Professional Development of ICT Integration for Secondary School Teachers in Hong Kong: Towards a Peer Support Enhanced Model

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ABSTRACT

Although information and communication technology (ICT) has gradually become a standard teaching technology in schools in many countries and regions like Hong Kong, the implementation of ICT in teaching and learning in schools still fails to meet high government and public expectations. This study was an investigation into the potential of peer support to enhance professional development of ICT integration for secondary school teachers in Hong Kong.

The study utilized peer support as a social approach to professional development and employed action research to examine the experiences of ten secondary school teachers who worked in five peer support groups for sixteen months. A peer support model was introduced to the participants who then applied these principles in their own contexts. Data on participants' reflections and evaluations of the peer support process was collected through individual interviews and peer-group conferences. Each participant was interviewed at the beginning, middle and end of the research period and each peer group was interviewed at the end of the project. By employing a grounded theory approach, themes related to the participants' experiences of peer support for ICT integration and the impact of peer support as a means of professional development were generated from the data.

The study's findings indicate that the participants responded positively to peer support as a means of professional development. Peer support was successful in: increasing professional interactions; broadening perspectives of ICT; increasing reflection; and providing personal and emotional support.

From an analysis of the study's findings, in conjunction with a review of the appropriate literature, a teacher professional development model for ICT integration has been developed that may be helpful in furthering the goal of successful ICT integration. This model focuses on the importance of intrinsic motivation rather than extrinsic incentives and is based on a developmental process in which individual teachers determine their own practice through peer support enhanced critical reflection that continually expands their personal context of ICT integration.

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I wish to dedicate this thesis to my family who

support me as I perused my study

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CHAPTER ONE: INTRODUCTION

This study arises from my personal experience and concern about the use of information and communication technology (ICT) in teaching. I started using ICT when teaching in secondary school in the late 1980s after graduating from university and beginning my career as a secondary school teacher. Equipped with knowledge of computers, I was enthusiastic to apply this new technology in my work. With limited resources and equipment in the school, computers were used to enhance my administration work and teaching preparation but were seldom used in the classroom. Not until the mid 1990s, did my use of computers change from an administration tool into a teaching and learning tool. Educational software, Internet and digital presentation were gradually introduced and used in my classrooms. Having used this technology in school and teaching for years, I recognized the differences between using ICT in administration and using it to enhance teaching and learning. The effect of using computers in administration and teaching preparation was direct and very visible. It made those aspects of my work more efficient. In contrast, the effect of ICT on teaching and learning was unclear and it took significant amounts of time and effort on the part of the teacher to prepare ICT teaching materials.

This study of professional development for ICT integration in secondary schools in the Hong Kong Special Administrative Region (HKSAR), China, is underpinned by my personal reflection on the experiences of using ICT in this context. The study examines the challenges for teachers in the integration of ICT into their daily teaching and seeks ways to support teachers in developing their

proficiency in ICT integration. The aim of this study was to develop a model of professional development, which would simultaneously provide a challenge to the teachers' perceptions of ICT and teaching, as well as offer them a level of personal support in using ICT in daily practice.

This chapter first gives a brief definition of some of the terms used in this study, then describes the background context of ICT in education in Hong Kong. This is followed by a definition of the research problem, and a description of the purpose and significance of this study. The chapter finishes with an overview of the thesis.

Definition of terms

This study is about professional development for ICT integration in teaching and the following definitions are intended to clarify the main terms used in the study.

Information and communication technology (ICT): This term, as applied to education, evolved from previous terms, such as information technology (IT) that described new technologies for transmitting, sharing and manipulating information (Anderson & Baskin, 2002). ICTs in their broadest sense include long-used, non-digital technologies such as writing, printing, drawing and painting but in the late 20th Century electronic means of communication such as the telephone, television, and digital media, such as computers and the Internet have dominated public perception of communication technology. Nowadays, ICT is commonly defined as those technologies that enable creating, accessing, gathering, managing, presenting and communicating information through electronic and digital means (Toomey, 2001; Blurton, 1999). Anderson and

Baskin (2002) maintained that "The addition of 'communication' to previous terms such as information technology (IT) emphasizes the growing importance attributed to the communication aspects of new technologies" (p. 126). In this study, ICT is used interchangeably with "information technology" (IT), which is used in some countries and regions, such as Hong Kong. ICT is also taken to mean more than the use of individual technologies and to include the combined use of different technologies and their continuous development.

ICT in Education: There is no single well-defined or generally accepted meaning of this term. It involves the interpretation of both ICT and education and their relationship. Education can be formal and informal, as well as structured and unstructured. In this study, the context of education is identified as the interaction between teachers and students in public schools. In education, ICT can be seen to "enhance the teaching and learning process and allow for various perspectives on issues", it can enable "teaching and learning to take place in a flexible environment" (Farren & Tweedy, 2002, para. 2). As ICT education is the learning of technology, ICT in education is defined in this study as the use of technologies to enhance teaching and learning and enable learning environments in ways that cannot easily be achieved without the help of these technologies, such as using video conferencing to enable real time conversation with an expert in classroom.

Professional development: In this study, professional development is taken to mean "those experiences which systematically, over a sustained period of time, enable educators to acquire and apply knowledge, understanding, skills, and abilities to achieve personal, professional and organizational goals and to facilitate

the learning of students" (Kentucky Department of Education, 2005, section 1.2). It covers a broad range of activities that contribute to the learning of teachers for both individual and systemic needs (Craft, 2000). It may refer to those activities, formal and informal as well as structured and unstructured, which maintain, improve and broaden teachers' skills, knowledge, and ability to teach, and the development of personal qualities for professional responsibilities. In this study, professional development refers to the processes aimed at increasing the effectiveness of teachers' practice. This is seen as a process of personal development to enable teachers to build professional knowledge and effective practice.

Background context

Technology has been rapidly developing and influencing society and daily life for centuries. The use of computers and digital media in daily life has grown at an exponential rate in recent decades. It is thus not surprising to find that more and more countries are investing in the use of ICT in education. Emerging at the same time as other education reforms, such as student-centred learning, the introduction of ICT in education has, in some countries, not only been regarded as a teaching and learning aid but also as a medium in which to embed these reform initiatives (Kozma, 2002).

Computers were introduced to the secondary school curriculum as a new subject for Secondary 4 and 5 levels in HKSAR in 1982 (Law, Yuen, Ki, Li, & Lee, 1999). The future direction of ICT in education in Hong Kong was laid in 1997 by Tung Chi Wa, the then HKSAR Chief Executive, who explained the government's vision and initiative for information technology in education in his

Inaugural Policy Address. The Hong Kong Government believes that equipping people with ICT skills is important to the future development of Hong Kong:

> We are seeing substantial changes in the economic structure and the knowledge-based economy is here to stay. Hong Kong is also facing tremendous challenges posed by a globalized economy. Politically, reunification with China and democratization have changed the ways Hong Kong people think and live. Our social structure is fast evolving and there is an urgent need to alleviate the disparity of wealth. The society is adapting its culture and mindframe to these changes. The rapid development of information technology has opened up new domains in all aspects of our lives and creating [*sic*] new challenges (Education Commission, 2000, p. 3).

In the following year, the Education and Manpower Bureau (EMB) published *Information Technology for Learning in a New Era: Five-Year Strategy 1998/99 to 2002/03* (Five-Year Strategies) and put forward the Information Technology in Education (ITEd) initiatives. Since 1997, the HKSAR government has been very active in promoting the use of ICT as an integral element in teaching and learning in all subjects in schools. Although Hong Kong is a late starter in its ICT policies (Law et al., 1999), the policy of ICT implementation in school teaching and learning in Hong Kong seems to be ambitious, as seen in a report to ITEd which stated, "The Five-Year Strategy signifies the Government's commitment to driving Hong Kong to become a leader, not follower, in the information world of tomorrow" (Education and Manpower Bureau, 2004, Forward section, para. 1). The document also detailed the government's ambition to change the teaching paradigm by means of ICT and this indicated that ICT was expected to be used

not only as a technical tool for teaching but also a change agent of education (Education and Manpower Bureau, 2004). To achieve this aim, a series of initiatives were introduced to encourage and support schools and teachers to integrate ICT in daily teaching and learning, and included developing ICT infrastructure in schools, training for teachers, funding for hardware and software, as well as technical support.

A few years after the publication of the Five-Year Strategy, the HKSAR government had put in place a good infrastructure for the use of ICT in schools. Many schools in Hong Kong had the latest hardware as well as easy access to the Internet in classrooms. Schools were provided with good technology support as funding was available for schools to hire IT Coordinators and hardware maintenance was contracted to external companies. Abundant opportunities for technical training were offered to teachers. This technical environment was believed to be very favourable for encouraging ICT penetration in schools as it addressed many of the factors necessary for ICT integration mentioned by researchers (for example, Hoffman, 1996; Loveless, 1996).

The Five-Year Strategy stressed that a paradigm shift was a central theme of the integration of ICT in education in Hong Kong. The introduction of ICT in education was not simply about the application of technology but also a way to achieve different educational purposes. The strategy specified the need for "a paradigm shift - from a largely textbook-based teacher-centred approach to a more interactive and learner-centred approach" in school education in Hong Kong (Education and Manpower Bureau, 1998, para. 1.2). The government aimed at "[encouraging] key players in the school system to take up the challenges of their respective new roles [and integrating] IT into school education meaningfully

through necessary curriculum and resource support" (Education and Manpower Bureau, 1998, para. 1.6). It also realized the importance of providing assistance and professional development for teachers in the use of ICT in order to allow them to take up the challenges of their new roles.

As Fullan and Mascall (2000) have concluded, "professional development is key to the success of any reform initiative" (pp. 32-33) and therefore to promote excellence in ICT in education, professional development was deemed necessary to ensure teachers would be prepared to realize the potential of these technologies. The ITEd initiative provided various levels of ICT training (that is, basic, intermediate, upper intermediate and advanced)[1] for teachers and teachers would be assessed against an ICT benchmark. All teachers were expected to achieve the basic ICT level of training, while 75% of teachers were expected to attain the intermediate ICT level (Education and Manpower Bureau, 1998). The HKSAR Chief Executive had already spelt out the demand for teachers to use ICT in classroom teaching for at least 25% of their teaching time (Tung, 1997). This passed on an important message that using ICT is mandatory for schools and teachers.

The problem

The environment for ICT in education in Hong Kong was complex as its purpose was combined with other educational reform agendas. Although the HKSAR government spelt out the importance of a paradigm shift to accompany the use of

[1] The ICT training for teachers in Hong Kong included, from low to high, Basic IT level (BIT), Intermediate IT level (IIT), Upper-intermediate IT level (UIT), and Advanced IT level (AIT).

ICT, the approach to ICT professional development for teachers in Hong Kong was mainly focused on providing skills and technical knowledge (Education and Manpower Bureau, 2005) which were usually detached from the context of classrooms. The ICT benchmarks, against which teachers were assessed, focused more on the teachers' technological competency than their deeper understanding and conceptualisation of opportunities for the implementation of ICT in education. This approach to professional development did not seem to promote the required paradigm and pedagogical change as the level of use of ICT in classrooms was found to be low (Education and Manpower Bureau, 2005). This is perhaps not surprising given that in Hofstede and Hofstede's (2005) study of cultural differences across 70 nations, Hong Kong people were ranked high in cultural orientation. This suggests that teachers in Hong Kong are likely to be strongly influenced by existing cultures and traditions and will need help in developing new, personal perceptions of ICT-based teaching approaches.

Large-scale ICT professional development for teachers seems to be more difficult than anticipated. For instance, the results of a study in Finland indicated that only a small percentage of teachers had adequate ICT skills despite a massive inservice training effort (Hakkarainen et al., 2001). Although the current technical approach to professional development has encouraged some teachers to use ICT in their classrooms, the evaluation of the ITEd in Hong Kong found that teachers still lacked confidence and competence to effectively and extensively integrate ICT in teaching (Education and Manpower Bureau, 2005). This finding indicates that integration of ICT in Hong Kong schools is still at an early stage and many teachers are still struggling to find ways to meaningfully and effectively integrate ICT in their teaching.

Purpose of the study

Schrum (2000) argues that computers alone are not enough to fulfil the extravagant promises of technology. Infrastructure and technical equipment are not the only prerequisites for successful ICT integration. Successful ICT integration depends on the involvement of teachers because it is not technology that makes teaching successful but the effort of teachers (Pea, 1998; Chaptal, 1997; McKenzie, 1993). The HKSAR government highlighted the importance of teachers in the use of ICT in schools and it provided plentiful skills training and technical support for teachers in both government and aided schools in order to encourage the use of ICT in teaching (Education and Manpower Bureau, 1998). However, the literature reinforces the point that skills and knowledge training for teachers in using ICT in teaching while necessary, are not sufficient (Page, 1999). Looking at the New Zealand experience, Page (1999) concluded that enhancing teachers' confidence and competence in technical skills did not necessarily lead to successful implementation of ICT. Teachers' attitudes towards the use of ICT in teaching seems to be a crucial determinant for meaningful and effective ICT integration (Campbell, 2001; Stratford, 2000). The question naturally arises as to how to enhance teachers' capability and motivation for ICT integration by developing an appropriate attitude to the use of ICT in teaching. It is for this reason that this study chose to take a social approach to professional development; an approach identified in the literature as being able to empower teachers to make their own professional judgements in teaching.

Teachers play a pivotal role in the use of ICT in teaching as they are the ones using ICT in classrooms, so it is vital that they feel comfortable in this new

learning environment (Chaptal, 1997). Without confidence and competence in the technology, teachers are unlikely to truly initiate and lead change in classrooms. Together with technical capability, teachers need to have a clear educational purpose (Fullan, 2003, 1999, 1993) for using ICT in their contexts so they can perceive the possibilities and potentials of ICT. While technology seems to be a useful vehicle to achieve the improvement of teaching and learning, professional development is the steering wheel that provides direction and purpose. David (1994) commented that asking how ICT could be used well in education was the wrong question to ask and suggested that asking why teachers need to embrace ICT in daily teaching was a better question. If teachers cannot uphold reasoning for their behavioural change, it may not be sustainable. Working in uncertain times of educational transformation, professional development in this research was intended to help teachers build a personal purpose for using ICT in teaching.

There seems to be a vast difference between teaching methods that teachers in Hong Kong are used to using, and ICT-based pedagogies. Many teachers, even in those countries in which they have used ICT in teaching and learning for some time, are still struggling with the meaningful application of ICT in daily teaching, for example, the USA (Cuban, 2001). ICT is more likely to be effectively integrated into teaching if teachers develop pedagogies that suit their individual characteristics and situations. As the HKSAR government emphasizes a cultural paradigm shift in teaching with ICT (Education and Manpower Bureau, 1998), a favourable attitude of teachers towards changing their pedagogical orientation will be needed. Although the current ICT professional development offers a sound skill and knowledge base for teachers in Hong Kong, they still have to apply this skill and knowledge to developing meaningful classroom activities in

context (Stein, 1998). Teachers need to reflect critically on their practice in order to effectively integrate and apply ICT in their teaching practice (Yost, Sentner, & Forlenza-Bailey, 2000). Yost, Sentner and Forlenza-Bailey maintain that "reflection implies that something is believed in or disbelieved because of some evidence, proof, or grounds for that belief" (Yost et al., 2000, p. 39). Continuous reflection on evidence from their practice would seem to be important to enable teachers to change their belief systems. As culture and beliefs cannot be imposed, mutual support among teachers could be a key to nurture a cultural change (Ryban & Anderson, 1990). Thus, this study sought to explore the benefits of teachers working collaboratively to nurture a new culture of sharing, support, inspiration and cooperation.

As using ICT is not a primary teaching technique for many teachers in Hong Kong, they are unlikely to sustain their motivation for using ICT if they work alone. This implies that teachers need support from colleagues who can understand their working situation and provide encouragement by working with them. In discussing the importance of peer coaching to teaching and learning, Becker (1996) makes the point that teachers often do not have much experience in working collaboratively. This points to the need for an explicit focus on developing a supportive and encouraging environment for building teacher capability to support each other in collaboration. The necessity for teachers to have this kind of support for their work has been well documented (for example, Swafford, 2000; Becker, 1996; Meyer & Gray, 1996; Showers & Joyce, 1996; Joyce & Showers, 1982).

The purpose of this study was to develop an understanding of the critical factors contributing to professional development for secondary school

teachers in Hong Kong who attempted to integrate ICT into their teaching and learning environments. Other studies have shown the power of peer support in achieving collegial support and encouragement for change (for example, Robertson, 1997), and this research examines the use of peer support as a professional development tool to facilitate personal and meaningful ICT integration. This study sought to refine existing theories of professional development by developing a model of professional development, based on peer support, that encourages personal attitude change towards ICT use. Towards this purpose, this study addressed three broad research questions:

1. What are the challenges for teachers in Hong Kong secondary schools in the integration of ICT in their teaching?
2. What are the impacts of using peer support and an online discussion forum as professional development tools on teachers' attitudes, teaching paradigms, and learning processes related to the integration of ICT in their teaching?
3. What are the processes of professional development that underpin the changes brought about by the peer support project?

Significance of the study

This study is significant because it focuses on the use of ICT, a topic considered to be crucial for meeting the needs of education development in Hong Kong (Education and Manpower Bureau, 1998) and internationally (Eadie, 2001). It also focuses on teacher change with respect to ICT which is recognized as a

significant challenge to educational reform (Ferneding, 2003; Education and Manpower Bureau, 1998). It addresses the requirement of teachers to integrate ICT in teaching in Hong Kong schools and targets professional development in the use of ICT as an essential element of successful ICT integration. This study seeks to identify the difficulties that teachers encounter and the assistance that they need in the process of integrating ICT in their teaching.

In this study, the development of ICT integration was considered with awareness of teachers' personal qualities, such as their personality, and capabilities, such as their ICT skills, through personal and emotional support in context. Teachers were encouraged to reflect on their beliefs and practices of ICT use. They needed support from people who could understand their situation and thus could provide stimulation and encouragement. This study considers that teacher change is more likely to occur where teachers have a personal commitment and purpose for ICT use in their teaching and learning. It is thus seen as worthwhile to study an approach to professional development that enables teachers to build personal confidence and purpose in using ICT. This study is especially relevant to the education environment in Hong Kong at a time when ICT integration is shifting focus to daily use after an initial stage of teacher training and infrastructure development. A professional development model would be helpful in enabling teachers in Hong Kong secondary schools to seek clear purposes and establish pathways of long term use of ICT in teaching. This study explores an alternative approach to professional development for teachers, one that involves the development of peer support among teachers. The findings will contribute to understandings of how professional development affects ICT integration in teaching and learning.

Overview of thesis

Having described the problem, purpose and significance of the study in the first chapter, the second chapter is a literature review outlining perspectives on the use of ICT in education and implications and challenges of ICT for teachers. Studies on professional development are also examined and the review traces the evolution of teacher professional development in ICT. The review also details and discusses the social constructivist view of professional development that is adopted in this study. Chapter Three addresses the study's design and research questions as well as a description of the study's methodology, data collection and data analysis. The research chronology is presented in Chapter Four which describes the progress of the action phase and the process of establishing and implementing peer groups. Chapter Five and Six synthesize the data and report the findings in three main themes. Chapter Seven concludes an analysis of the findings, and the development of a model of professional development of ICT for teachers as a peer-supported activity. The final chapter discusses the limitations of the study and makes recommendations for further research.

CHAPTER TWO: LITERATURE REVIEW

Introduction

The opening section of this review surveys factors that are considered to impact on information and communication technology (ICT) in education. These include visions presented by educational policy makers and pioneer ICT in education advocates and users. Their visions include views about the possibility of fundamental change to what students learn; the way students learn; the way teachers teach; and the medium of teaching and learning. This study focuses on the aspects of the medium of teaching and learning. The development of this research was informed by two bodies of literature in particular: literature concerning ICT in education and literature about the professional development of teachers, with particular reference to the use of ICT. The aspects of this research that have been influenced by this literature include the research questions, research design and methods adopted for data gathering, analysis and interpretation.

Many commentators refer to the underuse of ICT in classrooms. In the context of this study, I review and critically analyse explanations for that situation. These explanations fall into three broad categories: systemic issues, pedagogical issues and psychological issues. Arising from this critical analysis is a thesis that these systemic, pedagogical and psychological matters need to be given attention if the use of ICT in classrooms is to increase and to benefit student learning. It is argued that these matters need to include a change in the way professional development is provided for classroom teachers.

The second section of this chapter critically reviews approaches to professional development that have been used to introduce teachers to ICT in education. A technocentric approach to professional development is widely used, including skill-based teacher training and the use of best practice and exemplars. Two different approaches, which are now being explored by an increasing number of educators, reflect the importance of systemic, pedagogical and psychological perspectives in professional development. These approaches are a personal approach to professional development and a social approach to professional development. On the basis of detailed critique of the latter, the case is made for adopting this approach in this study.

Factors affecting the use of ICT in education

New advances in technology bring revolution to the way people live and work (E-Learning Advisory Group, 2002). Since the late 1980s ICT has been promoted as a tool for education, as a source of knowledge, as a medium to transmit content, and as a means to improve interaction (Jenkins, 1999). It attracts high public expectations of changing education to better prepare students for the future (Dawes, 2001; Charp, 1999; Papert, 1993; Salomon, 1993). The use of technologies in education has been inspired by the influence of functionalists and politicians as well as technological enthusiasts (Ferneding, 2003). It is not uncommon for these people to believe in ICT as "an important catalyst and tool for inducing educational reforms that change our students into productive knowledge workers" (Pelgrum, 2001, p. 163). This kind of anticipation can be identified in the literature: for example, ICT will guide and lead to improvement in the education system (Hamza & Alhalabi, 1999); it will enhance teaching and

learning (Massy & Zemsky, 1995); and it will prepare students to succeed in a rapidly changing world (North Central Regional Educational Laboratory, 1998). Although there is little research evidence of the achievement of these expectations, it is believed that ICT is able to empower student learning and enhance the innovation-learning environment and thus transform the education system and change the teaching paradigm, for example, in Hong Kong (Education and Manpower Bureau, 1998). This indicates that, for many, the introduction of ICT to education carries not only expectation that technology innovation will improve the efficiency of education but also the expectation of a change in education (Canadian Teachers' Federation, 2003; Education and Manpower Bureau, 1998).

Because of these expectations, many people, such as education reformers, policy makers, as well as the general public, tend to give quick credit to ICT whenever positive indications of using ICT in education are shown (Armstrong, 1999). This explains why ICT in education has become a worldwide trend so quickly and why many countries, such as the US (Office of Education Technology, 2000), New Zealand (Education Review Office, 1997), and Hong Kong (Education and Manpower Bureau, 1998), are so enthusiastic in promoting the use of ICT in schools.

Despite the great investment in ICT in schools, some commentators claim that ICT is still underused in classrooms (for example, Cuban, 1999a, 2001; Fuller, 2000; Loveless, 1996; Zhao & Frank, 2003; Zhao et al., 2002). Some early studies on teacher change and instructional reform have raised the issue that changes in teacher practice were often slow, minimal, or even nonexistent (Ball, 1994; Cohen, 1990). Echoing these findings, some later literature makes the criticism that teachers seldom use ICT in authentic teaching. Instead, the use of

ICT is often restricted to low-level tasks such as drilling, and low-level applications such as automating the current practice (Campbell, 2001; Norton, McRobbie, & Cooper, 2000; Stratford, 2000).

Many research studies have already attempted to comprehend issues related to the use of ICT in teaching and learning, and to identify barriers and suggest solutions for better ICT integration (Campbell, 2001; Murray & Campbell, 2000; McKenzie, 1999; for example, Brown, 1997; Loveless, 1996). Literature identifies that there are more than technical factors contributing to the use of ICT in education. These factors can be divided into three categories: systemic issues, pedagogical issues, and psychological issues.

Systemic issues

The implementation of ICT is often attempted via a systemic approach in which top-down policies and infrastructure are put in place with the assumption that these changes will subsequently bring about the required teaching and learning changes (Salomon, 1991). However, expanding technological infrastructure is seldom sufficient to promote the use of ICT in the classroom. The Ministry of the Flemish Community Education Department (2002) pointed out clearly, "Infrastructure is an important but insufficient condition to integrate ICT in education" (p. 25). The mere presence of ICT equipment and resources in schools does not necessarily ensure an appropriate application of ICT in classrooms (Dede, 2000b; Cuban, 1986). Coughlin and Lemke (1999) in a study that discusses professional skills for digital age classrooms in the US point out that professional development in the use of ICT in teaching and learning is complex. Teachers are unlikely to use ICT seamlessly in teaching and learning without intensive and

active support from schools. Systemic level problems are then regarded as a core issue of ICT implementation (Coughlin & Lemke, 1999; Cuban, 1999b).

The structure of schools seems to be an important factor affecting ICT integration. A report to the Commonwealth Department of Education, Science and Training in Australia about professional development for ICT integration in classroom practice suggests that school structure reform and the role of ICT in teaching and learning are interconnected (Commonwealth Department of Education, 2001). In a longitudinal study on two high-tech schools in the US, Cuban, Kipkpatrick and Peck (2001) found that the integration of ICT in education in these schools was slow despite investment in infrastructure. They suggested that changes at a systems level, such as how schools are organized, how time is allocated, and how teachers are prepared, were needed in order to improve the integration and uptake of ICT.

Schools are unlikely to provide a good environment for teachers to use ICT if they do not have a vision about how ICT might transform schools (David, 1994). In the US, Cuban (1999b) criticized schools for not holding clear objectives and organizational knowledge to provide a good environment for increasing teacher use of technologies. Many schools rush to adopt ICT in teaching and learning before they know clearly about the efficacy of the innovation (McKenzie, 1999; Maddux, Johnson, & Willis, 1992). Without a clear educational objective in using ICT, these schools are more likely to have a poorly planned implementation strategy, which focuses on utilising ICT features and functions to improve the school's administrational efficiency rather than achieving learning goals. Looking at factors restraining the use of computers in US public schools, Loveless (1996) noted that poorly planned ICT

implementation in schools was not uncommon and its implementation policies were often piecemeal. Such poor planning leads to unsatisfactory teaching and learning outcomes (Campbell, 2001; Norton et al., 2000; Loveless, 1996). Thus, an in-depth understanding of interactions between innovative infrastructure and implementation in teaching and learning is needed (Pearson & Naylor, 2006).

Since school management usually lack knowledge and experience of ICT, they have to rely heavily on external ICT experts or internal, ICT experienced, staff for formulating policies for infrastructure and implementation (Cuban, 1999b; McKenzie, 1999). As these ICT experts and teachers are often technologically focused, school policies can easily lean towards technical aspects (Cuban, 1996), overlooking the situation of non-technically oriented teachers. Roger's (1995) diffusion of innovation theory classifies users of innovation into five categories, from innovators to laggards. This categorisation implies that there are fundamental differences in personal characteristics between later ICT adopters and earlier ICT adopters. Later ICT adopters do not necessarily hold as favourable an attitude towards ICT as earlier adopters and they are more likely to be reluctant to use ICT before seeing some actual benefits. Therefore, a technocentric approach to ICT adoption in a school may possibly hinder those teachers who are not technologically oriented in their adoption of ICT into their practice (Rogers, 1995). Successful experience of ICT integration of earlier adopters may not necessarily inform later adopters' journey of searching for meaningful ICT integration.

In a systemic approach to ICT implementation, teachers are often required to fit into systemically oriented policies, which define their roles, responsibilities, learning paths, as well as integration strategies (Coughlin & Lemke, 1999). As

non-technically oriented teachers are likely to be assessed with set criterion of a technically oriented system, Cuban (1999b) expresses concern that explanation to frame the problem and solution of underuse of ICT in such a systemic approach will "[make] teachers again vulnerable to blame" (para. 28).

Since the teacher's roles and responsibilities are more likely to be further defined externally, the role of teachers in deciding the purpose of using ICT in education is often ignored (Conlon, 2000). Conlon (2000) noticed two common but contrasting views that affect the use of ICT namely, paternalist and libertarianism. Both of these views of the purpose of ICT in education seem to overlook the central role of teachers in teaching and learning. The paternalist vision of education sees the use of ICT in education as a structure to achieve the demand of society and teachers to be accountable for ensuring this structure. On the other hand, libertarianism has an intention to shift teachers from a teacher-centred paradigm to a student-centred view of learning (Conlon, 2000; Kunz, 1999; Loveless, 1996). As a consequence, implementation policies and approaches informed by these two views of ICT in education are often focused on the benefits to students and fail to see the importance of the teachers' role in ICT integration. The difficulties and concerns of ICT integration from the perspective of teachers are less likely to be a priority of the implementation policies and approaches. Teachers are thus disempowered as decision makers in ICT integration (Lim & Barnes, 2002). When teachers are not regarded as decision makers of ICT integration in education, ICT implementation is often dominated by a top-down approach, such as in Hong Kong (see Centre for Information Technology in School and Teacher Education, 2001). Since this approach "does not recognize how the process of change and adoption is both contextual and

situated" (Ferneding, 2003, p. 61), teachers are unlikely to be motivated to explore in-depth ICT integration. This makes the expectation of using ICT to change the deep-rooted traditions of teaching even harder to achieve (Cuban, 2001, 1986).

Implementation of ICT in education involves interactions between technologies, institutions and individuals (Commonwealth of Australia, 2000; David, 1994). Systemic solutions based on a technically oriented approach to ICT implementation will not be enough to improve the integration of ICT. Successful ICT implementation also requires understanding of the real needs of teachers and students, together with good planning and careful coordination of events, resources and infrastructure (Campbell, 2001; Murray & Campbell, 2000; de Rosnay, 1979).

Pedagogical issues

In a search for an ICT framework to support ICT in teaching and learning, Trinidad, Newhouse, and Clarkson (2005) suggested that an ICT development framework should "[take] account of the complexity for teachers in progressing their understanding and practice in integrating the use of ICT to support learning and the context within which this occurs" (p. 10). In another study investigating factors which contributed to the continuing use of ICT in UK schools, Cox, Preston and Cox (1999) suggested that the perception of ICT in teaching is equally as important as teachers' technical skill. These studies indicate that pedagogical issues, that affect the ways teachers use ICT in teaching, are an important element in ICT integration and therefore are salient in professional development for teachers. Generally speaking, the literature identifies two

pedagogical issues associated with ICT integration: teachers' beliefs and perceptions, and teacher training. These two issues will be discussed in turn.

Teachers' beliefs and attitudes

Teachers' beliefs about, and perception of, ICT are an important factor affecting ICT integration in teaching and learning. This factor is commonly reported in many countries such as New Zealand (Stratford, 2000), Australia (Albion, 1999) and the US (MacArthur & Malouf, 1991). A number of studies have found a correlation between teachers' beliefs and attitudes and the use of ICT in practice (Campbell, 2001; Page, 1999). For example, the results of Williams, Coles, Wilson, et al.'s (2000) survey of over 400 schools in Scotland suggests that the level of ICT use and teachers' attitudes are correlated. As the findings of a study of four US schools by Sugar, Crawley and Fine (2004) suggested, teachers' individual attitudes towards technology adoption in their work is likely to shape their technology adoption decisions. In a further US study about teacher dispositions as a factor of ICT use, Vannatta and Fordham (2004) found that teachers' attitudes, that is commitment and openness to ICT and willingness to take risks, affects their motivation to learn to use ICT. Norton, McRobbie and Cooper (2000), in a study investigating why mathematics teachers in an Australian technology-rich school did not use computers in teaching, also found that "individual teachers' resistance [to ICT] was related to their beliefs about mathematics teaching and learning and their existing pedagogies" (p. 87). Therefore, teachers' beliefs about and attitudes towards teaching are likely to influence their reactions to ICT and could also be a barrier to the use of ICT in teaching.

Teachers' perceptions of ICT can also affect their use of ICT. Stratford (2000), in a qualitative study of barriers to ICT integration in New Zealand schools, found that while teachers were often aware of logistical barriers, they often did not see the pedagogical barriers to using ICT. In a study of the ICT adoption of three Australian teachers, Lloyd and Albion (2005) who used activity theory to understand the teachers' technophobia found that "activity systems become dysfunctional when components [of ICT] are misapprehended or poorly understood" (p. 7). They noticed that the teachers "appeared to make the fundamental error in seeing the tool [ICT] as the object" and made it "an end rather than a means to an end" (Lloyd & Albion, 2005, p.7). This suggests that personal beliefs and attitudes towards ICT may mislead ICT adoption, especially when teachers are not clear about the role of ICT in teaching and learning. As Lloyd and Albion (2005) notice, there is a closed cycle of teacher belief, perception of benefits of ICT and pedagogical integration of ICT. It is unlikely that teachers will perceive the value of ICT if they cannot see its potential to improve their teaching performance. Therefore, teachers are unlikely to be motivated to seriously explore and learn how to use ICT in teaching if they do not truly understand and believe in its importance to their teaching practice.

If teachers learn to use ICT only in order to fulfil externally mandated requirements, they will have a limited view of the potential of ICT integration. As a result, teachers are unlikely to perceive the suitability and compatibility of ICT with their work but see it only as a tool to speed up the teaching progress and increase access to information (Doering, Hughes, & Huffman, 2003; Norton et al., 2000; Parr, 1994). In a study of pre-service teachers' attitudes towards the use of ICT in the classroom done by Doering, Hughes and Huffman (2003), the response

from a participant can possibly represent teachers' concerns about the usefulness of ICT: "It's a nice tool, but maybe it's less authentic and not really better. It's important to learn technology, but it's not everything" (p. 348). Like many teachers, this participant seems to perceive only a subsidiary role for ICT in teaching and learning (Hoffman, 2000). Dawes (2001) suggested that there were some issues that made the use of ICT different to traditional teaching and argued that if teachers did not perceive the presence of these issues, "Teachers concerned to use pupil time to maximum advantage [were] therefore likely to avoid ICT use" (p. 62). It seems that teachers are not ready to change their teaching style if they do not believe that ICT can bring advantages to their teaching and to their student's learning.

A teacher-centred approach has long been developed as a way to manage classroom dynamics (Lortie, 1975), particularly in secondary schools in Hong Kong. Teachers often have to work with large groups of students. Teachers need to fulfil multiple obligations and confront numerous uncertainties in classrooms every day (Yamagata-Lynch, 2003; Buchmann, 1990) and therefore they need to be very pragmatic in managing their work and time. This grouped nature of schooling increases the difficulty of classroom management and favours the direct and instructional teaching tradition (Cuban, 1996; Loveless, 1996; Lortie, 1975). This deep-rooted, teacher-oriented approach seems to conflict with the government and public expectation of using ICT in education to promote a student-centred learning approach.

Teachers are sensitive to any initiative introduced into classrooms, so that only those innovations that are perceived important and compatible with their work are likely to be adopted into their daily practice (Zhao & Frank, 2003; Zhao,

Pugh, Sheldon, & Byers, 2002; Loveless, 1996). In researching the underuse of computers in classroom instruction in US public schools, Loveless (1996) argued that diffusion of new technology depends on the innovation's compatibility with teachers' core tasks. If teachers cannot perceive the value and benefit of ICT to their contexts, they are unlikely to commit themselves to changing their teaching approach (Scrimshaw, 2004).

Teacher training

Although technically oriented training for teachers is a common channel to provide support to teachers for ICT integration in many countries and regions, such as Hong Kong, these training programmes are criticized for not being able to promote in-depth integration of ICT into teaching and learning (Vannatta & Fordham, 2004; Ferneding, 2003). A technocentric approach to ICT implementation often assumes that teachers will utilize ICT to support teaching and learning when they are equipped with these technologies. However, Kerr (1991) has pointed out the problematic assumption of a technocentric approach to ICT in education:

> … how teaching and the teacher's classroom role are conceived, what technology is 'good for' (and thus what it is seen as being able to accomplish in instruction), and how these elements do or do not come together in a vision of how 'teaching with technology' might look to a practicing educator (p. 115).

Such a technocentric approach has been criticized as a factor limiting in-depth integration of ICT into teaching and learning (Ferneding, 2003; Zhao et al., 2002) because such training programmes often lack stimulation for ICT integration in

authentic contexts (Campbell, 2001; Brown, 1997; Rogers, 1995) and the skill to revise pedagogical practices (Cox et al., 1999). Teachers who attend these training programmes are not necessarily aware of the potential of ICT for teaching and learning, other than seeing it as add-on functions to current teaching (Lai, 2001; Stratford, 2000; Williams, Coles, Wilson et al., 2000; Brown, 1997; Cuban, 1997; Morton, 1996). In a study searching for effective ICT-supported learning activities in Australia, Singapore and Hong Kong, Richards (2005) noticed tendencies for an add-on use of ICT in education. Another study in Canada also finds that pre-service teachers often view ICT integration into instruction as an "add-on" aspect of teaching and learning (Nolan, 2004). These findings indicate that teachers lack the skill "to make informed judgements of a wide range of ICT to support teaching and learning goals" (Williams, Coles, Wilson et al., 2000, p. 315). As a consequence, teachers often overlook the importance of the teaching paradigm and pedagogies using ICT. They often adopt ICT to assist traditional teaching approaches rather than look for an innovative ICT integration to renew their teaching (Balajthy, 2000; Stratford, 2000).

Summary

In summary, literature reveals that ICT integration in education is not a direct result of ICT training and indicates that pedagogical issues seem to be important. Although ICT skill training may enable teachers to use the technology, its utilisation in the classroom depends on the teachers' motivation and awareness of ICT pedagogical possibilities (Williams, Coles, Wilson et al., 2000). Hakkarainen et al. (2001) concluded from their study of ICT skill and pedagogical thinking in Finland that, "Only awareness of this need for pedagogical change and of the new

pedagogical possibilities offered by ICT could create in teachers a strong enough motivation to use ICT intensively in the learning-instruction process and develop their technical ICT skills" (p. 195), a comment that underlines the link between teachers' motivation and awareness of ICT pedagogical possibilities. However, the ability of ICT to transform classrooms is still uncertain as many teachers perceive ICT as a means to achieve existing teaching objectives and to solve current classroom problems (Rappaport, 2003; Newhouse, 2002). Many professional development programmes in ICT emphasize skills and knowledge with little support to change teachers' beliefs and attitudes towards teaching. Teachers are gradually shifted to a peripheral position in the process of ICT integration when their role in teaching is reduced to a series of technical tasks (Lim & Barnes, 2002; Armstrong, 1999). It is not surprising, therefore, that many teachers do not see the potential of ICT to renew their teaching practice (Norton et al., 2000).

