the micro-level and these external influences, and (2) that the focus group questions focused mainly on internal issues. The external factors most commonly brought up by practitioners and HTs were: (1) the national ICT policy, (2) the national ECE curriculum, and (3) support from educational authorities. Figure 7.4 shows these emerged factors in further details.

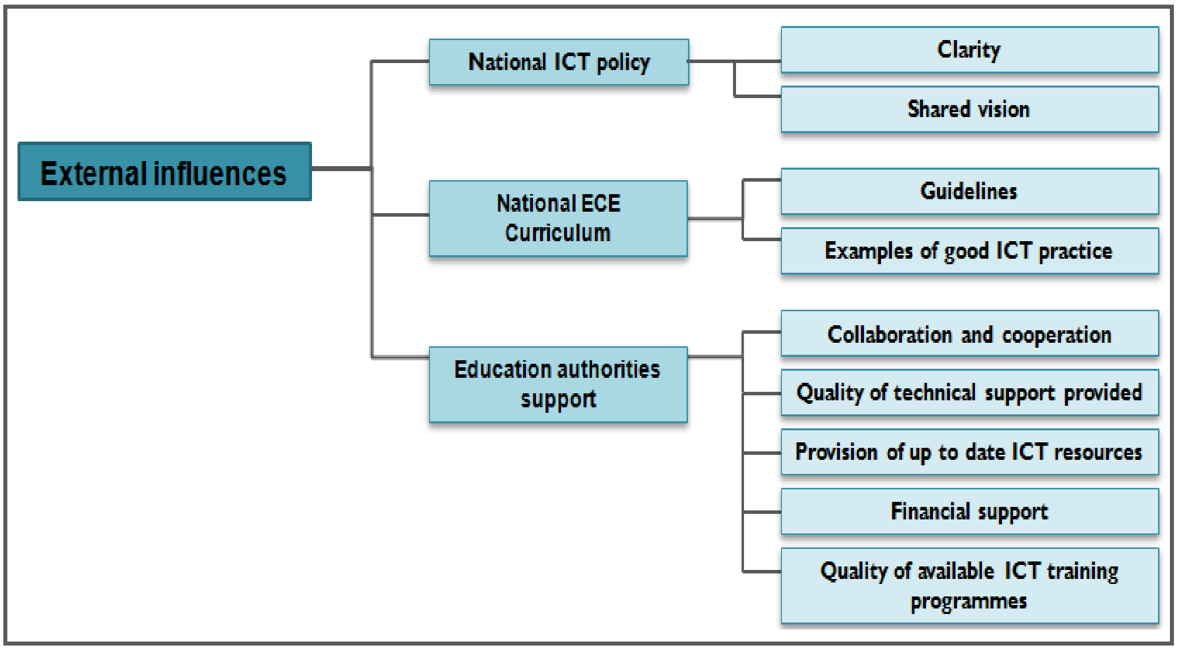


Figure 7.4 Key themes and sub-themes emerged in relation to External factors outside preschool

7.3.1. National Policy/Plan for ICT Integration into ECE

As argued earlier in section 7.2.1, findings demonstrated that at the preschool level there was a lack of whole-preschool ICT policy/plan in all the four cases and that the integration of ICT was mostly down to individual efforts. In questionnaire responses, the majority of teachers considered this lack of a written, national ICT policy for ECE as a barrier to their efforts to integrate ICT into the learning environment (67%).

Table 7.12 Teachers' responses on factors influencing ICT integration in ECE, Saudi Arabia n=64

Response	n (%)				
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
No clear plan or reference-point for teachers on the use of ICT	14(22)	29(45)	2(3.1)	18(28)	1(1.6)

Such an absence of national ICT policy for ECE resonates with both HTs and teachers' earlier comments, discussed in section 7.2.1, that most of the implementation of ICT in ECE is based upon the general ethos within their preschools:

> 'The initial use of ICT in ECE is not driven by guidance from the Local Authority but is a consequence of individual efforts amongst practitioners and teachers in the field of ICT.' (T4- A_3: FG)

Nonetheless, there was a general sense of a recent, external imperative that ICT use was compulsory and a necessity, as stated by case A_1 teachers throughout the focus group discussions (T4-A_1:FG). Case A_1 HT also continued that it was 'just last year' that computers (PCs) were added formally by the education authorities to the playroom (HT, A_1). Indeed, placing a computer in the playroom at the micro-level became compulsory in public preschools for KG3 level (5-6 year-old children) in the year of the present study, in order to meet the ECERS-SA standards introduced by Jeddah LA. The barrier to integration was that both HTs and teachers, namely from cases A_1 and A_3, found ICT initiatives coming from outside the preschool, at the macro- and exo-systems, to be unclear. Teachers from the same cases also did not feel properly prepared or supported:

> 'Mainly, one of the major difficulties associated with the integration of ICT in ECE is the random and sudden introduction of any new system or educational programme. Everything happens suddenly and the change is absolute, it is not gradual, there is no understanding of the background and the nature of this newly implemented programme.' (T4- A_1: FG)

This speed of ICT introduction into the playroom, along with a lack of clarity regarding the purpose of ICT integration, rendered the external initiatives coming from the educational authorities ineffectual. As a case A_1 teacher highlighted:

> 'The whole process behind adding computers to the early learning environment is to meet the quality standards of ECE provision without previous strategic planning, the existence of a clear plan, clear working objectives, or good preparation for both teachers and children. Should ICT integration work in such a way? I don't think so.' (T4- A_3: FG)

Similarly, another group of teachers from case A_3 also complained that decisions coming from the macro- and exo-systems were not well thought out in terms of reviewing teachers' duties in the playroom, meaning teachers had to do extra work while adjusting (A_3, T_2).

In case A_1, one teacher insisted upon a need for the gradual implementation of considered, well-organised plans, in order to embed ICT successfully:

> 'Introducing ICT and technology in general to children at an early stage should be carefully planned, introduced at the appropriate time and not be random.' (T3- A_1: FG)

ICT in these preschools is therefore not helpfully driven by policies coming from the exo- and macro-systems. There is no positive influence coming from the macro- and exo-systems to lead teachers beyond low-level teacher-centred integration.

7.3.2. ECE National Curriculum

Regarding issues related to the curriculum, participants indicated that one of the obstacles hindering effective integration of ICT is the ECE curriculum itself, as it does not make specific reference to ICT use and the skills that children should acquire. As a result of this oversight there is a misunderstanding about the ICT skill level that should be expected of the children:

> 'they were asked to participate in ICT based activities without teaching them acquire the suitable technical skills, as a consequence pupils start to depend on their own families when preparing these tasks' (T1- A_3: FG)

Another teacher commented:

> 'throughout the school levels there is the constant presumption that students or pupils are fully competent and have the necessary skills to use ICT, rather than a focus on teaching them basic skills in using ICT' (T4- A_1: FG)

In Scotland, the CfE has an outcome concerned with guiding ICT use in ECE. However, even with this guideline at the macro-level, it seemed from the Scottish cases that the policy often did not influence playroom practice. For example, B_2 HT noted that the initial support from the macro- and exo-systems for integration eventually stopped after the top-down sending of literature and purchasing of infrastructure. This cessation of support was cited as a barrier to achieving high-level integration:

> ‘To be fair it was about four years ago this [CfE] was given out and it wasn’t really explained very well. It’s just a booklet offering us some resources and it isn’t used. I’ll be honest; it sits on the shelf gathering dust.’ (HT, B_2)

Even in the case of B_1, where the HT was well aware of the principles of the CfE, there was scepticism over the ways in which it has changed practice:

> ‘I think that once people come to terms with the outcomes, and so on, they will realise that really practice isn’t changing so much, maybe shifts in emphasis, shifts in how we record and report, and so on. But the reality is that our day to day practice isn’t going to change that much.’ (HT, B_1)

It is important that when a policy is implemented from the macro-level that it is monitored and seen to affect playroom practice at the micro-level.

7.3.3. Education Authorities’ Support

Teachers were aware of the influence of the organisational culture and support at the meso-level of the preschool and this helped to sustain a positive attitude to ICT development. However, HTs (keystone species) and teachers (dominant species) felt that there was a lack of adequate support from other stakeholders at the exo- and macro-level to encourage them to benefit from this positive environment at the meso-level. As mentioned, case A_1 teachers felt that the emphasis was greatly on them to drive integration:

> ‘Yes, there is a Whole School view of the importance of ICT. However, it is still for you as a teacher, through individual effort to develop yourself and your skills.’ (T4- A_1: FG)

Some teachers provided extra information on the problems faced by their preschools in grappling with improvement plans coming from educational authorities. Their comments point to deficiencies in the education authorities’ plans. These included a lack of specific reference being made to ECE, financial support, technical support, guidance and supervision.

As part of their frustration with being left to their individual efforts, teachers felt that they were only getting support in non-tangible forms: ‘All that we’ve got is encouragement and verbal support.’ (T2-A_1: FG). They talked about the need for support which is practical in nature. A clear message was that teachers wanted to be provided with adequate time to train with technology:

> ‘Teachers in our nursery spoke to the management team asking for the provision of such a time during the daily duties but these requests for extra preparation time were never given to us.’ (T4- A_1: FG)

HTs also felt that embedding ICT training into original preschool teacher courses would benefit integration (see section 7.2.1 and 7.2.3).

Teachers recognised the need for support from the top and expressed a need for a national initiative (see section on policy, 7.2.1). They emphasised the need for the backing of educational authorities.

> ‘Support and encouragement for teachers to improve their skills and value individual efforts comes from the nursery itself.’ (T4- A_1: FG)

> ‘They are not ready to provide you with such support and motivation, except through providing facilities, which are again very limited.’ (T4- A_3: FG)

In spite of policy problems, generally speaking there is some intention from the ECE department in the Jeddah LEA:

> ‘There is indeed an effort from the LEA in Jeddah and the nursery management team to provision ICT tools to some extent’ (T4- A_1: FG)

Even given this limited support, financial issues still constitute another substantial hindrance and this was reflected by HTs who bemoaned only partial funding for ICT (see section 7.2.1.). The high cost of ICT devices and software was seen as a barrier to the integration. Teachers in case A_1 and A_3 were quick to point out that they even contributed and donated ICT software (see section 7.2.2).

In Scotland, in spite of their being a national policy for ICT use in ECE, funding was still seen as a major issue. As one teacher put it:

> 'When we look at the context of what the framework expects we have to look at it in terms of financial support, in terms of training and in terms of resources, quite expensive resources. And I think that is where the framework has fallen down: in giving us the vision but not support it with the resources and the finances.'
>
> (T1- B_1: FG)

Funding was given as one of the reasons as to why the Scottish national policy at the macro-level did not ultimately solve or alleviate external barriers to high-level ICT integration in Scottish preschools. A private preschool HT in Scotland also suggested:

> 'Funding again is limited at the moment with the LEA so they haven't identified it as being a priority to put that training back on for private provides like ourselves.' (HT, B_2)

The HT in B_2 regarded ICT as a tool that should be supplemented by the LA even though B_2 is a privately funded preschool. This raises a question about the prioritisation of ICT in private preschool budgets. Teachers generally felt that elements such as finance, support, hasty initiatives, a lack of set training time with ICT and unclear objectives for ICT integration were barriers coming from the macro- and exo-systems to integrating ICT into the micro-level of the playroom.

7.4. Discussion of Key Findings

In this coming section, the discussion focuses on the key themes which have emerged from the results, organised in a non-linear fashion. It explains in detail the complexity of teachers' ICT integration in teaching and learning, and shows the merging of the ecological and complexity perspective at different levels, from the individual to the system.

Complexity thinking and interactions in complex systems

In the theoretical framework chapter, the use of complexity theory as a way to further understand ICT integration within the ecological framework is discussed. Complexity thinking provides a complementary approach to ecological concepts, through which to examine the intricate network of interactions between the individual, preschool and larger community.

Complexity thinking extends the adapted ecological framework in two ways: firstly, by adding an interactional element within both individual/teacher levels and between different levels (i.e., complex systems which are nested) that interact with each other; and, secondly, by adding the conditions in which teachers' ICT integration emerges. The integration of the ecological concepts - the 'multileveledness' of the ecological framework and complexity thinking into an ecological-complexity perspective - provides an approach for discussing teachers' ICT adoption in teaching and learning.

The possibility of adoption and non-adoption

As mentioned earlier, in Chapter 4, the possibility of adoption and non-adoption is based on the interdependent relationship or interactions between the dominant species (teacher) and the keystone species (school head) in determining whether ICT adoption occurs in an ecosystem.

Inherent in the possibility of adoption and non-adoption is the concept of 'shifts' between the two positions. Shifts are defined as a movement between these two 'states', similar to Tearle's continuum (see section 4.1.2.2). However this movement between a state of adoption or non adoption is indirect; a consequence of the complex interplay between dominant species, inorganic factors, the keystone species, the ecosystem, and the external system. Teachers' ICT adoption or non-adoption shifts according to these influences and so does the level of ICT adoption in the school.

Dominant Species - teachers as individuals

The findings in Section 7.1.3, at the teacher level, show that ICT confidence played a role in influencing practitioners' integration of ICT. Mueller et al. (2008, p. 1533) found that ICT confidence contributes to integration of ICT in the classroom. There are a number of factors that led to ICT confidence in individual teachers as a dominant species: belief, attitude, teachers' professional development (particularly, ICT in-service training), teachers' pre-existing skills in using ICT, and ICT knowledge. Each factor contributed to the development of the teachers' ICT confidence and consequently helped shift the teacher towards ICT integration in teaching and learning. The emergence of these factors suggests that the ICT integration of individual teachers is complex and largely dependent on the individual. Furthermore, it indicates the complexity of relationships that occur in the process of developing ICT confidence. The findings of this research suggest that there are some reciprocal relationships, i.e., individual factors are interrelated, for example between teachers' in-service training and skills in using ICT for some teachers.

Actual ICT practices

A comprehensive understanding of how ICT is currently practiced in the research preschools is fundamental for deciphering the interactions between children and their practitioners within the playroom. Practices learnt vicariously from HTs and other practitioners in the same preschool influenced practitioners' ICT practices, as similarly found by Mueller et al. (2008, p. 1533) and Judson (2006, p. 585). New practices did not emerge because both HTs and practitioners lacked the pedagogical knowledge necessary for integrating ICT in teaching and learning. As observed by Judson (p. 585), this can result in a contradiction between the practitioner’s assertion as to what constitutes appropriate ICT teaching and learning practice and the longstanding pedagogical foundation on which their own practice is based. In this research, practitioners’, particularly, in A_1:O and A_3:O showed the contradictions between beliefs and practice. They believed that their teaching practices had changed and were appropriate and different when they used ICT in teaching and learning. However, observations showed that integration was superficial and instructional, and focused on the teacher. The following discussion focuses on the ecosystem.

Relationships between individual factors and actual ICT practices

The relationship between individual factors influences teachers' ICT integration in teaching and learning. One of the factors at the teacher level that has a strong impact on ICT integration is ‘pedagogical beliefs’. The results in Section 7.1.1 suggest that ‘constructivist teaching beliefs’ are a key factor in influencing teachers’ integration of ICT. Practitioners with stronger constructivist beliefs tend to use ICT more frequently as an instructional tool in the playroom. Clearly, constructivist teachers are more likely to use ICT in challenging ways (Hermans et al., 2008; Judson, 2006; Roehrig et al., 2007). Practitioners use ICT in ways that are consistent with their personal beliefs, and a broader spectrum of educational beliefs results in a more diverse use of ICT.

The observed teacher-centred practices, particularly prevalent in preschool A_1 and A_3, were influenced in part by teachers’ and HTs’ lack of pedagogical knowledge. The results in Sections 7.1.5 and 7.2.1.3 suggest that HTs and teachers have little to no knowledge about how to use these tools to support pupils’ learning. Mueller et al.’s (2008) finding that teachers learn through collaboration and self-help were corroborated in this research and confirmed in practitioners’ interviews and focus groups. Given a lack of formalised training, teachers, particularly in preschool A_1 and A_3, were not forced to challenge their teacher-centred, traditionalist pedagogical beliefs regarding ICT integration. The limited, constructional practices found in this research reflect those in Stephen et al.’s (2008) study. These observed practices were at a low-level of ICT integration as teachers primarily integrated ICT as an add-on to learning or as merely a tool for improving their delivery of information to preschoolers.

More positively, the findings reveal that teachers have existing Pedagogical Content Knowledge (PCK) upon which to build. What they typically lack, however, is specific knowledge about technology itself and how to incorporate it with their existing PCK to support children’s content learning. The source of this lack of pedagogical knowledge, meaning teachers were uncertain about what ICT skills they needed to improve, was felt to be a result of both current ICT in-service training practices and, teachers' initial preschool training at college or university. Provided ICT in-service training has clearly been promoting only basic ICT skills that focus on information delivery: this explains why A_1 and A_3 teachers were confident and showed high levels of competence in class management for traditional teaching but lacked confidence in class management when using ICT.

Confidence was a key issue and inter-related with many other factors at the teacher level (such as: belief, attitude, knowledge, and competence) that clearly influenced teachers' attempts at integration. The results in Sections 7.1.5 and 7.2.1.3 indicate that teachers were more ambivalent about using ICT as an integrated, scaffolded tool, as they were not yet confident and they felt that their ICT use was often not well supported. Teachers clearly had anxieties about classroom management with ICT and their own abilities to fix resources if they experienced hardware or software problems. Both the lack of experience in supporting and scaffolding children's learning with ICT and poor technical support for teachers' ICT use were barriers to higher levels of integration. Linked with ICT skills, access to ICT is seen to help teachers to be confident users of ICT.

