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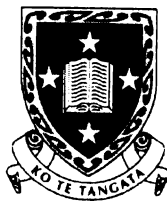
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**Towards a Pedagogical Model of
Learning to Teach with
Information Technology
A Study in a Primary Teacher Education
Programme in Hong Kong**

A thesis
submitted in fulfilment
of the requirements for the degree
of
Doctor of Philosophy
at the
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by

Kai Ming Li



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Abstract

The research reported in this thesis arose from the author's concerns that developed during his role as a teacher-educator in the field of instructional technology; specifically, in teacher education to facilitate pedagogical change by the use of information technology in teaching. The overall goal of the research was to investigate the effect of some pedagogical interventions involving with information technology, and based on constructivist views of teaching, for a primary teacher education programme in Hong Kong.

This research involved two phases. The first phase was a one-year study of a group of final year students from a primary teacher education programme of the Hong Kong Institute of Education. This involved the investigation of the learning of a cohort of students in the Designing and Developing Instructional Media (DDIM) module - an information technology and teacher education module, and a 'try-out teaching' component that formed part of the students' teaching practice. The second phase of the study consisted of a six-month investigation that took place in five different primary schools. This was an intensive study of the continuous development of five graduate teachers during their first year of teaching. In this phase of the study these beginning teachers attempted to implement an information technology project informed by an intervention developed and modelled by the researcher. Throughout the two phases of the study, data were collected by means of interviews, essays by the student-teachers', field notes of class observations taken by the researcher, and journals kept by the student-teachers. Quantitative data from questionnaires also were used as a means of data triangulation.

This study and the interventions developed in this study were informed by constructivist views of learning, which highlight the contribution of the cognitive, social and contextual aspects of the knowledge construction process. Drawing on a constructivist-based framework, a number of intervention strategies were subsequently identified from the literature: *cognitive apprenticeship*, *collaborative learning* and *resource-based learning*. These intervention strategies were adopted

in the development of the interventions used in this study.

The research reported in this thesis suggests that the participants underwent a professional development process of learning to teach with information technology, resulting in gains of information technology skills along with conceptual change about the application of information technology to teaching and learning. In the first phase of this study, the student-teachers showed improved understanding and mastery of knowledge and skills of applying information technology in education. The student-teachers also showed more concern about the effect of using information technology on their pupil's learning outcomes. Positive attitudes towards using information technology in teaching were seen for the student-teachers, and although they were anxious about classroom management problems, they attempted a variety of new strategies in some of their lessons during their teaching practice. The intervention for the second phase of the study resulted in increased understanding and mastery of both the content and pedagogical knowledge and skills of using information technology in education: a variety of student-centred activities with the use of information technology were observed. A strong theme to emerge from this phase of the study was that the student-teachers saw information technology as a tool to facilitate learning. A second theme was that the student-teachers became more reflective thinkers, and became more critical about the implementation of information technology in their classrooms and their schools.

Drawing on the above findings, the researcher developed an instructional model – the ‘Model-sharing, Interactive, Reflective and Contextual Learning Environment’ (MIRACLE) model. This model then attempts to summarise the intervention strategies that were developed in this thesis into a single comprehensive model, to help inform teaching with information technology. This model is intended to serve as a scaffold for the professional development process for beginning teachers, and thus serves as an agent to bring prospective teachers into a shared ‘technology-using subculture’ in education. The researcher also proposes that teachers experienced with the MIRACLE model may act as active agents and become leaders in pedagogical change in their schools, resulting in a more favourable learning environment.

A variety of factors affecting the professional development process of teaching with information technology were identified in this study. These factors include: time and workload concerns; adequacy or otherwise of school computing facilities; the 'technology-using subculture present in the schools; the subculture of a 'new comer' in the education field; support from the school principal and colleagues; and, school leadership. The research also developed a conceptual framework, which consists of six areas of technology competency for designing an information technology and teacher education course. This research concluded with a vision of potential applications of the MIRACLE model, intended to nurture a 'technology-using culture' at both teacher training institutions and primary schools. The thesis concludes with some suggestions to enhance school leadership, and how it might be possible to develop a holistic model for teacher education programmes in the use of information technology.

The literature suggests that the learning that occurs during teacher training involves conceptual change and that this conceptual change should be enacted in a favourable and authentic context, with appropriate scaffolding. The research findings reported in this thesis attempt to enrich pedagogical knowledge about learner-centred teaching, and to provide scaffolding for teacher training in the use of information technology in student-centred learning.

Dedication

To my family, and comrades who helped me as I pursued my study.

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Chapter 1

Introduction

1.1 Introduction

This study explores professional development with respect to learning to teach with information technology¹ for a group of teachers from the initial training stage in a teacher preparation programme, to the beginning teaching phase in primary schools in Hong Kong. As described by Feiman-Nemser and Remillard (1996), learning to teach is a developmental process that occurs at different phases such as in schooling as a student, in formal teacher preparation as a student-teacher, and on the job as a teacher (see also, Wildman, Niles, Magliaro & McLaughlin, 1989). It is also suggested that the issues concerning learning to teach should be examined from different perspectives such as the content to be learnt, the learner, learning theories that explain teachers' learning, and methods that facilitate teachers' learning in the teacher development process (Feiman-Nemser & Remillard, 1996).