Psychological issues

Although there is extensive literature discussing how ICT enhances student learning, there is still a gap in research examining what motivates teachers to use ICT in their teaching (Zhao et al., 2002; Office of Technology Assessment, 1995). Teacher's decisions about using ICT may not always be rational (Bullen & Sacks, 2003). Psychological factors, which are defined as the teachers' emotional responses to ICT integration, can be influential because teaching is an intertwinement of emotional and intellectual bonds (Dede, 2000a; Cuban, 1997). Teachers who have a fear of technical matters may develop anxiety about ICT if they do not see themselves able to manage the technology (Chapple, 1991). They

may "become extremely insecure when they are faced with the possibility of utilizing ICT in their classrooms" (Campbell, 2001, p. 249), and may develop resistance or even resentment towards ICT (Cuban, 1999a; Page, 1999). Studies find that some teachers have built up a sophisticated range of blocking strategies in order to resist the external call to use ICT in their work (Campbell, 2001; Clark, 2000; Murray & Campbell, 2000; Office of Technology Assessment, 1995). However, this issue is often overlooked and is not well addressed in many current ICT implementation processes.

The introduction of ICT may make teachers feel uncomfortable in the classroom (Cuban, 1997). In a study of the process of classroom technology integration, Zhao et al. (2002) argue that the introduction of ICT in education, unlike other educational technologies, requires teachers to be more socially sophisticated. Since ICT is a complicated technology, teachers often need to seek help and support from other personnel in the school, such as technicians. Zhao et al. (2002) found that the teachers who had successful classroom technology integration seemed to be confined to those who did not need much external support. This finding reflects a negative relationship between level of dependence of ICT using teachers and success of ICT adoption. Underuse of ICT of less technically able teachers seems to reflect that teachers have difficulty in handling sophisticated interactions outside the classroom. Friends and Cook (1992) argue that "teachers are accustomed to working in isolation in the classroom and had had little opportunity for collegial interactions" (p. 182), so these kinds of interactions are likely to be uncomfortable. As a result, teachers seem to lose their total control over their teaching using ICT in the classroom. It can be hard for teachers to entirely accept the underlying intention of policies that result in

moving them away from their core role in teaching and learning (Clark, 2000; Norton et al., 2000; Parr, 1994; Rudduck, 1991; Cuban, 1986). Thus, teaching with ICT in the classroom will become more complicated when teachers feel uncomfortable in using ICT and do not intend to change their teaching with ICT but have to graft it onto existing teaching practices (Rappaport, 2003; Newhouse, 2002; Armstrong, 1999). In this situation, the effect of ICT in classrooms is more likely to be small and temporary (Morton, 1996).

The need for a new approach to ICT implementation

Current implementation policies of ICT in education are often developed at a macro-level, for example Hong Kong (see, Education and Manpower Bureau, 1998). Cost effectiveness and productivity are often important concerns for making policy on the use of ICT in education, for example in the US (CEO Forum on Education and Technology, 1999). Evaluation of the use of ICT is thus often defined according to some measurable and accountable performance indicators of educational outputs, such as the teachers' qualification in ICT skill (Ertmer, Gopalakrishnan, & Ross, 2001; Cuban, 1996). These indicators are used to justify the enormous investment in resources (Newhouse, 2002; Selwyn, Dawes, & Mercer, 2001; Cuban, 1996). Therefore, strategies of ICT implementation usually focus on achieving technical standards. This focus on technical aspects often displaces other values and aims of education (Ferneding, 2003). ICT becomes an end in itself rather than a means to achieve educational goals.

Rappaport (2003) described technology as a destabilising agent of modern society, however, he argued that educational practice was highly resistant to change. In New Zealand, Lai (2001) found that efforts to ensure technical

readiness for ICT integration in schools did not ensure ICT integration at a personal level. Teachers seem to have difficulty integrating ICT into daily practice. Cuban (1999b) argues that a technocentric approach to ICT implementation is one reason for the low quality of ICT use as this technocentric approach does not necessarily create a need for teachers to rethink and transform their pedagogies (Pearson & Naylor, 2006), the implementation of ICT in schools in this approach is unlikely to bring about a revolutionary change in classroom teaching and learning (Cuban, 1999b; Cuban, 1996).

The above discussion indicates that the use of ICT in teaching and learning seems to be a multidimensional issue. There is unlikely to be a single sufficient condition for successful use of ICT (Granger, Morbey, Lotherington, Owston, & Wideman, 2002). Factors affecting ICT use are diverse and technical, systemic, pedagogical, and psychological issues are all important in creating a successful environment for ICT integration. Depending on a single approach, such as a technocentric approach, to ICT implementation is doomed to fail.

Apart from technical support, teachers seem to need help from other channels in order to address their pedagogical needs, personal concerns and psychological reactions to ICT implementation (Cuban, 1999b; Cuban, 1996). A technocentric approach usually deals with ICT implementation issues in a linear way. Selwyn, Dawes and Mercer (2001) argue that the path of ICT implementation "is being pre-defined before it reaches the classroom" (p. 5). Teachers are unlikely to make significant contributions to the direction of ICT implementation under these predefined conditions. This approach to ICT implementation seems not to be sympathetic to teachers, as Loveless (1996) comments:

> Computer advocates have failed to recognize these constraints in their campaign to encourage wider use of computers, arguing instead that computer usage will grow when teachers teach a different way and students learn a different curriculum. Moreover, they steadfastly believe, to their own cause's harm I have argued here, that policy is the vehicle for achieving these ends (p. 31).

The development of widespread and quality use of ICT in education requires the needs and perceptions of all stakeholders, including teachers, to be addressed (Seidel & Cox, 2003). An approach that acknowledges the personal needs of users, such as teachers and students, seems to be essential to ensure the integration of ICT into teaching and learning.

Since teachers are situated at the forefront of ICT integration - classrooms, their perception of ICT integration becomes a crucial factor to ensure quality application of ICT. Thus, they need to be empowered to become proactive engineers of the ICT integration in the classroom (Cuban, 1999b). Some studies emphasize the importance of teachers' roles in changing pedagogies with the use of ICT and ask for the empowerment of teachers to make professional judgements on the integration of ICT (for example, Campbell, 2001; Dawes, 2001; Lai, 2001). These studies identified that barriers to the use of ICT in classrooms are often very subtle and that they "do not present themselves to practitioners as well-formed structures …[but] as messy, indeterminate situations" (Schon, 1987b, p. 4). To survive in this messy environment, it is important for teachers to be able to seek a balance in using technology and managing classroom realities rather than to learn more technical skills.

Teaching practice is not a mechanical operation; it involves intellectual activities as well as personal enthusiasm and commitment (Granger et al., 2002; Armstrong, 1999). Teachers' perspectives and their perceived values of ICT develop shared and meaningful purposes of ICT for the profession (Levin & Darden, 1999; Chaptal, 1997). A clear purpose for ICT in teaching and learning would provide the energy and direction for sustainable ICT use (Fullan, 2003, 1999, 1993). Therefore, teachers need opportunities to take part in the development of "a shared understanding [of the use of ICT] about where to start, what is required, where help could come from and who could help" (Murray & Campbell, 2000, p. 4). Requiring teachers to use ICT without helping them to develop a clear vision for ICT in teaching and learning will only result in a bandwagon and cause teachers to "burn out attempting to find coherence and meaning" in "multiple, abstract reforms" (Fullan, 1995, p. 230).

Many teachers are not really prepared to change their teaching practice (Cohen, 1990; Porter & Brophy, 1988). Since teaching practice is mainly informed by past experiences, it is difficult for teachers to change and accept new teaching styles and paradigms that are imposed by others (Anderson & Bird, 1994). Hakkarainen et al. (2001), in a study of teachers' skills in ICT and pedagogical thinking in Finland, found that discrepancy between teachers' pedagogical principles and pedagogical practice decreased with increasing intensity of ICT use. Teachers seem to need encouragement to use ICT in practice so that they can gradually build links between theories and practice of ICT use. Adult learning theories suggest that teachers usually learn well within authentic situations (Driscoll, 2000). It seems to be desirable to create an environment in which they can explore and experience the use of ICT within their

own contexts so as to encourage them to seek a suitable solution to their use of ICT. This perspective of ICT integration has informed the design of this study to provide opportunities for the participating teachers to enhance their perspective of ICT use so as to enable meaningful and sustainable ICT integration in their classrooms.

As teachers are regarded as an absolute cornerstone of education, professional development of teachers is inevitably a key component of successful ICT integration. The next section will review the development of a new approach to ICT professional development.

Towards a new approach to professional development in ICT

This section starts with a discussion of a theoretical foundation for teacher professional development in ICT integration. Three different approaches to professional development in ICT integration are then critically reviewed. With a particular focus on a social approach to professional development, examples of social approaches to professional development, considered to be the emerging direction of effective professional development, will be described in detail.

Theoretical foundation of professional development in ICT integration

Professional development of teachers has grown in its importance since the late 20th Century because teacher quality is believed to have a strong connection with uplifting student learning (Darling-Hammond & Berry, 1998; Guskey, 1995).

The CEO Forum (1997) describes professional development for teachers, along with hardware, connectivity and digital content, as one of the four major pillars to achieving the successful use of ICT in education thereby recognises that providing quality and appropriate professional development for teachers is essential to improving ICT integration in the classroom (Williams, Coles, Richardson, Wilson, & Tuson, 2000; Williams, Coles, Wilson et al., 2000).

A review of literature indicates that effective professional development can be informed by two sets of theories, that is, constructivism, and adult learning. In the following sections, these underpinning theories will be discussed and some important elements of teacher professional development will be identified.

Constructivism

From a constructivist perspective, people construct their own concepts, understanding and knowledge of the environment by abstracting their experiences (von Glasersfeld, 1997; Prawat & Floden, 1994; Hein, 1991). In discussing the application of constructivist approaches in the classroom, Perkins (1999) points out:

> The stimuli that we encounter, including messages from others, are never logically sufficient to convey meaning. To some extent, the individual always has to construct or reconstruct what things mean. It thus makes sense to organize learning to reflect this reality (p. 8).

As learners' understanding of the environment will be challenged continuously by new experiences, they are likely to adjust their understanding to accommodate new experiences especially if they find that their current knowledge is inconsistent or not relevant to the new situation (Hoover, 1996).

In a study of the professional practice of 18 elementary, middle and high schools teachers in the US, Daley (2003) found that teachers' knowledge bases were changed each time they experienced something new. She said:

> The new information learned in professional development programs was added to a teacher's knowledge base through a complex process of thinking about the new information, acting on the new information, and identifying their feelings about the information (p. 64).

Her finding suggests that professional development is a process that supports teachers to construct and reconstruct new knowledge of teaching practice rather than to receive knowledge passively (Murphy, 1997). Professional development seems to help teachers seek understanding of their experience in practice, internalize new knowledge and accommodate this knowledge to suit their contexts (Holloway, 1999). Discussing elements affecting the practice of teaching mathematics in the UK, Ernest (1989) argued that teachers' mental models of teaching and learning mathematics affected their practice. In a discussion of school improvement in the US, Spillane and Seashore Louis (2002) believed that knowledge of instruction is generated by teachers inside classrooms and argued, "Efforts to improve instruction - policy, school reform initiatives, and professional development - are filtered through teachers' personal beliefs, knowledge and extant instructional practices" (p.91). Teachers are unlikely to import and use instructional knowledge without personal adjustment. Helping teachers to continuously build their knowledge base from experiences and to refine or change their own theory of teaching is likely to improve their future teaching practice (Holloway, 1999; Hoover, 1996).

Social interactions are believed to be a significant part of individual knowledge construction because they are an integral part of learning (Driscoll, 2000; Cole & Wertsch, 1996). Honebein (1996) believed that knowledge construction is a reflective process and learners need to ask themselves to "explain why and how they solved a problem in a certain way to analyze their construction of knowledge and process" (p. 12). Honebein (1996) advocates the value of exposing teachers to multiple perspectives on learning. Teachers may gain knowledge from working collaboratively with others as they are exposed to different perspectives causing them to examine different ideas and issues. Knowledge seems to be developed through active communication and negotiation with other people, by which learners refine their own interpretation of experiences and build their knowledge (Prawat & Floden, 1994; von Glasersfeld, 1984). Vygotsky's (1978) theory of the Zone of Proximal Development identifies a gap between a learner's current level of development and the learner's potential level of development and suggests a scaffolding process in which learners may learn through interactions with people in collaboration. It suggests that this kind of social learning may take the individual to a further level of knowledge construction (Meacham, 1996). Understanding that social interactions intertwine with personal knowledge construction, this study attempts to develop an environment for professional development based on communication and in-depth interactions and reflection aimed at enabling teachers to continuously develop knowledge.

Adult learning

Professional development for teachers is a type of adult learning (Peredo, 2000; Wood & Thompson, 1993). In a report on quality teaching in the US, the Education Commission of the States (2000) recommended that policymakers and educators should become familiar with the elements of adult learning that made professional development of teachers effective. Knowledge of adult learners seems to be important to the design and planning of professional development because the needs of adult learners are different from children and teens (Lieb, 1991).

Merriam (2001) suggests that self-directed learning is a foundation of adult learning. Brookfield (1995) describes self-directed learning as "the process by which adults take control of their own learning, in particular how they set their own learning goals, locate appropriate resources, decide on which learning methods to use and evaluate their progress" (p.375). Adults are usually self-directed learners (Brookfield, 1995; Merriam & Caffarella, 1991; Brookfield, 1986). They often perceive themselves as being responsible for their own decisions (Knowles, 1990). This suggests that teachers are more likely to be motivated in learning when they feel involved in the process of determining learning elements.

Literature identifies that adult learning is usually experiential and problem-based (Tight, 2002; Brookfield, 1986). It is more likely to be based on personal experience (Wood & Thompson, 1993). Adult learners carry their background and previous life experiences into learning (Kolb, 1984). When learning is contextualised and connected to their prior experiences, adult learners are likely to be more engaged and gain more from the learning experiences. In the

UK, Rogers (2001) recognized that adults will learn in real world situations and this suggests that simplistic and non-meaningful tasks may not contribute much to achieving learning initiatives. Detached training courses and workshops are unlikely to encourage teachers to change their practice as they are often separated from their classroom experiences. Effective learning is more likely to emerge from problem-based and situated learning contexts (Thiessen, 1992).

Brookfield (1986) summarized the characteristics of adult learning as "a respect for individual members" (p.3). This implies that individual differences of learners should be considered and addressed in learning processes (Driscoll, 2000; Brookfield, 1986). Adult learners do not necessarily follow a linear mode of learning (Merriam & Caffarella, 1991) and there is unlikely to be one best way of learning (Rogers, 2001; Galbo, 1998). Jamissen and Phelps (2006), after comparing three ICT professional development programs in Norway and Australia, concluded that it was important to address personal issues such as values, attitudes, beliefs and motivations. These findings indicate that professional development for teachers needs to be flexible and personal, so that teachers may have involvement and ownership of the direction of learning (Pierce & Hunsaker, 1996). As adult learners already have well developed ideas of life from their experiences, learners may feel threatened when their previous beliefs are challenged (Rogers, 2001). Discussing the design of staff development for the information age in US schools, McKenzie (1991) suggested that a professional development programme should provide non-judgemental support to ease this feeling. This indicates the need for emotional and personal support for adult learners.

Some important elements of professional development

A review of literature reveals two important aspects of successful professional development, that is, changing teacher beliefs, and changing teacher capacity. First, teachers' beliefs are "the frame of reference or the perspectives that teachers use to make sense of their practice and its effects on their students" (Anderson & Bird, 1994, p. 2). In a study on science teachers' professional development in New Zealand, Bell and Gilbert (1996) pointed out:

> Whilst different teachers seek different kinds of teacher development within science education today, the professional growth they seek includes responses to such concerns as continuity, progression, differentiation, the inclusive curriculum, assessment, teaching and learning activities, curriculum science that is relevant, meaningful and useful to the students, and resources to support teaching and learning (p. 1).

As the above comment suggests, teachers have their own purposes for developing and improving teaching practice when they participate in professional development. Since teachers' epistemological views may affect their practices, any attempts to change teacher practice without changing their beliefs will have difficulty in being successful (US Department of Education, 2000; Bell & Gilbert, 1996; Bradley, 1991; Joyce & Showers, 1988). The impact of teacher professional development is more likely to be strong if it also involves "changing the person the teacher is" (Hargreaves & Fullan, 1992, p.7). Successful professional development to change practice seems to be built on its power to change teachers' beliefs.

Second, professional development also involves building up the teachers' capability to improve teaching and learning. Mundry (2005) argued that professional development be recognized as a tool to build the knowledge and skill of teachers to enhance student outcomes. Capability can be stagnant know-how knowledge (Cohen & Ball, 1999; Jackson, 1992). In a study on professional development of teachers in the US, Pierce and Hunsaker (1996) described the intent of some professional development "to update the teachers' skills, knowledge base, and to get everyone charged up for the new school year" (p. 101). This type of professional development often leans towards technical aspects and they are criticized as being insufficient to help teachers to implement the acquired skills in practice. In a study of effective staff development involving more than 1,000 teachers who participated in the Eisenhower Professional Development Program in the US, Birman, Desimone, Porter and Garet (2000) commented:

> Professional development plays a key role in addressing the gap between teacher preparation and standard-based reform; it is a key focus of US efforts to improve education. Much of the professional development that is offered to teachers, however, simply does not meet the challenges of the reform movement (p. 28).

Their criticism highlights shortcomings of professional development that provide only stagnant knowledge to teachers. Writing from a US perspective, Joyce and Showers (1982) believe that the role of professional development is to provide the conditions for teachers to develop dynamic knowledge and skill in teaching. Similarly, Howell (1996), as an educator in a high school context, suggested that professional development should help teachers to accumulate knowledge and

expand their capacities to meet diverse challenges throughout their professional life. They both view professional development as a process of developing teachers' capacity to transfer stagnant knowledge into active practices.

While these two aspects of professional development (changing teachers' beliefs and capacity) indicate the key aims of professional development, literature also identifies three elements affecting the design of professional development to achieve these aims, that is, content, context and process (for example, NSDC, 2001; Kelly, 1994).

First, teachers are unlikely to effectively apply the content of professional development in practice unless they have in-depth understanding of the skill and knowledge gained (Birman et al., 2000; Bell & Gilbert, 1996). Some research studies suggest that professional development should be content-focused (for example, Birman et al., 2000; Hiebert, 1999; Cohen & Hill, 1998). However, other writers note that professional development need not necessarily be limited to technical content, such as technical skill and knowledge of ICT, because the effect of this kind of professional development will be short-lived and ineffective (Pierce & Hunsaker, 1996; Hopkins, Ainscow, & West, 1994; Fullan, 1991). Teachers are more likely to use their new skills and knowledge to change their practice if these skills and knowledge relate to teachers' belief systems and prior experiences (Birman et al., 2000; Bellanca, 1995; Loucks-Horsley et al., 1990).

Second, the context of professional development refers to the background and environment in which professional development programmes take place. It is believed that the context of professional development has a significant influence on professional learning (Merriam & Caffarella, 1991; Blackman, 1989). However, this aspect seems to be overlooked by some researchers. Reviewing the

literature about effective practice of professional development in the US, Guskey (1995) commented that the context of professional development is often neglected in many meta-analyses of the critical elements of successful professional development:

> What is neglected in nearly all of these efforts is the powerful impact of *context*. In fact, synthesizing the evidence across studies is done specifically to eliminate the effects of context, or to decontextualize the data…. What works in one situation may not work in another. Although some general principals may apply throughout, most will need to be adapted, at least in part, to the unique characteristics of that setting (p. 43).

By the same token, Knight (2002) argued in the context of secondary schools in the UK, "…an innovation that is presented to ten teachers participating in a continuing professional development event may morph into ten shapes, each reflecting different start-up conditions and contingencies in the ten sites to which it is taken" (p. 235). Teachers' knowledge is believed to build on authentic contexts, which may include the physical environment, socio-cultural environment, and personal situations. If professional development is de-contextualized, the programme may provide only discrete knowledge without linking to the teachers' realities. This kind of professional development is less likely to provide enough challenges to teachers to encourage critical examination of the relationship between technologies and changing contexts. Professional development programmes need to acknowledge the complexity and ever-changing nature of the teachers' contexts so as to provide a meaningful and relevant environment to suit their particular needs (Stein, 1998; Freire, 1996; Lieb, 1991;

Knowles, 1990; Shulman, 1987; Brookfield, 1986). This environment is essential, as Brookfield (1986) argued, "Environments that reinforce the self-concepts of adults, that are supportive to change, and that value the status of learner will produce the greatest amount of learning" (p. 29).

Third, to enhance teachers' capability to meet new challenges, Fullan (1999) emphasizes that teachers have to learn the learning process rather than reproducing skill and knowledge in practice only. Teachers may possess ICT skills and knowledge but they may not be able to transfer this knowledge into active practice (Wood & Thompson, 1993). According to Argyris and Schön (1978), shallow reflection on detecting and correcting errors in practice seems to lead to passive application of knowledge. Teachers who reflect critically on their reasoning in using ICT are more likely to be aware of the potential of ICT to change and improve their teaching strategies (Silvermand & Casazza, 2000; Hargreaves & Fullan, 1992; Fielding & Schalock, 1985; Joyce & Showers, 1982). ICT integration is believed to be an active and thoughtful process of knowledge transfer.

The above discussion indicates that the design of professional development for ICT can be significantly influenced by context, content and process. A review of literature shows that the approach to professional development in ICT changes when these elements change over time, and this change is discussed in the following section.

Developing an approach to professional development in ICT integration

Although growing in its importance, the development of professional development in ICT integration still seems to be far behind the technical development of ICT in schools. In reviewing the effect of ICT development on professional development in the UK context, Pye (1999) comments, "In reality accessibility and rapid enhancements of the new technology have not been matched with an equally enthusiastic reception" (p. 309). This reflects a gap between teacher development and expectation of ICT integration. Sparks and Hirsh (1997), in the North American context, argued for a change in the approach to professional development. A review of the literature shows that there is a trend in the evolution of professional development of ICT. This section will critically review three different approaches to professional development of ICT integration, from skill-based approach to an individual approach and then to a social approach.

Skill-based teacher training

Providing training to improve teachers' technical knowledge is common for the implementation of ICT in education, especially at an early stage of implementation (Williams, Coles, Richardson et al., 2000; Office of Technology Assessment, 1995). Many teachers do not usually have the right skills to use ICT (Murray & Campbell, 2000; Willis & Mehlinger, 1996; Office of Technology Assessment, 1995) and this suggests that technological capability is likely to become a bottleneck to the effective use of technologies (Jager & Lokman, 1999). Many professional development programmes are thus designed to update teachers' skills and knowledge so as to ensure that they acquire and maintain the

necessary ICT competencies (Howell, 1996; Pierce & Hunsaker, 1996; Fullan, 1991).

Since the 1990's, opportunities for ICT professional development for teachers in some countries have greatly increased, such as the US, the UK and New Zealand (Lai, 2005). However, authors comment that many of these skill-based teacher development activities are ineffective in changing classroom teaching with ICT (Zhao & Frank, 2003; Garet, Porter, Desimone, Birman, & Suk Yoon, 2001; Pierce & Hunsaker, 1996; Guskey, 1995; Little, 1994; Robertson, 1992; Fullan, 1991). The following citation from Hargreaves and Fullan (1992) summarizes their criticism of skills-based teacher training:

> At present, however, [skills-based teacher development] almost certainly consumes too much time, energy and resources within teacher development as a whole. Within this overall emphasis, skills-based teacher development is too often imposed on teachers rather than developed with them. It is too often based on excessive confidence in the supposedly proven wisdom of experts and research. It is too frequently treated as a matter of non-negotiable technical *skill*, rather than as an issue of professional *will* or of something whose worth should be discussed or debated. And the skills in which teachers are trained are all too often implemented out of context – their appropriateness for the teacher as a person, for the teacher's purpose, or for the particular classroom setting in which the teacher works, being overlooked (p. 6).

Their criticism reflects that skill-based professional development, providing discrete technical knowledge, does not lead to a change of teaching approach.

Although skill-based professional development may increase the teachers' technical capability to use ICT, it seems over-confident to assume that teachers can easily make connections between the learned skills and their practice. Reviewing the literature of ICT professional development, Lai (2005) alerts us to the fact that there is not necessarily a causal link between professional development in ICT and change in pedagogical approach. In another study examining teachers' beliefs about the role of technology in the elementary classroom in the US, Ertrner, Addison, Lane, Ross and Woods (1999) found that "teachers who used technology as a supplement struggled to make these connections" (p. 68). These findings indicate a missing link between skill-based professional development and daily practice. Improving skill and knowledge in ICT seems insufficient to guarantee the teachers' ability as well as willingness to utilize the latest technologies for teaching and learning. In a report about understanding instructional improvement in the US, Cohen and Ball (1999) argued that technical skills and knowledge are only a part of professional development of teachers and said, "…improving knowledge and skill of instructional interaction is a particularly salient feature of instructional improvement. This means that teachers' opportunities to learn such knowledge and skills are likely to be more productive than learning content or methods alone" (p. 28).

Since most teachers are inexperienced in ICT integration, it is not uncommon that teachers will ask for a "recipe" for classroom ICT application (Yocam, 1996). Examples from successful ICT-using teachers are an enormous help to beginning ICT-using teachers (McKenzie, 1998). The importance of these best practices of ICT application can be noticed by the redefined strategy of ICT

implementation of the Education and Manpower Bureau (2004) in Hong Kong after five years of ICT implementation, which is to:

> … foster the development of online and off-line communities of practice for teachers for exchanging experience and good practices as well as collaborative problem solving …[and] identify effective strategies for IT in education and distill elements of successful pedagogies. Exemplars will be more widely shared among teachers…. [and] to establish effective models of professional development such that the process will not only help teachers gain knowledge and skills, but will also provide a structure and support for continuous improvement in the application of IT in education in schools (p. 10).

Garet et al. (2001) also noticed a large body of literature describing best practice in professional development in a study on teacher professional development in the US. Incorporating exemplars and good practices of ICT application seems to have gradually become a part of professional development in ICT programmes (Hopkins et al., 1994; Hargreaves & Fullan, 1992).

However, the findings of a study of effective pedagogy using ICT for literacy and numeracy in primary schools in the UK indicates that experiences of earlier ICT adopting teachers are less likely to be compatible with the needs of those later ICT adopting teachers (Moseley et al., 1999). Echoing Rogers' (1995) diffusion theory which implies a crucial difference between earlier ICT adopters and later adopters, Moseley et al. (1999) noticed that those teachers who favour ICT use are usually enthusiastic about technologies and more receptive to using ICT in teaching. As well, the findings of a Finnish study of relations between teachers' skills in using ICT and their pedagogical thinking indicates that the

mismatch of pedagogical theory and practice does not appear to be so strong in teachers that are more active in using ICT (Hakkarainen et al., 2001). Later ICT adopting teachers seem to be less adventurous than earlier ICT adopters and more constrained by technical and operational factors as well as their reserved attitudes towards ICT in teaching. As the later ICT adopting teachers are at different situations from the earlier ICT adopters, they are less likely to replicate the successful experiences of their colleagues. On the other hand, Moseley et al. (1999) reported, "…effectiveness in teaching for our group of teachers lay in deciding *when* particular strategies and approaches are effective, rather than in the approaches themselves" (p. 95). This suggests a relationship between contexts of teaching and teachers' experiences of ICT integration. The success of a strategy and an approach to professional development of ICT integration depends on the individual teacher who applies it.

From a US perspective, Pierce and Hunsaker (1996) found that externally driven professional development programmes did not meet the needs of teachers and they said, "The professional development agenda is rarely the teachers' agenda; the consultants come and go, but there is no support system to help the teachers work through the 'bugs' that arise during the implementation" (p. 101). Defining a standardized learning path for teachers by the experience of those early adopters as a guideline to develop ICT capability and competency in teaching seems inappropriate for all teachers. Reviewing the literature about effective professional development to develop guidelines for professional development, Guskey (1995, p. 48) concluded:

> What is evident from these guidelines is that the key to greater success in professional development rests not so much in the discovery of new

> knowledge, but in our capacity to use deliberately and wisely the knowledge we have. This is true regardless of whether professional development is viewed as an integral part of one's career cycle, as a self-directed journey to find meaning and appreciation in one's work, or as a structured effort to keep professionals abreast of advances in their field (p. 48).

This suggests that individual teachers need a personalized professional development path. Being a professional developer supporting technology and information literacy efforts in schools across North America, Asia, Australia and New Zealand, McKenizie (1998) recognized using ICT in teaching as a process of personal invention that is influenced by personal depositions on the use of ICT. Therefore, Stein, Smith and Silver (1999) argued, "The new paradigm for professional development represents a clear departure from the use of workshops to teach 'techniques' toward the use of multiple professional development strategies to build teacher capacity to understand subject matter, pedagogy, and student thinking" (p. 263). This means that individually oriented approaches to professional development of ICT are necessary.

An individual approach to professional development

Decontextualized skills and knowledge are unlikely to be put easily into daily use (Hargreaves & Fullan, 1992; Hunt, 1987). Schon (1983) argued that classrooms are often "characterized by uncertainty, disorder and indeterminacy" (p. 16). Mooko (2005) describes teaching as a dynamic process for which teachers seem to need wisdom of teaching more than technical skills (McNiff & Whitehead, 2002; Schwienhorst, 1999). In a study on the process of facilitating practitioner

research in Australia, Groundwater-Smith (1998) argued that teacher professional judgement was significant for effective teaching. Correspondingly, Sugar, Crawley and Fine (2004) affirmed "the primary importance of teachers' personal decision-making on whether a new technology is adopted" (p. 211). Tracing teachers' use of laptop computers in a US school, Windschitl and Sahl's (2002) findings indicate that the teachers' beliefs about learners and their needs can be an influential factor affecting their decisions about ICT use. Teachers develop their belief systems from their prior experiences and knowledge, and that informs their reasoning for making these decisions (Rodrigues, Marks, & Steel, 2003; Sadker & Sadker, 1986). Therefore, professional development of ICT that does not relate to their personal beliefs seems less likely to affect their decisions on using ICT (McFarlane, 2001; Williams, Coles, Wilson et al., 2000).

ICT may not have a great effect in changing the teachers' way of teaching unless it also changes their teaching beliefs. In New Zealand, Bell and Gilbert (1996) noted, "Unfortunately, it is common for teachers to find themselves teaching in the same way they always have, perhaps utilizing some of the new materials but adopting them to fit traditional patterns" (p. 9). Similarly, in the US, Becker (2000) concluded, "computers have *not* transformed the teaching practices of a majority of teachers, particularly teachers of secondary academic subjects" (para. 61). As professional adults, teachers will change their way of teaching only if they can see the change as meaningful and valuable to them (Pierce & Hunsaker, 1996; Brookfield, 1986). Without developing a linkage to the teachers' specific needs in using ICT, professional development programmes are less likely to help teachers develop a clear purpose for using ICT. Hazzan (2002-2003), in a study on the attitudes of prospective high school mathematics teachers, concludes that

ICT will only be an optional element to teachers if they do not have a clear purpose for ICT use. Therefore, teachers' ownership of and active involvement in the development process is important (Jamissen & Phelps, 2006).

Recognising the need for "radical thinking" of professional development for teachers, Lieberman (1995) commented that the wide acceptance of externally driven professional development, ironically, reduced personalized learning opportunities for teachers:

> What everyone appears to want for students - a wide array of learning opportunities that engage students in experiencing, creating, and solving real problems, using their own experiences, and working with others - is for some reason denied to teachers when they are the learners (p. 591).

Therefore, Darling-Hammond and McLaughlin (1995) suggested a new perspective of professional development that provides "occasions for teachers to reflect critically on their practice and to fashion new knowledge and beliefs about content, pedagogy, and learners" (p. 597). Senge (1992) identified a point of high leverage for change and said "small well-focused actions can sometimes produce significant, enduring improvement, if they're in the right place" (pp.63-64). Teachers seem likely to be at the leverage point of change in using ICT if they are reflective.

Applefield, Huber and Moallem (2000/2001) argued that "learner conceptions of knowledge are derived from a meaning-making search in which learners engage in a process of constructing individual interpretations of their experiences" (para. 6). Teachers are knowledge creators rather than passive knowledge receivers. They often develop expertise of teaching from practical

experiences and this kind of knowledge is less likely to be taught easily (Yost et al., 2000). Acquired skills and knowledge need to be transferred and internalized as active personal repertoires so that they can be applied in different situations (Hazzan, 2002-2003; Silvermand & Casazza, 2000; Howell, 1996; Kelly, 1994; Fielding & Schalock, 1985; Joyce & Showers, 1982). To sustain this effect of learning, Rogers (2001) upholds the importance of reinforcement and practice so that learners may transfer skill and knowledge into practice. Joyce and Showers (1982) suggest that a deliberate skill transfer process may help teachers to transfer their skills into practice. In a study of professional development of 1,027 mathematics and science teachers in the USA, Garet, Birman, Porter, Desimone and Herman (1999) found that teachers who engaged in active learning improve their skills and knowledge, and change their practice. This enactive experience can significantly increase their confidence in ICT (Albion, 1999; Bandura, 1997). Therefore, Smyth (1989) suggests that teacher professional development should shift from problem-solving to problem-setting, because "professionals are being confronted by situations in which the tasks they are required to perform no longer bear any relationship to the tasks for which they have been educated" (p. 3). Teachers need to relate their personal experience carefully and creatively to their practice (Walkington, Christensen, & Kock, 2001; Boud, Keogh, & Walker, 1985).

This discussion indicates that an individual approach to professional development anticipates enhancing teachers' personal capacities to construct and accumulate knowledge rather than acquiring stagnant technical skills. This informs the design of this study to enhance teacher professional judgement with acknowledgement of their individual differences (Hegarty, 1997). However, over-emphasis on the individual and personal aspects may raise the danger of

individualism so that the range of knowledge development could easily be limited by the teachers' personal perspective and perception of education. In a study of effective professional development, King and Newmann (2000) argued if

> … professional development focuses only on the individual learning of teachers, we should not expect substantial achievement gains in the student body as a whole …[and suggests that] teachers' individual knowledge, skills, and dispositions must also be put to use in an organized, collective enterprise (p. 578).

Stein, Smith and Silver (1999) also argued "[Professional developers] must not only develop teachers as individuals, but also grow self-sustaining learning communities" (p. 266). This indicates the need to extend professional development to a wider community of learners. A social approach to professional development seems to be crucial.

A social approach to professional development

Researchers commented that teacher professional development which is oriented towards developing knowledge, by acquisition or generation, would not be enough to support teachers to change with the use of ICT practice (King & Newmann, 2000; Swafford, 2000; for example, Fullan, 1993). In a study on teacher learning in two US elementary schools, King and Newmann (2000) commented, "because professional development often presents information that teachers see as irrelevant to student learning in their specific school settings, teachers often don't learn and apply what professional development programs offer" (p. 576). Similarly, Swafford (1998) concluded in her discussion of teacher peer coaching that traditional professional development could not ensure the

application of new teaching practices. According to Vygotsky (1978), social interaction is an inseparable part of knowledge development. A supportive social environment would be crucial for encouraging teachers to search for personal meaning in the use of ICT.

Professional development could be collaborative so that participants contribute to and gain from the professional community. Yocam (1996), in the Apple Classrooms of Tomorrow [ACOT] project in the US, reported that a social approach to professional development for teachers in using ICT in classrooms could help teachers change their beliefs and attitudes toward teaching. Timperley, Wiseman and Fung (2003) argued the same notion in a report on the sustainability of professional development in literacy in New Zealand, they said, "… professional development programmes are effective if they enhance teaching professionals' capacities to participate in their professional community discourse so that they are able to co-construct and co-evaluate new professional knowledge of best practices based on high professional standards" (p. 18). When teachers are exposed to different perspectives through active interactions with a professional community, they are more likely to gain better understanding about ICT integration (Driscoll, 2000; Bruner, 1996; Honebein, 1996). Teachers seem likely to adjust and subsequently consolidate their acquired skills and knowledge when they have opportunities to exchange ideas with other colleagues. Teacher professional development is not necessarily provided on an individual basis only (Newmann, King, & Youngs, 2000; Elmore & Burney, 1999; Elliott & Calderhead, 1995). Fullan & Mascall (2000) argued "If a teacher does not work in a professional learning community, where teachers work collaboratively,

sharing passion and purpose for their work, then professional development is short-lived" (p. 34).

Shifting to a social approach to teacher development may involve a significant cultural shift to ensure that teachers learn in this way (Pye, 1999). This involves changes in professional interactions and reflection on practice, which are discussed in turn below.

Professional interactions

Effective professional development values different perspectives, accesses different ideas, appreciates the similarities and differences among contexts, and acknowledges the complexity of the teaching environment (Fullan, 1999; Elliott & Calderhead, 1995). In a study on constructivist classrooms in the US, Becker and Riel (2000) found that teachers who engaged in substantive interactions with peer teachers in the school demonstrated a different pedagogy in the use of ICT. Professional interactions can be a medium through which to encourage learning to using ICT effectively (Stewart, 2003). In a study comparing the effect of peer coaching and traditional university supervision on preservice teachers, Bowman and McCormick (2000) found that peer interactions expand teachers' opportunities for observation, feedback, and guidance. This kind of interaction seems to create spaces for teachers to explore and extend their teaching practice in a broadened perspective.

The importance of professional interactions is supported by the findings of a study of technology integration in education in three elementary schools in Canada, in which Jacobsen (2001) said:

> Through professional dialogue with colleagues and the Galileo teachers, and by exposure to the results that other teachers had achieved with students, teachers became more convinced of the relative advantage offered by innovative practice and ICT integration (Overall Research Findings From Three Schools section**,** para. 1).

Researching peer partnerships of school principals in New Zealand, Robertson (1997) argued that professional interactions enabled the participating principals to "attain access to a deeper understanding of each other and themselves" (p. 143) and thus enhance interpersonal relationships. Having good interpersonal relationships is important for teachers to maintain professional interactions (Showers & Joyce, 1996; Hargreaves & Dawe, 1990). This interpersonal relationship is not just a form of social harmony or shallow experience sharing but a close relationship which may "foster mutual cooperation, emotional support, personal growth and a synergy of all professional development efforts" (Timperley et al., 2003, p.21) and enhance teaching (Cohen & Ball, 1999; Robertson & Allan, 1999). In a study in Canada, Dussault and Barnett (1996) concluded that professional isolation of school managers was significantly reduced when they participated in a peer-assisted leadership programme. This suggests that supportive peer relationships which interweave both personal and professional issues provides a safe environment and supportive atmosphere for teachers to break the isolation and encourage them to try new ideas beyond their comfort zone (Yocam, 1996; Elliott & Calderhead, 1995; Chase & Wolfe, 1989).