Clearly teachers still need opportunities to develop skills using ICT as an instructional tool. In so doing, 'Teacher learning should prepare teachers not only for any kind of ICT integration, but should equip teachers for 'good practices' in ICT integration that contribute to improving existing teaching practice to achieve the goals of school reform' (Holland, cited in Law, 2008: 427). Furthermore, effective professional development for ICT integration requires: (a) technology knowledge and skills, (b) technology-supported pedagogical knowledge and skills (the ability to see a clear connection between the technologies being used and curriculum content being taught), and (c) technology-related classroom management knowledge and skills. Most importantly is that professional development programmes include information about how they can use these tools in ECE to support children's learning.

A change in teacher knowledge takes varying amounts of time, depending on each teacher's existing technology and PCK knowledge (Mishra & Koehler, 2006). According to Kanaya et al. (2005), the probability of implementing new technology-rich activities in the classroom is related more to the intensity of the training, as opposed to the duration. Therefore, when planning professional development programmes, it is important to consider how often and for how long teachers should meet, as well as for what period of time. Research from Kanaya et al. (2005) suggests it is possible to have a greater impact in a shorter period of time, if more time is allotted up front.

The ecosystem

Some teachers are intrinsically motivated to use ICT in educational practice, while others do not share this affinity with technology. For this reason, many researchers have centred on critical teacher related characteristics associated with educational technology use, such as innovativeness (Marcinkiewicz, 1993; van Braak, 2001; Zhao & Frank, 2003), 'ICT attitudes' (Albirini 2006a; Dementriadis et al., 2003; van Braak & Goeman, 2003) and 'ICT experience' (Becker, 2001; Bovée et al., 2007; Williams et al., 2000a). The impact of these factors aligns with these research findings: ICT integration depends in large part on the willingness and attitudes of individual practitioners.

In order to complete existing research by including preschool related factors, ICT integration from an ecological – complexity perspective is examined. This leads to a strong focus on the preschool as a unit of change and pays additional attention to the internal conditions at preschool level. Throughout the six case studies, significant differences in the way ICT is currently implemented in the playroom setting were observed; as a result, the six preschools were different in their level of ICT integration. The results demonstrate the need to and the success of adopting this blended theoretical framework. While there is still much to learn with respect to the impact of school characteristics, the findings presented in this research indicate that ICT integration depends on more than teacher related variables, as discussed in Chapter 7. A significant degree of difference in ICT use could be explained by factors at preschool level. In this respect, the findings in Chapter 7 corroborate previous findings (Baylor & Ritchie, 2002; Brummelhuis & Kuiper, 2008; Kennewell et al., 2000; Tang & Ang, 2002; Tondeur et al., 2008) that have shown the importance of also verifying the influence of characteristics at school level.

The keystone species

The ecological perspective denotes the preschool HTs as the keystone species as she has the most influence role in that ecosystem. Researchers in complexity thinking, such as Lichtenstein & Plowman (2009) consider the leader of an organisation (e.g., the preschool HT) as the central decider (p. 617). Thus, the preschool HT, i.e., the keystone species, can determine the interactions that influence ICT integration in teaching and learning.

The shifts in individual practitioners' ICT integration are influenced by the interactions practitioners have with the preschool HT, the availability and access to ICT infrastructure, the quality of offered technical assistance and training, and the needs for a clear plan. The findings in this research indicate two major concerns which influence the keystone species and the dominant species – clear ICT planning and the quality of available support. These concerns exert pressure on the ecosystem and species to act accordingly. Findings also show that external factors, such as the national ICT policies, national ECE curriculum and MoE support, further influence the shift towards ICT adoption or non-adoption.

Within the preschool, the network of interactions is principally determined by the preschool HT (the leader of the organisation). The literature has shown the influence of leadership on practitioners' ICT integration. Fullan (2000, 2001) and Tondeur et al. (2008) argue that innovations such as ICT require leadership and a supportive environment where the HT’s role should be as a facilitator, guiding change carefully, rather than as an authoritative dictator. Dexter (2008) and Tearle (2003, p. 573) further argue that effective leadership is a strong indicator in ICT integration in schools. Preschool leadership therefore performs a critical dual role: firstly, in provision of ICT resources, and secondly, in ensuring the effective integration of these resources into the schools principle responsibility - delivery of the ECE curriculum.

The school HTs as keystone species have hierarchical or positional power, as suggested by Handy (1993), which influences practitioners' shift towards adoption or non-adoption. As such, both Baylor & Ritchie (2002) and Fullan (2005) have asserted that the behaviour of the HT is fundamental in both the planning and action stages of ICT integration. The influence of the HT goes beyond the reach of individual practitioners, to a wider network of stakeholders, which including parents and other staff members. Preschool HTs therefore need to take a hands-on approach to ICT integration in order to support all participants through the change process. In practical terms, each HT must consider the present wisdom regarding preschool ICT integration and adapt it to the individual context of their own school (Robertson et al., 2007). Leadership influences either the possibility of ICT adoption or non-adoption, i.e., the possibility of practitioners using ICT in teaching and learning or otherwise.

Practicality considerations and quality of support provided

Three other significant preschool factors (reported in Chapter 7) influence ICT integration: the availability of preschool in-house ICT support, in-service training, and infrastructure. First, it appears that teachers reporting a high degree of ICT-related support incorporate ICT in their practice more often. This confirms research findings that teachers need considerable support in view of ICT integration (e.g., Galanouli et al., 2004; Lai & Pratt, 2004). In the majority of the case studies preschools ICTCs were available but they mostly provided technical support to teachers ICT uses, while their impact on educational or policy-related issues seems limited. Only in case B_1 was the ICTC one of the teachers and she was trained to provide ICT curriculum support. According to the literature it is advantageous for a school to have an ICT coordinator who provides both technological and curriculum support to teachers integrating ICT (Lai & Pratt, 2004; Tondeur et al., 2010). Both HTs and teachers pointed out that this lack of an in-house Curriculum ICT Coordinators (CICTCs) is a barrier to ICT integration.

Professional development should stay at the centre of an ICT policy. It is clear from the findings here that access to training in Saudi is particularly problematic for public preschools but that issues existed in both sectors; in Scotland private preschool B_2 also had LEA training issues. Findings reveal that ICT training is a major influencer, but only in view of one type of educational ICT use: “basic ICT skills”. Next to the importance of technical skills development, the analysis of the actual practices observed in the preschool case studies presented in Chapter 6 urges the adoption of training programmes that centre on a wider integration of ICT into the ECE curriculum.

Infrastructure, too, is an important condition for ICT integration. The location of ICT facilities and the availability of an Internet connection are central (Chapter 6 and 7). For example, due to a lack of provision, in the public preschools A_1 and A_3 the limited ICT equipment for pupils was held in the library and there were limited ICT practices in the playroom. In B_2, ICT access was restricted to the HT's office for administrative use and this represents a clear lack of investment. Positioning ICT tools in computer suites was at times a barrier to high levels of integration. The organisation of resources was another factor that discouraged the use of 'ICT as a constructional tool in the playroom', as the suite is prioritised for using technology.

At present, very few preschools can be labelled as 'learning organisations' with a shared commitment to ICT integration. Similar to other studies (Al-Dayel, 2009), the available data gathered in Saudi preschools do not present sufficient evidence to be able to conclude that teaching and learning with ICT has reached integration in ECE.

Interactions between species and inorganic factors in preschool

The HTs studied in this research clearly all tried to provide this support in their role as preschool leaders. As a keystone species of the integration process, HTs encouraged ICT use in a range of child, teacher and administrative related capacities. In preschool A_2 and A_4, with the good level of ICT integration, there were a number of factors that influenced the possibility of adoption. The preschools HTs used ICT personally, had knowledge about ICT, and created initial ICT preschool plan to benefit the teachers in the preschool. Further, HTs worked in collaboration with the ICT co-ordinators in their adjoining schools and in partnership with international companies to provide support for their teachers while they use ICT in the computer labs, as well as provide alternative opportunities for the limited in-service ICT training sessions offered by the MoE or the LEAs. In preschool B_1 ICT training was provided by the HT in person and the in-house preschool ICT co-ordinator. Preschool A_3, B_1 and B_2 HTs also encouraged cooperation between preschools from both sectors in the local areas to share ideas and practices. In general, practitioners in these preschools were more likely to adopt ICT.

However, in spite of the enthusiasm and positive ethos, HT pedagogical belief misrecognised and simplified the ways in which ICT should be integrated into the playroom as a complex tool. Furthermore, both HTs and practitioners often lacked the technological pedagogical knowledge and were mostly unaware of how to support child-centred learning with technology. In contrast to cases A_2 and A_4, HTs who were more aware of the complexities of ICT use and their knowledge influenced the preschool taking initial steps toward higher integration levels. In cases A_1, A_3 and B_2 HTs provided the same rationales for ICT use as practitioners and they demonstrated the same limited technological pedagogical knowledge. This was one of the reasons why the HTs did not work to change the 'subjective norm' in their preschools. Consequently, preschool A_1 and B_2 shifted into the possibility of non-adoption due to preschool heads who provided superficial support to the teachers in the preschool with regards to ICT. Findings in these two preschools showed that there were practitioners who adopted ICT. However, further ICT adoption in teaching and learning by these teachers and other teachers, were hindered by the lack of ICT coordinator and the lack of adequate ICT facilities available in the preschool, even though they were motivated to use ICT in teaching and learning.

The capacity of the HT to guide development and delivery of a shared vision for ICT practice and integration is a key component in this process. The study from Dawson and Rakes (2003) underpins the former: the more training principals receive, the more ICT integration at school level is being observed. Their findings suggest that without well-trained, ICT-capable principals, the integration of ICT into school curricula will remain deficient. Therefore, training of HTs should be a priority.

Pressures or concerns within the ecosystem influence how species interact and thus, affect inorganic components (such as the ICT provision, and its availability and access) and reinforce certain priorities. The next section discusses the effect of stability and instability in teachers' ICT adoption.

Stability and instability: ecosystem and species

In relation to the ecosystem of ICT integration, stability specifically concerns those factors; the activity and interactions, such as school characteristics or norms, which promote stability and discourage change. In contrast *instability*, or the flexibility that enables change such as ICT integration to occur, is a result of "supportive" or complementary" factors in a complex model. There are two characteristics of Saudi Arabian preschools that further influence ICT integration in ECE settings. They are: (a) the lack of shared vision at the school level, and (b) the lack of collaboration across system levels. In explaining stability, these two characteristics, which are present in the research preschools, are taken into account.

Need for a clear shared vision at the ecosystem level

For Fullan (2000, 2001), it is essential for change to happen that there is clarity in the process; clarity relates to a shared vision, goals and objectives within an educational environment (Fullan, 1991). With particular regard to ICT integration into ECE, it is possible to relate the notion of shared vision, goals and objectives, at the internal meso-level, to a coherent preschool policy or plan for ICT as well as to a clear, shared purpose for ICT integration in the minds of both HTs and practitioners in terms of their beliefs and attitudes. However, these issues are not just internal; plans and visions for ICT are also formed at the external macro and exo-levels. In Fullan's terms there has to be a 'shared meaning' underpinning ICT use across all levels of the ecosystem.

At the internal, meso-level of the preschool, the results show that a written whole-school plan was missing in the vast majority of the preschools; A_2, A_4 and B_2, though, did present a vision and targets for ICT use in their general preschool development plans. It was clear that this vision, even given that it did not qualify as a whole-school plan, encouraged teachers to use ICT more regularly in their playrooms. The only preschool with a whole-school policy that clearly aided a shared vision for ICT was B_1. This, too, was the only preschool to consistently use ICT in child-centred, constructivist practices, and confirms results of other studies that successful ICT integration depends on a shared vision (Bennett, 1996; Ely, 1990; Fullan, 2001; Guhn, 2008; Hughes & Zachariah, 2001; Otto & Albion, 2002). However, it is to be stressed that in this study only 'teacher perceptions regarding the inclusion of ICT in the preschool educational plan' and not the actual content of the ICT plan appears to have a significant impact on playroom use of ICT. As a consequence, an ICT policy seems to be an important incentive to foster the integration of ICT use in playroom, but only when teachers are aware of its content. In other words, successful ICT integration is much more likely when teachers share the values expressed within the school policy and understand their implications.

Nevertheless, as could be derived from the interviews (Chapter 7), teachers reported concerns over the ‘top-down’ approach taken from HTs at the preschool level without consultation from teachers themselves. Teachers would have liked to have participated in creating ideas for the plan for it to be a truly shared vision. This recalls the findings in the literature that ICT integration is more feasible when teachers share values with the school policy (Hughes & Zachariah, 2001; Otto & Albion, 2002; Tondeur, 2007; Tondeur et al., 2008). The surprise, as reported in this study, that teachers in the Saudi cases felt when the LEA introduced hardware or software into the playroom, is indicative of this lack of communication between HTs and teachers. A clear vision for ICT is essential before investing in hardware and software (Means & Olson, 1997). This reinforces the fact that policy decisions and change models do not always acknowledge the pivotal role of the teacher in effecting change (Olson, 2000).

Lack of collaboration across system levels

This lack of communication discussed in the section above was not only raised at the preschool level; also a number of HTs in Saudi were confused about what it even meant to have a whole-school ICT plan and they complained about a lack of a clear vision being passed onto them from the macro- and exo-systems. A shared vision for ICT requires clear communication, not just between HTs and teachers at the meso-level, but also between HTs and the LEAs or Government at the exo- and macro-levels respectively. This finding, in which both HTs and teachers felt disorientated by top-down approaches, and where integration practices varied across the case studies, demonstrated a lack of collaboration across system levels. They also demonstrate a particular lack of understanding, at the macro- and exo-systems, of the complexity of entering a new species into an ecosystem. The findings show here that this lack of collaboration between system levels certainly occurred in the Saudi context. However, even in Scotland, B_2 HT noted that the initial support from the macro- and exo-systems for integration eventually stopped after the top-down sending of literature and purchasing of infrastructure. This cessation of support was cited as a barrier to achieving high-level integration. In turn, change requires continuous collaboration and not just the initial impetus of support.

Fullan (2001) emphasises collaboration in each context across the system levels and warns that change at just one level will only bring about partial change overall.

Furthermore, Somekh (2008) suggests that a dialogue should be established based on parity between principals, teachers, and other stakeholders. Stakeholders at each level of the ecosystem need to engage dynamically in the development of an ICT plan and influence the on-going integration; stakeholders need to be authentic, collegial and collaborative (Bush, 2007; Tondeur et al., 2008b). In addition, Tang and Ang (2002) highlight the impact of communication on ICT integration. They suggest that teachers should not be considered as 'recalcitrant recipients' but as 'structurally constrained participants'. Without productive communication and collaboration between system levels the criteria of clarity for ICT integration cannot be met. The majority of preschools studied here, however, are not yet using ICT with a shared commitment and school vision meaning that ICT integration cannot be achieved in a systemic and systematic way (Tondeur et al., 2008a).

Stakeholders at each level of the ecosystem need to engage dynamically in the development of an ICT plan and influence the on-going integration; stakeholders need to be authentic, collegial and collaborative (Bush, 2007; Tondeur et al., 2008b).

The culture of uncertainty and non-collaboration across the system levels show that the research preschools were constrained in their ability to integrate ICT. These two characteristics partly influence whether the schools were stable (*stability*) or lacked stability (*instability*) or are between the two in the adoption of ICT. In complexity thinking, stability is dependent on the dominant species, the keystone species, the inorganic factors, and the interdependent relationships or networks that exist in an ecosystem. However, instability in the ecosystem is preferred as it allows for, in this case, ICT adoption to occur.

In *stable* systems, ICT integration remains at the periphery of the ecosystem and is superficially integrated or partial integration. In contrast, *instability* which provides space in the ecosystem and its species to integrate ICT may lead to a higher level of ICT integration. The interactions between species and other factors are influenced by the adoption of ICT. In stability, the boundaries are defined. In contrast, the boundary is permeable (less defined) in instability.

Ecosystem shifts - stability

Ecosystems can shift between stability and instability. Stability implies that the ecosystem is unable to change or adopt ICT, due to the preschool routines and norms that the ecosystem prioritises or is concerned with, or any other constrains. In this research, preschool A_1 and B_2 exhibited stability. The preschools were rooted in their practitioners' traditionalist pedagogical beliefs and attitudes concerning ICT use in ECE. ICT practices observed showed that the practitioners valued ICT as primarily a support tool and this represents a judgment about the ways in which ICT can be used. ICT, therefore, was often judged as an 'add-on' or alternative resource for teaching and learning than an integral part of the ECE curriculum and the daily routine (from findings in the previous chapter). This limited belief and attitude was culturally reinforced by similar misconceptions by the keystone species (HTs) that reinforced an ideology of ICT as necessary for mostly teacher-centred practices. The preschool prioritised the purely informational uses of ICT above constructional uses (from findings in the previous chapter). Stability, thus, does not provide space for any ICT uses in a constructivist, child-centred to disrupt the preschool. In preschools A_1, A_3 and B_2, advanced levels of ICT integration were perceived to be disruptive and remained in the periphery. Due to its stability, ICT adoption remained superficial in terms of the preschools' support and commitment in ICT, as articulated by the teachers (FG1, A_1, T1, T2, and T4).