This chapter provides some background about educational technology² training and a teacher education programme in Hong Kong that provided the context for the study. The current status for the use of technology in learning and teaching worldwide along with 'theory into practice' issues that initiated the study also are discussed.

¹ In this study, information technology and information and communication technology are used synonymously. They refer to the use of computer related technologies, both hardware and software, in an educational environment.

² Educational technology in this study is "the theory and practice of design, development, utilisation, management and evaluation of processes and resources for learning" (Seels, 1994, p. 9). The resources refer to a boarder range of technologies or instructional media including the traditional and computer related ones.

1.2 Educational Technology and Education Reform

The Hong Kong Government believes that the nation requires a workforce in which people are equipped with higher order thinking skills in order to be competitive in a global market.

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 globalised economy ... The rapid development of information technology has opened up new domains in all aspects of our lives and creating new challenges ... In the tide of changes, everyone has to meet new challenges. Adaptability, creativity and abilities for communication, self-learning and cooperation are now the prerequisites for anyone to succeed ... 'Lifelong Learning and All-round Development' is our expectation of everyone in this era. Education is infinitely important for everyone" (Education Manpower Bureau [EMB], 2000, p. 3).

The latter part of the last century witnessed tremendous advances in technology, particularly in the fields of information and communication technologies. One aspect of this is people's access to information. Vast amounts of information can now be accessed very rapidly and distance and time provide little constraint to such access in this new information era. Hong Kong also needs a workforce in which people can both learn independently and work collaboratively with others. Modern employees also need to be active, life-long learners and be able to use technology to access, evaluate, organize and present information. The Hong Kong Government expects that education will play a major role in achieving such goals. It is also generally believed that educational technology will play an important role in reforming education (Campoy, 1992). The potential of technology for education reform has been recognised by many governments, and as such technology has been an important part of educational technology policies. For example, in the USA Clinton (1996) introduced the *Technology Literacy Challenge Programme*, and in New Zealand, the Ministry of Education published the national strategy document *Interactive Education: An Information and Communication Technology (ICT) Strategy for Schools* in 1998 (MoE, 1998) and also the more recently the *Digital Horizons* (MoE, 2002). The Hong Kong Government also has placed emphasis on information and communication

technologies in the area of education technology policy. The views of the Government are clearly illustrated in the Policy Address of Mr. Chee-Wah Tung, the Chief Executive of the Government of Hong Kong Special Administrative Region (HKSAR) upon the return of Hong Kong sovereignty from Britain to China in 1997. Mr. Tung announced the provision of a total of around 3 billion Hong Kong dollars for capital costs, and 500 million Hong Kong dollars in annual funding, for the use of information technology in education. He put forward the goal of such initiative as follows:

We will launch a five-year IT education strategy to promote the use of IT to enhance teaching and learning. The main tasks are to equip our teachers with the necessary IT skills; to apply computer-assisted teaching and learning across the curriculum; and to place students in an environment where they can use this technology as part of their daily activities and grow up to use it creatively. (Chief Executive Policy Address, HKSAR, 1997, Section 46)

Thus, in order to enable students to become competitive and competent in the use of information and communication technologies, a 'Five-year Strategic Plan for Implementation of Information Technology in Education' was launched by the Government in 1998 and the Government has an aim that all libraries, staff rooms and computer laboratories in all schools across the HKSAR are to be networked and provided with Internet access (EMB, 1998, Section 2.6)

Modern theories of learning place greater emphasis on student-centred learning and suggest that knowledge acquisition is an active process in which knowledge is constructed by an active learner rather than transmitted by the teacher to a passive learner (Driver, 1988, 1993; Jonassen, 1991; Duffy & Jonassen, 1992; Merrill, 1992; Saunders, 1992). In such views of learning, the teacher is no mere provider of knowledge, nor is he or she someone who rigidly follows rules or suggestions from others such as curriculum designers, or textbook writers. Education reform that brings about pedagogical changes or a "paradigm shift" (EMB, 1998, p. 1) moving from a traditional to a more interactive and student-centred approach is what is desired by the Hong Kong Government. There is evidence in the literature suggesting that the integration of new technologies in schools may facilitate student-centred learning (e.g., Boyd, 1997; Jonassen, 1991; Mayer-Smith & Woodrow, 1988; Means, 1994; Means & Olsen, 1995; Office of

Technology Assessment [OTA], 1995; Pedretti, Liu, Macmillan & Timmons, 1988). Indeed, this literature suggests that a good understanding and mastery of technology in learning and teaching are essential in modern teacher education programmes.