A social approach to teacher professional development often carries a partnership setting. Professional interactions and good partnership relationships may bring teachers outside perspectives that enable them to see their practice in different

ways. An outside perspective "validates, expands, and enriches [their] internal conversations" (Costa & Kallick, 2000, p.61). It does not only enrich the teachers' sense of what is feasible and possible in their practice, but also challenges their understanding of immediate social realities (Smyth, 1991). Covery (1989) stated:

> The person who is truly effective has the humility and reverence to recognise his own perceptual limitations and to appreciate the rich resources available through interactions with the hearts and minds of other human beings. That person values the difference because those differences add to his knowledge, to his understanding of reality (p. 277).

Fullan (1993) described teacher development as a journey of discovery. When teachers go through this journey, they will be aware of what they could not understand previously.

The partnership setting will be discussed in detail in later sections.

Reflection on practice

The use of reflective thinking in education is not a new idea as Dewey (1910) had raised the importance of reflection as a way to improve education almost a century ago, however, it "has not assumed a prominent position in the literature surrounding ICT professional development" (Jamissen & Phelps, 2006, p.298). To engage in reflection helps teachers to be aware of the strengths and weaknesses of their practice so as to improve it (Schon, 1983). Teachers, however, need to be willing and able "to problemize practice, reflect and think critically about their practices in their specific contexts" (Walkington et al., 2001, p.343) and recognize

the difference from the past teaching experience in order to question the taken-for-grantedness of their practice (Walkington et al., 2001; Frick, 1996; Smyth, 1986). Teachers need to be sensitive to the purpose and appropriateness of their practice and be aware of their theoretical reasoning of the use of ICT (Brookfield, 1995; Kemmis, 1985). However, many teachers are less likely to engage in such reflection because they are used to working in a school environment in which the knowledge of teaching gradually becomes a kind of technical skill without reflection on individual and contextual aspects (Schon, 1987b).

Yocam (1996) identified in the ACOT project in the US that there is "a gap between the teachers' espoused beliefs about their practice and their practice in action" (para. 6). Teachers are unlikely to improve their use of ICT in teaching with "shallow" reflection on practice with intermittent knowledge updates a few times a year. However, through examining and questioning the assumption of their decisions and actions, they are more likely to have in-depth understanding of their decisions and actions (Pohland & Bova, 2000). Therefore, Schon (1983) argued that critical reflection was central to learning from practical experiences. Teachers who engage in critical reflection may realize the knowledge that they know in action but seldom describe (Tremmel, 1993; Schon, 1987a). Teachers are urged to reflect on "the assumptions underlying a decision or act and on the broader ethical, moral, political, and historical implications behind the decision or act" (Yost et al., 2000, p.41). Professional interactions that engage teachers in "ongoing conversations and reflection about their practice and how they might change and enhance it with technology" (Yocam, 1996, para. 10) is a process to "challenge their professional beliefs about practice" (para.9).

Teachers may have different focuses on the ICT issue for their reflection and these focuses express their personal beliefs and attitudes and determine their approach and direction (Boud et al., 1985; Kemmis, 1985). As a classroom educator, Buckley (2000) commented in a discussion of reflection, "Although individual reflection is similar across cultures, the ways in which people conduct discussion, and, hence, the ways in which they reflect together are remarkably different" (p. 147). Reflection is not a universal means to search for an answer or a solution for a particular problem but an interaction of the teacher, the culture and the context. Through engaging in continuous deeper thinking about their practice, teachers may extend their capability to make professional decisions on pedagogy and strategy in teaching as well as using ICT to enable teaching (Walkington et al., 2001).

Since teaching is informed by teachers' personal implicit values, Convery (1998) argued that "Teaching is often a way in which individuals find opportunities for self-expression…, but the identity which is invested in the professional role becomes a barrier to accepting the need for change" (p. 202). This suggests that reflection on teaching practice should be more than an inward-looking process, it is also a deliberate externally focused action (Smyth, 1986). Although teachers have many opportunities to meet and work together in the school environment, they usually work independently in the classroom and thus may look at their teaching in a limited personal scope. Offering a bigger picture of the teaching profession in different perspectives may help them to re-assess and critique their own practice (Robertson & Webber, 2004) and may lead to better understanding of their practice from a wider perspective (Golby & Appleby, 1995).

Reflection may empower teachers to think beyond the existing practice when new perspectives are taken into consideration. In-depth reflection is found to be a key to ICT professional development (Jamissen & Phelps, 2006). Convery (1998) argued that "individual teachers are unlikely to make essential changes to their practice if they are not supported and guided through the reflective process" (p. 202). Reflective processes can be enhanced and enriched by professional interactions. Professional interactions help to broaden teachers' perspectives and offers opportunities to teachers to examine different aspects of their own experience of teaching (Elliott & Calderhead, 1995). It is likely to challenge, and even change, their attitudes and beliefs about teaching and create cognitive dissonance that encourages them to reflect on existing practice. Teachers are likely to understand their practice better by engaging in continuing professional interactions, which challenge the teachers' existing perspective as well as providing them personal encouragement to perceive problems from other angles (Marshall, Adams, & Cameron, 1998; Janas, 1996; Smyth, 1986).

As a conclusion, a social approach to teacher professional development that builds on both professional interaction and reflection provides a safe environment and supportive atmosphere and helps teachers understand their personal reality better as well as collecting new information to expand their knowledge. This research drew on this approach to create a professional development process that was aimed at empowering teachers to take responsibility for their own learning path to using ICT in teaching rather than setting up a pre-defined learning path for them.

Examples of the use of a social approach in professional development

A social approach to professional development may take place in different ways and environments. This section reviews the literature about teacher professional development within a social approach. Two types of relationship are identified: professional development with hierarchical relationships, and professional development with peer relationships.

Professional development with hierarchical relationships

Some professional development, for example, mentoring (Tomlinson, 1995) and clinical supervision (Smyth, 1984), highlight the importance of help and guidance from expert, experienced or senior teachers for early and young teachers. Because of growing demands on teachers' competence, this type of professional development is especially important and popular among student teachers and young teachers, and also for teachers starting a new role in management (Butcher, 2000). In this section, because of its popularity in school settings, mentoring is selected as an example to illustrate the characteristics of this type of professional development.

From interpreting the character of Mentor in Homer's epic poem, *The Odyssey*, Anderson and Shannon (1995) concluded that mentoring is an intentional, nurturing, insightful, and supportive process. A mentor is usually described as a competent and more experienced person who teaches and gives information; a guide who shows the direction; a role model for protégés to learn from; and a friend who provides support (Anderson & Shannon, 1995). Thus, a

mentor is usually "close to, or at least familiar with, the mentee's context" (Jamissen & Phelps, 2006, p.305). A good mentor is described as "people-oriented, open-minded, flexible, and empathetic" (pp.2-3, Janas, 1996) and they need to be effective in adjusting their mentoring communications to meet individual protégé's needs (Rowley, 1999). Upholding a spirit of openness and collegiality is essential to nurture such a vigorous relationship (Eisenbach & Curry, 1999). Ackerman, Ventimiglia and Juchniewicz (2002) argued that mentoring is multidimensional and involves three kinds of elements, the professional, personal and social elements:

> The professional element involves sharing information about a profession, helping the protégé learn how an organization operates, and teaching specific skills; the personal element involves understanding the life situation of the protégé, which may mean helping him or her learn how to balance the values of a professional and personal life. It may also mean helping to seek the right supports or resources to overcome obstacles that may block success…. However, the social dimension usually means being a friend. Through friendship, a mentor can engender a feeling of 'fitting in' or belonging; the protégé can also learn appropriate social behaviors within the culture of the profession of the particular organization (pp. 1135-1136).

This argument illustrates that mentoring is a comprehensive and all-round process that aims at helping the protégé adapt in their early professional life in school. This view of mentoring implies that the mentor has a postioin of seniority relative to the protégés (Jamissen & Phelps, 2006).

Because of their seniority or expertise, the mentoring relationship usually starts with a hierarchical structure in which there is usually a great power difference between the mentor and the protégé. The mentor and protégé will have different expectations of their roles. In her thesis about the mentor and protégé relationship, Phillips (1978) found that "[it] is generally agreed that the 'invitation' to participate in the relationship is issued by the mentor, not the protégé, since the mentor is the one with more status or power" (p. 89). Mentors look at the protégé's situation from the perspective of seniors and perform the function of giving, providing, showing and directing. They serve as a role-model and guide the protégé along their path of development. Janas (1996) stated that "a successful mentor/protégé relationship requires desire by both parties" (p. 3). Both the mentor and protégé need to realize and accept their role in this relationship, and have a clear expectation of this relationship.

Mentoring is common during the early stages of adulthood and professional life because at these stages in life people are more open to new knowledge and thinking as they perceive themselves as inexperienced. They are usually eager to seek knowledge and skill to enable themselves to adapt to the new environment. Protégés, because of perceiving themselves in a junior role in this power relationship, easily accept the advice and guidance from their mentor. Therefore, the mentoring process can be powerful in ensuring adequate support for early teachers (Marshall et al., 1998).

Ackerman, Ventimiglia and Juchniewicz (2002) pointed out two implicit assumptions that affect the design of most mentoring programmes: "First, it is assumed that a body of explicit, somewhat systematically organized professional knowledge about leadership exists. Second, it is assumed that such knowledge

can be integrated, applied, understood and transferred through the work of mentoring" (p. 1157). These assumptions show that mentoring always puts the focus on helping the protégé to acquire the threshold of competence and thus, the input to the mentoring usually leans to the mentor's side. Although this hierarchical setting of mentoring helps distinguish the role of the mentor and protégé, the power of mentoring depends on the characteristics of a particular relationship in which the mentor provides personal support for the protégé (Butcher, 2000). Therefore, the success of mentoring seems to draw on the function of good professional interactions between the mentor and the protégé that bring the particular context into the learning process.

Mentoring relationships seem to be dynamic. Phillips (1978) recognized that the relationship of mentor-protégé was changing overtime. When a protégé becomes more experienced and knowledgeable, the mentoring relationship gradually transforms into providing support rather than giving guidance or advice (Bush, Coleman, Wall, & West-Burnham, 1996). This relationship serves a socio-cultural function of helping new comers adapt to the organisational culture (Marshall et al., 1998). The support and interest shown by the mentor is then far more important than their specialized knowledge and advice for the protégé. Therefore, Eisenbach and Curry (1999) argued that the partners should come from different disciplines, because if they are from the same discipline, they will be tempted to evaluate the content and not the process of instruction:

> Without specific knowledge of course information, faculty may be more willing to trust and respect their colleagues. Observers are then unencumbered by preconceived notions and are able to focus solely on pedagogy (p. 264).

However, this relationship has to be professionally focused as well as non-evaluative (Robertson & Webber, 2002; Johnson, 1995). Teachers need to develop effective interpersonal and conference skills and pay more attention to the quality of human relationships with their supportive partners (Eisenbach & Curry, 1999; Marshall et al., 1998; Janas, 1996; Barnett, 1995; Vaidya, 1994).

Long-term professional development for teachers needs not only the leadership of the mentor but also the active participation of the protégé (Enrich, 1996). A one-way mentoring process in which the mentor chooses the path of development for the teacher protégé will not satisfy the needs of teachers when they have built up competency in teaching and perceive themselves as more equal with experienced teachers. Therefore, an ongoing development for teachers, especially experienced teachers, should be in a form of partnership with mutual participation in which both teacher partners contribute to the developmental path.

Professional development with peer relationships

As teachers are practically independent from each other in their teaching practice in the classroom (Friend & Cook, 1992), they often develop personal tactics by accumulating experiences in their own classroom practices. Some scholars suggest that teacher professional development should emphasize continuous improvement in daily practice with peer support from the school community, such as peer coaching (Joyce & Showers, 1982) and professional partnership (Robertson, 1995).

Peer coaching provides a structure for peer partners to coach each other about transferring and sustaining skills and learning. It is a customized and focused support from teachers for teachers (McNerney, Nielsen, & Clay, 2006)

that is developed from responding to the shortcomings of the short-term nature of many teacher training programmes that do not bring real changes into classrooms (Joyce & Showers, 1982). Peer coaching is an interactive, simple and non-threatening structure involving teachers supporting teachers to develop expertise in new teaching skills or transfer new learning from other professional development activities (Gottesman, 2000; Swafford, 2000). Many teachers have difficulty in implementing new learning or innovations in their practice because these innovations are usually very different from their current practice. Swafford (1998) concluded in her study about peer coaching that, "teachers need time to practice new instructional practices in the context of their classrooms …[and] also need support from their peers" (p. 57). Peer coaching enables teachers to gain control of their own path of improvement and to sustain learning through receiving positive feedback and support from peers (Meyer & Gray, 1996; Showers, Joyce, & Bennett, 1987; Joyce & Showers, 1982).

Professional partnership, on the other hand, instead of focusing on a particular skill, enables participants to discover their personal theories-of-action from an outside perspective (Robertson, 1997). It bridges the discovery of personal theories of action and change in practice. Increasing professional interactions with peer partners may enable participants to be more open and look deeper into understanding each other, a process that can help teachers to see teaching issues from more than their own perspective (Robertson, 1997). In return, their personal learning becomes a part of the co-constructed knowledge with their peer partner through further enhanced professional interactions (Webber & Robertson, 2004; Robertson, 1997; Golby & Appleby, 1995).

Professional partnership focuses on enriching participants' perspectives and ways of thinking that help teachers evaluate and validate their personal knowledge of teaching (Robertson, 1997). They thus can be aware of matching their own underlying assumptions of practice with the use of ICT instead of adopting new innovations without considering whether the new practice suits their personal circumstance (Webber & Robertson, 1998; Louden, 1992). Awareness of others' reality brings challenge and reflection opportunities to teachers. The findings of Webber and Robertson's (2004) study showed that when teachers engaged in international professional dialogues, "Participants became more aware of the external realities that were different from their own, including those in other Western nations and societies, including developing countries and Eastern societies" (p. 271). This outside perspective creates an disequilibrium or dissonance and challenges them to reflect critically on their practice (Ball & Cohen, 1999). Robertson and Webber (2004) illustrate this challenge clearly:

> Study participants became more uncertain about whether their professional practices were the "right" professional practice. This loss of certainty allowed participants to consider what they might learn from others with quite different perspectives. Moreover, the loss of certainty facilitated more reflective consideration of the many facets of educational leadership. This led to increased skills in critically analysing educational contexts and previously taken-for-granted assumptions (p. 10).

This reflects that understanding how the partner comprehends teaching practice does not only enable teachers to frame teaching practice in a wider perspective, it also encourages teachers to self-critique and reflect in multi-angles (Webber &

Robertson, 2004). These opportunities, therefore, encourage the peer relationship to become more inquiry-oriented when facing challenges. It transforms the acquisition of best practices into the creation of suitable practice personally and socially. As Ball and Cohen (1999) proposed, it turns "teachers' experience into educative rather than reproductive ends" (p. 29).

This type of professional development with peer relationships, as discussed above, is not an improvement initiative by itself, it is a structure and process that enables teachers to improve their current practice or implement an innovation (Swafford, 1998; Showers & Joyce, 1996; Showers et al., 1987). It is a platform for peer partners to share, discuss and solve problems together (Meyer & Gray, 1996) in a flexible structure that can be used for a specific learning focus and with different professional development activities (Gottesman, 2000; Swafford, 2000). Although its structure looks simple, "it is a complex innovation… because it requires a radical change in relationships among teachers" (Showers & Joyce, 1996, p. 16). Robertson (1998), in her study of peer partnership of principals, identified an issue of impression management that "involved principals in controlling the extent to which their colleagues saw beyond this front" (p. 365). This indicates that successful peer relationships should be close and trustful. Since it is a private process in which partners are encouraged to open up the not-for-public zone of their practice, only with mutual trust can they discover and tackle the real problem in their practice together (Galbraith & Anstrom, 1995). It is also professionally oriented as partners give positive feedback focusing on the practice instead of evaluating each other's performance (Swafford, 1998; Showers & Joyce, 1996; Joyce & Showers, 1982).

A comfortable feeling about the peer relationship is important to extend the collegial partnership over a long period (Showers & Joyce, 1996).

With the objective of helping participants build suitable practice for using ICT in teaching for themselves, the peer partnership model provides an appropriate structure for this study to construct a supportive and simulative environment for participants.

Summary

In summary, since the needs of teachers will change over time, professional development on using ICT will evolve in response to different educational needs at different times (Commonwealth Department of Education, 2001). When ICT was introduced to the education sector, technical skill training was provided for teachers. Because of the huge investment in ICT in schools by governments, most teachers, especially in developed countries, have been equipped with basic level ICT skills. However, teachers still have problems integrating these skills into their daily teaching. Best practices and exemplars are then brought into professional development in ICT for teachers trying to increase and improve the transfer of skills. Many teachers, however, find that the experience from other teachers may not necessarily suit their way of teaching or their context. A personal approach to professional development is thus advocated to search for a suitable and comfortable way of integration by considering the teachers' personality, skills, experiences and context. This approach provides them with constructivist learning experiences that allow them to develop meaningful, personal and professional knowledge and skill (Beisser & Gillespie, 2003). However, this approach may raise the danger of individualism and limit the range

of knowledge development. Reviewing the characteristics of a social approach to teacher professional development, teacher mutual support is regarded as a way to enhance personal as well as professional growth, and empower teachers to improve the use of ICT in their context. It is suggested as being the next phase in the development of professional development in ICT for teachers.

Online discussion

Learning can happen in more than face-to-face interactions. In a research study at an American university designed to investigate the role of an online discussion group in student's learning of physics, Larkin-Hein (2001) found that online discussion provided an additional teaching and learning opportunities. Similarly, in another study of online discussion in a mixed-mode course in the US, Wu and Hiltz (2003) concluded, "…the results suggest that online discussions definitely improved students' perceived learning in the 'mixed mode,' meaning classes that meet face-to-face and also require additional asynchronous online discussions" (p. 695). These findings suggest that an online discussion could have potential for adding value to learning (Hammond, 1998).

In a study to investigate using an online discussion forum to support practicing elementary school teachers' professional development, Carboni (1999) suggested that online discussion forums may create opportunities for more equal participation as it allows a more democratic discussion. It is argued that using online discussion could complement the social approach to professional development. Since dialogue in an online environment need not necessarily be intuitive, it is more likely to create a safe and relaxed environment for developing professionally focused conversations (Kleiber, Holt, & Swenson, no date).

Participants, especially more reserved people, may have greater involvement in an online forum as they have more time to think before they speak (write) and they would not be interrupted while speaking (Carboni, 1999). This nature of time-delayed discussion may encourage participants to be more reflective as it allows participants to have more time to reflect on what they want to say and to organize their ideas. It may promote in-depth and well-thought out conversations.

However, the development of online discussion should not be seen as a straightforward process and a formula to automatically improve learning (Hammond, 1998). Analysing more than 3000 course evaluations in a US university, Rossman suggested that course instructors develop interpersonal relationships with online learners so as to improve online teaching (Rossman, 1999). It is argued that online community and relationships are less likely to be maintained if people are not conscious of their responsibility to build relationships through this virtual channel. An online forum may not automatically be successful in developing a professional community. All participants were responsible for its success. Participants' commitment is an important component of online discussion (Carboni, 1999). A socialisation process is crucial in building this kind of relationship in an on-going forum community (Campbell, 2001). Participants may need to maintain a friendly atmosphere of discussion, rather than debate, to encourage in-depth reflection and keep an open mind to different ideas and perspectives and to adopt a non-evaluative approach when giving feedback.

In a study of online discussion for professional development, Hammond (1998) reminded us that professional developers would need a sharp awareness of the issues of online discussion. Participation in online discussion could be very

time consuming (McLoughlin & Luca, 2001) and the permanence and public nature of online discussions could be a barrier to participation (Hammond, 1998). Although there may not be contradiction between social interactions and learning processes (Oren, Mioduser, & Nachmias, 2002), McLoughin and Luca (2001), in a study on investigating process in online environments, found that knowledge construction in online discussion could be minimal when it is dominated by social and collaborative interactions. This reflects that effective online discussion should have clear goals and be well moderated to help participants engage in meaningful discussions. The role of moderator is, thus, crucial to develop and nurture an open and supportive online discussion environment.

Conclusion

This review of literature has indicated that effective professional development of using ICT should be a menu of various strategies rather than only one (Bybee, 2001). It clearly shows that a skill-based approach is insufficient to develop a link between the technology and daily practice, nor to encourage large scale and in-depth use of ICT in teaching and learning. It is reflected in the review of the Five-Year Strategy in Hong Kong:

> … after receiving training, teachers still need to overcome further hurdles in implementing new teaching approaches using IT in their own classrooms (Education and Manpower Bureau, 2004, P. 14).

The EMB (2004) strongly urged for new models of professional development so as to build in mechanisms that will encourage and support the new teaching approaches. In a report on the status of technology in US schools, Coley, Cradler and Engel (1997) propose a more personal and social approach process:

> The challenge of integrating technology into schools and classrooms is much more human than it is technological. It is not fundamentally about helping people to operate machines. Rather, it is about helping teachers integrate these technologies into their teaching as tools of a profession that is being redefined through the process…. Rather than receiving knowledge from experts in training sessions, teachers and administrators should collaborate with peers, researchers and students to make sense of the teaching and learning process in their own contexts (p. 44).

This indicates that support to encourage teachers to use ICT in practice may help to fill the gap between development of technical skill and daily use of ICT. Supplementary to formal ICT training, this review suggests that informal teacher development can be an effective channel to help teachers develop their capability of ICT integration (Smerdon et al., 2000). Although comprehensive and careful design of professional development programmes are important, flexibility in implementation seems to be important too (Yocam, 1996). Empowering teachers to engage in critical reflection in using ICT in teaching through professional interactions is more likely to encourage teachers to use ICT (Smerdon et al., 2000).

This study supports the idea that the use of ICT in teaching should involve a change in teacher beliefs about, and attitudes towards, teaching, and recognizes the importance of enabling teachers to support each other through the process of change. With the belief that no one single model will suit all teachers, this study attempted to understand how teachers, through peer support, might develop a wider perspective and adopt reflective practices in the use of ICT. To this end, a social approach to professional development was adopted to this study. The study

employed peer support, complemented by an online discussion, to help participants to build up a private, comfortable and supportive community that might empower them to take control of the process of ICT integration in their teaching.

In the next chapter, the research methodologies and methods are described to illustrate how this research was conducted in order to achieve its aims and objectives.

CHAPTER THREE: METHODOLOGY AND RESEARCH DESIGN

The aim of this study is to refine a professional development theory in using ICT in Hong Kong classroom and develop a professional development model that informs the changes of teachers' personal attitude towards ICT use. This chapter begins by describing the research questions adopted in addressing this aim and then discusses research methodologies appropriate to this study. The methodology is embedded in and connected to the theoretical framework of this study. Next, the research design, including research activities used in this study, is described. The final sections discuss the research validity, describe the data collection and explain how the data was analysed.

The research questions

The literature reviewed in the previous chapter identified teachers' attitude as a major factor affecting the use of ICT. It has also argued the need for an alternative approach to professional development for using ICT. Design of this research was developed from literature which indicated that ICT professional development for teachers is likely to benefit from a social approach, especially peer support. This study has, therefore, employed a social approach to professional development, utilising peer support groups, with a complementary online discussion forum as an instrument to help participating teachers to examine their current attitudes and practices. The study was based on a constructivist view of learning with the assumption that teachers, as professionals, can develop and

construct suitable ways to integrate ICT into teaching and learning when they have appropriate support and personal preparation.

The study did not follow a predetermined process. Instead, this research sought to understand the process of change during professional development through teachers exploring peer support in their contexts. This is to refine a theory of professional development of ICT for teachers. This research began with three research questions that indicated the vision and the direction of this study. These research questions were:

1. What are the challenges for teachers in Hong Kong secondary schools in the integration of ICT in their teaching?
2. What are the impacts of using peer support and an online discussion forum as professional development tools on teachers' attitudes, teaching paradigms, and learning processes related to the integration of ICT in their teaching?
3. What are the processes of professional development that underpin the changes brought about by the peer support project?

The first question attempts to examine the challenges for teachers as they went through their journeys of learning and using ICT in education. Their attitudes towards ICT integration in teaching and learning were also explored. The second research question sought to identify the impacts of peer support on teachers' attitudes and practices in using ICT. The third question looked at the processes of professional development that promoted or constrained peer support as a teacher

development support tool. These processes evolved in response to feedback and the actions of teachers as the research continued through action research.

Methodology

> Men and women have long been concerned to come to grips with their environment and to understand the nature of the phenomena it presents to their senses. The means by which they set out to achieve these ends may be classified into three broad categories: experience, reasoning and research. Far from being independent and mutually exclusive, however, these categories must be seen as complementary and overlapping, features most readily in evidence where solutions to complex modern problems are sought (Cohen & Manion, 1994, p. 1).

In these words, Cohen and Manion provide a picture of the complex nature of inquiry into social issues. Education research, as social inquiry, is affected by influences of real life situations, attempts to comprehend the world and investigation of phenomena (Johnson & Christensen, 2000; Cohen & Manion, 1994). Embracing this perspective, this study was socially and politically embedded. It addressed a particular problem – integrating ICT into daily teaching; situated in a particular context – traditional classrooms in Hong Kong; and encompassed a particular purpose – teacher development (McNiff & Whitehead, 2002).

This research was designed with the aim of improving teachers' practice because education research "is like a compass pointing toward improvements" (Finn, 1991, p. 40). A practical solution for immediate problems was thus inevitably one of the main concerns of this research. Some authors have criticized

educational research as being over-concerned with immediate practicality and usefulness (for example, Daniel, 1996; Kerlinger, 1977) because, in their view, the ultimate objective of educational research should be the advancement of theory rather than just the solution of an action problem (Daniel, 1996). Kerlinger (1979) argued that "the solution of a research problem is on a different level of discourse" (p. 288). Although this research focused on a practical issue, refining a theoretical framework which informed this research was also a goal. Therefore, this research carried dual objectives: to improve teaching through actions, i.e. changes in attitudes and practices, and to develop a theoretical framework and professional development model for teachers' use of ICT.

To achieve these two objectives, this research adopted a qualitative approach to deal with the complexity of social contexts of teachers and to acknowledge and understand the changes in participants and their practices. The study's design was informed by a constructivist perspective that acknowledged the creation of knowledge from practical experiences. It utilized an action research methodology to gain an in-depth understanding of the impact and processes of change which were generated from interactions of teachers and their contexts. Finally, this research has drawn on grounded theory to assist in the development of a professional development model based on the participants' experiences. The following sections will discuss these methodologies in detail and describe the establishment of the inquiry framework of this research.

Qualitative Paradigm

A paradigm is essentially the worldview and basic beliefs in which research takes place (Denzin & Lincoln, 1994; Firestone, 1987). A qualitative paradigm is

commonly used in human and social science as a basic methodology (Creswell, 1994). Qualitative research is underpinned by an assumption that "there are multiple realities that are socially defined" (Firestone, 1987, p. 16). It is concerned with understanding the phenomenon of social realities performed by people (Firestone, 1987).

According to Creswell (1994), "…a qualitative study is defined as an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting" (pp. 1-2). This indicates that a qualitative paradigm recognizes the importance of the subjective, experiential 'lifeworld' of human beings (Burns, 2000). Thus, qualitative study "describes people acting in events" (Firestone, 1987, p. 19). As they live in a social world, teachers will hold different underlying assumptions of the world that influence their behaviours (Cohen, Manion, & Morrison, 2000; Young, 1981) and produce expectations of their behaviours as they react to the social environment (Popkewitz, 1984). A qualitative study discovers and understands the dynamics of the participants' realities (Johnson & Christensen, 2000; Neuman, 2000; Creswell, 1994). Instead of regarding participants' responses to a situation as a cause-effect relationship, qualitative study acknowledges choice as an alternative (Firestone, 1987). It reflects that there is no definite outcome in social realities - change is possible, so qualitative study may present "a more complex view of a world in which there are limits and opportunities that individuals must take into account and use" (Firestone, 1987, p. 19). This indicates that understanding the subjective world of participants' experiences from within and capturing the lived experience of the interactions of participants and their complex environment

becomes important (Cohen et al., 2000; Frankel & Devers, 2000; Sherman & Webb, 1988). As a result, a qualitative researcher, instead of being detached from the researched, "becomes 'immersed' in the phenomenon of interest" so as to capture these experiences (Firestone, 1987, p. 17).

Since this research was conducted within the teachers' context to understand the participating teachers' perspectives, beliefs and attitudes influencing their professional decisions and actions, a qualitative paradigm was employed. All emerging issues were studied in a natural, non-manipulating setting (Johnson & Christensen, 2000) because it is believed that there could be multiple perspectives and socially constructed meanings existing within a social environment (Burns, 2000). Although teachers were introduced to a new approach to professional development of ICT integration, they could make necessary modification to the process to suit their needs.

Constructivist approach

Constructivism is not a set of theories or a model of instruction and learning but a perspective from which to understand the process of knowledge construction (Perkins, 1999; Riesbeck, 1996). Eisner (1990) proposes alternative paradigms of research which "hold that 'truth' is ultimately a kind of mirage that in principle cannot be achieved because the worlds we know are those crafted by us and because we cannot uncouple mind and matter to know the world as it 'really' is" (p. 89). This perspective looks at the learner as a knowledge creator and learning as a process of knowledge creation. Participants in research employing a constructivist approach are regarded as being able to construct their own concepts and knowledge by abstracting their experiences (von Glasersfeld, 1997; Prawat &

Floden, 1994; Hein, 1991). It is recognized that people will not and cannot have a perfect reflection of the meaning of outside reality. This research recognized the importance of the process of adjusting mental models to accommodate new experiences.

Baumgartner (2001) argues that "knowledge is not 'out there' to be discovered but is created from interpretations and reinterpretations in light of new experiences" (p. 16). Processes of knowledge construction are interactions between learners' prior knowledge of contexts and new experiences from the environment (Murphy, 1997). This is an active process in which learners' current beliefs will be challenged by new experiences. Learners may adjust their belief system in order to accommodate the learning from new experiences (Hoover, 1996). The process of knowledge construction helps individuals to deal with different happenings from the environment (Jaworski, 1996).

Knowledge is thought to be socially distributed (Applefield, Huber, & Moallem, 2001; Salomon & Perkins, 1998) because individually developed thought and ideas will only be meaningful when they are placed into action in a specific external context (Stein, 1998; Kaptelinin & Nardi, 1997). Since individuals are living in a social environment, their thinking is influenced by its structure (for example, language). The social environment therefore constructs a social framework that enables individuals to acquire the meaning of internally constructed knowledge.

Constructivists recognize the significance of the social environment to an individual's knowledge construction (Cole & Wertsch, 1996). From a social constructivist perspective, knowledge is actively constructed either through personal sense or by way of communication (von Glasersfeld, 1984). Social

constructivists "[see] consensus between different subjects as the ultimate criterion to judge knowledge" (Heylighen, 1993, para. 8), and thus they believe that knowledge is a social product (Prawat & Floden, 1994). This implies that knowledge is socially constructed and may be redefined through active communication between people. Meacham (1996) describes this knowledge as socio-cultural knowledge reproducing itself within individuals. Therefore, the social environment seems to be the context in which knowledge is constructed (Cole & Wertsch, 1996).

In a study investigating the aspects that students discerned and brought into their focal awareness when studying science stories, Tao (2002) argues that meaning of knowledge comes from awareness of variation and said, "…students' prior conceptions strongly influence their construction of meanings from the learning experiences" (p. 97). This reflects that neither personal nor social constructivism alone can provide the whole picture of knowledge construction. Individual or social views of knowledge construction may only explain part of the knowledge construction process because they are interwoven and they cannot and should not be separated (Salomon & Perkins, 1998). Meacham (1996) argues that social knowledge carries the function of preservation and reproduction of meaning while internal knowledge construction is the process of transforming and creating new possibilities of knowledge.

Individual learning and social learning can be seen as the two ends of a continuum of knowledge construction (Salomon & Perkins, 1998) and both are essential to strengthen each other. Salomon and Perkins (1998) describe this process as a reciprocal spiral relationship. Individual and social learning are interrelated and they together lay the foundation for on-going knowledge

construction. Therefore, this research saw professional development as taking place through both internal and social construction processes.

Action research

In a study of teaching and learning of science, Feldman and Minstrell (2000) identified the purposes of action research as being to improve teaching practice as well as to improve understanding of the educational situation, and argued that action research is a "research *methodology*, a paradigm within which research is done rather than a set of specific research *methods*" (p. 432). This view suggests that action research should not be seen "as a set of concrete steps but as a process of learning from experience, a dialectical interplay between practice reflection and learning" (McNiff & Whitehead, 2002, p. 13).

Action research is a practical way of researching improvement and changes in ongoing practice (McNiff & Whitehead, 2002; O'Brien, 2001). Doing action research results in generation of knowledge and change of practice (Feldman & Minstrell, 2000). Feldman and Minstrell (2000) proposed that employing action research in education may "modify [the participants'] practice in some way …[as well as] determine what works and does not work in the classroom, and why" (p. 431). Action research is, therefore, transformative as well as practical as it questions, examines, acts, reflects and changes behaviours as well as beliefs (Cohen et al., 2000; Grundy, 1982).

Action research enables transformative learning by pushing the taken-for-granted practice to its boundary and uncovering underlying beliefs and assumptions of actions. Mezirow (1997) describes transformative learning as "the process of effecting change in a frame of reference… [which is the structure] of

assumptions through which we understand our experiences" (p. 5). Action research produces transformative learning in context which "[brings] about practical improvement, innovation, change or development to social practice, and practitioners' better understanding of their practices" (Zuber-Skerritt, 1996b, p. 83). Action research thus provides a systematic and collaborative framework for research (Gurney, 1989) and also links theories with practice (Robertson, 2005). These three characteristics of action research are discussed in turn.

Systematic learning process

Action research is a learning process and a means of developing teachers' professional learning that influences their practice (Lomax, 1989; Kemmis & McTaggart, 1988). Action research encourages teachers to create and accumulate professional knowledge by asking questions, researching themselves and finding their own solutions (Robertson, 1997). Consequently, an action researcher develops a feeling of how teachers' practice could be improved by deliberately investigating the context of practice and examining their underlying beliefs (McNiff & Whitehead, 2002).

An action research study is a systematic learning process (Bigum, Henry, & Stephen, 1986) that involves participants' active participation (McNiff & Whitehead, 2002). Action research provides a framework for participants to work towards their goals in a structured process. It is often described as a cyclic process (Kemmis & McTaggart, 1988). Kemmis and McTaggart (1988) noted:

> A distinctive feature of action research is that those affected by planned changes have the primary responsibility for deciding on courses of critically informed action which seem likely to lead to

improvement, and for evaluating the results of strategies tried out in practice (p. 6).

Participants in action research engage in action cycles that work like small modules of an experiment to test out their initiatives. Altrichter et al.'s (1990) definition of action research is one of progressive learning in a self-reflective spiral of planning, acting, observing, reflecting, and replanning. Participants are required to take part in continuous cycles of action that involve planning, acting, observing and reflecting (Johnson & Christensen, 2000). Actions involved in action research are often distinguished from everyday actions because they are more systematic (Gurney, 1989). It is a way to "improve and understand the world by changing it and learning how to improve it from the effects of the changes made" (Kemmis & McTaggart, 1988, p. 21).

Using action research is a way of leading teachers to a commitment to continual renewal, learning and growth from experience (McNiff & Whitehead, 2002; Stenhouse, 1975). Thus, action research based study is designed as "a small scale of intervention within the real world" (Cohen & Manion, 1994, p. 186) in which the researcher and participants work collaboratively to create the context by taking part in a continuous planning-action-reflection cycle. This learning-in-experience process enables the participants to improve and change their practice in the long term (McNiff & Whitehead, 2002; Cohen et al., 2000; Zuber-Skerritt, 1996b; Cardno & Piggot-Irvine, 1994).

Collaborative process

Action research is usually participatory (McNiff & Whitehead, 2002). Research that employs action research methodology is usually based on a participatory

worldview in which choices and actions are experiential (Heron & Reason, 1997). With this participatory worldview, action research links research to the participants' involvement in actions (Cohen et al., 2000). Zuber-Skerritt (1996a) suggests that action research works for "practical improvement, innovation, change or development of social practice, and the practitioners' better understanding of their practices" (p. 83). Through actions in context, evidence is likely to be produced to indicate how improvement might be achieved.

However, benefits for practitioners is likely to be limited if research is confined to individual actions and reflections (Burns, 2000). McTaggart (1991) warned that a strong autonomy view of action research could lead to individualism and hinder the potential to construct or reconstruct new knowledge through social and collaborative effort. Therefore, action research should not be confined to the individual. The autonomy of action research participants is likely to combine freedom of individual action with social responsibility (Habermas, 1974). Heron and Reason (1997) said:

> The participatory worldview allows us as human persons to know that we are part of the whole, rather than separated as mind over and against matter, or placed here in the relatively separate creation of a transcendent god. It allows us to join with fellow humans in collaborative forms of inquiry. It places us back in relation with the living world (pp. 275-276).

Action research involves participants not only in doing an activity but also engages them in defining the activity. It works as a form of collective reflective inquiry by the participants (Kemmis & McTaggart, 1988).

As McTaggart (1991) stated, one of the essential epistemological characteristics of action research is the "formation and extension of critical theorems and the development of theoretically informed practice through personal but shared engagement in the struggle to change" (p. 42). Doing action research seems to contribute to expanding knowledge that brings benefit to a wider professional community (Hult & Lennung, 1980; McKernan, 1991). It may also enhance individual professional judgements by identifying and modelling the way that participants achieve these changes on a personal as well as on a professional level (Griffiths, 1998; McTaggart, 1991).

Linking theory to practice

Kemmis and McTaggart (1988) describe action research as a way of working which links theory and practice into the one whole and implies that action research can bridge the gap between theory and practice (Gurney, 1989). Action research does not, and should not, contribute only to immediate practice but should also develop a theory to inform practice because both technical improvement and theory development are important to the fundamental change of teachers' daily practice (Winkler, 2001).