Ecosystem shifts - instability

Instability in an ecosystem, in contrast to stability, is reflected in the way the preschool adapts or accommodates change - in this case, the integration of ICT. Instead of routines or norms becoming enculturalised or locked within defined boundaries, small changes occur within the interdependent relationships between the dominant and keystone species, their interactions with inorganic factors, i.e., access and availability of ICT, and the balance between pressures to ensure that the preschool still manages to deliver the curriculum. Instability occurs when the preschool gives space to individuals within the ecosystem to implement ICT.

Providing space for practitioners to implement ICT is seen in all six preschools. However, preschool A_2 and A_4, predominantly, have adapted their routines to incorporate ICT into the daily activities. Practitioners in preschool A_2 and A_4 are required to make use of available updated facilities including Media suites, computer laboratories, and other ICT resources located in the playroom such as access to Internet and IWBs. In these preschools ICT teaching was balanced between treating ICT as a discrete tool in the Media Suites and integrating across the curriculum activities.

Practitioners are encouraged to initiate ICT projects for their playrooms in preschool A_2 and A_4. They also are required to create educational plans and schemes of activities through an online system created by the school head. Within the preschool there is an on-going digital library which contains all of the materials prepared by practitioners so that there is an accessible database for teachers of resources when they are required. This library also included a number of DVDs documenting school events such as parties and graduations. The teaching materials take different forms including transparencies, CDs, tape-recording and videos. In an on-going process, each year this collection is added to with new materials. Additionally, the IT services department in the preschool provided design materials, as well as support to teachers, for example, when they were searching for images to illustrate a particular theme.

By encouraging and supporting ICT adoption within the preschool, HTs create 'discomfort' among the practitioners, which Lichtenstein & Plowman (2009) suggest engineers instability in the ecosystem and thus stimulates the conditions for change. Teachers in (FG3, A_3, T1, T3, and T5) expressed their view that other teachers, whom had yet to integrate ICT, felt anxious and a number of them started to ask for help to learn ICT. The interactions between dominant species and the keystone species in the ecosystem help foster the collective need and shared understanding to adopt ICT. Further, the emergence of the collective need for ICT was intensified by these interactions in the ecosystem.

Even though preschool A_2 and A_4 routines and norms were not bound rigidly by the curriculum and provided spaces for ICT integration, curriculum objectives, experiences and outcomes were met too, comparable to preschool A_1 and A_3 achievement. Preschool

A_2 and A_4 played a role in creating an environment that encouraged and supported the integration of ICT among the practitioners. Further, ICT was perceived as supportive to the achievement of the school and had a place in teaching and learning. Preschool A_2 and A_4 instability enabled them to integrate ICT, and thus, affect the species in the ecosystem.

The next section elaborates how feedback loops, either positive or negative, have an effect on the ecosystem and species.

Feedback loops: positive and negative

The concept of the 'feedback loop' is used in ecological models to illustrate the causal relationship and balance between influencing elements in a system (Zhao & Frank, 2003). This idea can be simply understood by considering the thermostat metaphor of Davis & Sumara (2006). The thermostat registers the temperature in a room and if it falls below a certain threshold the thermostat will increases the heat output (positive feedback), and vice versa if the temperature rises (negative feedback). By this mechanism the feedback loop maintains balance by enabling (heating) or constraining (cooling) characteristics of the system as required. Feedback loops, in the context of this research, apply to ICT initiatives or influences (e.g., directives or factors that control the ecosystem) which constraint or enable ICT integration.

The feedback loops that occur at the ecosystem level are influenced by initiatives or directives from the system (e.g., the MoE). The positive and negative feedback loops influence the interactions between the practitioners, the HTs, the ICT coordinators, and the provision of ICT within the preschool or ecosystem. The interpretation and implementation of initiatives (in ICT) is dependent on the preschool head. The preschool, thus, shifts to either adoption or non-adoption.

The findings in this research show that ICT was added formally by the education authorities to the playroom in order to meet the ECERS-SA standards introduced by LEA. ICT initiatives that keep the ecosystem and system (external to the ecosystem) in check are negatively viewed in the context of ICT adoption. The findings revealed that both HTs and practitioners, particularly in A_1 and A3, found ICT initiatives coming from outside the preschool, at the macro- and exo- systems, to be unclear; consequently, initiative interpretation at each ecosystem differed. Further, there was no positive influence coming from the external initiatives introduced at the ecosystem level to lead practitioners beyond low-level teacher-centred integration. Instead, it led to the fragmentation of ICT, according to priorities.

Feedback loops: positive

Positive feedback loops can occur in the ecosystem. Initiatives, as found in the research, are interpreted and implemented differently by the keystone species and the dominant species across ecosystems. Preschool A_3 head found that LEA initiatives did not provide her preschool with sufficient support to integrate ICT. Instead of citing LEA initiatives constraints, the preschool head managed to renovate its preschool computer lab and had specialist rooms with in-built facilities, such as an audio-visual aids suite and computer lab from donations and parents' support. The preschool had these facilities despite being a stand-alone public preschool with no sufficient funding from the macro- and exo levels. According to A_3 HT, the involvement of the community and parents support had helped develop this preschool ICT infrastructure. Additionally, case A_3 HT assigned a part-time computing teacher as part of the teaching team who provided informal, optional in-house training to assist practitioners to meet their professional development needs. Generally speaking, none of the Saudi public-sector nurseries had any in-house ICT-related staffing; thus the presence of such a teacher in case A_3 reflects how ICT is there seen as a priority.

Initiatives implemented in school A_3 created a positive feedback loop for the dominant species. The teachers saw opportunities to use ICT for teaching and learning due to the availability of computer labs. Teachers were encouraged to adopt ICT in teaching and learning as frequently as possible, which led to minor conflicts when certain subjects were prioritised. In preschool A_3, positive feedback influenced teachers' adoption of ICT. Feedback loops can be in tension, shifting from positive to negative according to how policies and improvements plans are interpreted and implemented. The findings on teachers' perception of the MoE improvements plans with regard ICT integration showed that policies influence teachers' ICT adoption superficially, i.e., create a negative feedback loop.

Conclusion

Previous research related to teachers' adoption of ICT (especially in Saudi Arabia), as shown by Al-Dayel (2009); Al-Shoaiby (2010); Al-Showayer (2006); and Bogus (2009) has commonly presented a 'laundry list' of factors but has not linked the factors affecting ICT integration at different levels. In this thesis, a variety of factors in combination have been explored to obtain a more complete empirical understanding of the complex process of ICT integration. Influencing factors must be studied as a system: key elements that interact to determine the success or failure of ICT in ECE; the status of one factor is continuously affected by the status of many others.

The ecological perspective and complexity thinking, i.e., the adapted blended theoretical framework, provides a unique understanding of ICT integration beyond that of the traditional linear perspectives. Further it allows a deeper understanding of the relationships between the influencing factors. It is not a custom in ICT integration into ECE research to combine teacher, preschool and system characteristics in a multilevel framework. The findings discussed within this chapter demonstrates that a substantial part of the difference in educational ICT use is due to preschool environment related factors and factors external to the preschool. In the linear approach, factors are ordered in a hierarchy or according to importance. The factors gathered using theories and models, such as Tearle’s whole-school approach (2003; 2004), Zhao & Frank's (2003) ecological perspective, and TAM (1989; 2001; 2007), see Section 4.1, were sufficient in giving the researcher a linear understanding of teachers' ICT integration. Though linear factors are useful as starting points for further exploration, by using the ecological perspective as a frame and complexity thinking as a scaffold, the researcher has understood that teachers' ICT integration is able to shift from one state to another (non-adoption to adoption) based on a confluence of factors, at the micro, meso and macro system levels, situated in the context in which the ICT adoption is occurring (Chapters 6 & 7). Furthermore, the system or external influences may constrain or enable ecosystem shifts, either to enable or hinder ICT adoption. The ecological perspective, which includes complexity thinking, supports Fullan's (2000) assertion that the connection between cause and effect is difficult to identify and that complexity can offer another approach to understanding change.

As a part of my ecological-complexity perspective, complexity thinking provided a deeper understanding of the emergence of factors and the emergence of ICT integration. Furthermore, in expressing the three conditions in relation to emergence, the researcher was able to understand the interdependencies of the emergence of ICT adoption in a preschool and the emergence of ICT adoption across schools (at the system level). Originally, the framework included the individual (micro), the preschool (meso), and the external (macro). In reflection, this current research has evolved to essentially be a 'meso-theory', as suggested by Lichtenstein & Plowman (2009). It has primarily two levels of analysis, one concerning the individual adoption (practitioners in the preschool) and the other, the organisational adoption (in the preschool). The interdependent relationships between the species and the organisation are important linkages between these two levels.

Leadership, specifically in relation to the role of preschool HTs, arose as a key concept in the ecological-complexity framework of teachers' ICT adoption. In addition, a niche species, which was related to ICT leadership in preschool, was identified as playing an important role in teachers' ICT integration. The implication of *leadership of emergence* in this context recasts preschool HTs roles in preschools; instead of managing ICT, preschool heads should nurture and facilitate ICT. Extending *leadership of emergence*, the ICT coordinators are considered as the niche species in preschools that not only manage ICT but become agents for change and teacher leaders for ICT adoption in teaching and learning. As a result, it is suggested preschool policies should reflect the emergence of leadership and offer training and support for school heads and ICT coordinators.

To nurture teachers' ICT adoption in teaching and learning at the individual level, it is simply suggested that ICT training programmes in Saudi Arabia (pre-service and in-service) should include pedagogical elements as well as components to enable teachers to change. In this way, teachers may be able to reflect and change when ICT is adopted in their classrooms.

Chapter 8

Conclusive Summary and Recommendations

Chapter outline

Chapter 8

Conclusive Summary and Recommendations

8.0 Introduction

This closing chapter reflects on the central findings of the study, paying particular attention to the final research objective (RO3) and its sub-question:

RO3. To put forward a framework that integrates the teacher and preschool characteristics that are associated with ICT integration.

> RQ5. How can we move forward with ICT integration in ECE on both a local and international scale?

This first section will summarise the main lessons learnt from the research findings discussed in chapters 6 & 7. Following on from this conclusive summary, the central impact of this research for the education community will be explored in a series of suggested guidelines for ICT integration into preschool settings. Finally, recommendations for future research are provided.

8.1 Overview of research questions and key lessons learnt

This research aimed to gain a deeper insight of the actual use of ICT in ECE settings. It investigated a number of issues at the different levels of the ecosystem, to create a better understanding of core factors that affect ICT integration into ECE, and to provide a suggested guideline for integration as a result. This aim involved meeting a series of research objectives and related sub-questions. These were:

RO1. To explore how ICT is integrated into ECE settings in Saudi Arabia and Scotland.

> RQ1. What ICT resources are available in preschool settings?
>
> RQ2. What use is made of available ICT resources by practitioners?

RO2. To identify the factors that either help or hinder ECE practitioners integrate ICT into ECE in Saudi Arabia.

> RQ3. What are the important teacher characteristics that influence ICT integration?
>
> RQ4. What are important preschool characteristics?

RO3. To put forward a framework that integrates the teacher and preschool characteristics that are associated with ICT integration.

RQ5. How can we move forward with ICT integration in ECE on both a local and international scale?

As part of the research's endorsement of a holistic approach, multiple research methods have been used (questionnaire, semi-structured interview, playroom observation and documentary analysis) as a form of triangulation to investigate the situation and the actual status of ICT use in preschool settings. The research findings were able to address all the research questions and fulfil the aims and objectives of the thesis. The main lessons learnt from the key findings discussed in Chapters 6 and 7 are summarised as follows:

Lesson one: There is a lack of curriculum ICT Coordinators (CICTCs)

The ICTCs' limited knowledge of technological pedagogical practice in ECE influenced and restricted the number of constructivist scenarios employed by teachers, in spite of the co-ordinators' ICT technical knowledge being advanced. In the Saudi cases (A_2, A_3, and A_4), teachers needed ICT support with more pedagogical knowledge of high-level integration in order for their playroom practice to advance with ICT.

It has been recommended that the main focus of the ICT coordinator should be to guide ICT integration in teaching and learning (curriculum support) (Lai & Pratt, 2004; Tondeur et al., 2008). As mentioned in the findings, both HTs and teachers pointed out that this lack of an in-house CICT is a barrier to ICT integration. An example of more advanced practice was found in the Scottish case B1, where the ICT co-ordinator was one of the practitioners, and she was trained to provide ICT curriculum support. She originated from the same background as the knowledgeable Scottish teachers and therefore had both a technical and a pedagogical content knowledge of how to employ ICT constructively in the playroom. This type of co-ordinator clearly supported child-centred learning with technology. This was the case in $B_1$and it is a standard that could be reproduced internationally.

Lesson two: Teachers are unclear about their responsibilities in relation to ICT

In the Saudi cases, teachers often did not understand the distinction between their own roles and those of the ICT coordinators; they tended to delegate even small technological tasks to ICT coordinators. Therefore, one more reason for the limited instances of high-level integration in these cases was teachers misunderstanding their role with regard to ICT and the technology support workers. In terms of clarity of roles, teachers need to be made aware of their own remits to handle technology, in addition to the distinction between technical support and curriculum support coming from an ICT coordinator. In case B1, there was a better understanding of this distinction given the more informed knowledge at the macro and meso levels that all practitioners should make use of ICT.

Lesson three: Pedagogical ICT training is important to integration

Pedagogical ICT training is an important element to enhance the knowledge and skills of practitioners at the micro- and meso-systems of the preschool. CPD has been found to have a key role in how teachers integrate ICT (Baylor & Ritchie, 2002). It is clear from the findings here that access to training in Saudi is particularly problematic for public preschools, but that issues exist in both sectors. Findings presented in Chapter 7 demonstrate that ICT training is a major influence, but only in view of one type of educational ICT use, which was 'basic ICT skills'.

Consistent issues, in both contexts, raised in interviews by practitioners and HTs relate to quality of training, in terms of content, duration and trainers. They often criticise support coming from the macro- and exo-systems. Teachers also stated that training opportunities with technology were in general rare and that they had to attend this training outside of work hours. The skill-level taught in training was behaviourist, especially for practitioners in the Saudi preschools and B_2. Yet, some good examples for training provision solutions were spotted in cases, such as working in partnership with international specialised ICT companies to provide in-service training for teachers on weekly bases. In Case B1, in-house training was provided by the HT. Also, online CPD programs were provided by the LA as a solution to taking teachers for training over working hours. In both contexts, exchanging experiences among preschools and creating communities of learning were observed to improve knowledge and skills.

Lesson four: Private-public sector partnerships are essential

In order to fill the gap in CPD programmes and in-service training A_3, B_1 and B_2 encouraged collaboration between preschools in the local areas to share ideas and practices among practitioners from both sectors. In spite of differences in practices, all teachers and HTs overwhelmingly felt that they needed further support from the macro- and exo-systems to inform their knowledge and competencies in integrating ICT. Furthermore, findings revealed that some cases worked in collaboration with international companies specialised in designing computers software for ECE and in-service training was provided in A_2 and A_4 by the ICT co-ordinators in their adjoining schools, or provided by international companies, and in B_1 by the in-house preschool ICT co-ordinator and the HT.

Lesson five: There is a lack of time for in-house training and practicing with ICT

As suggested by both contexts, in order for teachers and HTs to be able to train they need sufficient time and space (Afshari et al., 2009). Teachers reported that they were already extremely busy and they felt that preparing technology for a lesson was a particularly time-consuming practice. Ideally, teachers should have enough time to train and enhance their confidence and skills with ICT, as well as to prepare for using technology in playroom practice and to experiment with its pedagogical possibilities (Plowman et al., 2010; Becta, 2004a; O'Hara, 2004). Teachers, in particular, felt that they were asked to train in their own time, which they felt was not valued as highly as preschool time.

Lesson six: An ICT zone within the playroom is important

The location of ICT facilities and the availability of an Internet connection are of central concern (Chapter 6 and 7). For example, due to a lack of provision, in the public preschool A_1 most of the limited ICT equipment for child use was held in the preschool library and there was infrequent computer or ICT tool practices within the playroom. In B_2, ICT access was restricted to the HT's office for administrative use and this represents a clear lack of investment. Positioning ICT tools in computer suites was at times a barrier to high levels of integration. They allowed a whole-class use of ICT but these instances were restricted to specifically scheduled times when one class could use the suite. Therefore, findings from these two preschools showed that the location of resources influenced the teacher-centred practices with ICT, as well as teachers' attitude and confidence.

Computers suites have to be supplemented by a well-resourced playroom replete with ICT tools that teachers know how to use in constructivist practices. These results have clear policy implications for schools wishing to promote specific types of educational ICT use.

Lesson seven: Leader support is crucial but leaders are being constrained

The HT has to take a hands-on approach to integration. The HTs studied clearly all tried to provide this support role. In their role as keystone species of the integration process, HTs encouraged ICT use in a range of child, teacher and administrative related capacities. For example, in A_2 and A_4 the HTs worked in collaboration with the ICT co-ordinators in their adjoining schools and in partnership with international companies to provide alternative opportunities for the limited in-service training sessions provided by the MoE or the LAs, and in B_1 training was provided by the HT and the in-house preschool ICT co-ordinator. A_3, B_1 and B_2 also encouraged collaboration between preschools in the local areas to share ideas and practices. In spite of differences in practice, all practitioners and HTs overwhelmingly felt that they needed further support from the macro- and exo-systems to inform their knowledge and competencies in integrating ICT.