Being a teacher-educator in the field of instructional technology; specifically, in teacher education, the researcher felt a need to revisit and to revise the curriculum of the relevant teaching module in a teacher education programme in Hong Kong so as to facilitate such a pedagogical change by the use of information technology in daily school teaching. Hence, the present research was conducted in 1998 after the 1997 Policy Address of the HKSAR. The following sections present the situations of educational technology and teacher education at the time of this study, which provide a context for this research.

1.3 Educational Technology Competency and Teacher Education

The modern teacher is charged with great responsibility, being expected to provide high quality education, and more recently to promote student use of technology in order to develop technological literacy for future citizens in this technology-dominated world. Moreover, teachers are increasingly expected to make use of educational technology to enhance student learning. Educational technology has long been a major component in teacher education programmes in Hong Kong (see Table 1, p. 7). However, despite great interest and belief in the potential of educational technology in achieving the above goals, its effects in classroom teaching is often not as great as expected or desired. Schrum (1991), for example, found that preservice training courses exerted little influence on beginning teacher's use of instructional media in class teaching after graduation from the teacher preparation programmes. Research in the USA also suggests that at the end of their training, few teachers are knowledgeable about how to use new technologies effectively in the classroom (Bosch & Cardinale, 1993; OTA, 1995). In the UK context it is likewise noted that new teachers make little use of information technology in their lessons (Her Majesty Inspectorate [HMI], 1993). It seems that this reluctance to use information and communication technologies in the classroom is widespread and Willis and Mehlinger (1996), after a

comprehensive review of the literature on the use of information technology in teacher education, remarked: “Most student-teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology” (p. 978).

Student-teachers now are typically provided with up-to-date knowledge and skills of the profession in their teacher education programmes. However, the success of implementation of such knowledge depends very much on the extent to which such knowledge and skills are conceptualised, the experiences students undergo in their teacher preparation programmes, and the attitudinal position they place on such experiences. Thus, student-teachers need to exit the teacher preparation programmes equipped with enough knowledge, and the requisite self-efficacy to eliminate anxiety about using technology. If this aim is achieved, then this may increase the likelihood that beginning teachers will develop skills in integrating technology into their teaching (Brush, 1998).

1.3.1 Educational Technology in Hong Kong

The current situation in Hong Kong is much as described above for other countries; that is, there is a perception that beginning teachers lack the ability and efficacy to use education technologies in their teaching practice. Recent Hong Kong-based studies of the teaching of science in secondary schools (Lee, Li, Yeung & Ling, 1997) and the use of instructional media in primary schools (Li, Lam, Li & Wu, 2000) suggest that the media currently used are limited to traditional tools. Li et al. (2000) also point out that textbooks, blackboards and printed material remain the dominant instructional media used in teaching. Other media such as photos, graphics, overheads and videos are used occasionally, but these tools are mainly used for the purpose of information delivery. The above two studies also draw a similar conclusion that the use of computer technology are rare. For example, of the 323 teachers in one of the studies, only five of them were reported to make use of information and communication technologies in the classroom (Li, et al., 2000). The same study on the use of instructional media in primary schools in Hong Kong also indicated that didactic lecturing is the

principal mode of teaching for Hong Kong primary teachers (Li, et al., 2000). It is possible that the limited use of both traditional and modern information and communication technologies is driven by a perception that didactic teaching style is an appropriate pedagogy. The research suggests that teachers in Hong Kong are not yet ready to adopt a student-centred teaching approach, and are reluctant to use information and communication technologies. This is in stark contrast with Government policy in education and recommendations in the literature for a more holistic, student-centred approach to teaching. Such a situation likely provides a barrier to reform of the teacher education programmes in the Region.

1.3.2 Educational Technology and Teacher Education in Hong Kong

Teacher training in the use of educational technology has its origin in former colleges of education established some 30 years ago. The colleges of education were administered by the Department Education, and were amalgamated into the Hong Kong Institute of Education (HKIED) in 1994 as recommended in the Education Report No. 5 (Education Commission of Hong Kong [ECHK], 1992). The aim of the amalgamation was to upgrade the quality of teacher education. The HKIED now offers preservice teacher education programmes at different levels: certificate, degree and postgraduate diploma. The research reported in this thesis has a focus on the development of certificate level training as the author has been working in this programme since 1990. Training in the use of educational technology is provided in the curriculum of Professional Studies, one of the domains of study in the teacher preparation programme in the HKIED, that is compulsory for all student-teachers.