Improving practice and developing theory can be seen as "two independent yet complementary phases of the change process" (Winkler, 2001, p. 14). Although participants take part in one set of actions, in practice, they actually consist of two goals, to question and challenge the effectiveness of actions as well as value systems (Cohen et al., 2000). These challenges may lead to the emergence of conceptual conflicts between the participant's practical knowledge and beliefs, which encourages participants to seek something more

than just direct application of skill and knowledge (Winkler, 2001). McNiff (2002) argues that action research involves values that are usually valued in principle but seldom expressed in daily practice (McNiff, 2002). Action research is about finding ways to accommodate these disconnected values in practice. To do so, participants need to be reflective (Kemmis & McTaggart, 1988; Carr & Kemmis, 1986) and reflexive (Zuber-Skerritt, 1996a; Winter, 1996). Reflection enables participants to understand, interpret and improve their own practice while sharing reflection on actions allows practitioners to "improve the rationality and justice of their own social or educational practices and the situations in which these practices [were] carried out" (Kemmis & McTaggart, 1988, p. 5). The reflexive aspect of action research is a self-critical process of "becoming aware of our own perceptual biases" (Winter, 1996, p.13). This may help participants to be less biased in research and also help to link theory into practice..

Grounded theory

In order to understand and model the way the participants improve and develop, this research needed to understand the development process from the participants' perspectives. To this end, this research utilized a grounded theory methodology. Grounded theory is one of the traditions in qualitative studies (Creswell, 1998). Glaser (1992) describes grounded theory as a general methodology of analysis linked to data. Glaser and Holton (2004) explain that grounded theory is "a set of integrated conceptual hypotheses systematically generated to produce an inductive theory about a substantive area" (p. 2). Grounded theory is, therefore, not only an analysis procedure but also a methodology for conducting research.

Martin and Turner (1986) state, "Grounded theory is an inductive, theory discovery methodology that permits the researcher to develop theoretical accounts of general features of a topic while grounding the account in empirical observations or data" (p. 141) and emphasized its approach of linking data and the development of theory. Grounded theory is data-driven and embeds a special approach to theory development that enables the researcher to study data from the perspective of participants (Myers, 1997). Grounded theory is an emergent and conceptual theory generating methodology (Glaser & Holton, 2004; Glaser & Strauss, 1967) that looks at incidents to generate categories and their properties and aims at generating an emerging conceptual theory from these categories and properties (Glaser, 1978). Therefore, research employing grounded theory methodology may go "beyond existent theories and preconceived conceptual frameworks in search of new understandings of social processes in natural settings" (Hutchinson, 1988, p.123). Thus, it is a research methodology that informs not only the design of research but also the development of theory.

Grounded theory emphasizes the role of participants in developing meaning and knowledge about the environment (Strauss & Corbin, 1990). This implies that data flows from the concerns and interests of participants but not the presumed framework of the researcher (Glaser & Holton, 2004). It offers a systematic method by which to study and capture the richness and diversity of participants' personal experiences and their reflections on these experiences (Llewellyn, 1997; Glaser, 1994; Hutchinson, 1988).

Theoretical sensitivity is an important feature of grounded theory. It refers to the process of developing the researcher's ability and insight to understand the meaning of events in a research situation (Glaser, 1978). Glaser and Holton (2004)

stress that keeping theoretical sensitivity is the ability to generate concept from data and they propose two essential characteristics for the development of theoretical sensitivity:

> First, he or she must have the personal and temperamental bent to maintain analytic distance, tolerate confusion and regression while remaining open, trusting to preconscious processing and to conceptual emergence. Second, he/she must have the ability to develop theoretical insight into the area of research combined with the ability to make something of these insights. He/she must have the ability to conceptualize and organize, make abstract connections, visualize and think multivariately. The first step in gaining theoretical sensitivity is to enter the research setting with as few predetermined ideas as possible – especially logically deducted, a prior hypotheses [*sic*] (p. 11).

Since the information recording process inevitably depends very much on the interpretation of the researcher in recording categories and properties, it is important for the researcher not to hold any predetermined perspectives or agendas for the information collected (Glaser, 1992). Researchers are reminded to "absorb the data as data, to be able to step back or distance oneself from it, and then to abstractly conceptualise the data" (Glaser, 1992, p. 11). The ideas and thoughts guiding the development of categories and sub-categories should be generated through the data and literature reviewed instead of the personal pre-assumptions of the researcher.

Grounded theory "provides a bridge to seeing the same problems and processes in other areas so the researcher can further inform his[/her] theory and

develop comparative substantive theory and formal theory" (Glaser, 1992, p. 15). Grounded theory "offers predictability from the specified consequences and conditions" (Llewellyn, 1997, p. 29). Glaser (1992) claims that if a grounded theory is carefully induced from a substantive area, it can fit the realities and explain the major variations in behaviours in the study, and thus, achieve relevance.

The procedure for grounded theory analysis is systematically arranged and consists of two levels of coding, substantive and theoretical (Glaser & Holton, 2004). Substantive coding conceptualizes data from the field while theoretical coding conceptualizes the connection between substantive codes into the theory. Glaser and Holton (2004) emphasize that theoretical codes should give "integrative scope, broad pictures and a new perspective" (p. 13). By doing substantive and theoretical coding, propositions or hypothetical explanations of research issues and events are developed through the data. These propositions are used to identify and classify phenomena and incidents which emerged from the data. However, developed propositions will not become a boundary to understanding the meaning of data because they are verified continuously as other pieces of information are collected. Denzin (1970) explains that when the developed propositions do not fit new incidents and issues identified from new information, they are reformulated. Verified propositions are further developed into categories and properties, which are used to code as many individual incidents from the data as possible until reaching conceptual saturation (Glaser & Holton, 2004; Glaser, 1992). Since these categories and properties are developed from the data, they are likely to preserve the richness and diversity of information and be recorded in a way very close to the participants' perspective.

In summary, this research was based on a constructivist view, acknowledging participants as knowledge creators, and employed a qualitative paradigm to understand the participants' experience in a natural social context. It utilized action research to enable participants to take control of the research process to improve their practice. In addition, the data was analysed with grounded theory methodology in order to preserve the originality of data. Therefore, the research findings are expected to be highly relevant and practical for the participating teachers.

Research design

The study was conducted in four secondary schools in Hong Kong in which the HKSAR government has strongly promoted the use of ICT in teaching and learning since 1998. The ICT infrastructure of these schools has improved significantly since the early 2000s. Teachers have access to a wide range of ICT equipment in classrooms such as computers, LCD projectors and big-screen televisions. They were also provided with extensive ICT training opportunities. In this study, ten secondary school teachers were invited to be participants. They were experienced teachers with teaching experience ranging from 4 to 15 years. Except for one teacher who, at the time of this research was studying towards her Certificate of Education, all had received formal teacher training. Two of the participants also had a Masters degree. Participants were organized into five peer pair support groups who used peer support as a professional development tool for improving teaching with ICT.

Recognising the effect of critical reflection in helping teachers transform their beliefs about teaching, this study specifically used ongoing peer support to

help teachers learn to be self-reflective (Mezirow, 1997). The design of the study was affected by the following concerns about the participants. First, in a study of the impact of IT on teaching practice in Hong Kong, Fox and Henri (2005) found that "Teachers are extremely busy, often overloaded with administrative trivia and other busy-work. They do not have sufficient time for the reflective practices that facilitate the development of some of Fullan's key measures of the change agent" (p. 168). Having time for critical reflection on practice would be a kind of luxury for practicing teachers, especially in the Hong Kong secondary school setting. Teachers are so busy that they are unlikely to have time to engage and develop a habit of in-depth reflection. With no time and no alternative approaches to ICT integration other than a technical approach, teacher reflections on ICT integration are more likely to be shallow and focus on these types of issues.

Second, as teachers do not have time for continuous in-depth reflection, not many teachers would have made a clear and in-depth examination and evaluation of their underlying beliefs. They are likely to perform teaching practice as a skill and routine rather than informed practice and are less likely to be aware of the influence of their beliefs of teaching on daily practice. Third, as teachers usually work alone in the classroom, they are less likely to develop a broad perspective of teaching through daily collaboration with other teachers. Their personal experiences would provide them with a relatively limited range of responses to situations and contexts.

Responding to these concerns, this study employed peer support as an intervention, in an action research methodology, with the purpose of encouraging participants to (re)discover and examine their beliefs about, and perceptions of, teaching, broadening their perspectives of teaching through continuous peer

interactions, and allowing them to develop a personal research process. A focus of the research design was to enable the participants to change their perspective of ICT through working collaboratively to examine beliefs and assumptions about ICT practice that may have limited the effectiveness of their effort in using ICT (Dickson & Green, 2001; Zuber-Skerritt, 1996b; Park, 1993; Mayher, 1991; Maguire, 1987). Through active participation in this study, it was hoped that participating teachers would convert their expert knowledge in teaching into communicable knowledge that they could share with other teachers.

This study attempted to discover and understand the dynamics of the participants' involvement in the professional development activities. From the point of view of a research partner, this study explored through interviews and ongoing personal communications how teachers' interactions, actions and experiences influenced each other. Throughout the research period of sixteen months, the study looked at developmental changes, such as the teachers' perceptions, rather than focusing on understanding a snapshot of how the participating teachers used ICT in teaching. It focused on understanding the processes by which these teachers changed their perspectives and practices through cycles of action and reflection (Cohen et al., 2000).

The design of this study aimed at producing change in teaching (through peer support) as well as providing information for improving teaching (through developing a professional development model) (Garner, Bingman, Comings, Rowe, & Smith, 2001). It created a collaborative environment for the participants and me within which to develop and conduct the research. As a researcher, I initiated a research initiative and the participants put it into practice according to their needs and contexts. We worked together to continuously devise the meaning

of the research. This collaboration method is believed to increase the chance of translating the research initiative into daily practice and sustain the effect of change (Huberman, 1990).

Although the participants and I worked in the same research project, we had different social realities. Different types of knowledge and understanding about the research contexts and actions are likely to be generated from our different perspectives (Huberman, 1999). The design of this study aimed at building a rich representation of both perspectives in the research findings and creating a learning community in which we learned from each other.

This study attempted to understand how teachers' learning in ICT can be facilitated in their daily teaching practice and within their normal social setting (Cohen et al., 2000; Sherman & Webb, 1988). External interference with the participants' daily practice was kept to a minimum. For example, teaching strategies were not imposed on the participants and feedback on the participants' teaching issues was only given on request. It was hoped that this approach would improve the sustainability of beneficial changes that might occur.

The study was explorative and it did not hold any prior hypothesis on the process of the participants' development. A broad theoretical framework, which is set out in the literature review chapter, served only as an initial direction for the study and its related activities. The participants did not seek change by performing a set of pre-defined actions. Instead, they had full power to determine the most suitable actions in the research process (such as conversations, and classroom observations). Data from the study was interpreted from the teachers' perspectives. Through studying their experiences in peer support, the study looked for factors affecting professional development of ICT use.

This section has described the context and rationale of the research design. A description of research phases will be used to lay out the process of the research and is followed by a discussion of research activities, that is, peer support and the online discussion forum.

Description of research phases

In order to develop an appropriate and practical way to help the participating teachers improve their use of ICT in teaching and learning, this research was planned to have three consecutive phases of intervention over a sixteen month period: the exploratory phase, first action cycle and second action cycle. These phases were developmental, as the findings of previous phases were used to inform the development of later phases. This arrangement helped to make the research process more appropriate and useful to the participating teachers because actions emerged from the research.

In the exploratory phase, in order to build up their sense of belonging to this research, the first five teachers who agreed to participate in this research were asked to invite their own partners in their school. As they needed to describe the rationale and nature to the targeted partners, this would help them to understand the research more deeply. Also, as those partners were invited by participating teachers directly, they would feel that the research was teacher-oriented rather than academically-imposed. After inviting partners, all participating teachers attended an introductory session to develop their skills in peer support as well as setting the goals for the research. This session helped teachers to become aware

of the importance and potential benefits of peer support in developing personal knowledge of ICT integration.

During the first action cycle, the teachers participated in peer conversations with their partners. The main objective of this phase was to build up the peer relationship and extend their perspectives of ICT use. These conversations offered opportunities for understanding their own ICT practice more deeply as they had to describe and explain it to their partner. As well, they could learn from the experience of their partner. This kind of experience sharing would not stay at the surface. They could look deeper into the rationale and beliefs of their practice when they understood their partner more and developed mutual trust through ongoing conversation sessions. A voluntary online forum was set up to supplement the process of peer support. It was open to all participating teachers in this research so that they could be further exposed to different perspectives of ICT in teaching.

In the second action cycle, teachers were expected to make decisions on making some changes to their practice. Support for teachers would mainly come from their partner. Since carrying out an action was risk-taking, emotional and personal support from the partner was believed to be the most suitable support for teachers.

Research activities

Inspired by the work of Robertson (1995) on using peer partnership as professional development for principals in New Zealand schools, this research employed peer support as an intervention to support and encourage participating teachers to seek change and improvement in the use of ICT in daily teaching in

Hong Kong secondary school classrooms. Peer support in this research was conducted within schools in which peer partners might have plenty of opportunity for interactions. Furthermore, this face-to-face peer support was supported by an online discussion forum to develop a supporting network for all participants in this research.

The design of research activities was based on the belief that an in-depth exploration of personal beliefs and perspectives of ICT in teaching may help develop useful and sustainable ICT integration. Advocating teaching and learning as participation in a community of learners, Rogoff, Matusov and White (1996) argue, "instructional models are based on theoretical perspectives on learning" (p. 389). Teachers are likely to adjust their pedagogical approach by reflecting on practice, examining their beliefs and perceptions of ICT use in a peer group. Peer support in this research was designed as a structure to enhance the environment for teacher knowledge construction. It did not consist of any theoretical perspectives of instruction or pedagogical approach to using ICT in the classroom. The participating teachers determined their own strategies and practices.

The details of these two research activities are now described in turn.

Peer support

Peer support is a lifelong process that focuses on learning and linking theory and practice (Robertson, 2005). In the context of US schools, Joyce and Showers (1982) proposed using peer support as a professional development tool to help teachers to transfer knowledge into practice. As teachers usually received little support for knowledge transfer from traditional professional development

programmes, peer support helped teachers to receive feedback and support from peers (Swafford, 1998; Joyce & Showers, 1982).

Peer support "is a simple, non-threatening structure designed for peers to help each other improve instruction or learning situations" (Gottesman, 2000, p. 5). In a peer support cycle, teachers usually share their problems and concerns with their partners (for example, ICT integration) while feedback from peer partners may help them see the existing practice in a new perspective (Bereiter & Scardamalia, 1996). This external stimulation is likely to enable them to reflect on their practice by challenging their theory of practice (Robertson, 1997). Teachers seem likely to engage in a deeper reflection, critiquing the unnoticed issues rather than taking a shallow reflection on technical matters only. By looking at the underlying issues of the practice from their renewed point of view, they may possibly generate new understanding of practice.

Glickman (2002) suggested that there could be four approaches to working with teachers on classroom issues in a peer environment. First, a nondirective interpersonal approach places the control over the learning process in the hands of the teachers who seek help. The teacher develops a self-plan of actions. In this approach, the major role of the peer partner would be "an active prober or sounding board for the teacher to make his or her own decision" (Glickman, 2002, p. 42). Second, a collaborative interpersonal approach is a process in which all participants in the group propose possible actions and negotiate commonly satisfactory actions. They share information and achieve a mutual plan. For these two approaches, participants regard themselves as having equal status. The status of participants in the next two approaches is more hierarchical. In a directive-informational interpersonal approach, a supervisor or leader directs a peer teacher

to choose from a restricted choice of actions while in a directive-control interpersonal approach, a supervisor or leader defines and reinforces actions for a teacher.

To translate these approaches into action, Glickman (2002) identified several key behaviours that worked in a classroom support situation: listening, clarifying, encouraging, reflecting, presenting, problem-solving, negotiating, directing and standardizing. Reviewing literature, these behaviours can be found in different peer support models. Different models for working with teachers in the classroom seem to be a combination of these behaviours. Four commonly used and significant peer support professional development models are used for comparison in order to examine some important elements of peer support. These models are clinical supervision, peer coaching, critical friends and professional partnership (Glickman, 2002; Robertson, 1997) (see Figure 3.1).

<table>
<tr><th>Clinical supervision</th><th>Peer coaching</th><th>Critical friend</th><th>Professional partnership</th></tr>
<tr><td rowspan="2">Pre-conference</td><td>Briefing</td><td rowspan="2">Introduction</td><td rowspan="2">Contextual interview; goal setting</td></tr>
<tr><td>Pre-conference</td></tr>
<tr><td rowspan="4">Classroom observation</td><td rowspan="4">Conducting observing and analysing</td><td rowspan="2">Teachers' presentation</td><td>Observation</td></tr>
<tr><td>Teachers' presentation</td></tr>
<tr><td>Clarifying questions</td><td rowspan="2">Clarifying questions</td></tr>
<tr><td>Examination of student work samples</td></tr>
<tr><td>Analysis and interpretation</td><td>Post conference</td><td>Warm and cool feedback</td><td>Evaluative feedback</td></tr>
</table>

Post-conference		Reflection	Reflection
Critique		Debrief	

Figure 3.1: Comparison of peer-support models

Clinical supervision is a well-known and widely used structure for working with teachers (Glickman, 2002; Smyth, 1984). It usually works in some type of hierarchical relationship. It often involves a supervisor or senior teacher working with a protégé in which the supervisor has higher power to determine strategies and actions. Peer coaching is usually used by fellow teachers to "work together for a specific, predetermined purpose in order that teaching performance can be improved as well as validated" (Becker, 1996, para. 5). Its purpose emphasizes transferring training elements into daily use (Gottesman, 2000; Joyce & Showers, 1982). Critical friends is a structure in which "a trusted person who asks provocative questions, provides data to be examined through another lens, and offers critique of a person's work as a friend" (Costa & Kallick, 1993, p. 50). Lastly, facilitating professional partnership with principals in New Zealand, Robertson (2004) explains that professional partnership is to "recognise and appreciate the uniqueness of each principal's circumstance. Then, through an agreed, structured process of reflective questioning, utilise our collective capacity to assist each person reflect and deal with the various types of challenges pertaining to their daily management and leadership roles" (p. 10).

These models have similar phases of process: pre-conference, observation/examination and post-conference. The purpose of pre-conference meeting is often used to improve the communication of peer partners. Usually,

the teacher to be observed will identify the issue or problem concerned, share goals of the peer support cycle and define focus of observation or help. During peer observation/examination phase, partners take notes according to the defined focus. At post-conference, they talk about and reflect on the observation details and hopefully, achieve a plan for further action. These phases seem to enable a structured process which participating teachers can easily follow.

Comparing these models, five common elements of peer support structure can be identified. First, a goal or focus is usually defined or expressed by the teacher to be observed before the peer process. This user-defined goal or focus seems to work as a guide for peer support cycles. Second, these models show a need for peer partners to develop an in-depth understanding of each other. They seem to provide a platform to enable deeper peer dialogues and interactions. Third, a phase of observation or examination seems to be an essential element of peer support. This can be a classroom observation, an observation of a certain skill for application or a study on some kind of action plan of the observed teacher. Partners usually give feedback to the observed teachers based on these observations or examinations. They ground their conversation and feedback on facts rather than feelings. Responses and reflections are usually used to help the observed teacher to develop further actions. This may help keep the interaction less evaluative. Fourth, peer support seems to be an on-going cyclic process in which the result of the previous cycle generates new issues or focus for oncoming cycles. Finally, peer support seems to be contextualized. The peer support process builds on the participants' need and environment. These models show that practitioners may receive professional feedback in peer groups. As their partners may have similar experience and understanding of their contexts,

feedback is more likely to be a powerful source of learning because it is likely to be practical.

Apart from the five common elements described above, three major differences can also be identified from these models. First, clinical supervision often build on a hierarchical peer relationship, while the other three models recognize that the participants have equal status in the peer relationship. Although the peer partners in these three models may also offer their personal experiences and perspectives, these suggestions are not likely to be directive. Second, these models are different in their focus and desired achievement. Clinical supervision and peer coaching are more likely to work on a recognized or recently learned skill that peer partners want to apply, while critical friends and professional partnership tend to work well with exploring personal concerns for improvement. For the latter two, teachers will state a focus or a problem as a goal for cycles of peer support. However, they do not discuss how well a skill is used or what else should be improved. Instead, partners identify some details from their observation that they found different from the observed teacher's purpose of actions. The process guides the teacher to think outside their personal perspective and helps the observed teacher to fine-tune his/her actions.

Third, roles of peer partners seem to be different in these models. In the first three models, partners offer suggestions to the teacher being observed on what they have observed (Glickman, 2002). The partner will impose a personal perspective on issues observed and take a lead in reshaping practice. The professional partnership model seems to minimize the opportunity of giving personal suggestions for action. The partner offers feedback on positive elements and the areas of development (Robertson, 2005). It leaves the teacher being

observed to reflect on this feedback and take responsibility to make a plan or suggestion of action.

The discussion above of peer support as a professional development tool provides the basis for the use of peer support in this research. This research regarded peer support as a facilitation process in which the participants needed to take responsibility for their own development. The research considered that teachers were likely to struggle to relate these professional development programmes to daily practices when professional development programmes were situated outside the teachers' own context. Peer support in this research was thus contextualized in the immediate environment of participants. Robertson (2005) suggests that peer partners need support and challenge from people who work and understand their daily issues and struggles. In this research, peer partners would offer professional and emotional support, guidance, and encouragement to ensure professional growth.

In a paper introducing critical friend as a professional development, Costa and Kallick (2000) note that professionally oriented conversation is usually more in-depth than daily conversation. This suggests that peer support requires close and in-depth interactions. Good interpersonal and professional relationships seem to be the heart of successful peer support. In this research, communication skills of peer partners were believed to be essential for peer support. Participants needed to demonstrate good interpersonal communication skills in order to achieve its full potential and benefit (Robertson, 1995). The purpose of peer support was more likely to be achieved if participants were committed to building mutual trust and understanding among themselves. Through the eyes of a trusted

peer, participants were likely to recognize and understand their strengths and weaknesses of practice so as to enable critical reflection (Robertson, 2004).

This research has adopted a non-directional interpersonal approach of peer support for developing the intervention (Glickman, 2002). It was believed that peer partners should be equal in status because this research targeted experienced teachers who had already developed personal repertoires in teaching and learning. Besides, using ICT for instructional purposes is relatively new to most teachers in Hong Kong so it was unlikely that any one teacher would have particular expertise in ICT integration. Since teachers usually use ICT in the classroom alone, they seem not to have a need to negotiate a commonly agreed action-plan as a team.

Peer support offers a structure extending professional development beyond snapshot seminars and workshops to a continuous teacher development process in context (Gottesman, 2000). It provides a simple framework for conducting professional development that participants may fill with their own efforts. Once teachers learn it, they may use it routinely (Belisle, 1999). In this research, participants would be introduced as partners. Peer partners were not selected for their experiences or expertise but for developing a mutual collaborative relationship between professional colleagues.

Since peer support in this research was built on on-going reflective conversations between partners, peer partners would get together to articulate their personal goal and develop in-depth reflection and understanding of this goal through peer conversations. They would perform peer observations or examinations as a subject of conversation. Robertson (1997) emphasizes that it should be a reciprocal process of in-depth inquiry to provide the peer partners

with non-evaluative feedback and constructive discussion on a focused issue. This kind of conversation was thus used in this research to scaffold personally and professionally oriented interactions.

Peer conversation in this research was divided into several phases: listening, questioning, self-reflection, feedback and discussion (Ellinger & Bostrom, 1999; Robertson, 1995). After defining a goal for peer support, a sharer began a conversation cycle by describing what had been done or what was planned to be done. The partner would use active listening in order to encourage teachers to express themselves freely. After the sharer unfolded his/her perception of an issue, the partner would raise questions, aimed at helping the sharer to clarify his/her actions, purposes and perspectives of the issue and encourage reflection on his/her underlying reasoning (Robertson, 1999). These probing questions needed to be non-evaluative and provide "opportunities for the questioned person to explore his or her knowledge, skills, experiences, attitudes, beliefs, and values" (Robertson, 1995, p. 91). This was more likely to expand and extend the sharer's thinking from different angles and perspectives (Barnett, 1995; Lee & Barnett, 1994).

This research recognized that giving feedback should be a cautious process. It needed to be positive and non-evaluative in tone and wording (Bowman & McCormick, 2000). Participants would be reminded not to break into discussion during reflection and feedback; otherwise the conversation would easily be sidetracked and prolonged. Discussion would follow only if both partners felt comfortable. This structure seemed to help to keep the professional conversation focused and concise as well as extend their perspectives on the issue in focus (Robertson, 1995).

Online forum

Physical constraints (such as, time and geographic distance) may limit teacher's access to other professionals and resources. Although Hong Kong does not cover a large area, the participating teachers were physically and practically separated because of the location of schools and daily busyness in teaching schedule. However, teachers in Hong Kong are usually highly accessible by Internet in the school or at home. An online discussion forum was thought to be a potentially helpful approach to support professional development in this research.

This research used an online asynchronous discussion forum to supplement the peer support group process. This online forum was moderated and intended to help the participating teachers focus on exchanging, comparing and analysing ideas in ICT integration and sharing concerns and experiences. Access to the forum was limited the research participants so as to provide a safe and private environment. The forum was a self-paced and voluntary participation platform, in which participants could post questions, provide feedback and comments over time. It was employed as a medium to build and maintain professional relationships between participants in different peer groups so as to enhance their accessibility to other teachers and ideas (Agre, 2002). It was intended to extend peer groups to a wider community and alternative learning opportunities.

Research validity

Validity is one of the main areas of criticism of qualitative research (Angen, 2000). Smith (1984) contends that the basic epistemological and ontological assumptions

of quantitative and qualitative research are incompatible, and, therefore, the concepts of reliability and validity in quantitative research should not be applied to qualitative research. The validity of qualitative research should refer to "qualitative research that is plausible, credible, trustworthy, and, therefore, defensible" (Johnson, 1998) and refers to the trustworthiness of qualitative research (Pulkkinen, 2003). Trustworthiness refers to the ability to persuade audiences of qualitative research that its findings are "worth paying attention to, worth taking account of" (Lincoln & Guba, 1985, p. 290). According to Johnson (1998), there are four types of validity, which may affect the trustworthiness of qualitative research. First, descriptive validity refers to the accurate reporting of descriptive information. Second, echoing qualitative research's obligation to understand the inner world of participants, interpretative validity refers to the accurate interpretation of participants' viewpoints, thoughts, feelings, intentions, and experiences. Third, theoretical validity is the degree to which a theoretical explanation developed from the research can explain the data. Johnson (1998) suggests that the "final explanation should accurately reflect the majority of the people in [a] research study" (para. 12). Lastly, internal validity refers to the strength of the researcher's justification of causal relationships.

To promote qualitative research validity, Johnson (1998) suggests several strategies and some of these were employed based on their applicability in this study. First, this research employed a reflexive approach to minimize biases. Reflexivity is a form of self-awareness in searching for knowledge in practice (Giddens, 1993). It does not place emphasis on discovering the external truth but on making the perception of truth clearer through encountering the environment (Gouldner, 1971). As a qualitative researcher is often 'immersed' in the research

process (Firestone, 1987), the research process is inevitably affected by interactions of the researcher with participants. Employing a reflexive approach means that the researcher attempts to control biases by actively engaging in critical self-reflection on potential sources of bias; for example, personal background (Parker, 1999). In this research, I engaged in cycles of reflection, questioning my own participation in the research process as well as my personal values, beliefs, interests, perceptions and knowledge about the research and participants (Willig, 2001). This approach helped me to remain open-minded, not taking a definite position to understand the research process.

Even when trying to keep an open attitude, personal pre-conceptions may inevitably affect the understanding and explanation of data. Negative case sampling was used as a second strategy to maintain the validity of this research (Johnson, 1998). I deliberately and carefully discovered evidence from data to disconfirm my own pre-conceptions. This helped me to keep a focus on developing concepts from data rather than on explaining data with my pre-conceptions.

Third, triangulation was used in this research. Although triangulation was first used in quantitative methodology, it was adopted and advocated by Denzin (1970) to increase the validity of social research. Relying on a single method of data collection may possibly limit the researchers' viewpoint (Cohen et al., 2000). Triangulation provides a process of data collection with different methods or from different sources in order to establish linkages and create a whole picture, which is supported by the data and information collected (Cohen et al., 2000; Eisner, 1979). It is often used as a way to study and understand differences in data, and thus it may help to highlight the richness and complexity of the data collected by

studying it from more than one standpoint (Cohen et al., 2000; Patton, 1990). Although a single data collecting method was used in this research, that is interviewing, data was collected from interviews at different times. By using a time triangulation method (Denzin, 1970), the effect of social and contextual change on data in this research is likely to be identified (Cohen et al., 2000). Since this research was a longitudinal study, data was collected and analysed continuously over time. Data collected at different times was compared in order to identify consistency or change over time. Emerging issues or patterns of behaviour were then likely to be identified. This research also applied space triangulation (Denzin, 1970) to overcome the limitation of data coming from one subculture. This research invited participants from different schools in different districts in Hong Kong so as to avoid subculture from a single school having a dominant influence on data collected. In addition, data was collected in different settings. Apart from individual interviews, participants were also interviewed in pairs. The interaction of pair interviews may provide a different perspective on the data.

Fourth, interview transcriptions and analysis summaries were sent to participants. Their feedback was used to cross check the interpretation of the participants' viewpoints. Findings of this research are presented in the form of direct quotations from interviews in order to help reflect the participants' intended meaning accurately.

As the perspective of a researcher may possibly exert bias on data interpretation, this research also adopted a grounded theory approach to generate propositions from data to minimize potential bias. Glaser (1992) argues that "grounded theory has several methods which reduce and forestall this bias in large

measure, such as constant comparison" (p. 14). Constant comparison means that data are compared and contrasted until all similarities and differences are identified (Llewellyn, 1997). By using constant comparisons in this research, data was broken into social incidents and facts, which were then coded into categories. Once new incidents or facts were added from another interview, they were compared with those already coded in the categories to find if there are any irregularities and contradictions (Cohen et al., 2000). Categories and properties were reformulated if necessary. This process was repeated until all incidents had been coded. Since such a comparison method may handle data from across situations, time and sources, it "resonates with the methodological notion of triangulation" (Cohen et al., 2000, p. 151).

Data collection - interviewing

This research was a qualitative research study. The data collection process was designed to collect information about the professional, social and personal aspects of the participants. Since the research looked at the attitudinal change of participants in their use of peer support as a professional development tool, it was appropriate to explore from the perspective of participants and therefore interviewing was chosen as the means of data collection (Frankel & Devers, 2000; Drew, Hardman, & Hart, 1996; Miles & Huberman, 1994). As this research applied a grounded theory approach to analyse the participants' perspective of teaching with ICT, interviewing was considered to be a suitable way to explore their beliefs more deeply.

Bogdan and Biklen (1982) describe interviewing as a "purposeful conversation" (p. 135) in which the participants use natural language to express

themselves so that in-depth information can be gathered directly from the participants' own words (Burns, 2000; Cohen et al., 2000; Johnson & Christensen, 2000). Hutchinson (1988) said, "[interviewing] permits researchers to verify, clarify, or alter what they thought happened, to achieve a full understanding of an incident, and to take into account the 'lived' experience of participants" (p. 125). Utilising in-depth interviews may help discover the participants' perceptions, opinions, beliefs and attitudes and illuminate some unfamiliar aspects of the research (Lee, 1999; Drew et al., 1996).

Rubin and Rubin (1995) describe interviewing as a "flexible, iterative, and continuous" (p. 43) method of data collection, by which interviewers may probe deeper questions and prompt participants to clarify their responses in detail (Johnson & Christensen, 2000; Best & Kahn, 1993; Bogdan & Biklen, 1982). Through cycles of questioning, responding, following-up and clarification, a researcher may also sort out the commonality and uniqueness of the participants' responses (Rubin & Rubin, 1995).

Interviewing is usually interactive so that the process is less likely to be completely neutral. Thus, interviewers need to be aware of the participant's beliefs, needs and interests, and actively ask for clarification or raise follow-up questions to explore issues more deeply (Burns, 2000; Rubin & Rubin, 1995). Apart from asking clear open-ended questions for detail information, interviewers should also ask questions to confirm and disconfirm meanings to avoid misinterpretation (Berry, 1999). The role of interviewers is to guide, listen and help participants to articulate their lived experiences. Furthermore, Burns (2000) reminds interviewers to be aware of non-verbal signals during interviews, which are likely to show something more than verbal language.

Interviewing is a very personal way to collect information from the inner world of participants (Johnson & Christensen, 2000; Drew et al., 1996). Participants are likely to open and expose themselves to outsiders when they participate in interviews. This process can be unpleasant and stressful for some participants, therefore they may feel hesitant about this form of data collection. Interviewers are thus advised to build a partnership relationship of trust and rapport with participants and make the interviewing atmosphere easy and comfortable for participants (Johnson & Christensen, 2000; Rubin & Rubin, 1995; Bogdan & Biklen, 1982). Burns (2000) emphasizes the need within this partnership relationship for "displaying empathy and acceptance, conveying respect and creating an ethos of trust" (p. 427). As well, Rubin and Rubin (1995) suggest that interviewer and interviewee should be conversation partners. Through ongoing communications and conversations, the researcher may establish rapport with participants. This personal relationship and mutual trust is likely to lessen their negative emotions. Participants may then be more willing to speak candidly in the process of data collection.

As qualitative research work with people, it was important to have a high standard of ethical consideration to protect the participants from potential harm. In this research, the data collecting process began only after written consent from participants was granted (Cohen et al., 2000) (see appendix one and two). The purpose and process of the research and the use of data was fully explained to the participants. They were also given a written research consent form attached with a cover sheet describing the details and issues of the research. Aware of the busy working schedule of teachers in Hong Kong secondary schools, the data collection process aimed to ensure that they spent minimal time. Apart from participating in

three cycles of interviews and attending a voluntary online discussion forum, they would not be requested to provide any form of written report or information. Fink (2000) reminds us that anonymity is an ethical issue in qualitative research. As participants might express personal feelings and concerns, it was the responsibility of the researcher to maintain the anonymity of all participants in every situation.

Since this research was designed for exploring personal improvement and change in professional development, it was important to understand the teachers' attitudes and perspectives of change in using ICT. This research recognizes that only the participants themselves could wholly understand their realities (Burns, 2000). An open-ended interviewing approach was thus employed to capture their views. Open-ended interviewing might help the interviewer to understand how participants perceive the use of ICT in education. As shared understanding of words and ideas was important in understanding participants' perspectives and concerns, the participants were asked to clarify the meaning of responses where needed.

There were three formal interviews scheduled for individual participants in this research: at the beginning, middle and end of the research period. Each interview lasted for about an hour. The interview topic and open-ended questions were carefully devised from the research questions and literature reviewed. Unstructured and semi-structured interviewing methods were both utilized. Although these interviews were explicitly designed, the atmosphere was kept as informal and relaxed as possible. The time and venue for interviewing were chosen by participants so that they may feel some kind of control over the interviewing process. However, they would be reminded to choose a time and

place that might not be interrupted. All interviews were tape-recorded to allow me to stay concentrated on the flow of interview and to probe for further in-depth responses.

In the first interview, I employed an unstructured interviewing approach (Burns, 2000). This was used to obtain a holistic understanding of the participating teachers' perspective of using ICT. Since the interview was spontaneous and loosely structured, it was flexible and explorative and aimed at understanding the beliefs and perspectives of participants to establish baseline information (Cohen et al., 2000; Johnson & Christensen, 2000; Bogdan & Biklen, 1982). However, Burns (2000) reminds us that it may be subtle for an interviewer to keep track of focus as well as to give freedom for participants to express themselves. Although the interview was guided by a topic, the focus of the interview was on sharing the interviewees' experiences. Interviewees had considerable control over the content, tempo and pace of the interviews (Kvale, 1996).

An unstructured interview was guided minimally to ensure the focus of interview topic (Burns, 2000). In this research, initial interview questions were only used to show a direction for participants to begin the conversation, while more questions would be developed during the interview to follow up the interviewee's ideas (see appendix three). Leading questions would be avoided (Herman & Bentley, 1993). However, questions on an issue might be asked repeatedly, if necessary, in different ways to probe for in-depth responses in order to get a better understanding of the beliefs and assumptions of the participant. This might help interviewees to explore their ideas thoroughly (Rubin & Rubin, 1995). As well, this strategy was also an opportunity to identify the consistency

or inconsistency of participants' responses (Herman & Bentley, 1993). On the other hand, the way interviewees presented their ideas and responses would be observed as some less obvious aspects of their views might thus be noticed (Cohen et al., 2000; Bogdan & Biklen, 1982).

The second and third interviews employed a semi-structured interview approach to gain further in-depth information (Burns, 2000; Mills, DeMarco, & Welch, 2000). The interviews were guided by some specific open-ended questions about some interesting issues which emerged from the previous interview and during the intervention (Burns, 2000; Bogdan & Biklen, 1982). These guiding questions were used as a protocol of the interview (see appendix four and five). Having an interview protocol and using semi-structured interview questions allowed for a degree of comparable data across participants (Cohen et al., 2000; Patton, 1990; Bogdan & Biklen, 1982). A basic checklist was prepared to make sure that all relevant issues were covered during interviews. However, the actual conversation would not necessarily follow an exact sequence and wording (Johnson & Christensen, 2000). A specific area of interest from participants could be explored deeply while still preserving greater flexibility and freedom for participants to express new ideas (Burns, 2000).

Apart from exploring issues of interest that came up from the first few months of intervention, the second and third interviews also served some emerging purposes. As the second interview was conducted in the middle of the research period, it was an opportunity for a brief evaluation of the process of intervention. For example, as needs for reviewing of research were identified during the process, the second interview cycle was likely to be a good opportunity for an interim review of the intervention as a whole. It was likely to help

participants see the strengths and/or weaknesses of the research intervention as well as remind them of the linkage between the intervention and research purpose. At the end of the research period, the third interview served to check the reliability of data collected in the first and second interviews. Some questions about comparing situations before and after the research were asked so as to validate any change of attitudes and behaviours observed. It was conducted in two parts, individual interviews and peer partners (the two partners in a peer group) conference.

Grounded theory data analysis

This research used a grounded theory approach to analyse the information gathered from in-depth interviews in order to emphasize "the role of human actors in shaping and giving meaning to the world around them, stressing the interrelationships among conditions, meaning, and action" (Mills et al., 2000, p. 36). Grounded theory analysis is utilized to find underlying structure and mechanism from the data (Robson, 2002). To utilize this data analysis method, all information was transcribed into text so it could be coded. Coding was the initial phase of grounded theory data analysis for summarising, synthesising and sorting data collected (Charmaz, 1994). It is a prolonged process. The data had to be re-read many times before major themes could be identified (Burns, 2000). Open coding, axial coding and selective coding were used in this research (Strauss & Corbin, 1990).