However, in spite of enthusiasm and a positive ethos, HT pedagogical belief misrecognised and simplified the ways in which ICT should be integrated into the playroom as a complex tool. It was only in B_1, where the HT had knowledge, as well as support from external system levels, that HT enthusiasm was able to influence integrated, constructivist uses of ICT across the curriculum. HTs in Saudi, however, need more support to grasp the complexities of ICT and match the knowledge, for example, of HT B_1. An important lesson, therefore, is that the training of HTs should become a priority in developing ICT-related professional training.

Lesson eight: A child-centred approach is central but teachers are unconfident when ICT is part of an activity

In spite of positive attitudes towards ICT use from practitioners, a belief in the purely informational uses of ICT presented by both teachers and HTs was a significant barrier to high-level ICT adoption. The positive attitude of teachers was, in turn, based on misguided perceptions about the need for and usefulness of ICT. This limited belief and attitude was culturally reinforced by similar misconceptions by the keystone species (HTs) that reinforced an ideology of ICT as necessary for mostly teacher-centred practices (particularly in A_1 and A_3). In this area, the Scottish context was more advanced. Particularly, in B_1, the HT was able to influence the ethos and culture in their preschool to promote the belief that learning *through* ICT with children was a necessity and part of the need for ICT integration into ECE. The niche of the HT in this Scottish case was to play a role in leading and influencing practitioners' understanding of the necessity of ICT integration.

Teachers' 'traditionalist teaching beliefs', where they misunderstood the pedagogical complexities of using ICT, provide the first explanation as to why the Saudi teachers used such a narrow range of ICT tools frequently in information-based and teacher-centred activities, in particular in cases A_1 and A_3.

Lesson nine: There is a lack of a shared vision at the school level

At the internal, meso-level of the preschool, a clear vision for ICT relates to both written policy and the preschool ethos and culture. The shared vision that arises from a school ICT policy results in more frequent, directed ICT use in the playroom (Anderson & Dexter 2000). A written whole-school plan was missing in the vast majority of the preschools. A_2, A_4 and B_2, though, did present a vision and targets for ICT use in their general preschool development plans. It was clear that this vision, even given that it did not qualify as a whole-school plan, improved playroom practice in these preschools.

Lesson ten: There is discontinuity between stakeholders at different levels of the ecosystem

A shared vision for ICT requires clear communication; not just between HTs and teachers at the meso-level, but also between HTs and the LA or Government at the exo- and macro-levels respectively. There are teacher-related concerns over the 'top-down' approach taken from managers at the preschool level without consultation from teachers themselves. The surprise that teachers in Saudi felt when the government introduced hardware or software into the playroom is indicative of this lack of communication between all system levels. Teachers want to participate in creating ideas for the plan as a truly shared vision.

The findings show that this lack of collaboration between system levels certainly occurred in the Saudi context. However, even in Scotland, B_2 HT noted that the initial support from the macro- and exo-systems for integration eventually stopped after the top-down sending of literature and purchasing of infrastructure. This cessation of support was cited as a barrier to achieving high-level integration. In turn, change requires continuous collaboration and not just an initial impetus of support.

8.2. The contribution of this research to new knowledge

The most significant contribution of this research is derived from its originality: this is the first study that presents a detailed picture of Saudi Arabian teachers' ICT use and perceptions, with the potential to inform future educational policy in ECE, both on a local and international level. Combining the theoretical perspectives of Bronfenbrenner, complexity theory and Fullan creates a novel multi-layered research framework through which to interpret the integration of ICT into ECE. As a consequence, the findings and recommendations of this unique approach are not a one dimensional 'laundry list' of suggestions, but encompass a variety of ecological layers which can be drawn on by practitioners worldwide to inform the design and implementation of future integration strategies.

By capturing the perspective of key stakeholders such as HTs and teachers this study yields up-to-date information on teachers' perceptions of the use of ICT in the playroom, in addition to identifying crucial factors supporting and hindering its adoption. These findings offer a substantial contribution to the previously limited knowledge base relating to ICT use in Saudi ECE settings, as well as reflecting more general global issues related to ICT integration. These findings will inform education planners of the current status in our on-going international journey to integrate ICT into ECE and the current perceptions of preschool teachers. This has a number of important implications for the professional development of in-service and pre-service teachers worldwide, and reveals essential control factors that need to be asserted to encourage teachers to use ICT meaningfully in teaching and learning.

At the international or cross-cultural level this study contributes also to the still limited evidence about ICT use in preschool education in the Middle East. On these terms, defining ICT integration is socially and culturally variable. Most theories and research studies pertaining to ICT integration into ECE settings have originated from Western cultures, which have their own definitions and perspectives in accordance with their culture and values. As a consequence, an appreciation of cultural context is vital when studying the status of ICT in non-western ECE settings such as Saudi Arabia, and investigating the factors influencing the learning environment. Nevertheless, this study also highlights essential universal elements relevant to the general integration of ICT into ECE, given the global reach of digital technology and the rapid speed at which innovations arise and spread across the world.

Finally, this is the first study of its kind in which ICT integration in both Saudi Arabian and Scottish preschools is examined. Through a series of explorative case studies from both contexts, this study provides a detailed picture of current practices and policies, including elements which have been particularly supportive, influential or problematic. The findings of the study are of significance for those involved in ECE: researchers, policy makers, funding providers, LA managers, inspectors, professional development providers, teacher education institutes, teachers, families and, most importantly, the children themselves. Furthermore, the study findings will have implications for the international ECE community as a whole. In addition to context-specific analysis, a series of broad and flexible recommendations are suggested as guidelines to assist preschool teachers, school policy and decision makers to gain a deeper understanding of how to integrate ICT meaningfully into their framework and to make further improvement in the field of ICT integration into ECE. It has also demonstrated, of relevance to the international ECE research community, that an integrated theoretical framework, one that draws from Fullan, complexity theory, and Bronfenbrenner’s ecological systems theory, can provide a powerful model for understanding the complex, organic and dynamic nature of ICT integration into ECE.

8.3. Implications of the research

This section will now lay out a series of recommendations, implied and informed by the lessons learnt summarised in section 8.1and the discussion in chapters 6 & 7, in order to suggest critical areas and factors to be considered by ECE settings that integrate ICT into their playroom programme and plan on advancing their practices. These recommendations are addressed to the wider ECE community, including HTs, teachers, ICT co-ordinators and LA or governmental decision-makers. This is neither a bottom-up or top-down approach, but a holistic set of recommendations that consider the multi-level, collaborative and bi-directional nature of ICT integration into ECE. Therefore, these recommendations should not be regarded as linear but as interacting across the different levels of the ecosystem. The aim of the suggestions is to help preschool practitioners enhance their current levels of ICT integration and move ICT integration forward in ECE settings.

The suggestions, therefore, are based upon the findings from (chapters 6 &7) and the lessons learnt (section 8.1). The flowchart below is structured to show this relationship (see figure 8.1). Each research implication and its related recommendations are elucidated more fully next.

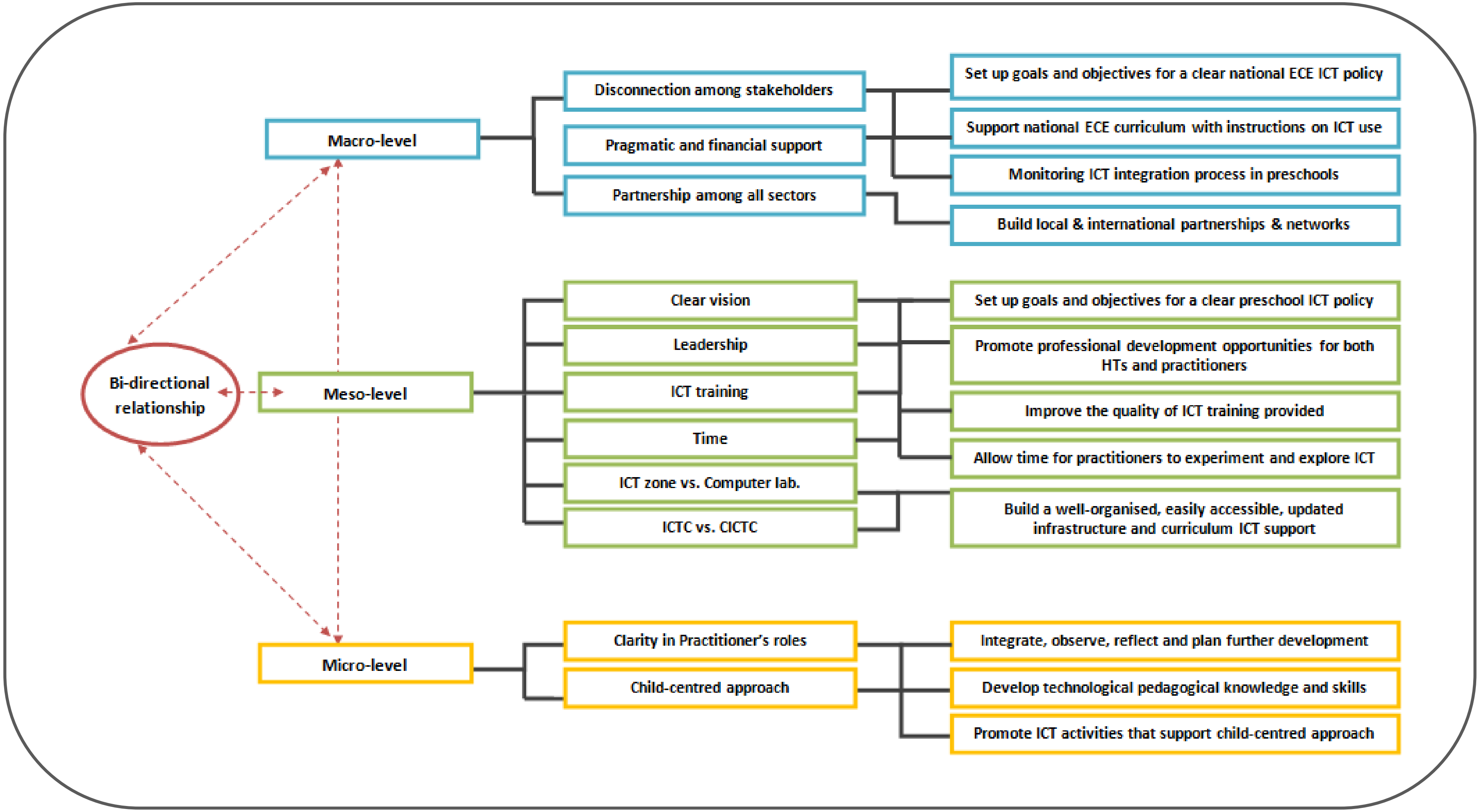


Figure 8.1. The Recommendations as based upon Key Findings and Lessons Learnt

1. Set up goals and objectives for a clear ICT policy/plan

- Stakeholders at the macro-level should make stakeholders at the micro- and meso-levels fully aware of any ICT policies or plans to enhance practitioners' knowledge and practice in preschools. A policy document should be distributed to preschools with the expressed intention of receiving feedback on its implementation from a range of practitioners to ensure that it is put to use.

- Stakeholders at the macro-level should appoint one governmental agency to control and formulate ICT policy, as well as oversee its implementation and evaluation.

- Educational environments at an **early stage of ICT integration** need to begin a process of planning, so as to:
  - Develop a systematic approach to ICT integration, one that can act as a guiding principle for wider use.
  - School leadership is a critical factor in facilitating ICT integration from the meso-level. The training of HTs should become a priority in developing ICT-related professional training. Dawson and Rakes (2003) suggest, too, that the more training HTs receive, the more ICT integration at school level is observed. HTs need to provide leadership and a shared vision for ICT integration into their preschool.
  - School HTs should work closely together with the teachers to address their beliefs and concerns about ICT and provide an influential level of personal support and provide additional resources.
  - Practitioners should engage in the development of an ICT policy/plan to give them the opportunity to reflect on their particular educational use of ICT. Some suggestions for professional goal setting may include meeting regularly to monitor progress and encouraging self-assessment.

- Educational environments at a more **advanced stage of ICT integration** need to improve the holistic and collaborative approach to integration:
  - Teachers should be aware of the evidential benefits of using ICT in a child-centred way in the microsystem of the playroom.
  - The research environment should be in touch with policy makers, as well as dynamic and well informed by the literature in the field.

- Top-down policies need to be seen as collaborative and engage with a range of stakeholders. Capacity building needs to be increased to include a range of voices from the eco-systems in and around ECE.
- A separate strategy, or a stand-alone ICT policy for ECE, is recommended so as to treat ICT integration as a means to an end (child-centred learning) and not as an end point in itself.
- Promote the idea that no single stakeholder or sector has control over ICT integration and that a collaborative approach is to the benefit of all ECE learners and practitioners.

2. Focus on ICT curriculum support

If a Government, at the macro-level, is serious about the importance of embedding ICT into its preschool curriculum, then it should take on board the findings of this research with regards to the following critical pre-requisites:

Build a well-organised, easily accessible, updated Infrastructure and ICT support for meaningful integration

- Documents are required in the preschool curricula that state clearly the importance of teaching with ICT in the playroom and provide instructions for practitioners on how to use ICT effectively in such an environment.

- Although infrastructure is an important condition for ICT integration in general, findings suggested that the availability of ICT *within the playroom* was positively related to the use of ICT as a learning tool; and this was in contrast to computers in a computer lab and ICT in media suites. In-playroom provision maximises potential, in contrast to computer labs where computer use depended on time-allocation mechanisms. The emphasis should be on playroom uses of ICT.

- When organising the ICT corner within the playroom ecosystem, practitioners should pay attention to issues such as: (a) safety; (b) functionality and practicality where they can easily integrate the equipment into different activities; (c) arrangement where they can easily supervise everybody and everything going on; (d) manageability and flexibility where preschools can start modest ICT zones before expanding; and (e) connection to the Internet.

- Preschools must have access to sufficient ICT support to maintain the infrastructure and provide teachers with the reassurance of a consistent and reliable teaching resource.

- The LAs should provide preschools with locally based and in-house ICT coordinators. It is recommended to distinguish between ‘technical coordinators’, who provide preschools and teachers with technical support, and ‘educational coordinators’ who focus primarily on supporting the educational uses of ICT in the playroom.

- Those teachers interested in ICT in each preschool should be provided with the suitable and required skills to support their colleagues.

Enrich preschool ICT resources with suitable software

- Desirable software characteristics expressed by respondents in this study included: (a) ease of use for young children; (b) designed to develop important cognitive, creative, social and critical thinking skills; (c) engage children though the use of bright and colourful graphics, interesting sounds and interactivity; and (d) offer a progressive range of learning options that can be tailored to the needs or proficiency of a particular age group or individual child. All of these features suggest the criteria to follow when choosing software.

- When considering a software program, practitioners need to look for built-in support features that (a) support them in a technical sense, such as tutorials and help functions; (b) guide the use of content, such as sample lessons, extension activities, and options to create their own additional activities; and (c) bolster their abilities as teachers to effectively provide instructional support to children, such as results and reports from the progress-monitoring features in software programs and making explicit connections to the curriculum or to learning standards.

Support national curriculum with detailed instructions on ICT use

- Curriculum documents should be revised to add specific instructions on how and when to use technology.

- A top-down implementation process alone is not desirable. One way forward is to stress the responsibilities of local schools to develop a school-based ICT plan at the meso-level. In a best-case scenario, an ICT plan makes ICT competencies visible for all parties involved and stimulates the dialogue among school managers, teachers and parents about ICT use in the curriculum.

Supplement practitioners' efforts to integrate ICT with adequate financial support

- The recommendation to authorities is for an equal division of the budget between building the infrastructure, ICT curriculum support and teacher professional development. The rationale behind this partitioning is that equal financial investment in all three components of the programme should ensure the provision of reliable and up-to-date technology. In planning for the long term success of this programme, an appropriate percentage of the budget should be allocated for upgrading the ICT infrastructure and software, as needed, in future years.

- LAs should give preschools more authority and freedom to manage and run themselves and that includes financial matters.

3. Promote professional development for practitioners

Macro-level bodies need to employ a workforce with the appropriate knowledge and skills to utilise ICT supported teaching and learning, so that ICT can become an integral and valuable component of ECE. Effective professional development for teachers should cultivate the skills and experience needed in everyday teaching practice, as well as the confidence to prepare and deliver technology-based learning.

Pre-service practitioner training

- Clearly practitioners still need opportunities to develop skills using ICT as an instructional tool. Thus, it is recommended that training should be delivered as a component of new teacher training programmes so as to adequately prepare newly qualified teachers with the same skills. The increasing relevance of ICT to teaching and learning is such that the researcher proposes that the future selection criteria for preschool teachers include at least one component related to ICT skills.

- Pre-service practitioners need to know: (a) how to encourage types of learning such as engagement, participation, and knowledge creation (Lai, 2008); and (b) how to use technology to support these types of learning. One of the most powerful strategies which can be used to help pre-service teachers gain the necessary knowledge is to provide opportunities for them to observe a variety of examples and models of how ICT works in the playroom and this must reflect their own role in the learning process.