Table 1 shows the development of educational technology curriculum in a teacher education programme in Hong Kong. It is observed that the nature and name of the topic taught under what is now known as educational technology has changed many times since the 1970s and, for examples, the content of the module was rather technocratic before 1978, Visual or Audio Visual Education, as it was named at that time, mainly dealt with the practical aspects of using audio-visual teaching aids. In 1978 there was a dramatic change in focus and the subject was renamed Resources and Research, and sought to incorporate communication and

Table 1

A comparison of different stages in the teaching of educational technology in teacher preparation programme in Hong Kong³

Year	Subject Name	Study Area/Domain	Status	Brief Contents
1974	Visual Education	Basic subject	Compulsory	Introduction to visual education; Application, operation and construction of non-projected aids; Safety precautions on using electrical apparatus; Application, operation and maintenance of audio and projected aids; Educational television; Practical work
1977	Audio-Visual Education	Included in the Education subject	Compulsory	Theories of audio-visual education; Types of common A-V aids and their use; Sources of A-V materials; Safety precautions in using electrical equipment; Practical work
1978	Resources and Research	Basic subject	Compulsory	Theory of communication; Human perception and learning; Instructional media; The working principles and applications of common audio-visual equipment; The design, production and use of supporting software; Sources of audio-visual equipment and material; The principles of programmed learning and the development and use of individualised learning packages; School library management; examination techniques and evaluations, item writing, item analysis and item banks; elementary concepts and methods in educational research together with related statistics.
1982	Educational Technology	Basic subject	Compulsory	General principles of educational technology: Selection and use of aids and resources; Planning, production and evaluation of aids and resources; Visual communication; Safety measures in the use of electrical equipment; Libraries, museums and community resources; Computers and education; Visual aids and materials; Audio aids and materials; Multimedia aids and materials; Photography; Books, libraries and resources centres; Microcomputers; 3-D Aids.
1984	Educational Technology	Educational Studies (new unit code in a subject)	Compulsory	Educational technology fundamentals: Introduction to educational technology; Resource-based learning and management of resources; library skills; Choice and evaluation of media; Multimedia packages; Audio-Visual systems; Communication theory and skills; Programmed learning; Computers in education; Instructional design; Photography; Practical audio-visual techniques; Production projects (including computer assisted learning).
1994	Designing and Developing Instructional Media (DDIM)	Professional Studies (new teaching module)	Compulsory	Research findings in the design, production, and use of instructional media; Fundamental operating skills in using non-projected equipment and accessories; Fundamental skills in designing; Producing, and using Non-projected Media; Fundamental skills in designing, producing, and using projected media; Interactive learning system; Understanding education technology support within Hong Kong context.

³ The information for previous colleges of education was provided by the Library Archive of the Hong Kong Institute of Education.

learning theories, and to cover both assessment and research in education. However, it was not until 1982 that the use of information and communication technologies in education was developed and at this time the name of the module was changed to Educational Technology. Educational technology as a subject at this time was provided independently by the Department of Education Technology in 1984. The contents were re-organised into teaching units grouped under three categories: Educational Technology Fundamentals - concerned with underlying concepts of applying various media in education; Practical Audio-Visual Techniques - which provided hands-on experiences of the operation and production skills for a variety of hardware and software; and, a Production Project - that aimed to strengthen particular skills and chosen according to the teacher trainee's own interests. Subsequently, two topics, Educational Assessment, and Educational Research, included in 1978 and omitted in 1982, were reinstated into the Educational Technology Fundamentals curriculum in 1990. Since then, the computer training for student-teachers was quite systematic. All the student-teachers received a minimum of four hours of instruction in the use of computer applications in Computers in Education, participated in a four-hour workshop in Computer Applications in Education, and participated in one or two 12-hour workshop(s) for their Production Project. This curriculum structure remained until the establishment of the HKIED. As mentioned above, further reform for the curriculum in teacher education occurred in 1994. Many of the teaching units were re-structured into teaching modules, and the modules subsequently put under four domains: Academic Studies, Curriculum Studies, Professional Studies and General Studies. The major syllabus in the Department of Educational Technology was placed under the domain of Professional Studies and was finally re-shuffled into three teaching modules: Designing and Developing Instructional Media (DDIM), Instructional Design and Strategies for Effective Teaching, and Classroom Teaching Skills. The research in this thesis is concerned with the DDIM module - a compulsory module for all the student-teachers in the certificate programme.

In the first instance, the content for the DDIM module was prepared by senior staff in the early colleges of education. Given the restriction of the credit hours allotted to the module, the content of previous syllabus in the Educational Technology Fundamentals unit was retained. However, the hands-on practical

units and workshops were changed to consist simply of demonstrations. Student-teachers were required to seek help on the operation of hardware from the Educational Technology Unit of the Institute when needed. Before the establishment of the Information Technology Strategic Committee of the Institute in 1999, student-teachers received their information technology training only in the DDIM module and training computer applications were offered by the Computer Section of the Department of Science as an optional module under the domain of General Education. The net result of this was that in a teacher education programme between 1994 and 1999, a preservice teacher could well have little knowledge of computer applications if he/she did not choose any of the computer application modules. Thus, at this time there was a mismatch between Government expectations and the provision of relevant teacher education programme in information technology in education. This mismatch provided the motivation for the development of an intervention and the research sought to develop out effective teaching model that could facilitate the understanding and mastery of information technology in learning and teaching.