Open coding was employed to enable me to look for what could be defined and discovered in the data (Charmaz, 1994). At the initial stage, all data was studied in detail and was broken into incidents or facts. These discrete units

could be a sentence or a paragraph. These incidents were coded into as many categories as possible, which were generated from collected information using open coding procedure. For example:

- Similar ideology;
- Personality influences; and
- External pressure on decision-making.

Robson (2002) notes that using pre-determined coding categories is against the spirit of grounded theory. The data in this study would be studied in detail to identify substantive codes emergent within the data. Substantive codes, in this sense, refer to a phenomenon that was thought significant to participants (Borowski, 2002). Since this coding method would pull the discrete research incidents together and develop some kinds of linkage, these provisional coding categories would be carefully defined and established, as Llewellyn (1997) noted that they need to be internally consistent and mutually exclusive.

Since raw research data would usually appear as a mess, not clearly organized and structured, a researcher needed to apply his/her expertise and experience in understanding the participant as well as organisation skill to sort them out (Charmaz, 1994). However, personal bias and attitude would possibly have some influence on the interpretation (Robson, 2002). Therefore, I maintained an open attitude and kept theoretical sensitivity, the awareness of subtle meanings of data, by looking at the data in every possible way during the coding process, as Glaser and Holton (2004) suggested. Open coding was used as "interpreting rather than summarizing" (Robson, 2002, p. 494). It provided a big picture of this research in the early stage of analysis. During open coding, it might possibly suggest some questions or issues that indicated the concerns of

participants and be valuable for further exploration in the following interviews (Burns, 2000). Therefore, it began as soon as information was collected.

During the coding process, provisional categories would be continuously re-examined through a constant comparison method. Incidents being coded were repeatedly compared with new incidents and new categories would emerge to replace the old and non-applicable concepts (Cohen et al., 2000; Glaser, 1994, 1992; Glaser & Strauss, 1967). At this stage, the focus was kept on the characteristics and nature of incidents, as Glaser (1992) recommends that the research should constantly ask "What category or property of a category does this incident indicate?" (p. 19). This focus would help to define suitable categories and generate appropriate properties (Llewellyn, 1997; Glaser, 1994).

After provisional categories were developed in the open coding process, axial coding or theoretical coding was utilized as a strategy to elaborate and build connections between these categories (Kerlin, 2002; Llewellyn, 1997). For example:

- Teachers used ICT as complement to their own teaching styles;
- Individual support and help were perceived useful; and
- Teachers became more reflective on ICT issues.

These connections (or conceptual codes) were an essential relationship between the data and theory. They gave "a condensed, abstract view with scope of the data that includes otherwise seemingly disparate phenomenon" (Glaser & Holton, 2004, p. 13). Theoretically oriented questions would be continuously asked of the data and provisional categories, and were focused on identifying causal connections, strategies, actions, context, and consequences that emerged (Kerlin, 2002;

Llewellyn, 1997). These questions were also with reference to literature reviewed so that the connections could be theoretically informed (Strauss & Corbin, 1990). In the process of axial coding, substantive codes were designated to meaningful units to represent emerged concepts (Llewellyn, 1997), or theoretical hypotheses (Glaser & Holton, 2004).

The result of axial coding was to suggest hypotheses linkages among the substantive codes, and to develop possible theoretical coding so as to strengthen the theoretical framework underpinning the analysis (Kerlin, 2002). For example:

- The teachers' decision on using ICT was affected by their perception of technical issues; and
- Peer support enabled teachers to broaden their perspective of ICT integration.

The data would be continuously coded into these theoretical codes until a core variable had emerged through saturation (Glaser & Holton, 2004). For example:

- Teachers' attitudes and perceptions on ICT integration have significant effect on their decision of using ICT; and
- Peer support provided the teachers new experiences of collaboration supporting personal and emotional needs of ICT integration.

These core variables explained the main concern of the data. It means that this core concern reoccurs frequently in the data and relates to other categories meaningfully.

Finally, selective coding was used to develop a structural relationship between categories and the core variable (Kerlin, 2002). Some core variables were chosen as core to relate to other categories systemically with reference to

literature and the hypothesized connections developed were subsequently validated by re-examining the empirical data so as to develop a central concept of the study (Llewellyn, 1997). That is, a personal nature of ICT integration. Finally, by elaborating this central concept, a theory has been formulated (Strauss & Corbin, 1990).

Summary

This research was an action research study in which I, as the researcher, and the participants worked collaboratively to search for improvement in integrating ICT in the participants' daily teaching. Through the research activities, i.e. peer support group and online discussion forum, I aimed at enabling the participants to examine their underlying beliefs and perceptions of teaching and learning so as to help them go beyond their restraints and achieve a shift in their teaching paradigm. Experiences from their participation in peer support provided evidence from which to develop a professional development model which informed the changes of personal attitude towards ICT use. The research was not conducted with an inflexible and predetermined blueprint. Instead, the research started only with tentative research questions, which could be re-formulated if necessary as the research developed.

The research employed a qualitative research paradigm to capture the richness of lived experience in the participants' natural context, so as to understand the development and emergence of actions through the participants' perspectives. The information for the research was collected through several interviews and continuous online discussions. This information was analysed by the grounded theory analysis method, and thus, the theoretical explanation of

issues which arose was based on data collected. This research is valid and reliable not in the same sense as quantitative research, but because of the plausible, credible, trustworthy, and defensible nature of qualitative research. Triangulation methods were utilized to increase the validity and reliability of this research. In the following chapter, the research process is recorded in detail.

CHAPTER FOUR: THE RESEARCH PROCESS

This chapter describes the process of the research. First, a chronology of the research process is listed to show the progress of the research from the beginning to completion. This is followed by a description of the different phases of the research.

Chronology

2002-2003: Research design phase

- reviewing the literature began
- developing research design

2003-2004: Action research phase

January (2003): Invitation of participants

- approaching target teachers
- teachers invited partners

February: First data collection (conducted in Hong Kong)

- first individual interviews - baseline information
- introductory session to peer support

March-November: Initial analysis and peer support process began

- peer groups began
- online forum began
- SARS outbreak

- continuous personal contact with teachers
- transcribing the first interviews began
- interview summary was sent to participants
- open coding began – developing substantive codes
- axial coding began – developing provisional propositions

November: Second data collection (conducted in Hong Kong)

- second individual interviews / reflection
- reviewing peer groups' progress

December-June (2004) : Initial analysis and peer support process continued

- peer groups continued
- transcribing the second interviews began
- teachers working independently in peer groups
- online forum terminated
- continuous personal contact with teachers
- interview summary was sent to participants for review
- open coding continued – refining substantive codes
- axial coding continued – refining propositions

June: Third data collection (conducted in Hong Kong)

- third individual interviews
- peer group conferences

July- December: Initial analysis continued

- transcribing the third interviews began
- interview summary was sent to participants for review
- open coding continued – refining substantive codes
- axial coding continued – developing propositions theoretical codes; core variable identified

2005-2006: Analysis and writing phase

- developing theoretical codes
- identifying core variables
- summary of emergent issues was sent to teachers
- selective coding – developing story-line linked to core variable
- developing model
- writing up thesis
- thesis submitted

The following sections describe the above phases of research in detail.

Research design phase

At the end of 2002, a preliminary literature review was developed after reviewing two bodies of literature especially concerning ICT in education and the professional development of teachers. In light of the literature and personal experiences in the use of ICT, a decision was made to try and develop a professional development model in using ICT for secondary school teachers in Hong Kong by studying the process of change mediated by peer support.

Influenced by a previous study using professional partnership for New Zealand principals (Robertson, 1997), the research was designed to utilize peer support as a professional development tool for ICT integration. Model development was built on the experiences of peer support groups who explored the use of peer support as a professional development means of improving ICT integration in their contexts. I critically reflected on these data as well as my experiences in facilitating these groups in order to inform the development of a new model.

In order to look for underlying issues that governed the teachers' behaviours and practice, the research was designed to allow me to work closely, interact and negotiate actively with participants over an extended period of time, that is, sixteen months (Burns, 2000; Cohen et al., 2000; Johnson & Christensen, 2000; Popkewitz, 1984). This approach enabled me to capture their perspectives and feelings so as to understand, interpret and analyse emerging issues from their viewpoint (Angen, 2000; Drew et al., 1996). Thus, the emerging theoretical explanation did not depend on explaining any single factor but focused on the full complexity of human-context interaction (Myers, 1997).

Action research phases

This section records the process and progress of putting the research design into action. It also logs the rationale and important issues of each cycle of the action research process. Implementation of research activities, that is, peer support and online discussion forum are described in turn.

Peer support

Peer support in this research focused on ongoing interactions and mutual support between professionals. Since the participants in this research had little or no experience of peer support and they were extremely busy with their daily teaching and administrative work, the structure of peer support used in this research was very simple and flexible. The peer group was simple as it consisted of only two partners who worked at the same school. This structure was believed to be efficient because peer partners did not need to spend much time arranging peer support sessions. With a minimum number of partners, it was easier for peer partners to develop a close relationship. The nature of peer support was flexible, as the five peer groups were not required to have the same progress and same peer-support activities. Although all peer groups began with peer conversations on using ICT in teaching, they subsequently generated their own direction of peer support in practice, setting their own goals and selecting the issues for peer conversations. For example, one peer group re-modified their focus of conversation to talk about teaching incorporating ICT while another group researched the effect of peer dialogue on expanding ideas in teaching using ICT. This study allowed the participants to adjust their level of involvement in peer support as the process went on. In this study, participants, rather than me, were the controller of the research process.

The simple and flexible structure of peer support was demonstrated by the process of peer group formation and development of peer support.

The formation of peer support groups

This research proceeded to the action research phase in early 2003. As action research, the participants were involved in both planning and implementing the project. They were invited to participate in the process of selecting participants. Eventually, ten teachers in four Hong Kong secondary schools accepted the invitation to participate in this research. In this section, the selection criteria and the selection of research groups are described.

Selection criteria

In January 2003, targeted teachers were approached. They were specifically selected either because of personal connection or being nominated by a teacher who was already selected. The following criteria were considered when the participant group was selected:

- size of the research group;
- focus on secondary school teachers;
- peer partner in the same school;
- curriculum subject;
- choice of partner;
- gender.

Size of research group

This research and all interviews were conducted in Hong Kong while the rest of work was completed in New Zealand. Considering the physical separation of the researcher and the research group and its impact on frequency of communication, as well as the amount of interviewing information to analyse, the size of the

research group had to be kept small. However, a diverse group of teachers participating in the research group was important to the research so that the findings could be grounded in a wide range of teacher experiences. Finally, ten teachers arranged in five peer groups were selected. This number of participants was believed to provide enough diversity to offer a degree of anonymity to protect the privacy of the participants.

Focus on secondary school teachers

This research focused on the use of ICT by secondary school teachers in Hong Kong partly because of my personal association to secondary schools in Hong Kong. My ten years teaching experience provided a rich base of experience and knowledge of teaching and learning in Hong Kong secondary schools, as well as personal connections to schools and teachers. Another reason was that secondary schools in Hong Kong have been given more resources to develop the use of ICT in teaching than primary schools at the time this study began. The constraint of resource was believed to be relatively low. At the time the research started, all the schools of the participating teachers already had broadband Internet connection, computer laboratories, digital LCD projectors/big screen televisions and computers for use in the classroom. There were enough computers for each teacher and they were located either on the teachers' desk or at the staff-only computer room. One of the participating teachers stated that teachers in his school could choose from having a desktop computer or a laptop computer in accordance with their own preference. At the time of the research, all the participating teachers had attained intermediate ICT training (IIT). They had learned basic operations of computers and peripheral equipment as well as the use

of some mainstream software such as word-processing, presentation, spreadsheet, Internet browsing and basic Web design. This provided them the necessary technical skills to work with ICT.

Peer partner in the same school

Proximity was a priority when matching participants for this research because having geographical closeness as well as a similar working background would be a favourable factor for starting partnership relationships (Janas, 1996). Considering the busy working routine of teachers in schools and the time that the participants had to commit to interaction with peer partners, peer partners in this research were formed only with teachers from the same school. This arrangement ensured that they would have already had a certain level of relationship and basic understanding of each other's working situation. This pre-existing relationship would be a favourable factor for the participants to start a peer partnership (Marshall et al., 1998). As well, teachers did not need to take time to travel around to meet their partners. It was believed that this would encourage frequent interactions between partners.

Choice of partner

When targeted teachers accepted the invitation to take part in this study, the options for inviting a partner to form a peer support group was discussed. As Robertson (1995) has demonstrated, participants' ability to choose their partners has a big influence on their involvement in peer support. Teachers who were already selected were therefore free to choose their partner. It was believed that this would enhance the development of a peer group.

Curriculum subject

Secondary schools in Hong Kong are divided into subject departments. Some subject departments are small and they consist of only one or two teachers. Teachers in these departments would have problems in choosing peer partners of the same subject. Therefore, there was no requirement for teachers to choose a partner of the same subject. To increase the diversity of participants, I approached teachers of different subjects. In the end, all peer groups consisted of teachers from different subjects except one group. This provided an opportunity for this research to look into the effect of different subject combinations on peer support. Besides, peer partners from different disciplines, as discussed in the literature above, are more likely to focus on pedagogy rather than the content.

Gender

The research did not place any limitation on the gender of participating teachers. Teachers of both genders were approached in the initial invitation. Finally, five males and five females agreed to participate in the research. With the exception of one group, all peer groups were formed with same gender partners.

Selection of research group

Initial targeted teachers were selected through my own personal connection. They were briefed by telephone about the purpose of the research and how the research could benefit them. When teachers agreed to participate in the research, the process of the research and the importance of their commitment to the result of the research were explained. Options in choosing a partner were also discussed.

Teachers were given the freedom to choose a partner with whom they felt comfortable to work with. Teachers were asked to approach their targeted partners in their school and to ask for permission for me to contact them directly. Then I contacted the invited partner and explained the research in detail.

Finally, five peer groups with five males and five females were formed. The five groups were from four different schools located in different parts of Hong Kong: the Hong Kong Island, Kowloon, North-west New Territories and North-east New Territories. Three of the schools had a religious background while the fourth was run by local cultural community. The history of these schools ranged from over 60 years to less than five years. The four schools were of a similar size, ranging from 25-35 classes. The teachers came from different curriculum subject backgrounds, including Chinese, Biology, Mathematics, Geography, Computer Studies and Putunghua. Their teaching experience also ranged from four years to over 15 years.

The process of inviting participants was not smooth. Only five out of the ten teachers initially approached showed interest in the research. Three of the already selected teachers had no problem in inviting a partner. They successfully invited a partner in less than a week. The other two teachers had to approach different teachers and it finally took them more than three weeks to form their peer groups.

Peer support process

Peer support required peer partners to have in-depth and professional interactions. Robertson (1997) highlighted the importance of contextual interviewing as a foundation of effective communication for peer support. Before the peer support

process began, the participants in this study were asked to conduct a similar open and in-depth session for self-introduction with their peer partner. It was believed to be able to enable a relationship by understanding the background and interests of each other as well as expanding their knowledge about each other's perspective. However, it was noticed that the peer support groups did not usually have a thorough session of self-introduction. Since teachers had selected their partners, they tended to choose a colleague with whom they had a good relationship and this affected their perception of the need for such a session. Nevertheless, developing a professional and trusting relationship was not developed through one session. The study noted that they gradually increased their mutual understanding as they discovered new aspects of their partners through continuous professional interactions.

Professional conversation was a vital process of peer support in this study. It was a reciprocal process of in-depth inquiry to provide peer partner with non-evaluative feedback and constructive discussion on a focused issue. Although the participants were encouraged to recognize their needs and develop a comfortable peer support process, they were encouraged to use techniques such as active listening, reflective questioning, self-reflection, and positive feedback. This was especially relevant in the beginning stage, when they were still relatively unfamiliar with peer conversation. Essentially, they were encouraged to look at things from their partner's perspective and to maintain a positive and non-evaluative attitude. In this study, peer partners usually set a learning goal for conversations although these goals were often vague and unclear. They had peer conversations in various forms, such as studying teaching material, classroom

observation, or examining teaching idea. The form of conversation was chosen to meet their needs and desires.

Disruption to peer process

In March 2003, the peer groups were about to start after the introduction sessions and the first round of interviews. Unfortunately, the Severe Acute Respiratory Syndrome (SARS) attacked Hong Kong at that time. It spread quickly and schools' operation was affected. During the affected period, the participating teachers were engaged in extra duties related to the SARS issue, especially those who were in administration positions. School hours were shortened because of the SARS issue. Teachers and students had to leave the school after the morning sessions for the school to be cleaned. Under such situations, peer groups found it difficult to set aside a definite time for a peer session in advance and thus they opted to have informal peer sessions instead of formal sessions. Besides, time for peer conversation was very limited. Meeting time for a peer session was often short, usually 15-25 minutes only. The interruption had a great influence on the development of the peer groups, and as a result the research schedule was greatly interrupted. This influence is discussed later in the chapters on the research findings.

Constraints to online discussion forum

The participants ran peer groups separately. They did not have the opportunity to meet research participants of other peer groups. To enhance the support for the participants, an online discussion forum was set up to enable interactions across peer groups. An asynchronous discussion forum was established on the platform

of ClassForum which was managed by the University of Waikato. The interface of the forum was user friendly. The participants would receive an email notice when new postings were added. It was a closed platform and the access to the forum was protected by password in order to preserve privacy of discussion. Because of its asynchronous nature, participants could have control over the time to access the forum. They could retrieve any postings and make contributions at any time. The forum consisted of two parts. The first part contained useful information about peer support such as the introduction of the research and guidelines for peer conversation. This information was linked to the welcome page of the forum so that they could read the information at any time when they logged onto the forum. The second part of the forum was a discussion area.

Before the forum began, the participants were asked to choose their username and password so that they could remember it easily. Login details, together with guidelines for using ClassForum, were then sent to them individually by email. In order to make the forum operate as a "real" environment, participation was voluntary. The forum began with a socialisation process (Campbell, 2001). The participants were invited to write a paragraph to introduce themselves to the whole group. To be a participant in the forum and as an example for other participants, I posted the first self-introduction to the forum. However, the participants did not respond to this process actively. Although several ways had been tried to encourage their participation in the forum, such as through email and telephone, not all participants had posted their self-introduction before the forum was terminated.

Although some participants had tried to raise discussion issues, discussion died down because of lack of responses. After several attempts to increase

participation, I decided to terminate the forum after the second interview. The teachers' feedback showed that they were not ready to participate in an online forum. The teachers' review of their participation in discussion forum is discussed in the chapter on findings.

Data collection

This research used mainly interviews as data collection method. Through multiple interviews throughout the research period, information was collected about the participating teachers' perspective of ICT in teaching and its changes over time. This section records progress and issues during data collection.

First interview and introductory session

In late February 2003, the first data collection process began. It was the start of the second semester for schools in Hong Kong, after the Chinese New Year holiday. In the middle of an academic year, teachers were usually relatively free from busyness of house-keeping duties, and the pressure of external examination. This time was chosen because teachers would be more likely to be able to spare time to attend an introductory session about peer support and an individual interview.

An individual interview was conducted at a time and place chosen by each teacher to suit their schedule. Most interviews were conducted at the teacher's school, although some chose their home or an outdoor location. The first interview opted to collect some baseline information. It was an unstructured interview that provided information for me to understand the teachers' personal

background, beliefs and attitudes to the use of ICT in teaching. For example, teachers were asked:

- In what ways do you use ICT in the classroom?
- What is the purpose of using ICT in the classroom? How can you achieve it?

Instead of recording the participants' response passively, I played an active role to prompt teachers to explain their meanings further and to share their experience in detail.

An introductory session to peer support was arranged after the first interview so it would not affect the collection of base-line information. Foreseeing the difficulty of gathering all ten teachers who were from different parts of Hong Kong, introductory sessions were conducted separately with each peer group. For the participants' convenience, introductory sessions were held at the participants' school. Each session lasted for about two hours. Apart from introducing the framework of peer support and its potential benefits to improve the use of ICT in teaching, the session covered communication skills that enabled the development of peer support groups such as active listening, questioning and giving positive feedback (Robertson, 1995). Processes and options for developing a peer group that fitted comfortably with participants such as the frequency and focus of their peer sessions were also discussed. To help develop the peer support process, teachers were asked to have a formal peer session of self-introduction. Peer groups were responsible for setting their own schedule of peer sessions. It was, however, suggested that they had regular sessions of about 30-45 minutes.

Since the study involved the teachers' personal feelings and relationship with a peer partner, ethical issues were discussed during the introductory session.

The teachers were reassured that they did not need to report the content of their peer conversations to me, and their privacy was respected. At the time the teachers agreed to participate in this research, an email that listed the ethical concerns had been sent to them for their reference. A formal consent form (see Appendix one) with a covering letter explaining the research design and the participant's rights and commitments was given to and signed by individual participants during the first interview.

Second interview

The second round of interviews was conducted in November 2003, in the middle of the first semester of the 2003/2004 academic year. After the rush at the beginning of the academic year, teachers might have some free time in late November before they started preparing for the first term examination in December. The second interview served two purposes. It collected information about the process of peer group development and worked as a teacher reflection on the development of peer support. I understood that the participating teachers had not had many opportunities to have peer sessions because of the disruption of SARS. Part of the second interview was conducted using the framework of peer conversation so as to remind the teachers of the framework as well as providing an opportunity to enhance their skills of peer conversation. Teachers were asked to reflect on three issues: the peer support, the use of ICT in teaching, and the use of the online forum.

Apart from the interview, I took time to discuss with individual teachers fine-tuning the schedule for the second half of the research period. According to the situation of each peer group, I gave them different advice. For example, it was

suggested that one peer group move their focus from the use of ICT to general pedagogical issues because both teachers perceived ICT as a part of teaching rather than separated skills.

Third interview and group conference

After the second interview, some peer groups made adjustments to their focus and process. One peer group changed their attitude towards peer support. Amanda said in the third interview, "As my partner said, it helped us, especially at the end of the research, we had opportunities to observe each other's lesson and to know what each other was doing" (Field 3/2004). However, not all peer groups experienced great changes; and for most groups, the change was gradual. As the peer groups had more peer sessions in the second half of the research period, more varieties were recorded, such as studying teaching materials and PowerPoint presentations.

At the end of the research period, teachers took part in an individual interview and a group conference. These were scheduled at the end of June in 2004 when teachers had finished marking the examination papers. Although teachers were still busy attending school meetings, it was thought to be a good time to do a review of the research, as they did not have any teaching duties at that time. The interview focused on collecting information about the teachers' changes in practice and attitudes towards the use of ICT after the research, as well as capturing their opinions about peer support as a means of professional development in ICT integration in school. Teachers shared their experiences and also raised their concerns about their participation in peer support groups. At last, both teachers in each peer group took part in a group conference. In this

conference, the teachers reviewed the research process as well as discussing the difficulty of their participation. In addition, they suggested ways to improve the effect of peer support as professional development for using ICT.

Analysis and writing phase

All interviews were taped-recorded and then translated and transcribed after the interviews. Since the interviews were conducted in Chinese, the translated transcription was a summary only. Transcriptions were sent back to the teachers for reviewing and editing. To involve the teachers in the analysis of information gathered, some issues identified from the collected information were sent to the participating teachers for their feedback. However, response was rare.

The coding process began as soon as the first round of interviews was completed. This research utilized AnSWR, a freeware from the Internet, to support the coding process. The transcription of interviews was broken into incidents, which were coded into different substantive codes as suitable. There was no limitation of codes and each incident could be assigned to more than one code. As new information was added in during the later interviews, these codes were subject to change so as to represent the attribute of data. Axial coding began after information of the open coding process. Provisional propositions that linked the substantive codes were developed. For example, as the research recorded the frustrations of participating teachers towards technical and resource issues, it also found that the teachers were usually very emotional towards these issues. An initial proposition that regarded emotions as a factor affecting the utilisation of technology was developed. This proposition was then used to compare data from different teachers and different interviews in this research. The data led to a

theme that identified the attitudinal factors sitting behind these issues rather than an infrastructure factor. As the theme was developed through data and verified through continuous comparison with data over and again, it became significant enough to explain the variations and achieve relevance. Data was again coded against these identified themes in a selective coding process so as to develop a central concept. Then, elaborating this central concept with reference to the literature, a professional development model in using ICT for secondary school teachers in Hong Kong was developed. The emerging themes and development of professional development model is discussed in detail in the next three chapters.

CHAPTER FIVE: FINDINGS (PART I) – CHALLENGES OF ICT

The purpose of this study is to develop a model of professional development to understand the critical factors contributing to professional development for secondary school teachers in Hong Kong and to support the teachers to integrate ICT into their teaching and learning environments. At the beginning, three broad questions were asked to guide this research process. These research questions were:

1. What are the challenges for teachers in Hong Kong secondary schools in the integration of ICT in their teaching?
2. What are the impacts of using peer support and an online discussion forum as professional development tools on teachers' attitudes, teaching paradigms, and learning processes related to the integration of ICT in their teaching?
3. What are the processes of professional development that underpin the changes brought about by the peer support project?

This study used peer support as a means of professional development for five peer support groups of secondary school teachers in Hong Kong. The peer support process was sustained for sixteen months, across two academic years in Hong Kong schools. Participation was voluntary. Each peer support group consisted of two teachers from the same school and teachers were involved in the invitation of partners. In the peer support group, teachers worked with their partners to share

their experiences of ICT in teaching, explore the use of ICT in teaching and support each other in practice. They had time for conversations, sharing resources and coaching.

As explained fully in Chapters Three and Four, the study had three formal phases of data collection; namely the beginning, the middle and the end of the research period. Each phase included an individual interview and, in the third phase, each peer group also had a conference meeting. The first interview sessions were intended to gather information about the teachers' perspective of ICT integration in teaching before the intervention while the latter sessions capture their responses and experiences with the on-going peer support process. This conference meeting was an overall review and reflection on the process of this study. Apart from formal interviews, informal personal contacts relating to issues and concerns about the research were also used as ways to develop a close partnership relationship with the participants. The data was analysed by using grounded theory. Themes and propositions were generated with reference to the data.

In order to answer the research questions, the findings are arranged into three major themes, in accordance with these questions. These themes are presented in two chapters. This chapter focuses on discussing the challenges of ICT for the teachers prior to the intervention in this study. The findings are presented from the teachers' perspective to understand their concerns and difficulties regarding ICT integration. Confirming findings in other literature as discussed in the literature review chapter, the findings of this study converge to a theme that the teachers' motivation of ICT integration is significantly affected by systemic issues, pedagogical issues and psychological issues. The next chapter

will present findings on the experiences of peer support, which was used as an intervention in this study. At the end of each theme, a summary of the main findings is provided.

Systemic issues

ICT in education was implemented through a systemic approach in Hong Kong as it was believed that providing favourable ICT infrastructure might encourage teachers to use ICT. This study found that this systemic approach did not necessarily provide a favourable environment that suited the teachers' needs. This study identified two issues: external pressure and external constraints.

External pressure

This study found that the teachers often perceived ICT use as an external demand. For example, Katy said, "We need to follow the trend of the society" (Field 2/2003). They used ICT because they felt the need to comply with a trend of digitalization in society. Mei's reflection on the use of ICT in the classroom is a good example of this perception. She said, "The atmosphere in Hong Kong makes people think that using IT in teaching is having something to 'click' in the classroom" (Field 4/2004). The teachers often felt powerless to resist a strong ICT movement in the society. In this study, only two teachers had already tried integrating ICT in teaching before the ICT policy was enforced. All the other teachers were later adopters. This suggested that most of the teachers appeared not to be personally aware of the value of ICT in teaching. In the findings of Robertson's (1995) study on peer partnership of principals in New Zealand, the teachers it was apparent that the principals were reactive in responding to external

forces. Similarly, the teachers in this study often reacted passively to the policy. External expectation emerged as a strong factor that affected their decisions in using ICT. Henry noted, "If the government do not require me to use IT, I won't use it" (Field 1/2003). The study noticed that the teachers were usually a follower of the leading role of government in ICT implementation instead of a decision-maker. Stephen said:

> As the government promotes the use of ICT and the introduction of new software, my view of ICT changes. With the improvement of computer facilities in the classroom, I should do more than preparing teaching materials and use it as a tool outside the classroom (Field 1/2003).

The government's policies and actions were a major driving force in the use of ICT in teaching. For example, Robert said, "Students have this expectation because the community has this expectation. That's why the government invest a lot in it" (Field 1/2003). However, the effect of external incentive did not appear to last long. When difficulties arose in the process of applying ICT in practice, external demands seemed to put pressure on teachers. For example, teachers felt that the government's requirement for teachers to apply ICT for at least 25% in every subject within five years[2] was unrealistic. It was pointed out that these demands exerted great pressure on them. For example, Mei described the situation in this way: "I think IT is now a trend. No matter whether you like it or not, you have to use it" (Field 4/2004). Teachers perceived the trend to using ICT

[2] In his inauguration speech in 1997, the first HKSAR Chief Executive, Tung Chi-Hua revealed the government's target that suggested teachers to use ICT in not less than 25% of their teaching work.

as unavoidable and they had no alternative. They are required to fit into the systemic oriented policies. They thus were anxious to fulfil the externally mandated requirement. Katy stated, "It is not a must to use it but we need to know how to use it" (Field 2/2003).

External constraints

This study identified three types of external constraints, that is, equipment issues, resource issues and inappropriate support.

Equipment issues

This study noticed that some teachers were uncertain about the effectiveness and functionality of ICT equipment to classroom teaching. Two cases were used to exemplify this issue. First, Katy said, "I think the TV screen in the classroom is too small…. Although the publisher provides a lot of PowerPoint presentation for the Form 3 curriculum, I do not use it" (Field 1/2003). She decided to stop using any PowerPoint presentations in regular classrooms because she thought that the quality of display was not satisfactory. In another case, Robert was dissatisfied with the ICT equipment because it did not provide a feature to switch from using projector screen to using blackboard and vice versa. He said, "At this moment, there is no good software that may combine the screen and the blackboard well" (Field 1/2003). He commented that ICT could not be fully integrated into current teaching activities, as ICT equipments were not totally adaptable to the teachers' teaching habits. He tended not to use ICT if it did not match his way of teaching. Robert said, "When teaching students calculation, it is hard to predict their problem. Supplementary should be given on site. It is hard to use IT to give an

ad hoc supplementary. Blackboard, a traditional method, has its advantage" (Field 1/2003).

Reliability of ICT equipment troubled many teachers. They were not willing to use ICT with unreliable equipment. Katy said, "We do not have a LCD projector installed in the room. The computer in the room is too old and it is not stable" (Field 1/2003). Some teachers had some unpleasant experiences of unreliable equipment. For example, Mei said, "One of the two servers in the school is open for students and it is very unstable. Yesterday, I spent five periods preparing a fantastic PowerPoint, but I could not access it in the classroom today" (Field 1/2003). Similarly, Katy said, "The computer is not very stable. Once, it caused the breakdown of a LCD projector" (Field 1/2003). Some teachers had to act especially cautiously when they had to use ICT in teaching. Robert's response to the reliability issue reflected the teachers' feelings of insecurity about using ICT, "I have to prepare more than one set of materials. I can still have something to use when the computer is down" (Field 3/2004).

It appeared to be the case that some teachers were uninterested in using ICT even if equipment was available, because of its inconvenience. For example, Susan did not feel enthusiastic about using ICT equipment in the classroom although she often used CD for teaching purposes. Susan said, "Although I can use the computer to play CD, it takes a long time to start the computer. Although the equipment is available, I do not use it often" (Field 1/2003). Instead, she chose to carry a portable CD player to the classroom each time. Similarly, another teacher, Terry said:

> The school has already provided us a lot of resources. Each teacher has a notebook computer. We have a projector that we

> may use it for our lessons…. Sometimes I do not want to use it too because…(pause). Computer is not a problem as we may bring our own but we have to book the projector in advance through the school net, send students to collect it and connect it to the computer in the classroom. It will take me 10 minutes in the worst-case scenario. There are only 40 minutes in a lesson and I need to spend 10 minutes for these logistics. I think it wastes my time (Field 1/2003).

These examples indicated that some teachers were less likely to favour using the latest equipment if they did not feel the equipment was handy to use. Susan's comment could be a conclusion of this issue: "…it is not worth to spend time to turn on the computer" (Field 2/2003). They did not feel it was worth spending time and effort on making arrangements to use ICT.

Resource issues

The teachers usually perceived suitable teaching resources as an essential factor affecting ICT integration in teaching. For example, Stephen said:

> The core of promoting teaching with IT should not be the hardware, although it is also important, it is not the most important. Technique is not the most important. The most important thing is creative ideas and how to turn these ideas into practice (Field 4/2004).

The study found that some teachers liked using ready-made teaching materials, that is, commercial products (such as software that came with textbooks) and shared ICT resources (such as teaching materials downloaded from the Hong

Kong Education City website[3]). However, they gave the impression that they were not particularly satisfied with the quality of these materials. Stephen said, "I find that the multimedia teaching materials may have great effect to us as a language teacher. However, there is not any very outstanding product in the market, especially in Hong Kong" (Field 1/2003). It was common to hear the teachers grumbling about the usability and suitability of these materials during interviews. They often needed to make substantial modifications to those materials before they used them in teaching. Some teachers needed to thin out the content or rearrange the presentation. For example, Lisa said, "Some resources provided by the publisher are too rich in content and not convenient to use" (Field 1/2003). Some teachers commented that ready-made teaching materials might not suit individual teacher's styles of teaching, and thus they did not necessarily improve teaching and learning. For example, Susan said, "Although there are a lot of materials from publishers and bookstores, they do not suit me" (Field 2/2003). This reflects that the teachers tend to have personal perceptions about the structure and development of ICT materials. They did not feel that these commercial products suited their needs. On the other hand, shared ICT materials from the Internet were not necessarily easier to use and better than commercial materials. Although these materials were mostly developed by teachers or academics, they did not necessarily suit all teachers' teaching styles. Mei commented:

[3] The Hong Kong Education City website is a public funded portal about education in Hong Kong. This website contains abundant teaching resources. These materials were usually produced by teachers. Many of these materials were some kind of outcome of funded projects of Education Department or in schools. Some were shared by individual teachers.

> … it is difficult to share [ICT] materials. Teachers have their own rationale in teaching maths when they use their IT materials. I need to modify the material extensively if I want to use it. It is not easy for me to follow their rationale (Field 2/2003).

Therefore, Stephen believed that the materials should be produced by teachers themselves:

> Materials will be the most suitable when it is produced by teachers themselves. Some teachers think that the IT materials produced by the publisher do not suit the need of our students. The effect of school-based materials is much better (Field 2/2003).

However, the study found that not many of the teachers in this study were interested in and willing to put effort into developing their own ICT teaching materials, although there were evidently a number of problems in using ready-made materials. They thought that they were not the most suitable people to work on this technical process because they did not necessarily have the appropriate knowledge and experience of multimedia production. Stephen's comment about his colleagues clearly reflects teachers' reluctance to produce their own materials, "Maybe they are not interested, they have no skill or they have no time, they do not participate in producing IT materials" (Field 2/2003). Teachers did not appear to feel it was their responsibility to produce multimedia-rich ICT teaching materials.

The study found that time was another factor affecting their willingness to develop ICT materials. Katy said, "[Multimedia presentation] is good and interesting but I need to spend a lot of time" (Field 1/2003). Although teachers wanted to take advantage of multimedia effects in the classroom, they did not

have the time to produce these materials. Another teacher, Stephen who was an enthusiast of ICT said:

> I believe that I should produce some practical teaching materials for daily teaching through the technology and software I know. It is my direction. However, it relates to the most important problem that the teaching time is too tight. There is not enough time (Field 4/2004).

The lack of time to produce ICT teaching materials was also a problem to Robert. He said, "…it takes time to produce these materials and we lack time" (Field 1/2003). Some teachers felt it was not worth spending large amounts of time on such technical processes. For example, Susan commented, "I need to spend a lot of time to prepare a PowerPoint presentation but it may not be a good one…. It is not worth to use it to present some texts and one or two pictures only" (Field 4/2004). They did not perceive a high educational value in self-developed ICT materials. Producing ICT resources was evidently seen as a luxury activity for those who might not have abundant technical support. Katy said, "Some major subject departments have teaching assistants who may help [to produce teaching materials]" (Field 1/2003) while her department did not have such support.

Since teachers did not have much time for developing new teaching materials, many teachers usually produced their own materials by copying from other existing resources, such as textbooks or websites. Copyright issues became a significant barrier preventing the circulation of their materials. Mei said:

> It would be alright if we produce the materials all by ourselves. But there is the problem of copyright if we copy something elsewhere. It would be too risky (Field 4/2004).

The above findings converge to a point that the teachers seem to perceive themselves as users rather than producers of ICT teaching materials. For example, Susan said, "My professional training is not on producing this software, so the effect of this software will not be good. The effect will be similar to the use of overheard transparency" (Field 4/2004). This reflects that production of ICT teaching materials was unlikely to be a part of their teaching profession. They thought that the technical process of producing multimedia-rich teaching materials should be left for technicians.

Inappropriate school support

Successful ICT integration requires the support from the school. Some teachers in this study were concerned about not having sufficient and appropriate support for ICT integration. Robert said, "It's about taking time to produce IT teaching materials. [Support from the school] is not positive at present" (Field 1/2003). On the other hand, insufficient support to teachers was also likely to be a barrier that discourages teachers from using ICT. The unpleasant experience of one teacher, Ming, is a good illustration of the negative effect of insufficient technical support. When he experimented with using email to collect students' homework, he found that his mailbox was overloaded. Many students' submitted work was then lost. Ming said:

> The storage for emails in the school server was not big enough. When some students sent me some big files, other students could not send me their mail. They asked me why they could not send files to my email address. The facility in the school cannot match the development of use in IT (Field 1/2003).

He though that he needed a bigger mailbox, however, he could not expand his mailbox size by himself. As he approached technical support persons in the school about this problem, his request was rejected. He complained that the school did not recognize his effort to experiment with the use of ICT. He commented, "The school usually regards homework as a hard copy assignment rather than an electronic homework" (Field 1/2003). Apart from being dissatisfied with the capability of ICT infrastructure, he was very frustrated with the inappropriate mind-set of the school. He was angry that the school did not value his attempts to use new technology and was not willing to support him. Without an appropriate and supportive environment, he then chose to stop his initiative of using email as a means to collect homework.