- To help pre-service practitioners 'own' technological knowledge and develop skills using ICT as an instructional tool, it is vital to provide opportunities for them to practise these same or similar strategies with learners in the ecosystem of the playroom.

- Practitioners need to be able to experience the entire process of facilitating a technology-based activity, including handling the technological and management issues that commonly occur (Hew & Brush, 2007). These experiences can build confidence in the observers who tend to believe 'if he/she can do it, then I can too.'

In-service practitioners continuing professional development programmes

- Ongoing training and staff development designed to support teachers' implementation of ICT in ECE is imperative in order for teachers to become and remain informed users of advancing technology, and this requires allocating sufficient time for teaching staff, including relevant support members, to undergo regular and appropriate training.

- Equally important, the content of professional development (PD) for preschool practitioners should include: (a) how to use ICT in their teaching; (b) concentrate on giving a rationale for integrating ICT; and (c) help teachers to becoming familiar with the possible benefits of ICT on young children's learning and development to support their own thinking. In effect, a successful professional development programme related to ICT must focus not only on technology concerns, but also on pedagogical concerns and how the technology is transforming teaching and learning.

- Staff development programmes also need to focus on explaining hardware and software to teachers (Wood & Willoughby, 1999). One of the issues raised by this thesis is that teachers often lacked adequate technological pedagogical knowledge. As a result, it is essential to train teachers how to choose developmentally appropriate technologies (hardware and software). Teachers can use the available software evaluation criteria (e.g. McManis & Parks, 2011; Siraj-Blatchford & Siraj-Blatchford, 2003; 2006) or create their own their own software evaluation system. To make these criteria clear, it would be helpful to demonstrate which software is developmentally appropriate to give practitioners hands-on experience.

- Professional development for ICT integration should also focus on content that includes: (a) technology knowledge and skills, (b) technology-supported pedagogical knowledge and skills (the ability to see a clear connection between the technologies being used and curriculum content being taught), and (c) technology-related classroom management knowledge and skills. Most importantly, when introducing teachers to specific ICT tools is that professional development programmes include information about how they can use these tools in very specific ways, particularly in ECE, to support children's learning.

- When planning professional development programmes, it is important to consider how often and for how long teachers should meet, as well as for what period of time. Training should be in the form of continuous professional development courses with flexible training hours as well as in-house training. When professional development is spread over a longer period of time, there is more time to experiment with new ICT tools in small doses (Brinkerhoff, 2006). These small implementations, then, are more likely to result in success, which is key in building confidence (Ertmer & Ottenbreit-Leftwich, 2010).

- ICT training that directly corresponds to teachers' contextualised environment is another key to promoting effective ICT integration. Cole et al. (2002: 443) concur in noting that 'onsite training is best'. Successful professional development, as recommended by Heath et al., includes providing experiences that are 'built on teachers' prior knowledge and provide opportunities for social interaction with colleagues', ones which focus on the 'investigation of problems supported by technology that were relevant for teachers, and that allowed time for reflection' (2000: 61).

4. Integrate, observe, reflect and plan further development

- Practitioners should be encouraged and supported to integrate more categories and types of ICT, extend the palette of tools, possibilities and try different scenarios and forms and witness children's responses.

- Teachers need to have opportunities to learn to be critical and reflective about their teaching. They also need to feel comfortable testing new ideas and taking risks, remaining flexible and being open to change and further development.

- Stakeholders in the field should have an opportunity to take part in evidence-based discussions about methods of integration. ECE stakeholders at all levels of the eco-system should be aware of the evidence-based benefits of child-centred ICT integration.

- Formalised, easily accessible, and up-to-date databases can be constructed where evidence and knowledge can be shared and accumulated about ICT in ECE. Practitioners and policy makers should be able to access and contribute to this for further development.

5. Build local and international partnerships and networks

- Practitioners need to build or engage themselves in communities of practice, ones which encompass networks of people with related goals, attitudes, and problems. **Within the preschool this may be achieved through:**

  - Observing successful ICT practices conducted by colleagues that are rooted in pedagogical beliefs.
  - Allowing time and space for collaborative discussions about practitioners' beliefs and knowledge about ICT, critiquing their own practice, systematically testing ideas and sharing their findings with each other in order to build and multiply their knowledge.

- **With other practitioners in other preschools in both sectors through** sharing experiences between both private and public sectors to promote collegiality and support to help ensure quality learning opportunities for children, and to increase teachers' perceived need for change and improve their understanding of new practices.

- Practitioners should try to build cooperation with **LAs and research institutions**, which are active in the field if ICT in ECE. Such cooperation can help in sharing, multiplying and disseminating knowledge.

- Over the period of conducting this research there was a clear desire from practitioners to gain a pedagogical knowledge of their counterparts in the **international community**. Education authorities and decision makers should encourage and support research opportunities that allow ECE practitioners to observe and learn from the experience of technology use in ECE in other countries (e.g. Scotland, New Zealand). Such professional development strategies can help to promote knowledge, assist the development of ICT integration and promote international goodwill.

6. Monitoring the ICT integration process

- A central implication for educational authorities at the macro-level is related to the importance of 'monitoring' ICT integration in ECE. A transparent understanding of actual ICT use can provide a well-grounded insight for policy developers to foster the integration of ICT in ECE learning environment. The results of this research (Chapters 6 and 7) encourage individual preschools to reflect on the educational use of ICT at the meso-level. ICT use should become linked to teacher, playroom and school variables. This monitoring will, hopefully, serve as an instrument to evaluate and elaborate local and national ICT policies.

- A systemic approach to monitoring at the meso and macro-levels should contribute decisively to informing decisions about scaling-up, getting value for money and obtaining feedback to achieve maximum results.

- Monitoring certain integrations can provide a clear sense of monetary costs but feedback loops from monitoring should also guide integration approaches by practitioners.

8.4. Strengths and limitations of the research

8.4.1. Strengths

This study offers a valuable and substantial contribution to developing the knowledge base in the fledgling field of ICT strategy internationally. In the Scottish context practice was supposedly informed by research and policy while in Saudi there was no literature or over-arching policy. However, common issues that influenced teachers' ICT integration in both contexts were observed. The study has yielded up-to-date information on preschool teachers' perceptions of the use of ICT in the playroom as well as identified those factors supporting and hindering its use. This information is not limited to the local setting but can inform education planners worldwide: it has several implications for the professional development of preschool teachers, and reveals the control factors that need to be put in place to encourage practitioners to use ICT in teaching.

Very few Saudi-based studies have addressed public and private ICT-related issues in the same study. The fact that this study fills this gap in research activities in Saudi Arabia contributes to the strength of this research. Furthermore, including public and private sector teachers in the study has positively influenced the interpretation of findings and assisted a better understanding of Saudi teachers' use of ICT, perceptions towards it, and factors influencing ICT integration. The private and public divide is of interest to international researchers. Exploring one side of the story, i.e. public preschools, and leaving out the private preschools, would have ultimately weakened claims that the study's findings could be considered representative of teachers' usage of ICT.

A further strength of this study is in its methodological triangulation, achieved by combining a variety of research tools, including questionnaires, individual interviews, focus group discussions, playroom observations and document analyses. These sources form a holistic picture. For example, this ensured playroom observations were supplemented by information gained through interview and document analysis. The ability to adopt various data collection instruments, i.e. questionnaires, interviews and observations, and develop them to better suit the Saudi context also allowed for a more accurate reflection of actual local teachers' ICT usage, perceptions, and future views. Moreover, although this study was dependent mostly on Western-based literature in both the review of related research and the interpretation of findings, it confirmed that similar patterns of ICT usage, perceptions, and supporting and hindering factors exist in Saudi preschools as in other countries.

To strengthen the study, all the research tools were subject to a number of pilot tests and examined by faculty members, HTs and teachers. This was to establish the content and face validity and to verify the codes and categories used in the analyses. Although analysing the data was lengthy, challenging and time consuming, the resulting analyses are well positioned to illuminate the highly complex subjects involved in the phases of data collection. Studying such highly complex processes using this multi-method approach was made possible by using a naturalistic or interpretative methodology and a qualitative approach, whereby the researcher was an insider, an integral part of the investigation in natural actions and sites. This data could not be obtained using a positivist approach. Qualitative studies such as this have been previously criticised for their small sample size, as Artiles & MacClafferty (1998) have stressed in particular. However, the triangulation data methodology adopted in this study's design gives a robust and more precise approach.

8.4.2. Limitations

The study focuses particularly on how practitioners integrated ICT in their practice, as well as considering the possible factors that support or hinder ICT integration at the macro, meso and micro levels. While these case studies provide a detailed and comprehensive snapshot of teachers' views and the situation regarding ICT integration in each case location, there may be some limitations to be considered.

Firstly, this research was site-specific, using six case study preschools (four cases located in Jeddah, Saudi Arabia and two cases in Greater Glasgow and East Dunbartonshire, Scotland). These case studies were chosen to reflect the diversity of provision through a case study approach. This did provide an in-depth snapshot of ICT integration and important observations have been made about teacher practice. However, although the design of this study could be replicated, the results may not be, as this research focuses on the perspectives of stakeholders at a specific point in time. Additionally, the rapid rate of change and development that characterises ICT's perpetual development provides another constraint. By the time this thesis is read, new technologies will undoubtedly be being used in preschools and this is a widely recognised challenge in the field (UNESCO, 2010). Nevertheless, the sample is representative of the two contexts and the two main forms of preschool provision (public and private) and reflects national guidelines, such as the national curricula of both contexts.

Secondly, the participants in the current study were preschool practitioners (both HT and teaching staff). It is possible that other ECE practitioners in the care and education sectors may have provided further insights if the scope of the research had been wider (such as at the macro-level, e.g. including the heads of Local Education Authorities (LEAs), inspectors, and quality improvement officers). Also, I have not gathered here the opinions of parents as a stakeholder, which could have provided more information on the link between home and preschool ICT use. However, it was felt that for this study, the greatest insights could be gained by concentrating research effort on those practitioners most directly involved in the integrations of ICT into ECE, and it is hoped that the responses of HTs and teachers, as well as the observations, are starting points for further discussion and research. Moss & Petrie (2002: 148) suggest, in a similar manner, that case study examples can be provocations for further critical evaluation and dialogue.

Further, on a more personal level, there was a certain tension between my role as an insider in the field and an outsider to the specific case locations. I was both an external researcher, and a co-practitioner, given my experience in Saudi ECE. I believe I earned the practitioners' trust and respect but my assessment of the 'other', the teachers' views and perceptions, may be biased by my position as a fellow practitioner. I therefore acknowledge my status as an insider to the ECE sector may be both a strength and a limitation of the research.

The process of this research also suggested several unanswered questions beyond the scope of the study. These are outlined in section 8.5 as suggestions for further research.

8.5. Suggestions for Further Research

In light of the current findings, as well as issues arising from this thesis, some future research suggestions are:

- Conducting a larger scale study that explores ICT use in a range of urban and rural sites in both public and private sector preschools;
- Interrogating the perspective of LEA managers and inspectors about ICT integration from a systemic perspective;
- Investigating the influence of cultural factors and differences at the meso-level on preschool teachers' use of ICT;
- Considering ICT in ECE from the perspectives of children and families;
- Examining early childhood teacher education students' perspectives of ICT in ECE.

From a local perspective, there are forty-one educational districts in Saudi Arabia aside from Jeddah that need to be researched. A more complex and ambitious study would further interrogate some of the side issues raised here, as well as a number of attributes that have not yet been considered: differences across rural and urban areas; public and private sectors; and the socio-economic status of the preschools' culture could be included to provide a fuller picture of teachers' current ICT use, perception and views.

As suggested by the second bullet point above, a possible area for further inquiry is to focus on ICT in ECE from the perspective of stakeholders at the LEAs. It is important to interview policy makers to investigate their views on the current status of ICT use in preschools and to discover more closely the procedures taken to promote supporting factors and reduce the effect of hindrances. Comparing their visions of the future of ECE with those of practitioners would reveal interesting comparisons and assist in bridging the gap between policies and preferable futures. This sort of research would enhance our understanding of the interactions that occur at the system level, as well as between preschools, and focus on the interactions between keystone species to uncover how and why (emergent) relationships are created between ecosystems.

Cultural factors, including the role of leadership and the school environment, clearly influence the adoption and implementation of ICT. These need to be considered even more closely to identify the exact nature and scope of their influence. Complexity theory could be a tool to elucidate this dynamic, for example, in how colleagues influence each other.

Children's and families' views and experiences of ICT need also to be more closely considered in Saudi. The influence of home life upon child playroom use of ICT has already been investigated internationally (e.g. Brooker & Siraj-Blatchford, 2002; MacPake & Plowman, (2010); Plowman et al., 2012; Stephen et al, 2011; Stevenson, 2008;). These studies indicate often a mismatch between what young children know and experience in relation to ICT in the home, compared to what is recognised in the early childhood setting. Besides this, there is evidence relating to the role ICT can play in increasing connections between home and ECE settings (Lee et al., 2002; Whalley et al., 2001; Rideout, 2007; Wilson et al., 2003). Further Saudi research to investigate the role of ICT in supporting connections between home and school would be useful and raise issues specific to the context.

With regards to teacher awareness, research needs also to further consider how ICT has been presented to teachers in their initial training. It is likely that ICT training has varied greatly with the years over the last two decades or so. Laffey (2004) has found that student teachers' understandings of ICT were highly influenced by their experiences whilst undertaking their practicum placements, therefore, it is crucial that research is undertaken to examine their understandings further.

With the recent and rapid expansion of technology into the worlds of young people it is important to ascertain what attitudes and views student teachers hold towards ICT in ECE, and how their attitudes facilitate or hinder their subsequent application of ICT in early childhood education settings when they are qualified teachers. It would also be valuable to explore what position teacher education sites take in relation to ICT in ECE, and how they see their role in the preparation or guidance of student teachers for working in technological early childhood teaching and learning environments. A research project such as this could contribute to gaining a deeper understanding of these issues and provide useful data for both the teacher education and the early childhood education contexts to consider.

8.6. Conclusion

This thesis investigates what lessons may be learnt from ICT integration approaches in the Saudi Arabian and Scottish ECE sectors. Through the application of six case studies, preschool teachers' use of ICT and relationships between school and system related factors, have been investigated to identify weaknesses in the established approaches to ICT integration into ECE. This was achieved through a unique holistic standpoint; one which draws from ideas by Hassan (2010), Mason (2008), and Davis and Sumara (2006), in conjunction with an ecological perspective.

Through this ecological-complexity perspective, an understanding of the barriers and attitudes that affect ICT integration into ECE has been reached, one that moves beyond merely producing a list of influential factors. This theoretical framework has allowed for the consideration of teachers' characteristics as fully intertwined with the school and its environment. Through this perspective we observe that it is not just the central role that teachers play in ICT integration that influences it, but that school and system levels, too, have the potential to promote or hinder ICT integration. This is a multifaceted interaction, and therefore achieving clarity within this complexity is a challenge; one which requires understanding the significant and influential factors across the ecosystems.

It is clear that teachers need to be appreciated and listened to. In their crucial role on the frontline of ICT usage we need also to understand which of their attributes affect ICT integration and how good practice can be disseminated. Policy makers, too, with their power to influence ICT integration need to be targeted. They should be encouraged to listen more attentively to teachers' views, and involve them in the process of creating policy. Currently, there is a failure to appreciate ICT's potential amongst teachers and a deficit in adequate training. This lack of awareness suggests a fault in initial teacher training that should be the subject of future research. Promoting a dialogue between MoE and teachers can ensure that educational policies match educational needs and enhance future models of technology integration into ECE.

Following the recommendations presented here can improve the quality of ICT integration into ECE. Practitioners need to be made aware of the complexities of ICT integration, its educational benefits and the long-term nature of its use in preschool playrooms. A shared vision across all eco-systems is necessary to move on from low levels of ICT integration. This vision has to put guidelines or policies to use in a way that enhances integration levels. This thesis stresses that following solely a top-down or bottom-up approach to integrating ICT into ECE is insufficient. A more collaborative approach is called for that emphasises the importance of feedback loops and connectedness between the eco-systems of ECE. Teachers' enthusiasm alone is not enough without policy; but this policy needs to be made collaboratively between practitioners at different eco-system levels. The recommendations provided by this thesis help to address weak-points in the current ECE system that may infringe upon any potentially collaborative approach. They suggest steps to be taken to ensure that teachers are confident, skilled and knowledgeable enough to use ICT in the playroom to its full potential as a child-centred learning tool.

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Appendices

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Appendix 1

UNIVERSITY of GLASGOW

Faculty of Education

Ethics Committee for Non Clinical Research Involving Human Subjects

EAP2 NOTIFICATION OF ETHICS APPLICATION FORM APPROVAL

Application No. (Research Office use only)	EA1446 - 3
Period of Approval (Research Office use only)	21 July 2009 to 30 June 2011

Date: 13 July 2010

Dear Nada,

I am writing to advise you that the Faculty of Education Ethics Committee has considered your request for an extension of the approval period for your application, reference EA1446 for 'A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings'.

I can confirm that the requested extension has been granted.

As stated in the notification of 21 July 2009, you may proceed with your data collection. The end date of your ethical approval is now 30 June 2011, as indicated in the heading above.

You should retain this approval notification for future reference. If you have any queries please do not hesitate to contact me in the Research Office and I will refer them to the Faculty's Ethics Committee.