The above discussion shows that training in educational technology was incorporated into the teacher education programme since the establishment of the colleges of education. Computer training in the teacher education also was offered in 1980s. The author's experiences in these teacher-training programmes in educational technology suggested that technology use in learning and teaching in school practice fails to meet desired outcomes. In the following paragraphs, the author describes his experiences and observations and reflects on past experiences as an educator in the field in order to provide some insights into the reasons for the current use, or lack thereof, of information and communication technologies in Hong Kong schools as stated in Section 1.3.1 (p. 5).

The Educational Technology Fundamentals lectures consist mostly of presentation of the contents of relevant textbooks. For example, the book *Planning and Producing Instructional Media*⁴ by Kemp was used extensively in the early years of the training. These lectures, although theoretical and conceptual in nature, failed to develop any insightful and contextual experiences for the student-

⁴ The latest version of this book written by Kemp, Jerrold E. is the 7th edition in 1994.

teachers. The lecturers mostly stood in front of the class, presented and delivered the same content provided in the textbooks using overheads while the student-teachers sat at the back of the room, watching and listening. After classes the student-teachers revised their notes using the textbooks, and were assessed by means of summative tests and an examination that tested their ability to recall lecture material. This type of learning was likely very superficial in nature. The following comment from a student is striking and points to considerable discrepancy between what is taught in the teacher education programme, and what is practised in actual teaching.

I prepared the teaching aids just for your supervision only when I was doing my teaching practice and now I am doing what a normal teacher does [i.e., teaching with textbooks].

Clearly, the learning experiences in the teacher education programme would be unlikely help the student-teachers to apply what was taught through text-book and assessment oriented approach. Furthermore, the practical workshops in the early stages of the teacher-training programme also were not in accord with the needs of a classroom teacher. It is not obvious, for example, why the teacher (the author in this case) was required to teach 'darkroom techniques' and 'silk screen printing'. It is also odd to teach student-teachers about the use of specific computer applications such as 'Word Star 6.0', but not about more generic word processing skills. Although the teaching materials produced in the Production Projects with computer applications were more relevant and of more use in classroom teaching, they were typically designed in accord with highly traditional teacher-dominated pedagogies and little theoretical input was made to any part of production. The teaching of educational technology at this time was thus focused on the skills of using specific hardware and software and the final presentation of the product.

The above description suggests then that early training programmes for teachers in educational technology in Hong Kong focused on teaching 'about' technologies and really only served to provide skills in the operation of audio-visual equipment, computer hardware and software. According to the literature, effective use of technology to support teaching and learning needs to incorporate

an instructional perspective and focus on realistic learning contexts (Means & Olson, 1997). Hence the basis to this thesis is that there is an urgent need for changes in the teaching of the subject of education technology for preservice teacher training programmes in Hong Kong.

1.4 Summary of Issues in the Training of Teachers in Educational Technology in Hong Kong

Student-teachers in Hong Kong are taught about student-centred learning theories and educational technologies in their teacher education programmes. However, no obvious pedagogical changes are observed in the practice of teaching in the region. Indeed, it seems that many teachers are still teaching in a very traditional manner using teacher-directed and textbook-oriented strategies despite ostensibly accepting the contribution that a student-centred approach can make to higher order learning. Furthermore, it seems that the use of new teaching technologies in school teaching is very limited. This is rather ironic given the advance of technology and the widespread belief in Government circles that technology can contribute to education reform and serve to enhance teaching and learning. The above issues then clearly warrant investigation given the huge financial commitment to technology in schools in recent years by the HKSAR Government.

The reluctance for teachers to use modern information and communication technologies to enhance teaching and learning is likely multifaceted such as the lack of time, availability of school resources, opportunities for discussion and collaboration with other teachers and administrative support (Mouza, 2002; Mumtaz, 2000; Pratt, Lai & Munro, 2001; Sheingold & Hadley, 1990). Also, given that the student-teachers have received some training in the use of hardware and software during teacher training, it seems unlikely that the lack of skills in using, for example, computers is the source of their resistance. More likely is that the students do not feel confident and have not developed an appropriate conceptual understanding of the value and use information and communication technologies – in other words the student-teachers have developed a mindset that is at odds with the use of information and communication technologies in the classroom. Thus there is a gap between the theories that preservice teachers are taught, and actual practice that is not aligned with the goals in the teacher