Susan was also frustrated: "Although there is a channel for me to report problems to the school, I don't know when they will fix the problem" (Field 1/2003). It seemed that she was losing trust in the school. Another teacher, Stephen said, "I think the school was going in the wrong direction in providing intensive training courses. Teachers were introduced to 7-8 types of software in a week and they were expected to know how to use this software well. It is a wrong concept" (Field 1/2003). This shows that school policies often misinterpret and overlook the needs of the teachers. It appeared to be the case they were not to be taken into consideration in the decision-making for ICT policies.

These findings confirmed the literature that schools often lack a clear vision of ICT integration. The ICT policies did not necessarily suit the teachers' needs.

Pedagogical issues

This study identified two factors affecting the teachers' current pedagogy of ICT integration. They are beliefs and perceptions and skill-based training.

Beliefs and perception

Echoing Cuban's (1986) alert on utilising 'high tech' equipment on a surface level in teaching, the findings of this study affirmed previous research findings, which showed that the use of ICT in teaching and learning in Hong Kong is below the government's expectations (Education and Manpower Bureau, 2005). There seemed to be a gap between the teachers' actual use of ICT and the external expectation of ICT integration. The findings of this study indicated that the teachers' perceptions of teaching and ICT had a profound influence on their actual use of ICT in the classroom, as noted by Norton, McRobbie and Cooper (2000). This finding confirms the literature that teacher use of ICT is not simply a technical issue. In a study of factors associated with teachers' attitudes towards ICT, as Albirini (2004) claimed that, "Past history has shown many promising technological innovations fail to attain their promise due to the negligence of the end-users' attitudes and needs" (p. 2). This study identified several common perceptions of ICT.

This study affirms Laferrière, Breuleux and Bracewell's (1999) findings that using ICT in teaching and learning is a perceptual issue. The teachers believed that ICT was a technical supplement to their existing teaching. Most teachers in this study perceived ICT as a tool to present teaching materials and information so as to enhance efficiency and raise student's interest. For example,

several teachers mentioned that ICT could help speed up the teaching progress. Lisa said:

> I do not need to copy so much on the blackboard as I have typed notes in the presentation. The lesson will run smoothly and the progress will go fast. I may have good presentation for the lesson because I only need to follow the presentation…. [IT] is a media that helps me to work more efficiently" (Field 1/2003).

Katy used a digital projector in her class to speed up teaching progress because she saw ICT as a handy tool to replace the overhead projector. She said, "I think that video, overhead transparencies, computers or audio equipment should be included as IT. Using this equipment may help us to teach smoothly and in a faster pace" (Field 1/2003). As well, Susan used ICT to present information, "I will use ICT if I want to show them a lot of information" (Field 1/2003). Even though Henry did not often use ICT for his teaching work, his perception of ICT integration was: "IT can really help us in doing presentations. I do not need to retype the document every time I use it since I have used Word for processing and storing documents" (Field 1/2003). This indicated that there is a common perception among the teachers that ICT helped to make the lesson more structured and organized so that they could deliver the lesson more efficiently and in a better way. It also reflected that they often perceived ICT as an add-on tool to support existing teaching practice. Teachers seemed to appreciate the function of ICT to efficiently accomplish repetitive tasks. They were likely to choose to use ICT as a replacement for repetitive teaching activities such as presenting notes or pictures. They focused on looking for ICT features than how ICT can enable a new learning environment.

Apart from saving teaching time, most teachers also see ICT as a tool to raise students' interest so as to improve students' participation in the classroom and enhance their learning. Stephen said, "Students may feel the difference [of using PowerPoint] from using blackboard. In general, students will feel fresh and special" (Field 2/2003). They made use of richer multi-media effects of ICT to deliver teaching content and to attract students' attention. They seemed to believe that this alternative media was more appealing to students than traditional delivery modes and thus could increase their participation. For example, Lisa said:

> I do want to raise the students' interest in the lesson through different kinds of media such as pictures and images and let students know that there is a lot more information out there for exploration. I will tell them different websites and ask them to read them for interest during the leisure time in order to let them have a richer exposure (Field 1/2003).

As well, Katy said, "I use it because it may increase students' interest in the class. They feel bored in the classroom. It provides diversity" (Field 2/2003). Susan also believed that ICT could change the classroom atmosphere, "If the school has the equipment and the teachers control well, the lesson will be interesting… The [students'] participation will increase" (Field 1/2003).

The findings of this study suggest that most teachers believed that interesting and attractive digital teaching materials are key to successful ICT use in the classroom. One teacher, Robert, spent a lot of time exploring and developing new software to present Mathematical concepts attractively and interactively as he perceived ICT being an excellent visual tool to raise his students' interest in Mathematics. He also used software to draw graphs, such as

dynamic geometry, “It lets students understand from another perspective other than my drawing on the blackboard and explanation” (Field 1/2003). Another teacher, Stephen, focused on using animated presentations to structure his teaching materials, as he thought that using pictures and images was likely to help students to build up their understanding and appreciate language. He said,

> One of the functions of IT is to attract their interest. It encourages them to receive the word as a symbol through images. Or, it brings them some stimulation. It stimulates them to convert some word symbol into a concrete image so as to lead them to an in-depth level of thinking (Field 1/2003).

While most teachers use digital materials with the expectation of attracting students, some did not believe that it could raise teachers’ teaching effectiveness and students’ learning capability. For example, Mei said, “To use IT in this way is not important to me. It just adds some colour to the classroom and makes the atmosphere become more relaxed. However, I don’t think that it may raise the effectiveness of teaching and learning” (Field 1/2003). Also, Stephen said, “In using IT in teaching, we are taking some risks. The IT material uses a lot of comics-like images. Although it helps students to receive information easier, they may not raise their ability in verbal and written presentation. It may not achieve our teaching objective” (Field 1/2003). On the other hand, the teachers noticed that students’ interest in multimedia in teaching diminished quickly as teachers used it more. Henry said:

> Students felt interested when I used PowerPoint presentation the first time because of the images and sound effects. However, they

> get used to it as I use it more, they won't feel interested any more (Field 4/2004).

Lisa also commented "when students get used to PowerPoint in the classroom, the effect becomes depreciated" (Field 1/2003). These teachers seem to notice that relying on ICT as a visual stimulation to raise students' interest did not have a long-lasting effect.

The study found that the teachers usually gave ICT a low priority in teaching. Although some teachers believed that ICT could save teaching time, they also found that it took more time and effort in preparing ICT teaching materials when they used it in practice. When they needed to catch up with the teaching progress, they would not bother about using ICT. Katy said, "If I'm too busy at a period of time and I have no time to do the work, I will not use [IT]. I use the old materials" (Field 1/2003). As well, Mei said, "Although I may use IT in many topics, I need to rush for the curriculum and I have no time to think about this. I will use it if I can. If I can't, it doesn't matter" (Field 1/2003). Terry also said that he would use ICT provided that he had the time, "The more important is… (pause)…whether I need to rush for the curriculum. If I have enough time, say I have finished the content early, I will use it" (Field 1/2003). Completing the teaching syllabus on time was always the highest priority of teachers. It also shows that teachers perceived only a subsidiary role of ICT in teaching and learning.

Although they recognized that ICT consisted of powerful features, they seemed to think that ICT pedagogy was inferior to the teaching methods they were used to using. They tended to perceive ICT integration as a simple application of ICT features and use it in a mechanical way, rather than a flexible,

effective and practical alternative to traditional teaching methods. They seemed to have preference for traditional teaching methods as they regarded these methods as more easy-to-use, suitable and reliable for daily teaching. For example, Mei said, "If I want the students to know how I solve a problem, I do not use IT and I prefer to write it by hand. It is much easier for me to explain the process" (Field 1/2003). She saw ICT as an add-on to her existing teaching. She said, "It won't matter if I do not use IT at all in teaching mathematics…. Without IT, I can still teach my students. Mathematics is a traditional subject that it doesn't require the use of IT" (Field 4/2004). As a result, she was less likely to explore further application of ICT in changing her way of teaching. As the findings showed that ICT was only an option to complement the traditional pedagogies, the teaching paradigm and pedagogies using ICT were likely to be overlooked, an issue as raised in the literature reviewed.

Some teachers in this study felt there was little space to change the current mode of using ICT as whole class teaching in Hong Kong. Since students are usually arranged in big classes in Hong Kong schools, the teachers had long developed strong perceptions of whole class teaching. Stephen's comment exemplified the case:

> The participation of students does not change a lot. The teaching materials I designed are not for student self learning. The teacher plays an important role to control the pace…. The condition in Hong Kong is different from the western countries, we are not teaching in small classes. There is more limitation in teaching larger classes (Field 4/2004).

This affirmed the literature that the teachers favoured direct and instructional teaching. They did not believe that the personal learning approach of ICT suited the Hong Kong classrooms. This seemed to explain why they were less likely to be motivated to change their teaching practices.

These findings suggested that ICT was not truly integrated in the process of teaching. The teachers were less likely to uphold the importance of ICT in teaching and were likely to give up using ICT when they encountered difficulties. For example, when teachers perceived a lack of time for teaching, they preferred not to use ICT. This also showed that the teachers did not appreciate the true value of ICT in teaching. They only saw ICT as a technical supplement and ICT integration was merely a technical issue. A theme emerged from these findings that pointed to the influence of teachers' beliefs and perception of ICT on ICT integration. This responds to Cuban (1997) who drew attention to "the problem of low-tech teaching as not one of resources, but a struggle over core values" (para. 19).

Skill-based training

As the HKSAR government has provided extensive ICT training for teachers since 1998, it was not surprising, as this study found, that all the participating teachers had already gained some skills and knowledge of ICT at the start of this study. All teachers stated that they had completed the intermediate level ICT training (IIT). For example, Henry said, "The government provided some training for teachers. I could learn some basic knowledge, such as PowerPoint, the Internet or Word, etc. I have finished the IIT training" (Field 1/2003). In a newsletter, the Education and Manpower Bureau (2003) stated that "By reaching

the 'intermediate' level, a teacher is able to use IT tools and make use of teaching resources available on the Internet and the Intranet in classroom teaching and lesson preparation". Apart from technical knowledge, the study also found that most teachers had already made some attempts to use ICT in teaching or related activities (such as preparing teaching notes) before this research. Some teachers thought that they were not particularly resistant to the use of ICT, for example, Amanda said, "I do not hate using IT. If I need to use IT, I don't mind to use it" (Field 1/2003). However, as Holland (2001) has argued, while teachers could master the technical skills, this did not mean that they could master ICT for instructional use. This study found that many teachers did not really feel comfortable with using ICT and were not willing to use ICT extensively in teaching. As ICT training was not usually related to ICT integration, they seemed unlikely to become active ICT users in classroom teaching, a point also made by Perkins (1999).

The findings of this study confirms the literature that skill-based training programmes lacked stimulation of ICT integration in authentic contexts and the skill to revise pedagogical practices. As it did not help the teachers to develop a clear direction of ICT integration, they might not perceive it as a transforming pedagogy. For example, Mei felt frustrated about not having a clear direction for ICT to guide her attempts to use ICT in teaching:

> Although we sometimes attend some seminar about IT, to be honest, they are not useful. I think that the Maths educators do not have a position on IT in this subject, including me. However, the Education Department pushes us to attend some seminars. We all know that the purpose of these seminars is for 'using IT' more than

> for the benefit of students. If we cannot position [IT in our subject], we will lose our subject's characteristics, doing the same thing as other subjects. It is hard to use IT in Maths because we do not know how to use IT. None in the Maths education leads us to discuss how to use IT effectively (Field 4/2004).

Mei's concerns reflected that teachers need a direction for ICT integration to guide them in developing appropriate application of ICT in their practice. Without a clear role for ICT in teaching, teachers were unlikely to identify and recognize the benefit of ICT in teaching and learning. Terry said, "Change is about challenging my beliefs. Since I still do not have clear picture for myself, how can I talk about change?" (Field 2/2003).

ICT training opportunities seemed unable to improve teachers' ICT integration. The teachers criticized the current mode of professional development in ICT in Hong Kong as not being as effective as it should be. Some teachers thought that standardized ICT training did not help individual teacher. For example, Henry said, "[ICT training programmes] are big scale events to serve many people at a time. It is a kind of mass production. It is hard to produce an effect on individual teachers" (Field 3/2004). Although abundant training opportunities were available, some thought that the ICT training could not really improve their ICT competency. For example, Lisa said:

> After I started teaching in this school, the school organized some training for us. However, I did not learn much from these training sessions because of its intensive nature. Since I was not very good at these skills, I forgot most of it after a period (Field 1/2003).

Henry felt participating in ICT training was stressful:

> I started using IT three years ago when the government started promoting the IT education. We took some training courses. I felt that it was quite hard for us because we did not have any background in IT before. I felt stressful (Field 1/2003).

Furthermore, Mei thought that the current skill training approach did not help teachers develop good ICT pedagogy:

> I think the training of IIT does not help with my teaching. What I have learned in the IIT training do not relate to my teaching. Many elements in the training are useless…. If you ask the opinions of teachers, they will tell you that they don't know how to use what they have learned in the training (Field 1/2003).

They did not seem to particularly appreciate the current process and content of ICT training. Susan said, "Although I have finished all assignments [of the IT training], it is not very practical [in helping me to integrate it into use]" (Field 1/2003). Teachers were specifically dissatisfied with the lack of hands-on practice in their contexts and on-going support during and after training. This suggested that a transmission approach to ICT training was less likely to enable teachers to retain and transfer knowledge into practice. This also suggested that the current skill-based ICT training for teachers did not effectively improve the teachers' capability to integrate ICT into daily teaching.

Psychological issues

As the teachers perceived great external pressure for ICT use, they developed anxiety about using ICT. For example, Henry remarked, "Teachers must learn it

otherwise they will be 'out'" (Field 4/2004). ICT in teaching was not simply a matter of teaching effectiveness but also an issue related to their job security. This anxiety was likely to make using ICT an obligation rather than a tool to improve teaching and learning.

External constraints, such as equipment, resource and support issues were found a source of negative emotions of the teachers. These emotions, such as frustration, insecurity and embarrassment caused by equipment breakdown or malfunctioning, were likely to reduce the teachers' enthusiasm in using ICT in the classroom. Mei said, "It made me feel frustrated and it wasted my time and effort" (Field 1/2003). Katy said, "Because of this, I try not to use the computer if possible" (Field 1/2003). The negative feeling will lead to resistance and even resentment as noted in the literature.

This study found that the teachers developed some negative feelings about the limitations of ICT from their experiences. Although ICT was always promoted as an interactive tool for teaching and learning, some teachers did not see ICT as a means to create a more interactive classroom. For example, Susan complained that she could not change the rhythm of teaching in the classroom when she used ICT, "The way to use these materials is hard to change immediately…. It is very difficult to change" (Field 1/2003). As well, Mei commented, "Many people think that using IT should be interactive. It is not a must. The information is preset and it is hard to stop to respond to students' questions" (Field 4/2004). Some teachers questioned about the effectiveness of ICT on student learning after they had used it for a period of time. For example, Stephen commented, "IT may attract them. If students do not participate actively,

no matter how many IT teaching materials we use, it cannot transform this interest into motivation in order to encourage learning" (Field 1/2003).

They felt frustrated about the effectiveness of ICT on student learning. Robert said, "IT is not a decisive factor to the student performance. The student attitude cannot be changed through the use of IT" (Field 1/2003). They thought that ICT had only little impact on student learning. Mei though that ICT was not really needed for daily teaching. She said, "For some difficult topics, students cannot learn well. For some easy topics, no matter what way I use, they may learn well" (Field 1/2003). She noticed that using ICT distracted her from providing quality teaching. She said, "When I start spending time on IT, I am distracted. I think less. In many cases, the flow of teaching is the worst when I use IT" (Field 4/2004).

Lisa's case is a good example of their frustration with ICT in practice. Lisa taught in a social science subject. She learnt to use computers when she was at university. She thought that ICT was a good tool for teaching when the ICT infrastructure gradually developed in the school and had tried to use ICT extensively in her practice. She, however, felt disappointed with the result and noticed that she failed to provide students with diversified learning experiences when she was too involved in using ICT in the classroom. She commented, "…it will be frustrating when a teacher spends a lot of time but with little effect". In her reflection, Lisa realized that using ICT took up most of her teaching preparation time. She said:

> In the past, I would prepare different varieties of activity. They could try different activities such as group discussion, debate or role-play. I prepare fewer activities like these and I am more

> focused on using computer now. Students may feel bored (Field 4/2004).

This illustrates a situation in which teachers might put too much time and effort into preparing ICT materials as they might not yet have the proficiency and competency to do this quickly. As a result, she experienced a drop of teaching quality:

> [My ICT skills] do not help me to improve my teaching. I do not find students improve a lot because I use it. I think there must be something that I do not do well to raise their interest in the class, in the subject or to improve their performance (Field 3/2004).

She commented, "[My] teaching becomes one-way. It changes my focus on teaching …. I do not know whether IT helps them" (Field 2/2003). Therefore, she insinuated the uselessness of ICT, "Using IT was thought to be very effective. Now, I feel that it is not a necessity" (Field 1/2003). Her negative experiences reduced her enthusiasm for ICT use.

Summary

This chapter focuses on identifying the challenges of ICT for the teachers prior to the study. Findings of this study showed that the teachers' teaching paradigm and pedagogy did not change because of the adoption of ICT. Cuban (1986) warned us two decades ago about teachers utilising 'high tech' equipment only at a surface level in their teaching and this study found that low level ICT application was still common among teachers today. The study reveals a gap between external expectations of ICT use, such as those of policy, and the teachers' actual ICT integration in practice. ICT challenges for teachers in this study divided into

three aspects, namely systemic issues, pedagogical issues, and psychological issues. These factors were seen to lead to a lack of motivation for ICT integration and thus the current low level of ICT integration.

Systemic issues included external pressure and external constraints. Some teachers perceived the external demands and expectations as a kind of pressure and reacted negatively to this pressure ass they saw themselves as having little or no power over the integration process. Consequently, teachers tended to be passive and less risk-taking and felt anxious about fulfilling the mandated requirement of ICT use. Although large amount of resources had been invested in ICT in schools, equipment in schools was not necessarily seen as encouraging ICT integration. This study recorded many of the teachers' unpleasant experiences in using ICT. Some teachers also found that the present ICT teaching materials did not suit their needs and support from school was insufficient.

The findings of this study suggested that the teachers' beliefs and perceptions and the current skill-based training affected their pedagogies. ICT was usually perceived as a technical supplement to present teaching. Teachers often used multimedia as a tool to present teaching materials and information and as a way to raise students' interest. However, some teachers discovered the effect of ICT seemed to depreciate rapidly and gave ICT a low priority in teaching. They perceived ICT as simply a mechanical application of technology and not as flexible and effective as their present teaching methods.

Although the teachers had abundant opportunities for professional development in ICT, the professional development was mainly skill-based training. Some teachers complained that the discrete ICT skills and knowledge did not particularly help them develop ICT pedagogy.

This study was aware of the teachers' emotions generated by their negative experiences in using ICT. Some teachers felt insecurity about their job while some teachers felt frustrated about the inflexibility and incapability of equipment for their needs. These negative emotions led to resistance and even resentment as some teachers found that they were distracted from teaching because they needed to spend too much time on preparing ICT teaching materials.

The findings about peer support and factors affecting the effectiveness of peer support as a means of professional development will be presented in the next chapter.

CHAPTER SIX: FINDINGS (PART II) – PEER SUPPORT

The teachers in this study participated in peer support groups for sixteen months. During this period, they worked together to build a supportive environment that aimed to improve ICT integration. This chapter is in two main parts. The first, presents the experiences of these teachers during the research period and the second identifies and discusses factors that affect the development of peer support as a means of professional development in schools. At the end of each theme, a summary of the main findings is provided.

Learning from the teachers' experience of peer support

Over the research period, the study has demonstrated benefits of creating an environment for teachers to learn to improve their personal ICT use through peer support. Garner, Bingman, Comings, Rowe and Smith (2001), in a paper concerning partnership relationships, concluded that "working together benefits all of us" (para. 20). At the end of the research, one of the teachers, Henry, thought that because of his participation in the research and his partner's support, he had become more enthusiastic about learning and using ICT. He said, "I am not a passive user now. I use IT to search information, to reorganize teaching materials, and to add pictures to Powerpoint" (Field 3/2004). This example suggests that peer support promotes attitude change. This study found that increased professional interaction between peer partners enabled teachers to reflect more on the role and purposes of ICT in teaching. Increased reflection enhanced their self-efficacy in using ICT. Although behavioural changes in the

use of ICT varied among individual teachers, they all found that their experiences of peer support helped them expand their perspectives to see a wider role of ICT in teaching. In this section, the ways in which peer support enhanced the teachers' ICT integration are presented in four categories: 1) increased professional interactions; 2) expanded perspectives; 3) enhanced reflection; and 4) emotional support and increased confidence.

Increased professional interactions

This section highlights the participating teachers' experiences of increased opportunities for, and quality of, interactions, especially professional interactions between the peer partners. The study found that the teachers' schools did not usually have a favourable culture for professional interactions. For example, Mei said, "It is about the atmosphere. We do not have a culture of sharing teaching issues in our subject" (Field 3/2004). In-depth sharing seldom emerged naturally in schools because they lacked an encouraging environment.

It was noticed that most of the teachers selected a peer partner with whom they had a good social relationship. However, the study found that good social relationships alone were insufficient to encourage sharing about professional issues among teachers. This study found that they did not often have opportunities to share professionally with other teachers in school. For example, Amanda stated:

> We have no time to get together unless we have a classroom observation. We are not used to asking other teachers about their teaching…. Since we are not teaching the same subject, I may not

be able to give good advice on another teacher's problem (Field 2/2003).

Similarly, Lisa commented, "We do not usually have opportunities to talk about teaching matters because we teach different subjects" (Field 2/2003). The teachers believed that professional interactions were about sharing teaching content. At the beginning of this study, they often emphasized that these kinds of professional interactions depended on "whether the partners teach the same subject areas" (Susan, Field 3/2004). Katy added, "The quality of sharing depends on whether the peer partners have similar thinking, or the same objectives. It will not have any effect if we don't have a suitable partner" (Field 3/2004). It reflected the fact that teaching the same subject areas and having similar thinking were the main factors in forming good professional interactions. Lisa said, "We do not usually have opportunities to talk about teaching matters because we teach different subjects" (Field 2/2003). This reflects the strongly departmentalized nature of their schools. Teachers tended to cluster in subject departments and sharing about teaching experiences seemed to happen only within departments. It was unusual for them to show interest in teaching issues of other subjects. For example, Katy's school had supported an ICT initiative in which a few teachers were appointed to be pioneers in experimenting with using ICT in their subjects. However, she did not feel interested in experience-sharing sessions in which those teachers reported their trials of ICT integration. She stated, "I didn't attend it because I was busy. Since I was not a teacher in these panels, I would not miss much if I didn't attend. Basically, I have had the skill of using PowerPoint. The teachers from the same subjects will attend" (Field

1/2003). She appeared to feel that these experiences were irrelevant to her subject area.

In the end, among the five peer groups formed, four peer groups were formed by teachers from different subject areas. It was partly due to the fact that some subject departments were very small and it was hard to choose partners from the same department. These four peer partners stated that they seldom had opportunities to talk about teaching issues with their partners before the research. Although the two teachers in the fifth peer group taught the same subject at the same level in school, this study found that, before the research, this did not necessarily lead to more opportunities to share their thoughts about teaching. Although they taught classes at the same level, they had students from different subject streams, that is, science and arts. Robert explained, "Although we teach classes at the same level, we have different progress…. I may have more interactions with those who have similar progress" (Field 3/2004). Since they used different teaching approaches and styles and utilized different resources for their classes, they were less likely to have a common talking point about teaching. Robert further commented, "Teachers have to search for their own resource in senior classes. There are great differences between teachers who have different styles" (Field 3/2004). It shows that teaching the same subject might not necessarily be a decisive factor in encouraging professional sharing of teaching.

As pointed out in the literature, peer support partners of the same subjects will lead to evaluation of teaching content (Eisenbach & Curry, 1999). The study found that when teachers engaged in a peer group with a partner from different subjects, they were less likely to focus on discussing subject content. On the other hand, they were more likely to share their thoughts about their general teaching

practices or pedagogical issues. For example, Henry found that the peer group provided him a good opportunity to learn from his partner about ICT skills and knowledge. He said, "It helps me to have more opportunities to learn ICT skills from him. This encourages me to use IT more frequently" (Field 3/2004).

This study affirmed the literature that peer support enabled professional interactions. The teachers in this study all agreed that the peer support arrangement help to form an encouraging environment that promoted professional interactions among peer partners. Lisa said, "this research provides us the opportunity to talk more about teaching" (Field 2/2003). Also, Amanda commented:

> If we do not participate in this research, we will not have much opportunity to have this kind of interaction. We are teaching different subjects. We sit apart. We live in different areas, and work in a different administrative group. We have little common things to share (Field 3/2004).

The peer support arrangement in this study helped to pull them together so that they had opportunities to engage in in-depth communications. Lisa said, "Before we participated in the research…we did not have conversations very often" (Field 3/2004). Communication was improved because they had more in-depth interactions. Henry remarked, "It is easy to encourage communication in this [peer support] setting" (Field 3/2004). The findings suggested that the depth and breadth of professional interactions was enhanced by peer support. For example, Ming said:

> Since we have worked together for a long time, it is not an important element to improve our relationship through the peer

> group. The peer group helped me understand that I am not alone in this school to think in an "unrealistic" way. It encourages us to work further although we are working in different ways. The interactions encourage and support me to work in my way (Field 3/2004).

The two partners in Ming's peer support group had many opportunities to work together in different situations as they were both middle managers in the school. Although they were both active in experimenting with ICT use in their school, they had few opportunities to share their experiences in ICT integration. In their reflection on the peer support, both of them stated that the peer group arrangement in this research offered them an opportunity to understand each other more.

In summary, peer support provided the teachers a structured environment to develop a new relationship with their colleagues. This enabled them to have interactions beyond subject boundaries.

Expanded perspectives

At the beginning of the research, the teachers seemed to be sceptical about the value of peer support to promote self-reflection and self-change and thus to improve the use of ICT in teaching. They were doubtful whether they could obtain what they wanted in such a peer group setting. After the research, the teachers agreed that peer support provided an environment for them to know each other more deeply so that they could appreciate each other's ways of using ICT. This study did not record many dramatic changes in the teachers' behaviours of using ICT, however, as a result of the peer interactions, it was found that the

teachers' attitudes towards the potential and possibilities of ICT in teaching changed at the end of the research period.

As the teachers in this study engaged in peer interactions, they were exposed to different perspectives of ICT from their partners. Lloyd and Albion (2005), in the conclusion of their study on understanding the complexity of teacher technophobia, argued that teachers' personal perspective significantly affected their behaviours:

> … the way to encourage Level 0 teachers [teachers with low technical skills] to begin on their own personal journeys may be to show them what is possible. What they are (or are not) doing makes perfect sense when you come to understand their worldview and see the lenses with which they view their activity systems and when you understand their logical flaw in collapsing tool into object and leaving them with no processes to enact change, and no clear view as to where they are heading (p. 7).

To rejoin Lloyd and Albion's argument, different perspectives of peer partners in this study made the teachers look beyond the boundary of their personal perspective and understanding of ICT integration. For example, Stephen stated, "The peer support helps me to recognize and broaden my perspective of ICT integration to include more than images" (Field 3/2004). Although the two peer partners did not have similar perceptions of ICT integration, they began to appreciate different types of ICT integration and were willing to explore the possibility of applying their partners' ways of using ICT in their own context. They seemed to become more open to new ideas and possibilities, as Ming said:

> I get some new ideas from my partner, for example, to ask students to submit a recorded report. Apart from written report, I think the report can also include picture or video. My partner stimulates me to think more about this idea (Field 3/2004).

Amanda had similar experiences:

> From the peer support, my partner gives me a fresh idea about the direction of another subject. I gain a lot from this relationship…. If we can have more opportunities to share, I may understand how other teachers work and try to transfer it to my own use (Field 3/2004).

The teachers were likely to be positive about their partners' ideas because of quality peer conversations in a harmonious and supportive atmosphere. For example, Ming said,

> Although we do not always have the same ideas, it does not affect our relationship. We are talking about the matters. Although we do not usually work in the same way, it is possible for us to modify the way of doing or be stimulated by this different way of doing (Field 3/2004).

Since they enjoyed the peer conversations, they were more likely to be willing to know and accept different ideas. For example, Susan noted, "We may have different ways of thinking…. If we are in the same subject, we may share information. If we are in different subjects, applying other's perspective on my subject will produce new ideas" (Field 2/2003). The differences between peer partners did not adversely affect their interactions. Instead, the participating teachers acknowledged that peer support inspired them to perceive new potentials

and broadened their perspectives of ICT in teaching and learning. For example, Lisa said, "I may find different experiences, ways of teaching or skills from teachers of different subjects" (Field 3/2004). Similarly, Robert also highlighted the significance of peer support as a means to recognize a wider range of possibilities for ICT:

> To work with experts makes me feel 'high' to start doing new things. When I work with colleagues, it helps me to know what is practical. Workshops help me to learn knowledge. The teachers' sharing and interaction helps me to see different possibilities in the process of application (Field 3/2004).

This kind of interaction evidently encouraged them to be more accepting of different possibilities of ICT in teaching.

This study suggested that expanding perspectives of ICT alone was insufficient to change teaching practice. Teachers will consider whether these new perspectives can be applied to their own situation. Stephen said:

> There are advantages in his approach. It reduces the teachers' workload. However, I think it is affected by the students' quality. They cannot do this if they are not smart. I think his experience can only be a reference to me and it is hard to apply this approach to my lesson (Field 2/2003).

However, peer interactions could lead to changes in attitude. Robert said, "I use [ICT] more carefully. I use it less now…. I use it in a practical sense…. It makes me understand that using it better is more important than using it more" (Field 3/2004). He thought more deeply about his application of ICT in teaching. Attitudinal change was also likely to affect teachers' future practice. For example,

Ming said, "Because I know what my partner is doing, it encourages me to work more in this direction. It is the effect of peer support" (Field 3/2004). They felt comfortable exploring new ICT applications in this setting.

Most importantly, these professional peer interactions might serve as active learning processes for the teachers to build up their self-efficacy beliefs in regard to their capacity to integrate ICT in teaching and learning (Albion, 1999; Bandura, 1997). This indicates the importance of peer support in exposing teachers to different perspectives so as to enable them to change their attitudes and, subsequently, their behaviours.

Enhanced reflection

As noted in the last chapter, current skill-based training could not lead to reflection on ICT integration. Moreover, as discussed in the literature review chapter, shallow reflection will not bring about change in teaching paradigms and pedagogies. Critical reflection, which challenges teachers' beliefs in regard to ICT is believed to be important in changing the teachers' practice.

Teaching review is a common practice in schools in Hong Kong; however, from the teachers' experience sharing, it failed to lead to critical reflection. In general, teachers will conduct teaching reviews among themselves. However, they seemed not to take these reviews seriously. These teaching reviews were more likely to be a kind of shallow reflection rather than an in-depth examination of teaching effectiveness and teaching methods. For example, Mei sometimes had teaching reviews with colleagues after they finished teaching a module in school. She, however, admitted that this kind of review did not usually have much effect on changing or improving her practice. Mei said, "There may be some sharing

among teachers when we have finished teaching a topic. However, we may not remember [the result] the next year" (Field 1/2003). Since the focus of these reviews was mainly on particular issues, such as teaching content, they were less likely to reflect on pedagogy that could be embraced across the whole curriculum. On the other hand, the teachers in this study agreed that peer support stimulated reflection and it was found that they engaged in reflection more after they participated in peer support. Several teachers reported having such experiences. For example, Terry said, "The major difference is that the peer group gives me an opportunity to reflect on using ICT in teaching" (Field 3/2004). Another teacher, Stephen remarked, "The peer support motivates me to explore more about my application of IT" (Field 3/2004). Susan also stated, "Her opinions help me. I feel that I get something when I have conversation with her. She does not help me to do my work. Her opinion stimulates me to think more" (Field 3/2004).

Peer support motivated the teachers and enhanced their ability to look into their practice further, more widely and deeply. As Katy noted, "Sometimes she will stimulate me to think something new that I do not think before the peer conversations" (Field 2/2003). In peer conversations, the teachers described and clarified their rationale for ICT practice to their peer partners. It provided an environment for critical reflection and opportunities to re-think and re-organize current experiences and for them to re-examine their practice. For example, Lisa said, "I begin to evaluate how much students learn rather than focus on my own teaching" (Field 2/2003). As she began to reflect on her use of ICT, she discovered that ICT integration was more than merely the application of ICT skills. She explained:

> Apart from sharing the use of IT in my classroom, I also tell her about other activities in my subject that can also have the similar effect. I want her to know why I change my way in the use of IT. It is about my teaching strategy. I try to explain it to her (Field 2/2003).

Another teacher, Mei also started looking into her assumptions in ICT use after the first phase of peer support:

> I start to think about the effectiveness of using IT in teaching. Not all materials we use are useful. I also produce something that is not useful. Through the discussion, it encourages me to think about whether it is effective (Field 2/2003).

Lisa began to examine her reasoning about ICT use in teaching in the first phase of peer support. She pondered, "Peer support makes me think about whether it is a must to use IT in my teaching. I also think about what activities in teaching are the best" (Field 2/2003). At a later stage, she began to think more about the underlying reasoning behind her actions. She remarked, "The peer group helps me to explain my issue of using ICT" (Field 3/2004).

This study concluded that the influence of peer support on reflection could be subtle, as Katy said, "It could just be a sentence [or a little idea]. It may stimulate me to think and reflect. So, it is important" (Field 1/2003). Although peer support extended the teachers' opportunities for reflection, this could be a slow process. Robert stated, "I think more. The actual way to use it does not change a lot" (Field 3/2004). Peer support may not have led to dramatic change in practice but it stimulated teachers to discover and reflect on different perspectives of ICT use. The study found that for teachers to become reflective practitioners,

leading to changes in practices, was a gradual process. Although there was insufficient time to produce subsequent changes in behaviour of teaching during the research period, the findings showed positive results in encouraging teachers to think more broadly and deeply about their teaching with ICT.

Emotional support and increased confidence

The study found that the teachers had a common feeling that peer group provided a safe and comfortable environment for sharing emotions, weaknesses and problems, as reflected in Henry's remark, "Teachers may share their weakness with their peer partner. It is hard for them to raise questions in a seminar because they will wonder whether their question is appropriate" (Field 3/2004). This suggested that teachers in a private and secure environment, like peer support, were more likely to express their concerns and problems, be it personal or professional. They seemed to feel less stressed about sharing their personal feelings and issues with peer partners. Susan was the only teacher teaching the subject in her school. Susan stated, "I do not have another teacher teaching the same subject, the peer group gives me an opportunity to share" (Field 3/2004). Teachers needed opportunities to relieve tensions associated with personal emotions and concerns. Their needs were not necessarily to gain excellent ideas or suggestions from their peer partner, but, as Susan's example suggested, they needed someone to endorse their effort so as to build up their confidence in practice.

The study found that this kind of emotional support was important to teachers. For example, Amanda commented, "Without the conversation with my partner, I do not know that we share similar issues. It releases my [negative]

emotions [towards the use of ICT]. This kind of support is important to me" (Field 3/2004). Peer partners were more likely to understand difficulties as well as anxiety they faced because they shared and understood similar experiences and issues. Having someone who could listen to them and understand their feelings and concerns was important, so that they felt that they were being recognized, accepted and encouraged, as Lisa said, "[My partner] reaffirmed me about the use of IT in my teaching" (Field 2/2003). The findings suggest that the feeling of recognition helped the teachers to be more willing to take part in ICT integration. Ming said:

> The peer group helps me understand that I am not alone in this school to think in unrealistic way (new innovation). It encourages us to work further although we are working in different ways. The interactions encourage and support me to work in my direction (Field 3/2004).

This study found that peer support helped to boost the teachers' confidence in ICT integration. Since teachers might not know clearly about the effectiveness of their ICT integration, they needed feedback. Peer support provided them with the opportunity to share their ideas with peer partners. When they obtained positive responses from peer support, they were likely to be more confident in applying these ideas, as reflected in Katy's experience, "I will certainly use it when I have someone to support me. For example, I told her about my plan to use IT for S3. Her positive feedback on my plan increases my confidence to use it" (Field 3/2004). This kind of emotional support seemed to be a source of motivation to encourage ICT integration. In another example, Henry went beyond his psychological barriers of using ICT because of peer support. Before the study,

Henry was anxious about using ICT in teaching because he worried about his ICT competency. The relaxed atmosphere of peer support seemed to reduce his anxiety about ICT. Taking part in peer support helped him gradually develop a positive attitude towards ICT integration. Henry concluded:

> I became more proactive to learn about IT, such as to search for information through Internet, to seek for teaching related information. I now feel that using computer is no longer a hard job. I start using more IT in the classroom (Field 2/2003).

He began to appreciate the benefit of ICT rather than to look at the difficulties, "Before this, I did not like to go beyond what I could do. I used to avoid doing what I don't know" (Field 2/2003). Peer support enabled him to face difficulties positively. He said:

> I used to give up when I don't know how to do. But I feel easy to learn when there is someone who helps me. It is how the peer group helps me to do better (Field 3/2004).

This kind of support became a source of motivation to encourage ICT integration. Peer support could provide the support that meets the teachers' needs. This kind of support was an important factor in bringing about actual change in attitudes and practices. Katy said, "As these suggestions and support are practical, I would find myself changing" (Field 3/2004). Similarly, Amanda commented:

> I find that she is willing to have change. She has some good teaching practice in her class, such as to revise and test students immediately after the lesson. It inspires me to think whether I need this type of practice for my subject (Field 3/2004).

Influenced by her partner's enthusiasm in ICT, she began to adopt some of her partner's practices. Peer support was able to produce proactive actions to change the teachers' practice.

Summary

Peer support, through professional interactions, exposed the teachers to new experiences in learning to use ICT in teaching. Although the teachers were initially unclear about how peer support could help them build their capability in personal ICT integration, the findings showed that they gradually discovered the benefits of peer support as a means of professional development. This process provided valuable experiences of developing professional development at a personal level. These experiences included: increased professional interactions, expanded perspectives of ICT integration, enhanced reflection on ICT integration and emotional support and increased confidence in ICT integration.