Regards,

Terri Hume
Ethics and Research Secretary

University of Glasgow
Faculty of Education Research Office
Ethics: Room 425b
St Andrew's Building, 11 Eldon Street, Glasgow, G3 6NH
The University of Glasgow, charity number SC004401

Tel: 0141-330-3007
Fax: 0141-330-3065
E-mail: T.Hume@educ.gla.ac.uk

(A)

University of Glasgow | Faculty of Education

Educational Studies Department

The University of Glasgow, charity number SC004401

Plain Language Statement

A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings

Dear Nursery Head Teacher,

I am a PhD student in the Department of Educational Studies at the University of Glasgow, currently conducting a research project entitled "Integrating ICT into Early Childhood Education (ECE) Settings" under the supervision of Dr. Jane Magill and Dr. Brian Canavan.

You have been selected for this study as you are a practitioner closely linked to the field. I am writing to invite you to participate in this research study, which aims to investigate how ICT is being integrated into ECE and the factors that may contribute to more effective integration. The rapid growth in the use of technology in the playroom generates a need for a better understanding of how it can be most effectively used.

Participation in the research is on a voluntary basis. If, after consideration, you agree to participate, you are invited to complete a twenty-minute questionnaire, which will be followed by a small number of interviews elaborating on the issues raised in the questionnaire. Audio-taped interviews will last for thirty to forty minutes, at a venue to be mutually decided, and, if you decide you would also like to take part in this stage, you will be asked to read the relevant consent form and sign it.

Taking part in the research will support diversity in the ECE sector and will help to provide quality learning experiences for preschool children. You will be allowed to express your needs in improving your knowledge and skills in ICT. This information can help overcome any perceived barriers of integrating ICT into ECE.

All information will be kept strictly confidential and will be securely stored. You will be given an ID number and this is known only to the researcher. You will not be personally identified at any point in the completed work. The information will be used for the purpose of a research project which is a requirement for being awarded a PhD degree from the University of Glasgow, Faculty of Education, Educational Studies Department. The collected data will also be used for related future publications or presentations.

For queries or additional information, please feel free to contact the researcher Nada Hammed: n.hammed.1@research.gla.ac.uk. The project has been passed by the Faculty of Education Ethics Committee. Please contact the Ethics Officer with any concerns.

A detailed plain language statement can be made available to participants if they request one from the researcher.

Thank you, your participation in this study would be sincerely appreciated.

Further Contacts

Dr. Jane Magill, Research Supervisor, Email: j.magill@elec.gla.ac.uk
Dr. Brian Canavan, Research Supervisor, Email: b.canavan@educ.gla.ac.uk
Dr. Georgina Wardle, Ethics Officer, Email: g.wardle@educ.gla.ac.uk

(B)

University of Glasgow | Faculty of Education
Educational Studies Department
The University of Glasgow, charity number SC004401

Plain Language Statement

A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings

Dear ECE teacher / Assistant teacher,

I am a PhD student in the Department of Educational Studies at the University of Glasgow, currently conducting a research project entitled "Integrating ICT into Early Childhood Education (ECE) Settings" under the supervision of Dr. Jane Magill and Dr. Brian Canavan.

You have been selected for this study as you are a practitioner closely linked to the field. I am writing to invite you to participate in this research study, which aims to investigate how ICT is being integrated into ECE and the factors that may contribute to more effective integration. The rapid growth in the use of technology in the playroom generates a need for a better understanding of how it can be most effectively used.

Participation in the research is on a voluntary basis. If, after consideration, you still agree to participate, you are invited to complete a twenty-minute questionnaire, which will be followed by a small number of interviews elaborating on the issues raised in the questionnaire. If you agree to the interview you will be invited to participate in a sixty minute audio-taped focus group discussion, at a venue to be mutually decided, and asked to read the relevant consent form and sign it.

Taking part in the research will support diversity in the ECE sector and will help to provide quality learning experiences for preschool children. You will be allowed to express your needs in improving your knowledge and skills in ICT. This information can help overcome any perceived barriers of integrating ICT into ECE.

All information will be kept strictly confidential and will be securely stored. You will be given an ID number and this is known only to the researcher. You will not be personally identified at any point in the completed work. The information will be used for the purpose of a research project which is a requirement for being awarded a PhD degree from the University of Glasgow, Faculty of Education, Educational Studies Department. The collected data will also be used for related future publications or presentations.

For queries or additional information, please feel free to contact the researcher Nada Hammed: n.hammed.1@research.gla.ac.uk. The project has been passed by the Faculty of Education Ethics Committee. Please contact the Ethics Officer with any concerns.

A detailed plain language statement can be made available for participants if they request it from the researcher.

Thank you, your participation in this study is sincerely appreciated.

Further Contacts

Dr. Jane Magill, Research Supervisor, Email: j.magill@elec.gla.ac.uk
Dr. Brian Canavan, Research Supervisor, Email: b.canavan@educ.gla.ac.uk
Dr. Georgina Wardle, Ethics Officer, Email: g.wardle@educ.gla.ac.uk

(C)

University of Glasgow | Faculty of Education
Educational Studies Department
The University of Glasgow, charity number SC004401

Plain Language Statement

A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings

Dear Parent / Guardian,

I am a PhD student in the Department of Educational Studies at the University of Glasgow; currently conducting a research project entitled "Integrating ICT into Early Childhood Education (ECE) Settings" under the supervision of Dr. Jane Magill and Dr. Brian Canavan. This research study aims to investigate how ICT is being integrated into ECE and the factors that may contribute to more effective integration.

I will soon be visiting your child's preschool to conduct observations for the purpose of my research. These observations will aim to monitor how technology (ICT) is used in the playroom environment. I am interested in observing how ICT is used in the classroom by teachers and children alike. Two to four observations, 30 mins long for organised activities and 60 mins during free play activities, will take place within the daily playroom environment and will not disturb the everyday teaching and learning in any way. Pupils will not be disadvantaged in any way.

Allowing the participation of your child in this research is completely voluntary and whether your child takes part or not is entirely your own decision. If you decide that your child may take part you can still withdraw her or him from the study at anytime without giving a reason.

A requirement of these observations is that playroom interaction be videotaped. The intention of the video recording is to document exactly what happens and create a record of the observation which I can analyse critically during my study.

I would therefore like to ask for your consent that your child may take part in these videotaped observations. All information collected will be confidential and only used for the completion of my PhD. The information will be kept in locked and safe filing cabinets until the end of the project, giving some time for publication, and then tapes will be destroyed. I will never disclose personal information about your son or daughter in any way.

This study involves no risk to your child's physical or mental health. An abstract of the study can be requested from me after completion of the project.

I kindly ask that you consider the attached consent from and, if you are happy for your child to be part of this research, to sign it and return it to the preschool.

For queries or additional information, please feel free to contact the researcher Nada Hammed: n.hammed.1@research.gla.ac.uk. The project has been passed by the Faculty of Education Ethics Committee. Please contact the Ethics Officer with any concerns.

Thank you for your time, it is much appreciated.

<u>Further Contacts</u>

Dr. Jane Magill, Research Supervisor, Email: j.magill@elec.gla.ac.uk
Dr. Brian Canavan, Research Supervisor, Email: b.canavan@educ.gla.ac.uk
Dr. Georgina Wardle, Ethics Officer, Email: g.wardle@educ.gla.ac.uk

University of Glasgow | Faculty of Education
Educational Studies Department
The University of Glasgow, charity number SC004401

Consent Form

Title of Project:

A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings

Name of Researcher:

Nada Mohammed Hammed

1. I have read and understand the Plain Language Statement for this study and I have had the chance to raise any queries with the researcher.
2. I know that involvement is voluntary and that I can leave the research at any point, without the necessity of giving a reason.
3. I know that the interview will be taped and later transcribed. I also know that copies of transcriptions will be available to check validity and accuracy.
4. The researcher has assured me that my confidentiality is guaranteed and that all identifiers will be eradicated from data and instead a code will be used for identification or the data will be referred to by a pseudonym.
5. I know that the data I provide will appear in a research project that will be used as part of the requirements of a Doctor of Philosophy degree. I also know that the data may appear in future publications or be used in future presentations.
6. I have been informed that an abstract from the completed report will be available upon m request.
7. **I agree / do not agree (delete as applicable) to take part in the above study.**

Name of Participant	**Date**	**Signature**
Researcher	**Date**	**Signature**

University of Glasgow | Faculty of Education
Educational Studies Department
The University of Glasgow, charity number SC004401

Consent Form

Title of Project:

A study of the Integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) Settings

Name of Researcher:

Nada Mohammed Hammed

1. I have read and understand the Plain Language Statement for this study and I have had the chance to raise any queries with the researcher.
2. I know that my child's involvement is voluntary and that they can leave the research at any point, without the necessity of giving a reason.
3. I know that the playroom observations will be video recorded and later analysed.
4. The researcher has assured me that all collected data is confidential and personal information about my child will not be referred to in any future publications or in the doctoral thesis.
5. I know that the data collected will appear in a research project that will be used as part of the requirements of a Doctor of Philosophy degree. I also know that the data may appear in future publications or be used in future presentations.
6. I have been informed that an abstract from the completed report is available upon request.
7. **I agree / do not agree (delete as applicable) for my child to take part in the above study.**

Name of Child's Parent	Date	Signature
Name of Person giving consent (If different from parent, eg Legal guardian / School principal)	Date	Signature
Researcher	Date	Signature

المملكة العربية السعودية
جامعة الملك عبد العزيز
كلية الاقتصاد المنزلي
قسم دراسات الطفولة

عزيزتي مديرة الروضة الفاضلة
السلام عليكم و رحمة الله و بركاته

يسعدني دعوتك للمشاركة في هذا البحث المتطلب لنيل درجة الدكتوراه في مجال استخدام تقنيات المعلومات و الاتصال في رياض الأطفال. يهدف هذا البحث إلى استكشاف واقع استخدام تقنيات التعليم في هذه المرحلة و ذلك للوقوف على العوامل التي قد تسهم في تفعيل دمج وسائل التقنية الحديثة في تعليم طفل ما قبل المدرسة.

بالموافقة على إجراء مقابلة شخصية معك قد تستغرق ثلاثون دقيقة على الأغلب من وقتك لغرض التوسع في عدد من النقاط التي تم طرحها في الاستبيان فإنك بذلك ستساعدين الباحثة في التعرف على المحاور التي من الضروري أن ينظر إليها في مرحلة رياض الأطفال بشيء من التمعن لما قد تشكله من أهمية لتحقيق الاستفادة المثلى من استخدام تقنيات المعلومات والاتصال.

تدور المقابلة حول ثلاثة محاور رئيسية ابتداء من واقع استخدامات تقنيات المعلومات و الاتصال في رياض الأطفال محفزات و معوقات دمج التقنية في رياض الأطفال الاتجاه السائد حول التقنية في تعليم طفل ما قبل المدرسة ، تأثير السياسة التعليمية على استخدام معلمة رياض الأطفال للتقنية و المقصود هنا سياسة وزارة التربية و التعليم و ما يتبع ذلك من نظم و توجيهات أو تعميمات إداريه توقعاتك و رؤيتك لمستقبل تقنيات التعليم في رياض الأطفال في ظل الوضع الراهن من جانب أخر المستقبل النموذجي المأمول الوصول إليه. جميع المعلومات و البيانات التي سترد في هذه المقابلة ستعامل بسرية تامة ولن تستخدم إلا لغايات البحث العلمي فقط.

خالص الشكر و التقدير لثقتك و تلطفك بالمشاركة و حسن التعاون، راجية من الله العزيز القدير لنا ولكم دوام التوفيق.
للاستفسار أو مزيد من المعلومات فضلا لا تترددي في الاتصال بالباحثة: ندى محمد أبوعوف، على البريد الالكتروني التالي: n.hammed.1@research.gla.ac.uk

بعد الإطلاع على خطاب التعريف بالدراسة و تفهم طبيعة المشاركة و الغرض من المعلومات التي ستقدم للباحثة من خلال أداة البحث هذه لا أمانع من المشاركة في هذه الدراسة.

التوقيع

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ملاحظة:

لتحقيق الهدف من هذه المقابلة الشخصية فإن مصطلح تقنيات المعلومات و الاتصال فسر بالمعنى التالي: هو مصطلح يشير إلى استخدام تقنيات الاتصال الحديثة من الحاسب و شبكاته و الوسائط المتعددة من صوت و صوره، رسومات، و آليات البحث، و مكتبات الكترونية سواء كان عن بعد أو في البيئة الصفية. بالإضافة إلى البرامج التعليمية و الأجهزة التي يمكن أن تستخدم كمصادر للمعلومات و وسائل للتدريس و التعليم.

المملكة العربية السعودية
جامعة الملك عبد العزيز
كلية الاقتصاد المنزلي
قسم دراسات الطفولة

عزيزتي معلمة رياض الأطفال الفاضلة
السلام عليكم و رحمة الله و بركاته

يسعدني دعوتك للمشاركة في هذا البحث المتطلب لنيل درجة الدكتوراه في مجال استخدام تقنيات المعلومات و الاتصال في رياض الأطفال. يهدف هذا البحث إلى استكشاف واقع استخدام تقنيات التعليم في هذه المرحلة و ذلك للوقوف على العوامل التي قد تسهم في تفعيل دمج وسائل التقنية الحديثة في تعليم طفل ما قبل المدرسة.

بالموافقة على الانضمام لحلقة النقاش هذه والتي قد تستغرق ستون دقيقة على الأغلب من وقتك لغرض التوسع في عدد من النقاط التي تم طرحها في الاستبيان فإنك بذلك ستساعدين الباحثة في التعرف على المحاور التي من الضروري أن ينظر إليها في مرحلة رياض الأطفال بشيء من التمعن لما قد تشكله من أهمية لتحقيق الاستفادة المثلى من استخدام تقنيات المعلومات والاتصال.

تدور حلقة النقاش حول ثلاثة محاور رئيسية ابتداء من واقع استخدامات تقنيات المعلومات و الاتصال في رياض الأطفال محفزات و معوقات دمج التقنية في رياض الأطفال الاتجاه السائد حول التقنية في تعليم طفل ما قبل المدرسة ، تأثير السياسة التعليمية على استخدام معلمة رياض الأطفال للتقنية و المقصود هنا سياسة وزارة التربية و التعليم و ما يتبع ذلك من نظم و توجيهات أو تعميمات إداريه توقعاتك و رؤيتك لمستقبل تقنيات التعليم في رياض الأطفال في ظل الوضع الراهن من جانب أخر المستقبل النموذجي المأمول الوصول إليه. جميع المعلومات و البيانات التي سترد في هذه المقابلة ستعامل بسرية تامة ولن تستخدم إلا لغايات البحث العلمي فقط.

خالص الشكر و التقدير لثقتك و تلطفك بالمشاركة و حسن التعاون، راجية من الله العزيز القدير لنا ولكم دوام التوفيق.
للاستفسار أو مزيد من المعلومات فضلا لا تترددي في الاتصال بالباحثة: ندى محمد أبوعوف، على البريد الالكتروني التالي: n.hammed.1@research.gla.ac.uk

ملاحظة:

لتحقيق الهدف من هذه المقابلة فإن مصطلح تقنيات المعلومات و الاتصال فسر بالمعنى التالي: هو مصطلح يشير إلى استخدام تقنيات الاتصال الحديثة من الحاسب و شبكاته و الوسائط المتعددة من صوت وصورة، و رسومات، و آليات البحث، و مكتبات الكترونية سواء كان عن بعد أو في البيئة الصفية. بالإضافة إلى البرامج التعليمية و الأجهزة التي يمكن أن تستخدم كمصادر للمعلومات و وسائل للتدريس و التعليم.

بعد الإطلاع على خطاب التعريف بالدراسة و تفهم طبيعة المشاركة و الغرض من المعلومات التي ستقدم للباحثة من خلال أداة البحث هذه، لا أمانع من المشاركة في هذه الدراسة.

توقيع عضوات حلقة النقاش:

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الباحثة: ندى محمد أبوعوف

التوقيع

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التاريخ

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Appendix 2

University of Glasgow | Faculty of Education

Educational Studies Department

The University of Glasgow, charity number SC0044

Serial No.

Date

A Questionnaire on the Integration of Information and Communication Technology (ICT) in Early Childhood Education (ECE) Settings

Dear Nursery Head Teacher,

I am a PhD student conducting a research project that explores how ICT is being integrated into the early childhood education. The aim of this research is to investigate the factors that may contribute towards the effective integration of ICT in early childhood education (ECE).

I would like to invite you to take part in this research by filling out the attached questionnaire which aims to identify how ICT is used in preschool settings.

By agreeing to complete this questionnaire you will help the researcher to identify the issues which nursery schools consider important in making the best use of ICT. Completion of the questionnaire should take no more than 20 minutes of your time. All information will be kept strictly confidential and will be used for the purpose of a research project which is a requirement for being awarded a PhD degree from University of Glasgow, Faculty of Education, Educational Studies Dept.

Taking part in the research is completely voluntary. You alone have the right to decide whether or not to take part and if you decide to take part you are still free to withdraw at any time and without giving a reason. Your participation will support diversity in the ECE sector and will help to provide quality learning experiences for preschool children. You will be allowed to express your needs in improving your knowledge and skills in ICT. This information can help overcome any perceived barriers of integrating ICT into ECE.