education programme. The literature suggests that well-designed instruction which provides student-teachers with the necessary skills and experiences and gives them opportunities to apply or to integrate technology in the actual teaching situations is needed (e.g. Handler, 1993; Hunt, 1995). Teacher training programmes need to provide opportunities for student-teachers to use information technology and to study exemplars of how such technology may be integrated into teaching practice (Lai, 2001). Recent research shows that the provision of instructional models for classroom implementations of technology is more significant than the mere reception of knowledge and skills of technology (Haywood & Norman, 1988; Diem, 1989; Novak & Knowles, 1991). Therefore, to provide teachers with the required competencies to use teaching technologies in classroom teaching, instructional models in the teacher education programmes need to focus on the use of technology in a learning environment. Instructional strategies should be student-centred rather than terminology and hardware driven (Bigum, 1990), with knowledge and skills acquired by actually using the technology. Task-based or problem-based activities can be given to student-teachers rather than mere development of specific certain hardware or computer software applications. Adams and Krockover (1997) suggest that classroom teaching is strongly influenced by learning experiences that student-teachers undergo during training. A well-designed teaching model for educational technology in a teacher education programme is believed to be important and have great influence on the actual implementation of teaching practice in schools. Therefore, teacher education institutes may need to restructure current approaches to the teaching with technology (Davis, et al., 1996). As an educator in teacher education, the author felt a responsibility to take a model role in implementing technology in teaching and learning so as to “assure that current and future investments in technology can be realised” (OTA, 1995, p. 2) and to better prepare our teaching force for the 21st century.

1.5 Research Objective and Research Questions

Given that quality practice of using information technology in education is one of the major governmental concerns for educational reform in Hong Kong, the author revisited the current teaching contents and teaching strategies used in the

DDIM module. Based on an in-depth study of the technology education literature at the time of this study, the contents of the DDIM module were restructured into six competency areas (see Chapter 3, p. 82). Different teaching and learning strategies and resources were then developed for the intervention⁵ in the study based on a constructivist view of learning. The effect of this intervention on a group of student-teachers is discussed in this thesis. The study was based on an interpretivist paradigm and employed qualitative and quantitative methods of data collection.

The overall aim of the research reported in this thesis was to explore the teaching practice of Hong Kong student-teachers and in particular to help them make better use of information technologies in their teaching. The research questions for this thesis are:

1. How does the intervention derived in this study influence novice teachers' use of information technology in the development of a student-centred classroom?
2. What pedagogies enhance novice teachers' conceptual change of the use of information technology in facilitating student-centred teaching in the teacher education programme and in beginning teaching?
3. What factors promote or constraint novice teachers' use of information technology in facilitating student-centred teaching in the teacher education programme and in beginning teaching?

The first question attempts to examine the effect of the intervention on the participants as they went through their teacher education programme, and as they began teaching in primary schools. Changes in their attitudes towards using information technology in teaching and learning, their understanding and mastery of knowledge and skills of applying information technology for student-centred teaching all were explored. The second research question sought to identify what

⁵ Hence, the intervention in this study refers to a learning environment in which particular learning strategies and resources were developed for the learning among the student and beginning teachers who took part in the study.

pedagogical strategies induce the conceptual changes, and enhanced competencies of the participants in using information technology, and the third research question looked at the factors that promote or constraint the adoption of student-centred strategies in teaching and learning.

1.6 An Overview of the Thesis

This research starts with an introduction and background to the thesis in Chapter 1. Chapter 2 which follows consists of a review of relevant literature related to the present study: the current use of information and communication technologies in teacher education; learning theories that underpin the teaching intervention developed in the study; and, strategies that facilitate teaching and learning to teach with information technology. Chapter 3 provides details of the research design used in the study and includes a description of the sample used, data collection methods, data analyses strategies, intervention methods and ethical issues. Chapter 4 provides a description of the student-teachers' prior teaching experience with information and communication technologies before they undertook training. Chapter 5 follows on with a description of the influence of the intervention used to enhance student-teachers' use of information and communication technologies in the DDIM module. Chapter 6 continues to report the learning experiences in the 'information technology try-out teaching' during teaching practice. Chapter 7 describes the development of an Information Technology Reinforcement Induction Programme (ITRIP) developed for the beginning teachers who went on from the first phase of the study. This latter programme aims to support the on-going development of the application of information technology in school teaching for beginning teachers. This chapter also explores the current situation in the use of information technology among the beginning teachers in different school contexts. Chapter 8 reports the experiences and influences of the ITRIP on beginning teachers. The last chapter, Chapter 9, summarises the findings and discussions in previous chapters. Then it concludes the study with the proposal of an intervention model for learning to teach with information technology in education for teachers and the description of the implications of the findings for teacher educators, the limitations of the study and the suggestions for further research.

Chapter 2

Literature Review

2.1 Introduction

This chapter starts with a review of the current state of information technology and teacher education in the literature. In this section, the current use of information technology in education, the problems in training courses, the technology competency required for teacher certification, the different models and approaches used are examined. The theoretical basis that leads to the development of the intervention of the present study is described next and two main areas are addressed. The first area describes learning theories relevant to the present study, and two learning theories are discussed. The cognitive information-processing model explains how knowledge is constructed in human's mind and provides the base for the use and the design of instructional media or resources in a learning environment. Second, constructivist-based views of learning emphasise the importance of learner-centred strategies and social interaction, both in teaching in primary schools, and in the learning that occurs in teacher preparation modules. Constructivism (and its variants) also supports the development of a scaffolded learning environment that facilitates teacher development or teachers' learning. This discussion also includes the development of some instructional strategies and the use of technologies in learning informed by constructivist views of learning. The last part of the chapter discusses issues of teachers' learning: based on conceptual change theory, strategies consistent with constructivist views of learning specific to teacher's learning in this study are explored.