The findings of this study suggest that the teachers did not usually have professional interactions with teachers in other subjects. Peer support helped to pull the teachers together to provide more opportunities for in-depth communications. The findings suggested that the depth and breadth of professional interactions was enhanced.

The results also suggest that the teachers' perspectives of ICT were expanded because of peer support. The arrangement of peer groups of teachers in different subjects helped them to look at the use of ICT beyond the boundary of individual subjects and allowed them to develop wider pedagogical perspectives. They became more likely to appreciate different possibilities for ICT use and to explore new ICT application in this setting.

The peer partnership relationships encouraged the teachers to be more active in examining different possibilities and ideas in practice. It provided them with an environment for critical reflection and opportunities to re-examine their reasoning about ICT integration and how these influenced their daily practice.

This study found that peer support provided the teachers with a safe and comfortable venue for sharing emotions and the opportunity to obtain positive responses from peer partners. The findings showed that peer support helped them feel recognized, accepted and encouraged and boosted their confidence in ICT integration.

In conclusion, the findings suggest that the limitations of skill-based training to stimulate critical reflection were offset by using peer support as a professional development tool for ICT integration. Peer support helped teachers reduce their negative emotions associated with using ICT in teaching. When the teachers had a more positive attitude towards ICT integration, they became more relaxed about external expectations of ICT integration.

Factors affecting the effectiveness of peer support

Although this study has demonstrated the benefits of peer support as a professional development tool for ICT integration, the study found that external disruption is a major factor affecting the effectiveness of peer support. Several other factors are also identified from the teachers' point of view. They include: a) peer relationship; b) peer support as a voluntary participation; c) peer support as a mandatory requirement; and d) the role of the researcher. These factors are discussed below in turn.

External disruption

This study found that external disruption could significantly affect the development of peer support and its effectiveness. At the end of February 2003, when the peer support process of this study was about to begin, SARS, a serious respiratory disease attacked Hong Kong. Since SARS was a highly infectious disease and its fatality rate was high at that time, many Hong Kong people felt a sense of panic and anxiety. Schools had to take extra precautions to protect students because of the concentrated nature of the student population in schools. The school routine was then greatly interrupted.

Understandably, the participating teachers in the study stated that they were distracted from their normal working routines and schedules during the SARS period. Peer meetings were delayed and the frequency of meetings was reduced. The teachers reported that their progress with peer support was hindered. For example, Mei said, "Because of the influence of SARS, most of our work almost stopped. We could only have 30 minutes for each lesson…. Generally, we did not have formal sharing sessions between us" (Field 2/2003).

The SARS issues made their busy daily schedule even tighter. Time became a significant factor affecting their participation in peer support. For example, Henry complained, "Time is a factor…. Everybody is busy now" (Field 3/2004). Similarly, Robert admitted, "Many activities are cancelled. We can only maintain minimum contacts. We have chats sometimes when we are working at the computer corner" (Field 4/2004). Some teachers stated that they could hardly arrange regular peer sessions in this situation as they were usually engaged in more daily responsibilities or ad hoc issues in school. Stephen was one of those who agreed that time was tight, "As we are in the middle

management, we have too many responsibilities and we can hardly make arrangement for peer meetings… We do not have much time to meet and we usually work on our own" (Field 2/2003). This reflected the fact that the teachers were greatly affected by the SARS issue and found it difficult to have quiet time for sharing.

Many forms of professional development, for example, workshops and seminars are often tightly organized and are constrained by time and place. Conversely, peer conversations can occur whenever and wherever the peer partners agree. It was this flexible nature of peer support that enabled some peer support to progress despite the SARS disruption, no matter how irregular, informal and short the peer sessions were. And it was the peer support that provided teachers the opportunity to talk about ICT use, as in Lisa's case, "We have some conversations on [ICT use] because of this research" (Field 2/2003).

Although external interferences were uncontrollable, the flexible nature of peer support allowed the teachers to make adjustments to adapt to new situations. This indicated that the structure of peer support was highly adaptable.

Peer relationships

The teachers often considered the good social relationship of peer partners as a significant factor affecting the successful development of peer groups. Amanda said, "When you asked me to find a partner, I did take time to consider whom I should invite. I thought that if I invited [my current partner], the peer group might be good because she was very friendly" (Field 3/2004). Her rationale to select peer partner reflected that good social relationships seemed to be perceived as an essential criteria of good peer partner. Mei agreed, "Peers cannot develop a

quality relationship unless they have very good prior relationship…" (Field 3/2004). Stephen echoed, "When teachers do not have a good prior relationship, they can hardly have open and in-depth interaction" (Field 3/2004). They all stressed that to feel at ease and comfortable with the peer setting, they needed a partner whom they knew well and with whom they had a good social relationship.

Having a good social relationship was more likely to increase their motivation towards peer interactions and thus improve mutual understanding and trust. Katy said, "Through daily communication and work, we feel that we think in similar ways. This encourages us to have on-going sharing. If we are different, the door [of communication] will have been shut" (Field 3/2004). Peer partners were less likely to engage in in-depth conversations if they did not share similar thoughts. This suggested that a preferred peer partner should hold similar beliefs and values, so that they could build up mutual trust.

The case of the online discussion forum in this research is a good example of the adverse effect of lacking mutual trust and social relationship. Although this study planned to use an online forum to supplement the development of peer support, the study found that teachers did not show much interest in this kind of discussion forum because they did not feel a close relationship with other participants in the forum. Their emotional reactions to this distant relationship in an online environment seemed to inhibit their enthusiasm towards the discussion forum itself. Although Amanda had the skill to use the media (as she has a degree in computing), this knowledge did not particularly help her feel involved in a distant relationship. She did not feel comfortable with an online environment, "However, I do not feel comfortable to write more because I think I can only talk in a private environment.... I do not know other people in the forum…. I do not

have the intention to give my opinions" (Field 2/2003). This suggested that the teachers were less likely to feel comfortable to speak to a group of 'unknown' people if they lacked a developed mutual relationship. Katy concluded, "Peer partners must be willing to communicate and help each other" (Field 3/2004). Without a sense of belonging to the group, teachers were less likely to initiate in-depth interactions. Lisa said, "I do not have motivation to attend the forum especially if I do not have much to say… After I read messages from others, I do not think I have anything to feedback" (Field 2/2003). The teachers were less likely to enjoy interactions in the forum and they feel uncomfortable in expressing themselves in this situation. Although Lisa had tried to take a first step to start conversations in the forum, the low participation rate in the forum eroded her motivation, "I attend the forum once and leave a message there. However, I did not receive any feedback from other participants…. When I find that the forum is very inactive, it affects my participation" (Field 2/2003). Although the online environment was intended to provide a flexible way of communicating, the study found that these teachers were still not personally ready for using this media.

Peer support as a voluntary participation

The teachers usually regarded peer support as a personal deed, and thus they purported that the participation should be voluntary. Stephen was one of those, "Peer support should develop upon voluntary peer relationship. It is not suitable to promote this type of development through a management approach" (Field 4/2004). His emphasis on voluntary participation suggested that the teachers valued professional autonomy. School intervention in peer support was seen as a potential threat to their professional autonomy. Terry's comment exhibited a

tension between professional autonomy and school-managed professional development: "The effect of a 'forced' peer support will be different from a voluntary peer support" (Field 3/2004). Furthermore, Mei was worried about peer support being used as a teacher evaluation tool instead of simply a means of professional development: "Peer support may be successful if teachers have no negative feelings towards this type of activity and they are willing to open themselves to improvement. It should not become a tool to measure teachers' teaching" (Field 3/2004).

Susan's impression of her negative experience on school-managed partnership programmes indicated the teachers' hesitation towards a school intervention on matching peer partners:

> Like the policy of having two class teachers in a class. It is expected that both teachers may help each other. However, when we have a wrong partner, it can be very bad. It should not be compulsory. Peer support is natural. We will choose a suitable partner ourselves. If it becomes a policy, it may not work (Field 3/2004).

She did not have confidence in school-managed peer support because she was worried about unmatched partnerships producing fruitless results. She emphasized that peer relationships should be developed naturally in an unrestrained atmosphere. The teachers thought that peer support, as a professional-to-professional relationship, should be a voluntary activity. They preferred to maintain peer support in a private and comfortable atmosphere so that they could be free to participate, as reflected in Lisa's comment, "A compulsory policy may not bring a good effect…. Peer support should be voluntary…. If

there is a compulsory policy, say 50 hours of peer sharing, it is difficult" (Field 3/2004).

Peer support as a mandatory requirement

Interestingly, the study found that the teachers' perception of using peer support as a part of professional development in school was mixed. On the one hand, some teachers prefer peer support to be a voluntary activity and not be controlled by school. On the other hand, some seemed to think that professional development was unlikely to be successful if it was not mandated and well-managed. Some teachers, for example, Ming, thought that school intervention and monitoring were essential:

> It is hard to have good effect to promote peer support through voluntary participation. Not many teachers will feel the need to have this kind of interactions. The Education and Manpower Bureau also has a clear instruction to guide the development of Continuous Professional Development in its proposal. The development of peer support should be management-oriented and the school should have a quality control (Field 3/2004).

This study found that some teachers lacked self-initiation in directing their own professional development. Since they often regarded professional development as an optional task, they seldom had clear purposes for their participation. This was reflected in Amanda's comment, "Teachers may not attend professional development workshops if there is not a requirement in policy. Unless a teacher has a very strong vision, they won't expect to do more than their required duties" (Field 3/2004). While Lisa felt that peer support should be voluntary, she

admitted that she needed some kind of external pressure in order to push her to participate in this type of professional development: “Without external force, we will not do it” (Field 3/2004). Therefore, this study found that some teachers usually gave higher priority to formal tasks in which they were given clear instructions because “formal tasks will create pressure,.. it may create a need to fulfil requirement” (Robert, Field 3/2004). Stephen also agreed that an external force was important, “We need an external pushing force. We are busy and do not have much spare time to think about the peer group. If it is not a responsibility, we will not push ourselves to do it” (Field 3/2004). As they already felt themselves overloaded, professional development became an optional task to which they gave lower priority.

Voluntary participation could also lead to disincentive on their participation, as Mei said, “The priority to do an informal task is low because there are too many formal work to do. If this group is a little bit more formal, say requiring us to write a short evaluation, the operation of the group will be better” (Field 4/2004). This showed clearly that they were likely to rely on external pressure as a source of motivation for their work.

Although some teachers valued their autonomy in peer support as professional practice, they were also concerned about the lack of tangible outcomes of peer support. For example, Henry said, “It is good that a person's experience can help to inspire others. But, it is hard to be defined and measured” (Field 3/2004). His comments reflected that peer support, as a means of professional development, should be accountable to the school’s goals and objectives. They accepted that the school needed to take certain measures to ensure the quality of professional development. For example, Lisa stated that the

school could find it "difficult to verify the teachers' participation in peer sharing" (Field 3/2004). Her comment reflected her perception of the bureaucratic school structure. Some teachers were doubtful whether peer support, as a voluntary activity, could work successfully within the bureaucratic structure of a school. Specifically, some of them, for example, Stephen, were concerned about whether their effort to maintain good peer support would be recognized by the school, "I also doubt whether the school recognizes the teachers' effort in peer support and accredited it as the teacher's professional development" (Field 3/2004). They thus were likely to hold back their wholehearted participation in peer support because of this tension.

The role of the researcher

The study found that the teachers wanted clear direction and guidance for peer support, at least at the beginning stage. When reflecting on the peer support process, Terry said, "If we have a regular questionnaire, our group will be better. We just forget about the peer group sometimes when we are busy. The questionnaire may at least remind us that we have a responsibility to do my part" (Field 3/2004). Robert proposed that a guideline was required, "We need a group task. We do not have a very strict guideline on the operation of the group" (Field 3/2004).

The role of the researcher was found crucial in supporting teachers by giving clear direction and guidance, and in creating an environment of peer support in which the teachers could build a personal path of professional development in a comfortable and relaxing environment. This section records my

reflections on the process of supporting the participants to develop peer support in this study as a coach and a facilitator.

The role of a facilitator was to ensure the teachers' understanding of the purpose of peer support. Findings from the initial phase of peer development showed that some teachers did not have a thorough understanding of peer support although an introductory session was given to all participating teachers. For example, Amanda said, "I did not quite understand what the aim of the research was. [My partner] told me that you [the researcher] do not focus on research on how to use IT but how peer partner helped each other to learn to use IT" (Field 3/2004). Some teachers were strongly affected by their prior experiences and beliefs about informal peer relationships. They often regarded peer support as a social process. For example, Lisa said, "It is hard to focus on talking about only IT. We shift to talk about teaching instead. Since the use of IT is affected greatly by the student feedback, we shift to talk about student problems and our teaching methods" (Field 2/2003). This suggested that the effectiveness of the brief introduction and training to participants before the start of the research was limited. This affirmed the literature (e.g. Joyce & Showers, 1982) that the teachers felt difficult to convert the newly learned peer support principles into practice. The participants' pre-conception of peer support was likely to strongly and continuously affect the development of peer support. Teachers might need on-going facilitation so as to gradually build an appropriate perception and develop their skill of peer support, especially at the early stages.

As a coach in this study, I kept reminding teachers of the important concepts of peer support and provided personal and practical assistance if needed. For example, two peer groups raised a similar problem that they got lost in the

peer support process because they lacked a concrete guideline for peer conversation. For example, Henry said, "I think that we do not have a concrete guideline to help us to stay focused. Sometimes we get lost" (Field 4/2004). Looking from their perspectives, their requests were reasonable because they did not have any experience in this process. In response to their request, a simple guideline was developed based on the teachers' needs. This guideline restated the principles of peer support and gave them a step-by-step procedure for peer conversation. The teachers thought that this guideline was helpful, such as Amanda, "We follow the note. We do not know how to start if there is not a note for us" (Field 2/2003) and Lisa, "Having some general guidelines is good, such as let your partner say more, because we tend to give our opinion at the first place. The guideline helps us to stop ourselves. It is a good reminder because we often make this mistake" (Field 3/2004). This suggested that a guideline could be a reminder of some important principles of peer support. Some teachers thought that having a guideline helped them focus on developing an appropriate peer support process. This study found that they became less reliant on this guideline in the later stage of the research period as they became more familiar with the process of peer support. They became more creative in seeking a suitable process for themselves. Amanda stated at the end of the study:

> We don't have any guideline for the conversation. We start to have more sharing. I think that it will be better without a guideline. We will know what each other talk and share. We did not follow the guideline when we talk about the worksheet today (Field 4/2004).

This showed that she had internalized learned skills as personal competency based on suitable support gained at the early stages.

The development process of peer groups in this study confirmed that the facilitation role of the researcher was important to enhance peer support. This facilitation role was acknowledged by the participants such as Lisa, "After I have a conversation with you [the researcher], I have a reflection on myself" (Field 2/2003). This suggested that a facilitator might encourage participants to think beyond their existing boundary. As they brought their reflection to the peer group, it was likely to provoke more sharing and discussions.

It was found that a researcher, being facilitator, also needed to be sensitive to the participants' emotions and to develop rapport with the participants. In general, participants were more likely to express their emotions in an informal, private and safe environment rather than in a formal interview. Therefore, I would have to make use of private conversations to help them express their feeling regarding the research that might hinder their participation. I had some informal contacts with the teachers during the course of the study through phone calls and lunch meetings (during the time I stayed at Hong Kong for conducting interviews). It was found that they were more willing to tell me about their concerns and difficulties in such settings. For example, a conversation with Lisa raised my awareness of her worry about external comments on her way of using ICT in teaching. In another case, another pair of teachers felt pressurized to have regular and long peer sessions. My role, as a facilitator, was to keep the participants enthusiastic about their involvement in peer support. In the middle of the study, the teachers seemed to develop anxiety about using the online discussion forum. It was noticed that the teachers felt uncomfortable and unready

for using this media. Some teachers, during the interviews, felt embarrassed to mention their infrequent participation in the forum. Considering their feelings, the online forum was closed after analysing their feedback. Failing to be responsive to their feelings was likely to mean missing the very important and underlying issues of their concerns.

Summary

This section identifies some factors affecting the effectiveness of peer support as a means of professional development. External disruption was found to be a major factor affecting the development of peer relationships. However, the flexible nature of peer support has been able to ensure that some form of peer conversations could still carry on despite these disruptions. All teachers agreed that having good relationships with the peer partner was a major factor leading to the success of peer support. The study also found that the teachers had mixed feelings about the nature of peer support. Some emphasized professional autonomy and preferred to keep peer support as a voluntary activity; while some thought it should be a mandatory requirement and accepted schools' intervention was crucial to the success of this form of professional development.

This study found that the role of the researcher, both as a facilitator and a coach, was crucial to ensure that the teachers fully understood the aim and rationale of the research and the purpose of peer support, especially at the beginning of the research. Clear directions and guidelines were important as the participants were not familiar with this type of professional development. This study also noticed that the facilitator needed to be sensitive to the teachers' feelings. The experience of facilitating peer support in this study demonstrated

that the professional development needs of teachers were diverse and unique. A flexible attitude towards the personal needs of the participants was an essential quality of a professional developer.

CHAPTER SEVEN: DEVELOPMENT OF MODEL

This chapter develops a peer support enhanced model for teacher professional development in ICT. The model is based on this study's findings and is developed in three main parts. The first section looks at issues associated with current approaches to ICT professional development. This is followed by an examination of the significance of intrinsic motivation for ICT integration. Next, the influence of teachers' pedagogical reasoning on decision-making in ICT integration is examined and the discussion then draws attention to a personalized approach to ICT integration. This chapter concludes with the presentation of an emerged professional development model.

Current skill-based professional development is ineffective

At the beginning of this study, seven out of the ten teachers seemed uninterested in exploring further application of ICT integration. This study has identified five factors affecting ICT integration, namely, beliefs and perceptions, skill-based training, external pressure, external constraint and negative experiences. It was found that these factors have led to a lack of motivation in using ICT (see Figure 7.1). These factors can be divided into two levels: external level and personal level.

The implementation of ICT in education in Hong Kong is mainly driven by a top-down approach in which the government is the major driving force of ICT use in schools. In 1997, the Hong Kong government published its Five-Year Strategies, which laid down its vision and the future direction of ICT in education.

Since then, the government has been very active in promoting the use of ICT as a means to transform teaching and learning. It is noticed that the government implements its vision of ICT in education through two means: infrastructure and ICT training. Since 1998, the government has invested heavily in school infrastructure. At the same time, the government has provided abundant ICT skills training opportunities for teachers. The government expects that through the provision of resources and training programmes, teachers will be able to integrate ICT into their teaching practices. However, this study argues that this simplistic systemic approach is unlikely to lead to the intended result.

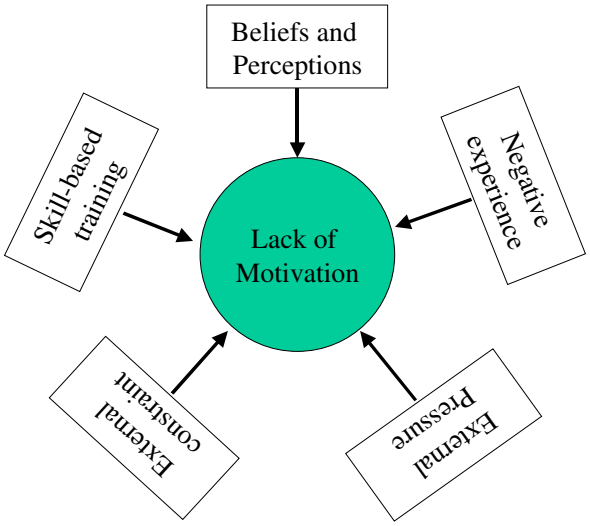

Figure 7.1: Factors contributing to the lack of motivation

Teachers are professionals who bring values, beliefs, knowledge, attitudes and insights to their role (Blackman, 1989). However, in the process of ICT implementation, instead of taking an active part in ICT integration, they are only passive users that have no control over the policy making process. Rather than

promoting motivation to use ICT, the external incentives introduced by the government become pressure that discourages teachers from using ICT. To add to their frustration, this study found that teachers faced a number of external constraints. The teachers complained that the provided equipment was often unreliable or ineffective; ICT teaching materials and resources were inadequate or not suitable; and the support from school was insufficient. Since their needs and concerns were not being well addressed, the teachers in this study became frustrated, passive and avoided risk-taking.

The current skill-based training appears to bring about low-level ICT application. This mode of training offers teachers a narrow technocentric perspective of ICT integration. It further reinforces many teachers' perception of ICT as only a technical supplement to traditional pedagogy, a time saving tool, a content-delivery tool, and a tool to attract students' attention. They thus do not have high expectations of ICT to improve students' learning and will be less likely to develop pedagogical links to teaching and learning.

Results from this study suggest that the current skill-based training should only be part of an effective professional development programme. As discussed in the literature review (Chapter 2), effective professional development for ICT integration should help teachers improve their capability to use ICT as well as to develop their beliefs and perceptions of ICT so that they can see more potential for ICT integration. Behaviours and beliefs are closely related so any attempt to change behavioural skills without reference to the impact of beliefs and attitudes are likely to be ineffective (Hargreaves & Fullan, 1992).

It was also found in this study that teachers' emotions, especially negative emotions have a profound impact on ICT use. Even when the teachers have

acquired the required skills, and also believed that ICT has a high pedagogical value, if they have negative feelings towards ICT integration, they will not have the motivation to use it. Comprehensive professional development should also address emotional issues and provide emotional support for teachers (see Figure 7.2).

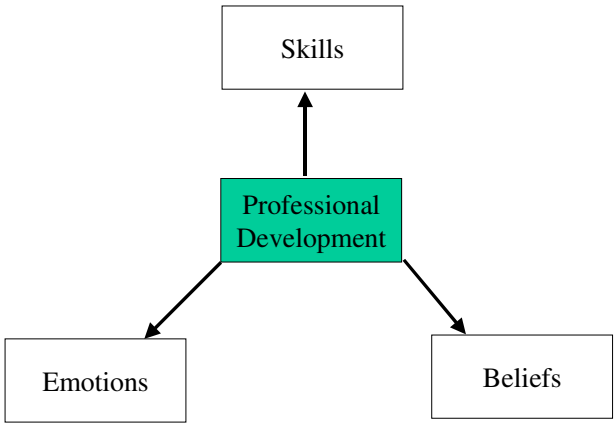

Figure 7.2: Elements of professional development

This study found that the current technically oriented professional development neither provides stimulation for teachers about ICT integration in authentic contexts nor addresses their negative emotions (see Figure 7.3).

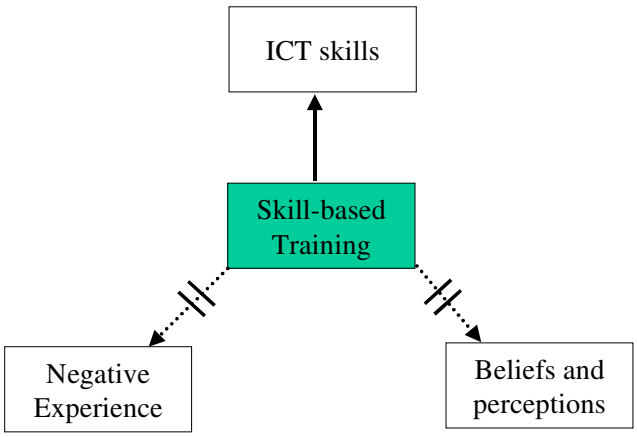

Figure 7.3: Inadequacy of skill-based training

As the aim of this study is to improve the professional development of ICT integration for teachers, rather than attempting to tackle external issues, that is, external pressures and external constraints, this study focuses on developing a professional development model that provides teachers comprehensive support that suits their individual needs. This model intends to help teachers to turn ICT integration into a personal and intrinsically motivating process. In this way, the negative impact of external forces may be reduced.

Extrinsic motivation versus intrinsic motivation

As Hong Kong uses strong external incentives and policies to drive ICT implementation, it was found that the teachers in this study were mainly motivated by external forces to use ICT. The findings of this study suggest that these external incentives, in additional to the external demands and expectations which were laid out by the ICT policies, such as using ICT in 25% of classroom teaching time for all teachers, have became a source of pressure tension for teachers.

Extrinsic incentives are only able to spark a beginning of ICT integration. Although external incentives and resources are important to the development of ICT in education, they alone are insufficient to sustain a cycle of improvement of ICT integration. In a pamphlet outlining the principles that underpin the matter of allocating resources for schools for the 21st Century in the UK, Caldwell (2006) noted that resource is a significant but not sufficient factor for school education:

> No reform in education can succeed without appropriate resources to support the endeavour…. Traditionally such a statement would be assumed to mean more money is needed from government….

> The focus on money as the chief resource for schools has not resulted in expectations being achieved to any great extent (p. 5).

This is echoed by Mumtaz (2000) who commented, "Even if teachers are provided with up-to-date technology and supportive networks, they may not be enthusiastic enough to use it in the classroom" (p. 338). The effect of external forces alone in motivating teachers to use ICT is likely to be little and short-lived.

Furthermore, it is argued that excessive external incentives will eventually produce negative effects on the teachers' motivation. In a paper analysing motivation in the economic sector, Benabou and Tirole (2003) concluded:

> [Psychologists] have called attention to the fact that explicit incentive schemes may sometimes backfire, especially in the long run, by undermining agents' confidence in their own abilities or in the value of the rewarded task (p. 516).

Similarly, excessive external demands and expectation may have similar negative effects on teachers' ICT integration. The findings of this study show that the teachers felt anxious about externally defined directions for ICT integration. The teachers' passiveness towards ICT integration was believed to be a result of strong external incentives and demands. These external forces were a disincentive to the teachers' creativity in ICT integration (Hebb, 1955). In the findings of a study on teachers' dispositions as a predictor of ICT integration in six US schools, Vannatta and Fordham (2004) argues that teachers need to be intrinsically motivated, open-minded and have a risk-taking attitude towards ICT use: "Because technology is a dynamic innovation, learning to use it as a personal or instructional tool requires a willingness to make mistakes and learn from them and an ability to take risks" (2004, p. 261). However, this study found that as a result

of excessive external forces, teachers became less inclined to take risks (Higgins et al). Instead they only passively follow instructions and fulfilled externally mandated requirements.

Increased external forces will not necessarily change teachers' ways of using ICT (Hanushek, 2005) because teachers are less likely to be reflective on their use of ICT when they react passively to external forces. ICT use, when driven by strong external forces and lacking reflective practice, becomes a linear process (see Figure 7.4) that is difficult to sustain. As indicated in Figure 7.4, when motivation for ICT integration is external and evaluation of outcomes is also based on externally provided criteria, the lack of intrinsic drive is likely to end in the stagnation of the developmental process.

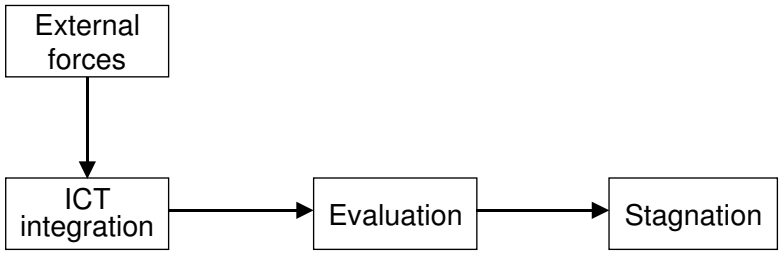

Figure 7.4: Linear effect of external forces on the use of ICT

In the absence of personally formed pedagogical links between teaching and ICT, teachers tend to use ICT as a mechanical tool (Cuban, 1997) or supplement to existing teaching practices. This study's findings show that teachers often use ICT to attract student's interest and to speed up their coverage of the curriculum. When teachers encounter difficulties and limitations (such as lack of time and unreliable equipment) or find that the outcome is not satisfactory (such as students' initial interest begins to wane), they become doubtful about the

effectiveness of ICT. If they cannot see further potential of ICT integration for teaching and learning, they lose motivation to apply ICT in their teaching and may give up using ICT regarding it as something they can do without [Stagnation]. In this model (Figure 7.4), since the use of ICT is mainly driven by external forces, stronger external forces will be needed to produce further changes and, as discussed above, excessive external forces will create greater tensions for teachers and are likely to have a negative effect on ICT integration.

In research on the effect of extrinsic incentives on qualitative aspects of task performance in Israel, Kruglanski, Friedman, and Zeevi (1971) distinguished between an intrinsically motivated person and an extrinsically motivated person:

> [intrinsically motivated individuals] might include such 'qualitative' attributes of performance as comprehension of the task, recall of task-relevant features, creativity with respect to task-pertinent solutions, etc. [Extrinsically motivated individuals] might involve more 'quantitative' features of performance, e.g., the rate of production or speed of performance (p. 607).

According to their findings, intrinsic motivation has more benefit on qualitative performance while extrinsic incentives are more likely to boost quantitative performance. Teachers are less likely to develop intrinsic incentives if they are distracted or overwhelmed by external forces which suppress individual reflectivity and consequently reduce the likelihood of change. This is supported by Deci, Koestner and Ryan (1999) who found that overused extrinsic rewards were likely to undermine intrinsic motivation while Kohn (1993) warned that, "people are likely to become less interested in their work, requiring extrinsic incentives before expending effort" (p. 63).

The findings in this study deliver a clear message that the teachers lacked intrinsic motivation to sustain their attempts at ICT integration. The systemic, pedagogical and psychological issues put together led to a lack of motivation and a low intrinsic incentive for ICT integration. Fullan (1993) argued that intrinsic motivation is important to teacher change: "It is no denial of the potential worth of particular innovations to observe that unless deeper change in thinking and skills occur there will be limited impact" (p. 23). When teachers are intrinsically motivated, their practice will be driven by self-satisfaction. Chance (1992) argued that intrinsic motivation was a result of intrinsic rewards:

> We learn to throw darts by seeing how close the dart is to the target; learn to type by seeing the right letters appear on the computer screen; learn to cook from the pleasant sights, fragrances, and flavors that result from our culinary efforts; learn to read from the understanding we get from the printed word; and learn to solve puzzles by finding solutions (p. 202).

When teachers are intrinsically motivated, they will look at how closely their practice follows their objective rather than how far their actions fall short of the external demand. They will be more excited to achieve the intended outcomes and be more inclined to improve their actions. They are more likely to reflect on their current use of ICT and to look for better ways to deal with problems encountered. As they are more willing to take risks to experiment with different uses of ICT, their practice is more likely to change if and when needed.

As intrinsic motivation is very important to maintain a cycle of ICT integration improvement, it is thus crucial to help teachers develop this intrinsic motivation. The findings of this study indicate that teachers lack the motivation to

change their current ICT use because they do not see the pedagogical values of ICT and are, therefore, unlikely to gain intrinsic rewards from practice that is disconnected from these values. The current approach to professional development fails to challenge the teachers' existing beliefs and perceptions. Instead, these beliefs and perceptions are usually reinforced by skill-based training. Therefore, this study acknowledges the significance of engaging with teachers' beliefs and perceptions and its findings suggest that peer support can be an effective way of achieving this.

Peer support as enabler of intrinsic motivation

As discussed in the literature review chapter, peer support is a social approach to professional development that "take[s] the risk of developing open, interactive, quality information systems" (Fullan, 2003, p. 32). It provides a structured but flexible environment for professional interactions through socially-mediated collaboration processes, like sharing, clarification, explanation, feedback, discussion and giving suggestions. Professional interaction is different from social chatting which is usually shallow and unfocused. Instead, it provides teachers with opportunities and a safe and secure environment to talk about their concerns and experiences of ICT integration with a trusted partner. In this setting, individual teachers' personal experiences are equally valued. No single teacher will be regarded as having absolute expertise over peer partners. It promotes mutual appreciation and collegial support regardless of subject areas, experience and style of teaching. Through the process they may gain support and feedback and affirmation from their partners.

Through in-depth and focused conversations, teachers have opportunities to share their concerns and be listened to. Teachers are required to describe their practices, and they need to reorganize their experiences and re-examine their rationale of practice. During the process, teachers will become aware of the beliefs behind their practices. This is a very important process as beliefs behind practices are usually taken for granted. Schon (1983) explains why we are often unaware of our beliefs behind our actions:

1. There are actions, recognitions, and judgements, which we know how to carry out spontaneously; we do not have to think about them prior to or during their performance.
2. We are often unaware of having to learn to do these things; we simply find ourselves doing them.
3. In some cases, we were once aware of the understandings which were subsequently internalized in our feeling for the stuff of action. In other cases, we may never have been aware of them. In both cases, however, we are usually unable to describe the knowing which our action reveals (p. 54).

Since teachers are usually unaware of their beliefs that have been internalized, they often make decisions and carry out actions spontaneously. When they begin to be aware of their beliefs, they are more likely to reflect on their own practices and examine the appropriateness of their beliefs within their contexts.

Peer support also provides opportunities for teachers to listen to their partner. As the findings of this study show, teachers may gain new learning from examining their partner's experiences, these opportunities enable teachers to see different perspectives and gain new insights into ICT integration. As peer support

encourages teachers to recognize ICT integration beyond their own perspective, it may create discrepancy between the new perspectives and the teachers' existing beliefs. Again, this perceived discrepancy will encourage teachers to examine the appropriateness of their own beliefs about practice. If they consider their partner's perspective or experience to apply to their situation, they may consider adapting thier practice. If not, they still gain new insights from reflecting on their beliefs critically.

The discussion above suggests that reflection is important in changing and improving current ICT integration. Figure 7.5 shows that peer support is an activating force that encourages reflection. Reflection appears to be at two levels, reflection on technical use of ICT and reflection on beliefs and perceptions. Although this study found that some teachers already engaged in self-reflection on their use of ICT, their reflection was likely to be limited by their existing beliefs and perceptions of ICT as a technical supplement to existing teaching practice and thus their reflection was focused on improving the technical application of ICT. This study argues that reflection on technical issues is shallow and insufficient to enable teachers to see the pedagogical values of ICT integration. As found in this study, the teachers felt frustrated when they found themselves short of ideas for applying ICT in practice or when they faced external constraints outside their control. When they found the ability of ICT features to attract students' attention diminished quickly, they soon returned to traditional teaching. Therefore, this level of reflection is insufficient to enhance in-depth thinking about the reasons for, and purposes of, ICT integration.

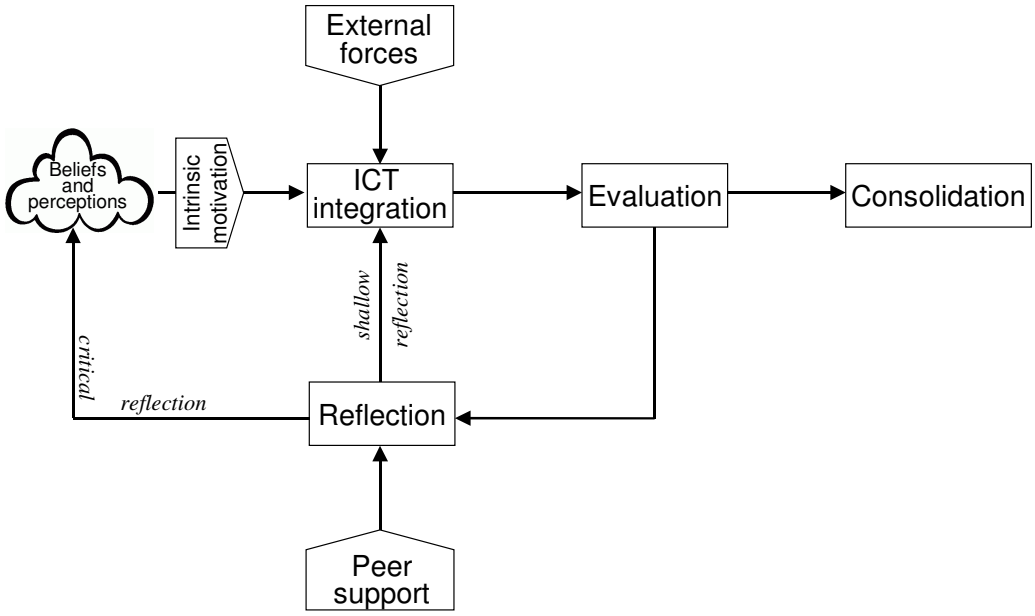

Figure 7.5: A double loop reflection of ICT integration

Figure 7.5 shows that peer support can encourage another kind of reflection, a critical reflection, on beliefs and perceptions of ICT. Critical reflection enables teachers to critically re-examine their beliefs and perceptions for their practice. This critical reflection is argued to be a result of cognitive dissonance as described above. Through ongoing critical reflection, teachers are likely to gain new insights and gradually see the pedagogical values of ICT. As described in the pervious section, when teachers perceive pedagogical values of ICT they begin to generate intrinsic motivation that maintains the cycle of change and reflection, and thus spur on the ICT integration process.

Teachers' needs and concerns about ICT integration change over time when they are situated in different contexts (Fullan, 1999). They thus need a continuous support process to continuously enrich their self-reflection on their beliefs and perceptions and readjust their ICT strategies and pedagogies in

accordance with changes in context. Figure 7.6 shows that experiences of both peer partners are connected through a peer-enhanced reflection process. This process can continuously provide exposure to different views from a trusted partner. Reflection is thus not solely a personal endeavour but can also be a co-development process of shared meanings and values of ICT integration. As peer partners share the same process, they are able to provide and gain perspectives and insights through peer support. This is a highly dynamic process that draws on the most up-to-date knowledge and experience of both partners and is likely to increase the depth of self-reflection. Also, peer-enhanced reflection, which is a mutual scaffolding process, helps teachers continuously identify suitable goals and challenges to improve ICT integration. Through this change process it is expected that teachers will gradually see the pedagogical values of ICT and as a result develop intrinsic motivation, which becomes a force for further improvement of ICT integration.

This study has demonstrated that peer support can be an enabler of teachers' self critical reflection on beliefs, perceptions and practices. This peer-enhanced reflection process through injecting wider perspectives and more insights into ICT integration, may enable teachers to be the change agent of their own ICT integration rather than external demands. In responding to Fullan (1993) who argued, "The only alternative that works is creating conditions that enable and press people to consider personal and shared visions, and skill development through practice over time" (p. 23), this study concludes that professional development in ICT integration for teachers should shift from providing mainly technical support to providing conditions to empower teachers to develop their

pedagogical values and thus develop intrinsic motivational forces for change in their ICT integration.