The questionnaire will be collected by the researcher on **-- /--/2010.**

Thank you in anticipation of your co-operation in this study.

For queries or additional information, please feel free to contact:
Nada Hammed, University of Glasgow (Researcher)
Email: n.hammed.1@research.gla.ac.uk

Further Contacts
Dr. Jane Magill, Research Supervisor, Email: j.magill@elec.gla.ac.uk
Dr. Brian Canavan, Research Supervisor, Email: b.canavan@educ.gla.ac.uk
Dr.Georgina Wardle, Ethics Officer, Email: g.wardle@educ.gla.ac.uk

Notes

For the purposes of this questionnaire ICT (Information and Communications Technology) should be interpreted as meaning: *Any computer based and communication technologies, networked and standalone, including both hardware and software, which can be used as teaching, learning and information resources.*

1. Please indicate to what extant you agree or disagree with the following statements relating to the philosophy of your nursery school. Tick the most appropriate box.

No		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	Teachers and children in this nursery are encouraged to utilise ICT	❒	❒	❒	❒	❒
2	The use of ICT in this nursery is emphasised only when it is relevant for the curriculum	❒	❒	❒	❒	❒
3	Teachers are encouraged to attend ICT staff development courses	❒	❒	❒	❒	❒
4	The use of non-ICT resources is generally preferred by teachers in this nursery school	❒	❒	❒	❒	❒
5	The majority of teaching staff in this nursery are comfortable using ICT	❒	❒	❒	❒	❒
6	This nursery school would like to invest in ICT but the cost is too high	❒	❒	❒	❒	❒
7	The use of ICT is encouraged across the pre- school's curriculum	❒	❒	❒	❒	❒
8	This nursery keeps up to date with ICT using informal networks	❒	❒	❒	❒	❒
9	Getting up to date with ICT resources is generally too time consuming for teachers in this nursery	❒	❒	❒	❒	❒
10	ICT resources generally get a positive reception from our children	❒	❒	❒	❒	❒
11	The chance of ICT improving teaching is unlikely in this nursery	❒	❒	❒	❒	❒
12	ICT floods this nursery school with too much information	❒	❒	❒	❒	❒
13	In-service in this nursery is often ICT based	❒	❒	❒	❒	❒
14	Any ICT initiatives/purchases are fully supported by the local education authority	❒	❒	❒	❒	❒
15	The use of ICT is more likely to take place at a child's home than in school	❒	❒	❒	❒	❒
16	The use of ICT in the pre-school classroom is generally supported by children's' parents in this nursery	❒	❒	❒	❒	❒
17	ICT use is too difficult for this nursery to implement at the moment	❒	❒	❒	❒	❒
18	New ideas are brought to this nursery school through external ICT courses	❒	❒	❒	❒	❒
19	Administrative work in this nursery is aided by the use of ICT	❒	❒	❒	❒	❒
20	ICT developments in the nursery are overseen by an assigned person	❒	❒	❒	❒	❒
21	There is a personal pressure to pursue the use of ICT in the nursery school	❒	❒	❒	❒	❒

No		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
22	The amount of ICT usage is encouraged to be at the discretion of	❒	❒	❒	❒	❒
23	ICT generally makes teachers in the nursery feel uncomfortable	❒	❒	❒	❒	❒
24	The majority of teachers would feel positive about having more ICT in their classroom	❒	❒	❒	❒	❒
25	Teaching can be enhanced by sensible ICT usage	❒	❒	❒	❒	❒
26	This nursery school does not offer enough ICT to meet pupils' needs	❒	❒	❒	❒	❒
27	In this nursery more money will be put into ICT resources over the next few years	❒	❒	❒	❒	❒
28	ICT usage is understood by recently qualified teachers	❒	❒	❒	❒	❒
29	Usually, parents would prefer money spent on books for pupils rather than on ICT	❒	❒	❒	❒	❒
30	Effective teaching and learning in the future will require ICT	❒	❒	❒	❒	❒
31	Children feel that books are less relevant than ICT	❒	❒	❒	❒	❒
32	The nursery school's information management is made more effective by ICT	❒	❒	❒	❒	❒
33	The ICT resources in the nursery are provided in a SMART room/ lab	❒	❒	❒	❒	❒
34	The ICT resources in this nursery are provided in the normal playroom environment as an activity centre	❒	❒	❒	❒	❒

2. In your opinion do you think that use of ICT in education in general has become a necessity?

Yes ❒
No ❒

3. In your opinion has the use of ICT in ECE become a necessity or is it just a luxury?

Necessity ❒
Luxury ❒

4. Can ICT replace traditional teaching methods?

Yes ❒
No ❒
Sometimes ❒

Can you explain why you feel this way (maximum three reasons)?

1. ……………………………………………………………………………..
2. ……………………………………………………………………………..
3. ……………………………………………………………………………..

5. With regards to ICT usage, is there a Whole School Policy in place in your nursery?

Yes ❐
No ❐

6. If you have a Development Plan in your nursery, does this plan contain clear objectives supporting ICT use?

Yes ❐
No ❐

7. Can ICT be integrated into the educational system in ECE so that it will compliment traditional teaching methods?

Yes ❐
No ❐

8. What are the requirements to integrate ICT effectively into ECE? (Please organise your points according to importance).

1……………………………………………………………………………
2……………………………………………………………………………
3……………………………………………………………………………
4……………………………………………………………………………

9. In your opinion what factors would help to raise teachers' awareness of how to use ICT in ECE?

1……………………………………………………………………………
2……………………………………………………………………………
3……………………………………………………………………………
4……………………………………………………………………………

10. Is your nursery school's sector:

Public? ❐
Private? ❐

11. In the development of ICT integration in your nursery, is there a key priority?

(Please give details below)

……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

12. Please feel free to add any additional comments below.

This questionnaire will be followed up with a small number of interviews elaborating upon the issues raised in the questionnaire.

Thank you very much for your assistance.

Please remember to return this questionnaire by --/ --/ 2009

University of Glasgow | Faculty of Education

Educational Studies Department

The University of Glasgow, charity number SC004401

Serial No.	
Date	

A Questionnaire on the Integration of Information and Communication Technology (ICT) in Early Childhood Education (ECE) Settings

Dear preschool teacher,

I am a PhD student conducting a research project that explores how ICT is being integrated into the early childhood education. The aim of this research is to investigate the factors that may contribute towards the effective integration of ICT in early childhood education (ECE).

I would like to invite you to take part in this research by filling out the attached questionnaire which aims to identify how ICT is used in preschool settings.

By agreeing to complete this questionnaire, you will help the researcher to identify the issues which nursery schools consider important in making the best use of ICT. Completion of the questionnaire should take no more than 20 minutes of your time. All information will be kept strictly confidential and will be used for the purpose of a research project which is a requirement for being awarded a PhD degree from University of Glasgow, Faculty of Education, Educational Studies Dept.

Taking part in the research is completely voluntary. You alone have the right to decide whether or not to take part and if you decide to take part you are still free to withdraw at any time and without giving a reason. Your participation will support diversity in the ECE sector and will help to provide quality learning experiences for preschool children. You will be allowed to express your needs in improving your knowledge and skills in ICT. This information can help overcome any perceived barriers of integrating ICT into ECE.

The questionnaire will be collected by the researcher on **--/--/2010.**

Thank you in anticipation of your co-operation in this study.

For queries or additional information, please feel free to contact:
Nada Hammed, University of Glasgow (Researcher)
Email: n.hammed.1@research.gla.ac.uk

Further Contacts
Dr. Jane Magill, Research Supervisor, Email: j.magill@elec.gla.ac.uk
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Dr.Georgina Wardle, Ethics Officer, Email: g.wardle@educ.gla.ac.uk

Notes

For the purposes of this questionnaire ICT (Information and Communications Technology) should be interpreted as meaning: ***Any computer based and communication technologies, networked and standalone, including both hardware and software, which can be used as teaching, learning and information resources.***

A. *Your use of ICT*

In this section I am interested in finding out how you use ICT. I would also like to know what your experiences of ICT in different contexts are.

1. Have you used ICT before?

Yes	☐	(Please go to Q2.)
No	☐	(If No please answer Q6 only in this section)

2. What type of ICT resources do you use? *Please tick all that apply*

1	Computer desktop, laptop, and handheld	☐	10	Electronic whiteboard	☐
2	Internet & (WWW)	☐	11	Video conferencing	☐
3	E-mail	☐	12	Online information sources & Databases	☐
4	Digital cameras	☐	13	Programmable toys	☐
5	Video cameras	☐	14	Word-processing (e.g. Word)	☐
6	TVs &Videos	☐	15	Spreadsheets (e.g. Excel)	☐
7	Tel, mobile, fax	☐	16	Slideshow program (e.g. PowerPoint)	☐
8	LCD projector	☐	17	Educational software packages (externally produced)	☐
9	Overhead projector	☐	18	Educational software packages (internally produced)	☐
19	Other *(please state)*	☐	………………………………………………..		

3. In what locations do you use ICT resources? *Please tick all that apply*

1	Playroom	☐	4	Library	☐
2	Computer lab	☐	5	Staff room	☐
3	Smart room	☐	6	Home	☐
7	Other *(please state)*	☐	…………………………..……………………		

4. In what spaces do you use ICT resources? *Please tick all that apply*

I have defined the following spaces:

- ***Playroom practice:*** *e.g. using ICT to support your teaching in the playroom.*
- ***Professional development:*** *e.g. networking with other teachers; using software packages for developing professional skills.*
- ***Personal use:*** *e.g. finding information for personal interest; playing computer games.*
- ***Administration:*** *e.g. monitoring pupil progress; recording pupil grades.*

1. Playroom practices	☐	3. Personal use	☐
2. Professional development	☐	4 . Administrative work	☐

5. Normally, how frequently would use the ICT resources listed below in each of the areas of playroom practice, professional development, personal use and administration?

Please mark as follows: ***D = Daily W = Weekly M = Monthly T = Termly N = Never***

	ICT resources	**Playroom practice**					**Professional use**					**Personal use**					**Admin work**				
		D	**W**	**M**	**T**	**N**	**D**	**W**	**M**	**T**	**N**	**D**	**W**	**M**	**T**	**N**	**D**	**W**	**M**	**T**	**N**
1	Computers																				
2	Internet access																				
3	E-mail																				
4	Digital cameras																				
5	Video cameras																				
6	TVs &Videos																				
7	Tape recorder																				
8	Tel, mobile, fax																				
9	Data projector																				
10	Electronic whiteboard																				
11	Video conferencing																				
12	Educational software packages																				
13	CD-ROM information sources																				
14	Online information sources																				
15	Programmable toys																				
16	Word-processing																				
17	Spreadsheets																				
18	Slideshow program																				

6. If you **do not** use or use **very little** any of the following ICT resources in each of the areas of the playroom, professional development, or administrative context, please mark a reason why by ticking the appropriate box (es).

		Not available at all	**Not accessible when needed**	**Not familiar with**	**Lack of skills**	**Not appropriate**	**Cost of buying/ using**	**Lack of technical support**	**Lack of time**
1	Computers	☐	☐	☐	☐	☐	☐	☐	☐
2	Internet	☐	☐	☐	☐	☐	☐	☐	☐
3	E-mail	☐	☐	☐	☐	☐	☐	☐	☐
4	Digital cameras	☐	☐	☐	☐	☐	☐	☐	☐
5	Video cameras	☐	☐	☐	☐	☐	☐	☐	☐
6	TVs &Videos	☐	☐	☐	☐	☐	☐	☐	☐
7	Tape recorder	☐	☐	☐	☐	☐	☐	☐	☐
8	Tel, mobile, fax	☐	☐	☐	☐	☐	☐	☐	☐
9	Data projector	☐	☐	☐	☐	☐	☐	☐	☐
10	Electronic whiteboard	☐	☐	☐	☐	☐	☐	☐	☐
11	Video conferencing	☐	☐	☐	☐	☐	☐	☐	☐
12	Educational software packages	☐	☐	☐	☐	☐	☐	☐	☐
13	CD-ROM information sources	☐	☐	☐	☐	☐	☐	☐	☐
14	Online information sources	☐	☐	☐	☐	☐	☐	☐	☐
15	Programmable toys	☐	☐	☐	☐	☐	☐	☐	☐
16	Word-processing	☐	☐	☐	☐	☐	☐	☐	☐
17	Spreadsheets	☐	☐	☐	☐	☐	☐	☐	☐
18	Slideshow program	☐	☐	☐	☐	☐	☐	☐	☐

7. Why are you using ICT in your teaching?

1	To keep abreast of advancement in technology	☐
2	To catch up with developed nations	☐
3	Change of activity routine to maintain interest	☐
4	Make use of available equipment	☐
5	Method for improving and developing teaching	☐
6	Its use is a symbol of modernisation	☐
7	Pressures to change from pupils, teachers, and parents	☐
8	Effective method to convey information	☐
9	It is the era of technology use; the illiterate one is the one who does not know how to use ICT	☐
10	Professional way of teaching	☐
11	Other *(please state)* …………………………………………………………………	☐

8. In general what sort of impact does ICT have upon your teaching?

Positive	☐
Negative	☐
Mixed	☐
Don't know	☐

If you can give examples please provide them below

…………………………………………………………………………………………………
…………………………………………………………………………………………………
……………………………………………………………………………………………

9. In general what sort of effect has ICT had on your preschoolers' learning?

Positive	☐
Negative	☐
Mixed	☐
Don't know	☐

Please give examples

…………………………………………………………………………………………………
…………………………………………………………………………………………………
……………………………………………………………………………………………

B. Barriers and motivations for ICT use

10. In this section, I want to find out what encourages you and supports you making good use of ICT for teaching and other professional duties. Please indicate how much you agree or disagree with the following statements:

	All these statements are for motivations and supporting factors	**Strongly Agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly Disagree**
1	Whole school view of the importance of ICT, guidelines and policy	☐	☐	☐	☐	☐
2	Support, encouragement, and motivation from senior management	☐	☐	☐	☐	☐
3	Competition among teachers	☐	☐	☐	☐	☐
4	Children advanced competence with ICT	☐	☐	☐	☐	☐
5	Career progress (teacher annual assessment, letters of gratitude and appreciation, to keep my job, for promotions, and good for my CV)	☐	☐	☐	☐	☐

	All these statements are for motivations and supporting factors	**Strongly Agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly Disagree**
6	Leave good impression on pupils and parents as using ICT is an indicator of teachers' proficiency	☐	☐	☐	☐	☐
7	Encouraging school environment, i.e. good access to internet, training, technical support, updated ICT resources, availability of professionally developed software	☐	☐	☐	☐	☐
8	The new curriculum requires ICT use in teaching	☐	☐	☐	☐	☐
9	Another enthusiastic teacher	☐	☐	☐	☐	☐
10	Children acceptance and support	☐	☐	☐	☐	☐
11	Availability of training opportunities	☐	☐	☐	☐	☐
12	Believe in ICT benefits and importance	☐	☐	☐	☐	☐
13	First hand experience of using ICT and my own success creates an incentive for continuing to use ICT	☐	☐	☐	☐	☐
14	My interest to know more about ICT and to develop my skills	☐	☐	☐	☐	☐
15	Do not want to be ignorant	☐	☐	☐	☐	☐

11. From your personal experience, what are the major difficulties or barriers which hinder the integration of ICT in ECE? Please indicate how much you agree or disagree with the following statements:

	All these statements are for factors that hinder your ICT use	**Strongly Agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly Disagree**
1	ICT not seen as a whole school priority	☐	☐	☐	☐	☐
2	Lack of technical support and maintenance	☐	☐	☐	☐	☐
3	Lack of professional development opportunity	☐	☐	☐	☐	☐
4	Lack of time for training, too many other demands on my time	☐	☐	☐	☐	☐
5	Taking ICT courses is not beneficial salary wise	☐	☐	☐	☐	☐
6	Whole school limitation in the infrastructure, facilities, learning resources (software) and equipments (old hardware, no or slow Internet access)	☐	☐	☐	☐	☐
7	Time constrains and needs tremendous effort put into preparing activities	☐	☐	☐	☐	☐
8	Teachers' resistance to change and being more used to traditional methods	☐	☐	☐	☐	☐
9	School financial difficulties	☐	☐	☐	☐	☐
10	Lack of appropriate skills to use ICT effectively	☐	☐	☐	☐	☐
11	Lack of awareness of ICT advantages in ECE	☐	☐	☐	☐	☐
12	Some teachers create a bad influence on others	☐	☐	☐	☐	☐
13	Lack of class management skills	☐	☐	☐	☐	☐
14	Lack of support from the society and family	☐	☐	☐	☐	☐
15	No clear plan or reference-point for teachers on the use of ICT	☐	☐	☐	☐	☐
16	I can't cope with ICT jargon	☐	☐	☐	☐	☐

C. *Your feelings, Skills, and development needs for ICT use*

12. I'm interested in finding out your opinion of ICT. What are your views regarding ICT? Even if you do not use ICT, please indicate the extent to which you agree or disagree with each of the statements below by marking the appropriate box.