2.2 Current State of Information Technology in Teacher Education

In Chapter One (Section 1.3.2, p. 6), the researcher described the development of educational technology related curriculum for teacher education in Hong Kong.

The development in Hong Kong follows a similar trend seen in other countries around the world. There appears to be an international trend from the provision of teacher education modules in 'audio-visual teaching aids' which focus on practical skills about the operation of a variety of audio-visual instruments, to courses that emphasise both theoretical considerations and the production of technological-based teaching aids (Saettler, 1990). The content of the educational technology area in teacher education were (like other aspects of teaching and learning) traditionally driven from behaviourist or objectivist perspectives in which technologies were treated simply as aids for didactic teaching. The researcher also has described the problems of actual use of technologies in school teaching (see Sections 1.3.1, p. 5) and it seems that like other countries around the world, the teacher work force in Hong Kong is not well prepared to use technologies in learning and teaching (at the time of the present study). Furthermore, the literature suggests that Hong Kong teachers often adhere to didactic teaching methods that are not consistent with the expectation of the education reform proposed recently by the Hong Kong Government (CITE, 2001; Li et al., 2000).

In the United Kingdom a large-scale evaluation of the impact of information and communications technologies (ICT) on pupils' attainment, *ImpaCT2*, was conducted. The interim findings of the *ImpaCT2* report revealed that many teachers were not ready to use information technology in their teaching. The teachers "have yet to develop confidence and competence in ICT" (Department for Education & Skills [DfES], 2001, p. 13). It was also reported that "relatively few teachers are integrating ICT into subject... [although it is believed] that [information technology] motivates pupils and enriches learning or stimulates higher-level thinking and reasoning" (DfES, 2001, p. 13). The National Centre for Education Statistics (NCES) in a report for the USA Department of Education on the preparation of school teachers, pointed to a similar situation about the use of technology in education in the USA: "...relatively few teachers reported feeling very well prepared to integrate educational technology into classroom instruction (20 percent)" (NCES, 1999, p. iii). In Hong Kong, a review on the progress of the implementation of the *Information Technology for Learning in a New Era: Five-year Strategy 1998/99 to 2002/03* was also conducted. The report prepared by the Centre for Information Technology in School and Teacher Education (CITE) of the University of Hong Kong for the Education Department of Hong Kong showed

that local schools are equipped with modern information infrastructure and the teacher work force has improved in information technology skills. However, the report pointed out that integration of information technology into school curricula and the use of information technology in facilitating student-centred learning are still very limited.

There has been a marked improvement in the teachers' IT skills since 1998 ... [However], there has not been, in our view, a paradigm shift in teaching and learning as advocated in the Five-year Strategy ... many teachers still perceive their role mainly as providers of knowledge ... [The way of using IT] suggests a direct teaching pedagogy. (CITE, 2001, p. 205)

The above comments suggest then that although investment has been put in the establishment of computing infrastructure and teacher development in information technology in Hong Kong, the expected outcomes are still not satisfactory. It seems that schools are not making good use of the available infrastructure and that few teachers integrate technology in the teaching and learning process. Likewise, it seems that didactic teaching is still dominant in classroom teaching in Hong Kong. The findings also suggest a pressing need for a review of current courses in information technology and teacher education and to develop such courses that match the expectation of education reform (CITE, 2001).

2.2.1 Problems in Information Technology and Teacher Education Courses

Studies on the reasons of the lack of effectiveness of teacher preparation programme in the technology area have revealed a number of issues relating to information technology and teacher education courses. The literature suggests that these problems are related to either content or the design of the information technology and teacher education courses, along with a lack of appropriate role models with respect to the use of technologies applications in learning and teaching in teacher preparation programmes. These issues are now discussed in turn.

Course Content and Design

An examination of the literature reveals that many information technology and teacher education courses in teacher education programmes exist in the form of computer-specific courses. The content of such courses is usually focused on training pre-service teachers in the use of computing tools or software applications such as word processors or spreadsheets (e.g., Brownell, 1997; Lintner et al., 1991; Moursund & Bielefeldt, 1999; Willis & Mehlinger, 1996). It appears that such a skill-based and software-orientated focus of information technology and teacher education courses is influenced by drawing on computing expertise outside the education field when computing technology is introduced to the education community (Collis, 1994; Eraut, 1989).