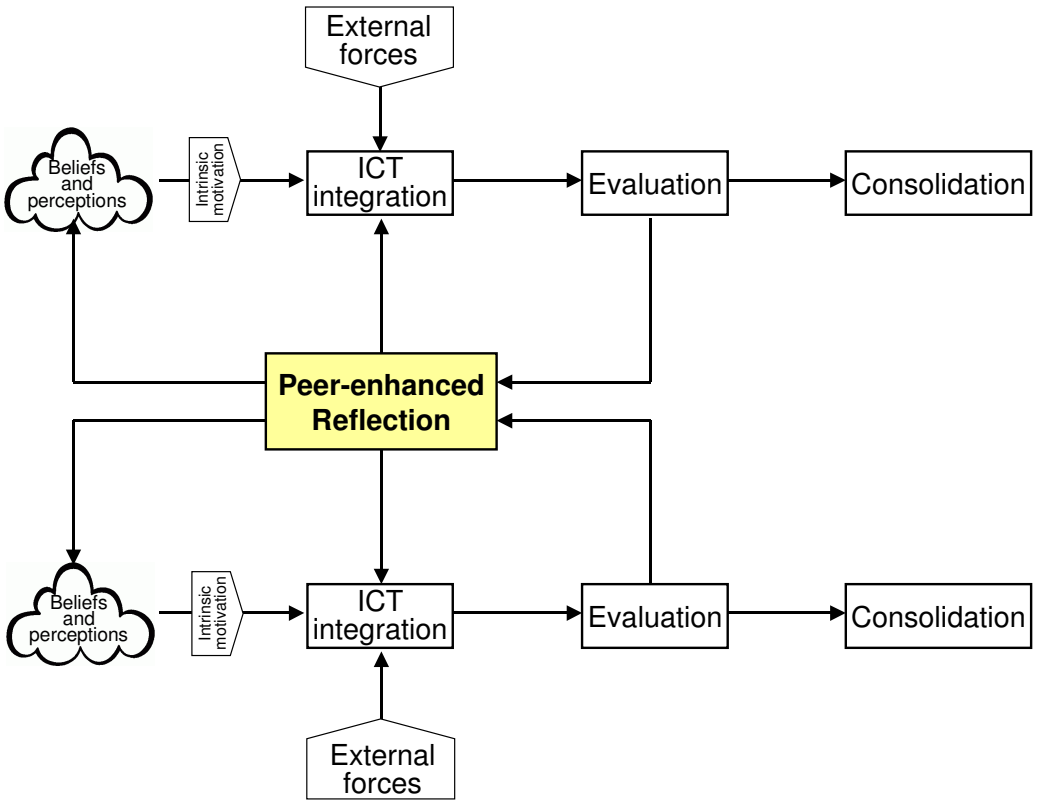

Figure 7.6: A peer-support enhanced reflection model

Pedagogical reasoning

In the previous section, we have discussed how external forces and skill-based training have negatively affected the quality of ICT integration. We have also discussed the importance of teachers' beliefs and perceptions in their practices. These factors, together with external constraints and negative experiences of ICT integration, were found to be significant in affecting teachers' ICT practices.

However, this study argues that factors such as external pressures, external constraints and negative experiences of ICT integration do not determine the practice directly. Adult learners are usually self-directed (Merriam, 2001). They make decisions for their own actions. In a study on teachers' views of technology as catalyst for change in teaching practice, Dexter, Anderson and Becker (1999) concluded that "[The participating teachers] made it clear that their changes in instructional approach were the result of thoughtful reasoning. We could describe this thought process as their construction of knowledge about what does and doesn't work in the classroom" (Dexter et al., 1999, pp. 236-237). This implies that teachers' pedagogical reasoning informs their strategies and practices of ICT integration. Rodrigues, Marks and Steel (2003), in a study on developing science and ICT pedagogical content knowledge, emphasized that complex reasoning and synthesis are the underpinning of good teaching. This suggests that enhancing pedagogical reasoning is important for teachers to seek better ICT integration (Fullan, 2003; Becker, 1996).

Pedagogical reasoning is a personal decision-making process through analysing and interpreting factors that affect practices. This process leads to personal ICT integration strategies (that is, paradigm) that are subsequently translated into practice (that is, pedagogy) (see Figure 7.7). This model illustrates that these factors affect ICT integration through the teachers' interpretation with pedagogical reasoning. This is a subjective process. This study argues that teachers interpret and analyse these factors though personal lenses of interpretation, namely, personal theories and emotions. These personal lenses of interpretation distil the effect of the factors and simultaneously define possible and probable teacher practices.

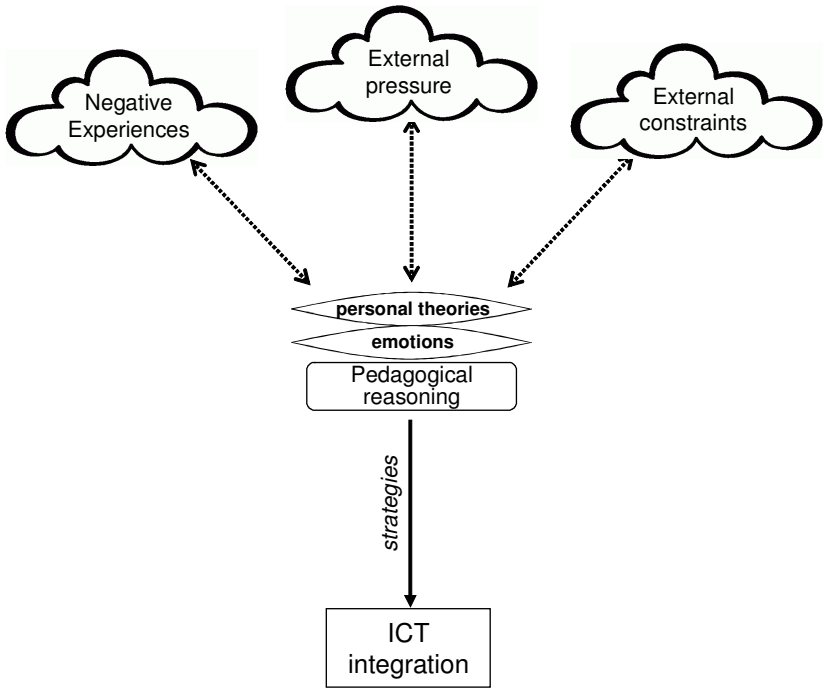

Figure 7.7: An illustration of the effect of negative factors upon the decision-making process of teachers in using ICT

Personal theories refer to the teachers' judgements that are "based on certain frames of reference which guide teachers' decision making and structure classroom activities. These frames of reference constitute a theory, which endows teachers with a capacity to predict what will work and thus produce desired outcomes in the classroom" (Chan, 2001, para. 2). Personal theories are thus implicit and practical, as Fox (1983) concluded, "The kind of analogy a person uses will not only reflect his way of thinking about teaching and learning, it will also affect the way he approaches the tasks and will determine the tasks he attempts" (p. 162). According to Chan (2001), personal theories are constructed from teachers' interpretation of past actions and are influenced by teachers' knowledge, beliefs and values. Teachers apply different personal theories in

different contexts. Because personal theories are often deeply rooted in personal beliefs and experiences, teachers are usually not aware of the influence of their personal theories on their practices. Personal theories are also hard to change unless significant experiences and knowledge are successfully accommodated into their belief systems (Pajares, 1992). Therefore, teachers may be blinkered towards, or unaware of, other possibilities when they interpret factors through this lens.

As Ajzen (2002; 1991) described in his theory of planned behaviour, immediate contexts are never neutral to teachers because teachers always apply personal lenses to interpret the context. Teachers facing similar external constraints, for example, lack of suitable resources, lack of school support, etc, will react differently because they may have different interpretations of the environmental factors due to different theories used. Therefore, if teachers consider external factors as determining elements in ICT integration, they are more likely to perceive the immediate environment as something beyond their control. They are likely then to develop a perception of low controllability over the environment. When they face such external constraints to ICT integration, they are more likely to give up. On the other hand, if teachers believe that ICT competency is the determining factor, then even if they are confronted with limited resources and unreliable equipment, they may respond by trying to acquire more skills to face these challenges.

Teachers' interpretation of these factors is also influenced by their emotions. Emotion plays an important role in decision-making, especially when the decision is about personal choices (Naqvi, Shiv, & Bechara, 2006; Page, 1999). Bullen and Sacks (2003) said, "Emotion is an intrinsic part of the way we

decide as human beings. A decision framework which bans emotion is doomed to failure" (p. 4). The effect of emotions on teaching and learning has already been well documented in the literature (for example, Hargreaves & Fullan, 2000). To ignore the effect of negative emotions would only hinder the teachers' development. As Hargreaves (1997) said, "If educational reformers ignore the emotional dimensions of educational change, emotions and feelings will only re-enter the change process by the back door" (p. 108-109).

This study found that emotions, especially negative emotions, significantly affect the teachers' interpretation of ICT integration and affect their behaviours. These negative emotions emerge as a result of negative experiences of ICT integration, lack of school support, unreliability of equipment, etc. In the absence of appropriate emotional support, negative emotions, such as frustration, disappointment, insecurity, anxiety, discouragement, and lack of control were likely to emerge. Teachers are likely to feel vulnerable in using ICT in teaching. Some teachers, as found in this study, perceive ICT as a threat to their existing role and status in teaching and learning. They are likely to become insecure, nervous, passive and consequently hesitant to try something new and work outside their comfort zone (Holland, 2001). On the other hand, as teachers often work in isolation (Darling-Hammond & McLaughlin, 1995), they are likely to feel lonely and powerless towards ICT integration issues. Since they seldom shared their difficulties about ICT integration apart from asking for technical help, they are less likely to perceive their problem beyond their own knowledge and perspective. They can become doubtful about the value of ICT in their practice as they are overwhelmed by integration problems. Isolation seems to become a source of disempowerment – lack of support and encouragement on the use of ICT.

Negative emotions can then become a lens through which teachers interpret their experiences of ICT integration and external constraints. It will further exaggerate the intensity of perceived difficulties and thus greatly reduce teachers' confidence and motivation to change. Negative emotions also undermine their capability to make good judgements about ICT integration (Fullan, 2003).

Peer support as enabler for decision-making

Findings from this study indicate that the personal development of ICT integration cannot be precisely predicted and planned. Teachers will look at ICT integration through a particular set of personal lenses created by personal theories and emotions that define for them the meaning of their practice. These personal lenses affect teachers' confidence, willingness and motivation regarding ICT integration. To maximize the chances of a positive result of ICT integration, this study suggests using peer support as a means to broaden personal perspectives of ICT integration and as a buffer against negative emotions (see Figure 7.8).

In the previous section, it was argued that peer support helps teachers to see a wider perspective of ICT integration so that their beliefs and perceptions of ICT can be challenged. Since teachers' beliefs and perceptions of ICT are important elements in constructing their personal theories, peer support may thus help to further develop their personal theories.

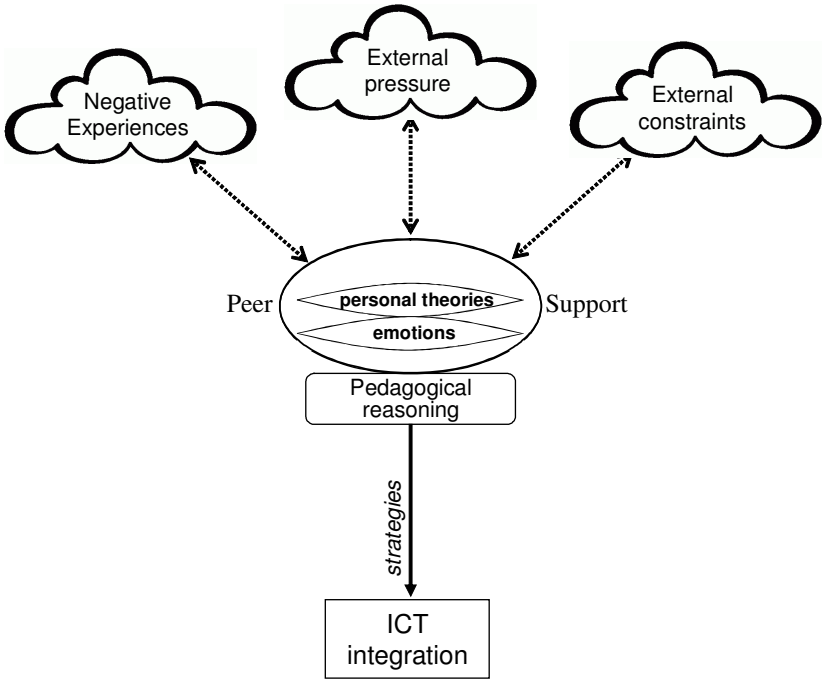

Figure 7.8: Peer support as perspective broadening and emotional buffering process

As discussed above, negative emotions may bias teachers' decision-making, such as exaggeration of difficulties. Teachers need some means to channel these negative emotions. This study suggests that peer support is able to provide teachers with long-term emotional support. As this support comes from trusted partners, teachers are more likely to feel secure about expressing their emotions and to be aware of the influence of their emotions on ICT integration. In addition, peer partners, as in this study, come from the teachers' immediate environment, that is, the same school, and can provide just-in-time and just-in-context support. By sharing problems and gaining recognition from peer partners, teachers are less likely to feel alone confronting problems and difficulties.

Greater tolerance to negative circumstances is likely to result (Vannatta & Fordham, 2004). The effect of negative emotions may be reduced.

Providing "ready-made spectacles" to regulate the teachers' lenses of interpretation is not effective in helping teachers seek and develop pedagogical reasoning for using ICT because their perspectives are personally situated (Fullan, 2003). Peer support offers a safe and comfortable environment within which teachers can further explore personal meanings and pedagogical values of ICT integration instead of adopting externally imposed goals. It thus enables teachers to construct and sustain positive pedagogical reasoning to inform new strategies and pedagogies of ICT integration. Therefore, this study suggests that the search for personal pedagogical reasoning of ICT integration "must go beyond the individual; must be larger and more collective in nature" (Fullan, 2003, p. 12).

Towards a personalized approach of ICT integration

The discussion above concludes that personal pedagogical reasoning is a key to decision-making about personal ICT use. Fullan (2003) commented that personal decisions cannot be directed by external forces as any attempt to manipulate the individual decision-making process is unlikely to unfold as intended. Echoing a central message of Fullan's (2003; 1999; 1993) trilogy on change, this study acknowledges that change in ICT integration happens in complex contexts that are not amenable to simplistic approaches to professional development. Dexter, Anderson and Becker (1999) also argue against a simplistic view of the change process of teachers using ICT:

> A simplistic view of computer as catalyst of instructional change is misleading because it disregards what we have learned about

> teacher development and the change process. Specifically, it underestimates the impact teachers' beliefs have on how they teach, it simplifies the process of how teachers develop and learn professional knowledge, and it diverts the examination of how social norms and structures might support or contradict a proposed change (p. 237).

With reference to Tosey's (2002) application of complexity theory in education, the following characteristics of teacher professional development can be identified:

First, the process of developing a personal approach to ICT integration is driven by tension caused by having to choose between taking a familiar, safe and comfortable approach or an unknown, unfamiliar and perhaps risky approach, or somewhere on a continuum between these two ends. Of course, the context for decision-making continuously changes over time. Teachers' decisions about ICT integration are an outcome of ongoing responses to changing contexts in which they assess and evaluate contextual factors through their personal lenses. Individual teachers will develop their coping strategies in accordance with their pedagogical reasoning which will also change over time. This suggests that teachers' ICT use is an emergent outcome rather than a fixed routine. This also explains the diversity of the teachers' actions and responses to ICT integration found in this study.

Second, decision-making is emotionally driven. As found in this study, teachers' emotions, especially negative emotions, can become a barrier to teachers exploring ICT integration further. Because this decision-making is, to a large extent, emotionally determined, the decisions that teachers made are not always

logical or rational. This makes it difficult to precisely predict the outcomes of professional development programmes.

Third, individual teacher's ICT integration is determined by a complex decision-making process which is emotionally driven, self-propelled and self-organising. A decision made in the present context will affect decisions in a future context. As ICT integration is an ongoing and evolving process, one is unlikely to be able to specifically predict and plan outcomes at the beginning of the process.

Thus, a linear, simplistic and stimulus-response approach to professional development will not encourage and empower this complex decision-making process. A comprehensive, flexible and personalized approach is necessary.

Contribution of this study to professional development

In the previous sections, it has been argued that ICT integration is a process in which teachers, through peer support, can continuously improve their practice through reflecting on their practice as well as their beliefs and perceptions of ICT. This self-reflection cycle is driven by intrinsic motivation. When intrinsic motivation is present, this reflection cycle will continue. Whenever teachers are exposed to new experiences, or when they notice a discrepancy between their beliefs and new perspectives, this reflection cycle will be activated. Therefore, improvement in ICT integration is a cyclic process.

In response to Illeris' (2002) who argues that learning happens in a particular learning plane, this study argues that a reflection cycle, as a process of learning, is also situated in a particular personal learning context of ICT integration. This context is formed by the teacher's ICT skills, their beliefs and

their emotions and defines a boundary in which teachers make decisions about teaching and learning ICT. Therefore, professional development to enhance teachers' ICT integration needs to provide support for teachers in these aspects. Peer support plays a significant role in providing emotional support for teachers. Peer support also enables an environment that encourages teachers to develop intrinsic motivation.

In the early stage of ICT integration, as suggested in the findings, teachers' ICT integration usually happens in a restricted context, that is, they have limited ICT skills; they do not have a clear perception of the pedagogical values of ICT; and they are likely to be influenced by their negative emotions when they encounter difficulties in their attempts to use ICT. The teachers' application of ICT may be restricted by this narrow context. Unlike Illeris' model which considers learning in a particular context and at a particular time, the model proposed here extends Illeris' model to include an expanding learning context over time. When teachers gain new experiences and insights and renew their beliefs and perceptions of ICT from peer support and reflection on their practice, an expanded learning context of ICT use will emerge.

When teachers' needs within the present learning context are fulfilled, an expanded knowledge base, broadened perspective and intrinsic motivation are likely to produce the conditions necessary for a new level of learning. Further new learning will then be developed in this new learning context and further expand the learning context of ICT integration (see Figure 7.9). This expanding personal learning context is likely to make continuous personal development possible and sustainable.

Individual teachers will have different needs at different times (Day, 1993). For example, teachers are likely to need more support in technical aspects at the beginning stage of ICT integration. As they encounter difficulties in applying technical knowledge in daily practice, they need emotional and social support that give them encouragement and motivation to reinforce their efforts. Professional development needs to be responsive to changes in personal needs at different times. It should also be flexible, multi-dimensional and proactive to support teachers to meet their own needs.

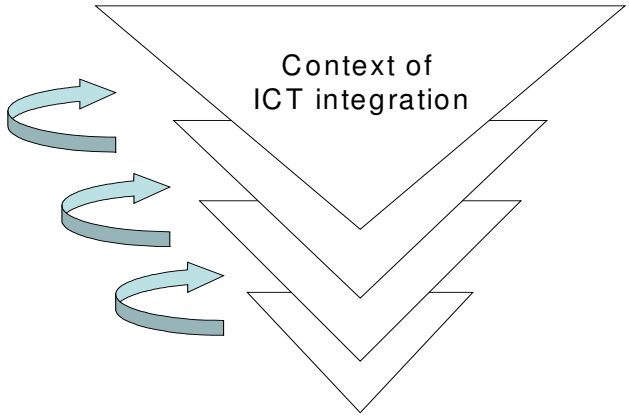

Figure 7.9: Expanding personal learning context of ICT integration

This study sees professional development as a developing process informed by a constructivist view of learning in which teachers learn ICT integration through making connections between their own and shared reflections on practice (Perkins, 1999). With the aim of developing an alternative professional development for teachers in Hong Kong secondary schools to enhance ICT integration, an emerging professional development model of ICT integration for teachers, which summaries the findings and discussions of this

study is presented (see Figure 7.10). This model is characterized by an upward spiralling path of teachers' ICT integration, which represents the expanding reflection cycle and new strategies and actions of ICT integration. When peer enhanced personal reflection happens in personal learning contexts of ICT integration, it produces new understandings and perspectives of ICT integration. It could generate new strategies and actions of ICT integration, as teachers are well supported and encouraged. The upward and expanding path in the model shows that the learning context of ICT integration is further expanded and provides a new environment for further personal reflection. This reflects that personal ICT integration is an emerging result of the personal context of the ICT integration and reflection process.

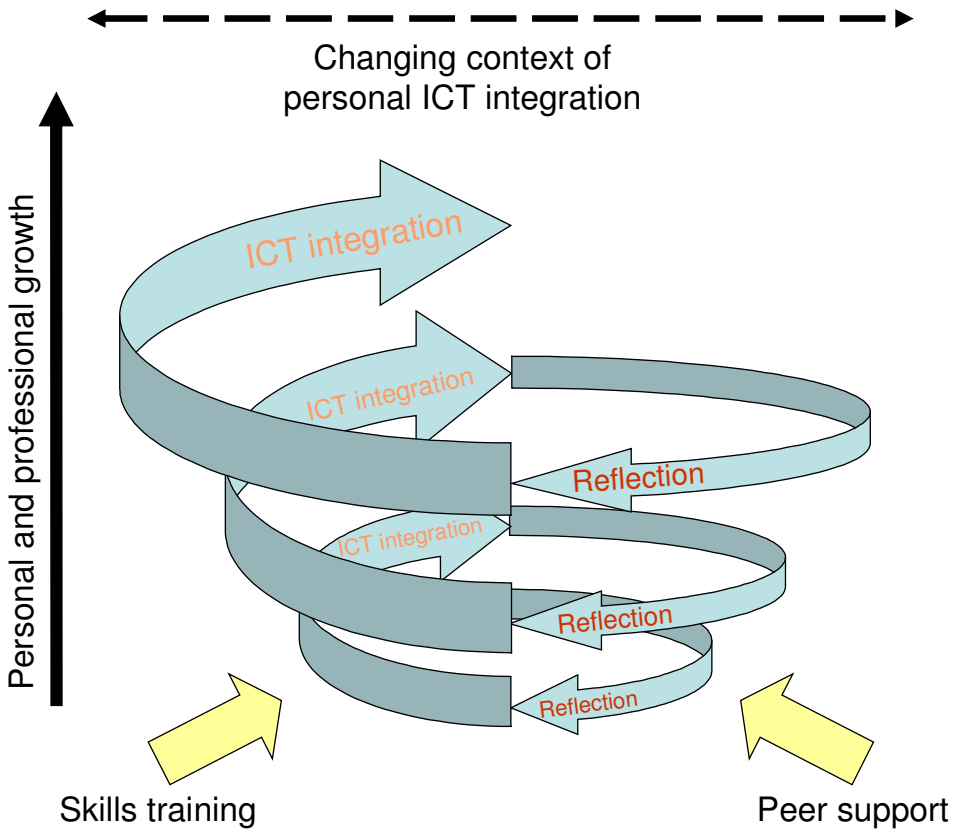

Figure 7.10: Professional growth of teachers in using ICT

This model acknowledges that ICT integration is a complex personal decision-making process that cannot be precisely pre-determined. The role of a professional development programme is to encourage and enable teachers to develop intrinsic motivation and to maintain reflective practice. It focuses on increasing the positive effects of a personal learning process, rather than on promoting a pre-defined, externally driven sequence.

Peer support is unlikely to lead to improvement of ICT integration by itself. Rather, it is a support for teachers within their context so as to encourage them to search for improvement for themselves. The influence of peer support, as found in this study, can be subtle. It does not offer teachers a sudden or dramatic change; instead, it brings changes in a gradual but ongoing process. Therefore, peer support should be a long-term professional development for teachers. It is not meant to be a substitute of skill-based training, but a supplement to enhance and support current professional development programmes.

CHAPTER EIGHT: CONCLUSION

This study started with a broad aspiration about improving the practice of ICT integration of secondary school teachers in Hong Kong. Through an action research process with ten teachers using peer support, a clearer picture of how a social approach to professional development might enhance ICT integration has gradually emerged. The findings and the subsequent professional development model indicate a direction for a personalized professional development process for teachers. In this chapter, the implications of this study and recommendations for enhancing the process of ICT integration are discussed in turn.

Implications

At the beginning, this report identified teachers as being at the heart of education. As ICT integration is clearly a challenge for teachers, professional development that enhances teachers' ability to cope with this challenge is thus particularly important. This study's findings indicate that sustained ICT integration is a personally driven process and underlines the central role of teachers in this process. This finding suggests that teachers need personalized professional development that provides personal and emotional support to develop meanings for and build strategies of ICT integration.

The professional development model developed from the findings of this study explicates the challenges of ICT integration for teachers beyond those of simple technical competency. This model provides possible answers to questions about professional development in ICT integration, such as "What do teachers

need?" and "What is the role of professional development for teachers?" It illuminates a complex and dynamic professional development system of expanding learning contexts and cyclic personal developmental pathways. Teachers who have experienced mainly technically oriented professional development in ICT integration may not be aware of the role of personal qualities as factors affecting their attempts to integrate ICT in practice. This study exemplifies the need for professional development to assist teachers in developing wider perspectives of ICT integration.

The expanding nature of professional development shown in the developed model indicates that teachers have different needs and concerns at different stages of development (Hall & Hord, 2006, 1987). Professional development should be personalized and ongoing. Teachers need more than technical knowledge of ICT, they also need personal and emotional support for transferring technical knowledge into practice. This study provides evidence that peer support can be an effective part of the design of successful professional development programmes.

Recommendations

This study brings new challenges to stakeholders of ICT integration at different levels, from individual teachers to the wider professional community. Details of recommendations of this study are discussed.

Recommendations for teachers

The strategy of personalized professional development appears to be effective in lifting individual teacher's confidence in ICT integration. This study suggests that

teachers should prepare to involve themselves in the process of professional development for developing personal ICT integration. Regarding ICT integration as a personal developmental process, teachers need to identify the pedagogical values of ICT, be aware of changing contexts and readjust strategies of ICT integration over time. Since ICT integration is more than repetitive tasks in the classroom, they need to be conscious of the fine balance between the technical use and pedagogical use of ICT.

As the findings of this study indicate that teachers' personal perspectives affect their responses to the demands for ICT integration, teachers are encouraged to broaden their perspectives of ICT integration through continuous peer-enhanced reflection. This study has demonstrated the value of peer partners as a source of stimulation to enrich and deepen self-reflection. Through dialogue with trusted peer partners, teachers can look beyond their personal situations. While teachers are not intended to imitate the practice of their partners, different perspectives can help teachers to expand their perceived possibilities of ICT integration so that they may develop alternative strategies. The professional development model developed in this study provides a framework that shows the dynamic and non-linear nature of teacher personal growth when they collaborate in this way. Its emphasis on the skill, belief and emotional aspects of the developmental context implies that teachers need personal and emotional support from long-term professional peer partners to support ongoing improvements in ICT integration.

Recommendations for schools

The study reaffirmed that support from the school was an important factor in ICT integration. However, it also identified teachers' concerns about tensions between schools' bureaucratic structure and teachers' professional autonomy as a barrier to ICT integration. Given the importance of a personal ICT integration process, it is suggested that school management needs to recognize and acknowledge the teachers' central role in ICT integration. Schools need to support individual teachers in developing their capability in performing their role.

At the institutional level, schools have to take responsibility, with active contributions from teachers, to develop a shared vision of ICT integration. Schools should be responsible for maintaining this shared vision and creating spaces for creative integration by developing flexible ICT integration policies and implementation plans. As found in this study, teachers are very sensitive to the evaluative role of school management in issues related to professional autonomy, such as peer support. Schools are recommended to apply a formative approach that is consistent with the continuous improvement nature of professional development. It is recommended that schools avoid using narrow and standardized performance indicators, but rather put their emphasis on formative evaluation and on developing clear purposes of ICT integration. Schools thus need to define clearly their role and purpose for teacher evaluation and their level of intervention in professional development issues.

Teachers' concerns about over-intervention of school administration can result in tensions between school management and teachers and affect the outcome of continuous professional development of ICT integration. However, on the other hand, teachers in this study felt that professional development such as

peer support should be managed for it to be successful. It is recommended that schools invite external professionals as partners to manage peer support. External moderators are independent and can bring new insights to teachers. It may help build teachers' confidence in professional development in school and help teachers become more self-responsible for personal ICT integration.

To build a professional learning community in schools, schools are encouraged to facilitate the sharing of personal experiences between individual teachers and amongst peer-support groups. However, as this study has shown, sharing among peer support groups should be conducted only once these groups have matured to a level that there is a high level of trust between peer partners. Sharing should be confined to groups of teachers in the school unless they feel comfortable with having outsiders join in.

Recommendations for professional development developers

Although this study has demonstrated a successful intervention using peer support, this should not be a formula for professional development. The expanding context shown in the proposed professional development model suggests that continuous teacher learning is a crucial element of professional development to sustain ICT use and improve ICT integration. Professional developers should be sensitive and responsive to the changing contexts of teachers so that they can envisage new possibilities to support teachers' changing needs. They should understand that there is no one-size-fits-all professional development programme for teachers. Types and contents of professional development need to be informed continuously by monitoring needs and concerns of participants.

Recommendation for policy makers

This study provides a deeper understanding of factors affecting teachers learning and integration of ICT in practice. It has implications for policy makers in the development of new policy and the allocation of resources. Policy makers need to realize that there is a wide range of experience and competency in ICT integration within the teaching population. A linear approach to professional development therefore would not seem to be particularly helpful in sustaining continuous development of ICT integration. It is recommended that ICT implementation policy and resource allocation should be informed not only by the present needs of ICT integration, but also by the needs generated by the developmental stages of teachers from novice to experienced ICT user. Apart from providing a basic ICT infrastructure, policy makers need to ensure an environment that encourages innovative exploration.

Factors affecting the research

This study was conducted at a time when many other education reform initiatives were in progress (such as curriculum, assessment, school structure, medium of teaching) in Hong Kong. In addition, many teachers were feeling the pressure of an economic recession and reduction in the number of school-age children in Hong Kong. It is important to note that these reform initiatives and changes in the socio-economic situation produced increased workloads and stress for many teachers and that this study was conducted against this background.

As was explained in Chapter Four, the second year of the study was conducted against the backdrop of the Hong Kong SARS outbreak. While this did

not prevent the successful completion of the project, it did create a unique situation that undoubtedly had a profound impact on the research participants.

This study was explorative in nature and was designed to study the impact of peer support as a means of professional development in ICT integration and on changing the teachers' perceptions of, and attitudes towards, ICT use in the Hong Kong secondary school context and Chinese culture. While the project has provided helpful insights into the factors affecting the success of professional development in ICT integration within this context and culture, its findings may not be entirely applicable in other contexts or cultures.

Recommendations for further research

Professional development for ICT integration in teaching and learning is often regarded as a system-wide issue and there is not much research on personalized professional development in ICT integration for teachers. This study was an attempt to make a small contribution to our understanding of the factors affecting personalized professional development in ICT integration. The following sections suggest general areas in which further work is needed.

Application of personalized ICT integration

This study, echoing research in this field, has observed that ICT integration in teaching and learning does not follow from an improvement in the ICT infrastructure in schools. There is a very real need for more research into personalized professional development of ICT integration for teachers. The central role of personalized professional development is to convert technical

knowledge and skills training into effective classroom pedagogies. This ought to be a priority for further research in this area.

This study was conducted on a small scale and focused on the development of individual teachers. Peer support in this study was developed to complement the current standardized skill-based ICT training for teachers in Hong Kong. While this study suggests that personalized professional development could be a successful way to improve ICT integration, further research will be needed to fully evaluate the influence of this approach. Related to this point is the need to consider providing peer support matched with flexible skill training for teachers beyond current technocentric training models.

Application of peer support

This study implies that change in school context and the use of peer groups may bring about positive outcomes in ICT integration. Further studies could be conducted in a variety of schools with different combinations of peers so as to produce a repertoire of good practice in utilizing peer support in local contexts. Because of the small scale and relatively short duration of this study, research is suggested that examines the applicability of peer support as a means of professional development on a larger scale, as a school-wide practice, or over a longer term. Although this study has identified some of the worries of teachers affecting the development of peer support as formal professional development in schools, there is a need for research into, and development of practical processes for introducing peer support as a means of general professional development in schools. The findings of such studies might underpin the development of new approaches to professional development in schools.

How to provide effective professional development in ICT integration is a question shared by many different countries. As this study was carried out in a particular context and culture, the outcome might be unique. More research is needed to examine the application of the findings of this study in different cultures and contexts.

Application of professional development model

The professional development model developed in this study needs to be tested in other situations. More research will be needed to examine the usefulness of this model in developing teacher development programmes and at a policy-making level. The implementation of this professional development model should not be limited to ICT integration only. It is believed to be a general approach to teacher professional development that may benefit different areas of practice. Research is suggested that applies this model to the implementation of different innovations and reform initiatives.

Concluding remarks

Hong Kong's ICT in education policy aims at reforming teaching and learning and producing a new, ICT-based teaching paradigm (Education and Manpower Bureau, 1998). While this study has argued that this goal is unlikely to be achieved until teachers have positive attitudes towards ICT integration, it has contributed to the goal by identifying key factors influencing teacher professional development in ICT integration and by developing a model which may be helpful in furthering the goal of successful ICT integration.

APPENDIX ONE: INFORMATION FOR PARTICIPANTS

The University of Waikato
Centre of Science & Technology Education research

Dear [name of participant],

Further to our conversation on the research outlined above on [date], I now write formally to invite and welcome your participation to this project. Here is the brief information about the research and myself.

I am a PhD student at The University of Waikato in New Zealand, where I am conducting a research project about the professional development in using ICT for teachers in Hong Kong secondary schools.

As a former teacher in a Hong Kong secondary school, I understand that there could be a lot of barriers for a teacher to integrate ICT in their teaching practice. The objectives of this research are to identify the difficulties that teachers encounter and assistance that they need in the process of integrating ICT in teaching, and to empower them to improve their practice.

The research project will last for one and a half years (from February, 2003 to July, 2004). Your involvement will include the following:

Work with a partner from your school in peer coaching so that you both help each other to reflect on the daily teaching practice. Before the start of the peer coaching, you will need to attend a 3-hour training session about the operation of peer coaching. Further guidance may be offered on your demand.

Participate in an online discussion forum in which you will share your experiences of your practice using ICT. The contribution to the forum is voluntary, however, your participation is vital to the success of this research.

Attend three interview sessions at the beginning, the middle and the end of the research project respectively and a peer group conference. Each interview session will last for about an hour.

Participation in this research is voluntary and you have the right to withdraw at any time for your own reasons. All the information collected will be kept securely, confidentially and used for academic purpose only. Your identity will not be revealed in any publication.

Please read the Written Consent Form attached carefully and return the signed form in the envelope attached. Please feel free to contact me for any inquiries. If you still have any further questions about the research, you may contact my supervisor (Dr. Mike Forret) or the Centre Director (Dr. Alister Jones).

Regards,

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APPENDIX TWO: PARTICIPANT CONSENT FORM

The University of Waikato

Centre for Science & Technology Education research

Participant Consent Form

This form should be read in conjunction with the attached "Information for Prospective Participants."

I understand that participation in this research project will involve the following:

1 I will be involved in a study on *Professional development in using ICT for teachers in Hong Kong secondary schools: An action research.*

2 Data gathered for this project will not be made available to any third party and will be subject to the provisions of the New Zealand Privacy Act (1993).

3 I will not be identified in any way other than a code number or pseudonym in data records or reports of the research findings.

4 My participation in this project will not in any way affect my academic progress.

5 I may withdraw from parts of this study at any stage, and if I wish I may withdraw from the project completely.

6 If I have any concerns about my participation in this research project I may approach the Director of the Centre for Science & Technology Education Research.

Signed _____

Date _____

APPENDIX THREE: GUIDELINE FOR THE FIRST INTERVIEW

Please describe your background as a teacher.

Please describe your purposes and experiences in teaching using ICT.

- When and how to begin using ICT
- Current use of ICT
- Perception of ICT
- Potential of ICT in teaching
- Criteria for the successful use of ICT in teaching?
- Personal feelings about using ICT in teaching
- Issues and concerns

Please describe the support you had for using ICT in teaching.

- Response to ICT policy
- Support needed for using ICT

APPENDIX FOUR: GUIDELINE FOR THE SECOND INTERVIEW

Second interview arrangement

This interview serves dual purposes, to collect information about the use of professional conversation and to encourage reflection on the peer group process. It employs "conversation" as an interviewing process for the second interview:

- The participant will be given the focus of the interview and be asked to prepare for a description of these focuses.
- Follow-up questions will be asked to clarify the details of their experience and prompt them to provide further explanation and illustration.

Focuses

Focus 1: experiences of peer support and professional conversation

About the professional conversation

Please describe your peer group in the first phase.

- follow-up
  - the actual process
  - their relationship
  - the areas that they have worked on

Do you have any issue and concerns about peer support?

About the online discussion forum

Please describe your participation in the forum.

What is your expectation of this forum?

Do you want to raise any issues and concerns about the forum?

- Follow-up
  - Their emotions and feelings

Focus 2: ICT experience in practice

Please describe a typical session in which you use ICT in teaching.

- follow-up
  - purposes and objectives
  - how ICT is used, e.g. preparing teaching materials, presentation, etc.

- students' feedback
- teachers' feeling about the use of ICT
- other potential of ICT

Other questions:

What are your strengths and weaknesses in using ICT in teaching? Please explain.

Why do you think ICT in teaching is important/not important?

What is the role/importance of ICT in your own teaching?

How can students learn (learn more, better) in the way your use ICT?

How does ICT change your way of teaching?

APPENDIX FIVE: GUIDELINE FOR THE THIRD INTERVIEW AND PEER GROUP CONFERENCE

Individual interview:

Please describe any changes in the way you use ICT over the last year. Please explain.

- follow-up:
  - purposes and objectives
  - ways to use ICT
  - priority of using ICT
  - concerns about using ICT
  - frequency

Please describe your effort in using ICT in teaching in the last year.

What factors encourage or stop you using ICT?

- follow-up:
  - school policy
  - colleague
  - external pressure
  - personal reason

Peer group conference:

What were your expectations of this peer group? Do you think your expectations have been met?

Please describe the process of this peer group in the last year.

What have you learned from your partner in the last year? Please elaborate.

Please describe your feelings about your participation in this peer group.

How would you suggest improving the arrangement of this peer group?

How do you think about peer support as a means of professional development in school?

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