	All these statements are about general ICT use in education	**Strongly agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
1	I'd like to know more about ICT	☐	☐	☐	☐	☐
2	ICT scares me	☐	☐	☐	☐	☐
3	ICT helps me find a lot of relevant information for my teaching	☐	☐	☐	☐	☐
4	I know the basics of ICT but that's it	☐	☐	☐	☐	☐
5	I feel I suffer from information overload	☐	☐	☐	☐	☐
6	I use ICT effectively myself but I'm not sure how to teach children to use it	☐	☐	☐	☐	☐
7	I don't know what I would do without ICT	☐	☐	☐	☐	☐
8	I manage information more effectively because of ICT	☐	☐	☐	☐	☐
9	I wish ICT had never been invented	☐	☐	☐	☐	☐
10	I find ICT helpful for non-work related tasks	☐	☐	☐	☐	☐
11	I find using ICT time consuming	☐	☐	☐	☐	☐
12	Some children are scared of using ICT	☐	☐	☐	☐	☐
13	ICT makes my work easier	☐	☐	☐	☐	☐
14	I prefer using ICT on my own when no-one is around to see me make mistakes	☐	☐	☐	☐	☐
15	ICT helps children acquire new knowledge effectively	☐	☐	☐	☐	☐
16	ICT reduces preparation time	☐	☐	☐	☐	☐
17	ICT is moving too fast for me	☐	☐	☐	☐	☐
18	using ICT increases work load	☐	☐	☐	☐	☐
19	I find it easy to select appropriate ICT resources for my teaching	☐	☐	☐	☐	☐
20	I feel supported in my use of ICT	☐	☐	☐	☐	☐
21	Children can get distracted by ICT	☐	☐	☐	☐	☐
22	ICT helps me communicate with colleagues	☐	☐	☐	☐	☐
23	ICT systems are slower than using a book	☐	☐	☐	☐	☐
24	Sometimes I feel disorientated by the information age	☐	☐	☐	☐	☐
25	ICT encourages children to work together collaboratively	☐	☐	☐	☐	☐
26	I can never find any relevant ICT tool for my pupils	☐	☐	☐	☐	☐
27	ICT seems to motivate the children to learn	☐	☐	☐	☐	☐
28	ICT swamps children with information	☐	☐	☐	☐	☐
29	The children are way ahead of me in their use of ICT	☐	☐	☐	☐	☐
30	ICT can cause limitations in teacher and child interaction	☐	☐	☐	☐	☐

13. Did you ever have any ICT training?

Yes	☐
No	☐ (If No please go to Q15)
Can't remember	☐

If yes please give details of this training

a) Anything that was useful about it

- ………………………………………………………………………………………..
- ………………………………………………………………………………………..
- ………………………………………………………………………………………..

b) Anything that was not useful

- ………………………………………………………………………………………..
- ………………………………………………………………………………………..
- ………………………………………………………………………………………..

14. If you use ICT, how competent do you feel in the following areas?

	Very competent	**Competent**	**Not competent**	**Don't know**
Playroom practices	☐	☐	☐	☐
Professional development	☐	☐	☐	☐
Personal use	☐	☐	☐	☐
Administration work	☐	☐	☐	☐

15. In what ways do you keep up to date with new skills and ICT developments? *Please tick all that apply*

1	Self – learning	☐	7	In-service training courses	☐
2	Exchanging experiences with other teachers	☐	8	External training courses	☐
3	Exchanging experiences with family members	☐	9	Professional journals	☐
4	Librarians	☐	10	Computing department	☐
5	Technician	☐	11	Internet	☐
6	Inspector	☐	12	Other *(please state)* ………….	☐

16. Would you like to enhance your skills and knowledge in ICT?

Yes	☐
No	☐

17. You may or may not be interested in improving your skills and knowledge in ICT. Please indicate how much you agree or disagree with the following statements:

		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	I am interested in learning more about using ICT	☐	☐	☐	☐	☐
2	I feel ICT training isn't appropriate to my teaching	☐	☐	☐	☐	☐
3	I find training courses in ICT useful	☐	☐	☐	☐	☐
4	I need to develop my skills and knowledge for professional development	☐	☐	☐	☐	☐
5	I feel I should develop my skills to keep up to date with developments in teaching	☐	☐	☐	☐	☐
6	I don't think I need ICT skills to progress in the profession	☐	☐	☐	☐	☐
7	I'm not that interested but I suppose I should be	☐	☐	☐	☐	☐
8	I need to develop my skills and knowledge for the children benefit	☐	☐	☐	☐	☐
9	I don't see the need to learn about ICT	☐	☐	☐	☐	☐
10	I'm interested but don't have the time	☐	☐	☐	☐	☐
11	I'm interested but don't have access	☐	☐	☐	☐	☐
12	I don't need to use ICT in my teaching	☐	☐	☐	☐	☐
13	I really want to know more about developing my skills in ICT	☐	☐	☐	☐	☐
14	I am interested personally but developing my skills and knowledge in ICT isn't appropriate to my teaching	☐	☐	☐	☐	☐
15	I'm interested but training doesn't seem to be available	☐	☐	☐	☐	☐
16	I don't think it's necessary, no-one else in the school is bothering	☐	☐	☐	☐	☐
17	I would like to develop my skills and knowledge in ICT as everyone else is	☐	☐	☐	☐	☐
18	I feel my skills and knowledge in ICT are adequate	☐	☐	☐	☐	☐
19	ICT training isn't a priority for me	☐	☐	☐	☐	☐

18. In what ways would you like to develop your skills and knowledge in ICT in each of the contexts below? *Please list up to three in each context*

Playroom practice	1. ……………………………………………………………………… 2.……………………………………………………………………… 3.………………………………………………………………………
Professional development	1. ……………………………………………………………………… 2.……………………………………………………………………… 3.………………………………………………………………………
Personal use	1.……………………………………………………………………… 2.……………………………………………………………………… 3.………………………………………………………………………
Administration	1.……………………………………………………………………… 2.……………………………………………………………………… 3.………………………………………………………………………

D. *Policy and ICT*

19. Do you know any details of or have an overview of the Scottish Executive's policy framework for ICT in early years?

Yes	☐
No	☐

20. Does the early childhood curriculum (Curriculum for Excellence 3-18 years) make any reference in favour of ICT usage?

Yes	☐
No	☐

21. Is there a Whole School ICT Policy in place in your nursery?

Yes	☐
No	☐
In progress	☐

(If your answer to question 19, 20 or 21 is "no" then you do not have to continue answer questions in this section. Please go to section E)

22. As far as you aware, what encouraged your nursery to create a whole school policy for ICT usage?

1	The national educational policy is generally supported to the use of ICT in ECE	☐
2	The curriculum for early childhood education emphasised on ICT use	☐
3	ICT use in preschool is fully supported by the local education authority	☐
4	As a response to the lack of clear plan or reference-point for teachers on the use of ICT	☐
5	personal pressure to pursue the use of ICT in the nursery To pursue support teachers' individual efforts	☐
6	Influenced by ICT policy in other levels of education	☐
7	As a step to support ICT integration into ECE	☐
8	The use of ICT in the nursery is generally supported by children's parents	☐
9	Teachers' positive feelings about using ICT	☐
10	None of the above is applicable	☐

23. According to your knowledge does your school policy address any of the following issues?

1	Using ICT is a must for all teachers	☐
2	Well maintained, actively used school website	☐
3	Children should be encouraged to utilise ICT	☐
4	Full support for use of ICT in all activities	☐
5	All teachers should have a minimum level of ICT skills	☐
6	Teachers should attend ICT staff development courses	☐
7	Children Internet use should be supervised by teachers	☐
8	Any ICT initiatives/ purchases are fully supported	☐
9	Teachers should make use of the learning resources room at least once in a term	☐
10	Other policies………………………………………	☐
11	None of the above is applicable	☐

24. How do you think your school ICT policy is influenced by the Scottish Executive's policy framework for ICT in early years?
……
……
……

25. In general what sort of impact does your school ICT policy have upon your teaching?

Positive	☐
Negative	☐
Mixed	☐
Don't know	☐

If you can give examples please provide them below

…………………………………………………………………………………………

…………………………………………………………………………………………

……………………………………………………………………………

26. We want to get your views on your school ICT policy versus the Ministry of Educations ICT policy. We would also to find out their influence on your perceptions towards ICT

		N/A	Strongl y Agree	Agree	Neither agree nor disagre e	Disagre e	Strongl y Disagre e
1	My ICT use is influenced by school policy	☐	☐	☐	☐	☐	☐
2	Our school ICT policy has positively influenced my feelings and perceptions towards ICT	☐	☐	☐	☐	☐	☐
3	Our school ICT policy is ahead of the Ministry's ICT policy, therefore, it is not important for our school	☐	☐	☐	☐	☐	☐
4	The Ministry's ICT policy is more concerned with managerial aspects of schools	☐	☐	☐	☐	☐	☐
5	Ministry policies are all theories not applied in reality with no tangible results	☐	☐	☐	☐	☐	☐
6	All Ministry policies lack explanation and teachers have to apply them without fully understanding them	☐	☐	☐	☐	☐	☐
7	I am encouraged to use ICT in teaching by the Ministry's policy	☐	☐	☐	☐	☐	☐
8	Teachers and head teachers do not know the Ministry of Education's ICT policy	☐	☐	☐	☐	☐	☐
9	The Ministry of Education raises awareness of its ICT policies among teachers	☐	☐	☐	☐	☐	☐
10	The Ministry of Education sets goals and guides teachers to fulfill them	☐	☐	☐	☐	☐	☐
11	I am put off using ICT in teaching because of the unclear ICT policies of the Ministry of Education	☐	☐	☐	☐	☐	☐

E. *Future of ICT integration into ECE*

27. We want to get your views on the possibility of the things below happening in the future. Please indicate whether the statement is highly likely to happen, likely, or highly unlikely to happen

		Highly Likely	**Likely**	**Unlikely**	**Highly Unlikely**
1	Activated school website	☐	☐	☐	☐
2	The curriculum will change	☐	☐	☐	☐
3	Computer for each student	☐	☐	☐	☐
4	Use of smart boards in teaching	☐	☐	☐	☐
5	Wireless Internet connection	☐	☐	☐	☐
6	Paperless education	☐	☐	☐	☐
7	ICT will dominate our lives	☐	☐	☐	☐
8	All hardware will be available at schools	☐	☐	☐	☐
9	No more traditional teaching	☐	☐	☐	☐
10	Better hardware will be available for teachers	☐	☐	☐	☐
11	School internal network	☐	☐	☐	☐
12	Electronic assessment	☐	☐	☐	☐
13	Fulfilment of educational goals	☐	☐	☐	☐
14	I am not optimistic the gap will decrease between us and developed nations	☐	☐	☐	☐
15	Teacher role will focus more on supervision and observation	☐	☐	☐	☐
16	Teachers assessment standards will include ICT skills	☐	☐	☐	☐

28. How would you rate your school's progress at the integration of ICT into its learning environment in terms of the scale-line below (0 indicates just at the beginning, 5 indicates about halfway through, and 10 indicates ICT is fully integrated into the school)?

At the beginning ***Half way through*** ***ICT is fully integrated***

0 ***Obstacles and difficulties*** 5 ***Almost there*** 10

29. What are the needs and priorities to develop the integration of ICT in ECE? Please rank the listed factors below according to it's priority from your point of view
To what extent are the following factors important to support the integration of ICT in ECE? Please rank them according to its priority from your point of view

1	Infrastructure and facilities	
2	A supportive local school policy	
3	Continuing Professional Development courses to improve ICT skills for teachers	
4	Overcoming teachers fear and worries about using ICT	
5	Provide teachers with the necessary time to prepare activities and develop them based on the proper ICT use	
6	The adequate provision of ICT devices	
7	Developing the curriculum and pedagogical understanding of ICT	
8	Organise regular meetings between teachers to exchange ideas and experiences	

9	Promote an electronic culture	
10	Support educational trends toward the use of ICT in early years teaching	
11	Create databases as an ICT resource for teachers to access and benefit from	
12	Inform and educate parents on the importance of ICT in ECE	
13	Please list any other appropriate factors	

F. *You and your teaching experience*

30. How long have you been a teacher (including the probationary period)?

Less than 1 year	☐
1-5 years	☐
6-10 years	☐
More than 10 years	☐

31. Are you a:

Specialist Teacher	☐
Nursery Teacher	☐
Assistant	☐

32. What is your school sector?

Public	☐
Private	☐
Voluntary	☐

33. What level(s) are you teaching at the moment?

KG1 (Age 3-4 years)	☐
KG2 (Age 4-5 years)	☐
KG3 (Age 5-6 years)	☐

34. What is your highest teaching qualification?

High School Certificate	☐	
College DipEd	☐	
BSc	☐	
MSc	☐	
PhD	☐	
Other *(please state)*	☐	………………………………………………………..

35. What is your academic speciality?

Early childhood education	☐	
Other *(please state)*	☐	…………………………………………………………

36. How old are you?

20-30	☐
31-40	☐
41-50	☐
51-60	☐

G. Other comments

37. Please provide any additional comments you would like to make below.

We will be following up this survey with in-depth interviews that will look further at teachers' experience of ICT and what teachers perceive to be the important issues.

Thank you very much for your assistance.

Please remember to return this questionnaire by -- / --/ 2010.

University of Glasgow | Faculty of Education

Educational Studies Department

The University of Glasgow, charity number SC004401

Head Teacher Interview Schedule

Location: ……………………….	**Start time: …………………**
Room No.: ……………………...	**Duration: …………………..**
Date: ……………………………	**Audio recorded** ☐
	Hand recorded ☐

A. Use of ICT in the Nursery

Question 1

Can you tell me a bit about the Information and Communication Technology (ICT) facilities in your nursery school?

Question 3

In what ways can ICT support Early Childhood Education (ECE)?

Question 5

From your experience in your nursery, what factors are important in ensuring the effective embedding of ICT in ECE?

B. Perceptions Towards ICT Integration into ECE

Question 2

When did you decide to invest in ICT and make it part of your nursery school budget?

Question 7

How can ICT in ECE compliment traditional teaching methods?

<u>Or</u>

Question

How should the balance be set between ICT and traditional methods in the early learning environment?

Question 6

As a Head Teacher, what are your priorities to develop ICT knowledge and skills for your nursery school teachers?

C. Impact of Educational Policy on ICT integration in ECE and Teachers' Perceptions

Question

Is the use of ICT in your nursery a consequence of whole preschool policy or influenced by the policy framework for ICT in early years?

Question 4a

What are the factors you consider crucial to forming an explicit plan for the use of ICT in your nursery school?

Question 4b

With regard to ICT usage, in what ways do you think that a whole preschool plan will affect or improve the integration process? Does your nursery school plan consist of clear objectives to support ICT in ECE?

If possible, could you please provide me with a copy from your nursery ICT usage policy?

Question

How is the policy framework for ICT in early years reflected in your nursery daily use of ICT in teaching and other aspects?

Question

What is your view about ICT educational policy?

D. Visions on Future Deployment of ICT in ECE

Question

Based on the current situation, do you see a place for ICT in pre-schools in the future?

Question 5b

What are your priorities to improve ICT use in your nursery school? / What change would you like to see in your nursery in the next ten years?

Question 6b

As an ECE practitioner, what kind of support do you think is needed from other stakeholders/agencies to promote effective integration of ICT in ECE settings?

Question

How would you describe the association between the past, present, and future of ICT in ECE?

Question 8

Is there anything else you think is important for me to know?

University of Glasgow | Faculty of Education

Educational Studies Department

The University of Glasgow, charity number SC004401

Teacher's Interview Schedule

Location: ……………………….	**Start time: …………………**
Room No.: ……………………...	**Duration: …………………..**
Date: ……………………………	**Audio recorded** ☐
Attendants: …………………….	**Hand recorded** ☐

Question 1
What are your opinions on the use of Information and Communication Technology (ICT) in Early Childhood Education (ECE) in general? Do you think it is necessary to use ICT? Could it replace traditional teaching methods?

Question 2
In what ways can you see ICT being used in an ECE context?

Or
As a preschool teacher, what advantages or disadvantages do you consider ICT offers?
For you as a teacher ***And*** For children as learners

Question 3

With regard to ICT usage, in what ways do you think that a whole preschool plan will affect or improve the integration process? Does your ***Daily, Monthly and Yearly*** plan consist of clear objectives to support ICT in ECE?

Or

What are the factors you consider fundamental to forming an explicit plan for the use of ICT in your nursery school?

Question 4

In what ways do you think a blended-learning strategy is crucial in enhancing pre-school children's learning (or to provide new opportunities for learning in ECE)?

Question 5

How do the available ICT resources support your current activities in the playroom?

Question 6
In preparing for activities, how do you decide on using appropriate ICT devices for day to day teaching practice?

Question 7
When the activity is in progress, how do you evaluate and select the most appropriate ICT device for a task?

Question 8
Based on your observations in the playroom, how often do children choose to you use the available ICT resources?

Question 9
In what ways do you evaluate the benefits and demands of ICT on both yourself and pupils?

Question 10
In terms of CPD and training programs to develop your ICT knowledge and skills, what kind of support does your pre-school or local authority provide?

Question 11
Your Head Teacher has indicated that the use of ICT to support ECE will be a priority area in your Nursery School Development Plan. She has asked teachers to respond with some ideas as to how ICT might be integrated into the design and content of the nursery plan and staff development programme.

What are your thoughts?
What issues might you want to consider?

Question 12
From your personal experience what are the major difficulties associated with the integration of ICT in ECE?

Question 13
What are your needs and priorities in relation of the integration of ICT in ECE?

Question 14
Is there anything else you think is important for me to know?