Moreover, there is criticism in the literature that such courses do not actually provide student-teachers with opportunities to apply their computing knowledge and skills in actual learning and teaching situations (Byrum & Cashman, 1993; Moursund & Bielefeldt, 1999). Rather, in most information technology and teacher education courses, student-teachers simply learn skills or techniques of using specific technologies and are not able to practice their use. Likewise, they seldom are involved in decision making about the use of appropriate technologies or strategies for accomplishing a teaching task, or for addressing an educational problem or issue (Kearsley, 1998). The USA-based National Council for Accreditation of Teacher Education (NCATE) in its review of accreditation programmes using technology in the classroom found that student-teachers in most of these programmes were not given the chance to apply technology during their studies (NCATE, 1997). As a result, it seems most USA graduates from teacher education programmes continue to follow traditional teaching methods (Gilbert, 1996) and are unable to integrate technology across the school curriculum (OTA, 1995). Hunt (1995) drew similar conclusions and believes that courses confined to learning how computing applications work can neither bring any educational use in learning and teaching nor produce any information technology competent teacher. It is also argued by other researchers that separate courses in educational computing will never produce effective information technology-using teachers and, for example, Su (1992) and Owen (1992) suggest that such crude skill-based

courses have little practical use in actual teaching. Smaldino and Muffoletto (1997) go on to argue that information technology and teacher education courses that focus on information technology skills in a single course inhibit the transfer of skills and are unable to facilitate understanding of how technology can support learning. This view is supported by the work of Cuban (1995) who found that student-teachers provided with experiences in the actual application of technology during teacher preparation programmes perform better in integrating technology in classroom teaching.

Role Models of Using Information Technology

It is also argued in the literature that student-teachers will never be competent in using information technology in teaching and learning if they are not given opportunities to observe other more experienced teachers using information technology in instruction both in teacher education programmes and in classroom teaching (Collis, 1994b; Davis, 1992; Gooler, 1989; Handler, 1993; White, 1994; Wright, 1993). Remarkably, despite this argument, it is reported that few teaching faculty teacher education institutes actually use information technology in their own courses. Rather they seem to rely on a notion of 'do as I say', rather than as 'do as I do', and thus fail to provide a convincing role model for the use of technology in instruction for their students (Bosch & Cardinale, 1993; Gilbert, 1996; Gooler, 1989; Moursund & Bielefeldt, 1999; NCATE, 1997; Pan, 1999; Siegel, 1994). The NCATE (1997) report explained that this latter problem is often the result of insufficient technology and technical support along with a lack of technology training for faculty in their own institutions, further commenting that teacher education faculties in training institutes are commonly out of touch with the school environment. Austin and Willis (1994), for example, found that teacher education faculties commonly lack both hardware and software, and that information technology service to institutes is usually limited to hardware maintenance and the provision of standard software applications.

In Hong Kong, student-teachers in the certificate programme of the Hong Kong Institute of Education (the sample group for the present study) were required to

attend a compulsory information technology and teacher education related module¹ *Designing and Developing Instructional Media* (DDIM) by the time of the present study (see Chapter One, Section 1.3.2, p. 6). This DDIM module covered the demonstration on the skills of information technology used in education and includes hands-on workshops on the techniques of using different computer application software. All of these workshops were stand-alone and self-contained. They were skill-based and focus on the production of teaching software. Furthermore, Hong Kong student-teachers were neither given sufficient opportunities to apply and practice the use of information technology skills in their learning and teaching, nor did they have the opportunity to see the application of information technology in other modules of the teacher education programme or in classroom teaching. The result is that the student-teachers may have improvement in their information technology skills; however, they are unable to apply such skills to the actual teaching situations (CITE, 2001; Li et al., 2000). Hence at the time the present study began the use of information technology in teacher training in Hong Kong was much the same as that reported in the literature.

These difficulties reported in the science and technology education literature were known to many governments and ministry officials worldwide, and were of great concern to many. In order to address problems in the use of information technology in the classroom such as those identified above, the USA government established the Preparing Tomorrow's Teachers to Use Technology (PT3) grants in 1999. The purpose of these grants was to improve and to develop teacher education programmes to prepare teachers to use technology for improving instruction and student learning. This was intended to be achieved via curriculum restructuring of teacher education modules, cross-disciplinary or organisational collaboration and resource development (USA Department of Education [USA DoE], 1999). Likewise in Europe a consortium of teacher training institutions from eight European countries led by the University of Exeter in the UK was established in 1996. Supported by the European Commission, the consortium developed a *Core Curriculum Framework for Telematics for Teacher Training* (known commonly as T3). The main goal of T3 is to encourage teachers of European countries to adopt information technology as part of their daily work (Davis & Tearle, 1998). The

¹ Module and course are synonymous in the present study.

core curriculum provides a framework for development of a more detailed curriculum for teacher preparation in the use of information technology related to the national and local infrastructure, culture and context of the participating countries. The framework provides three areas for consideration when such a curriculum is planned: pedagogical considerations; technical considerations; and, networking and collaboration considerations (Tearle, 1998). Apart from the provision of direction for the preparation of technology using teachers in the teacher education programme, both the USA and the UK governments recently developed requirements and standards of information technology competency for the purpose of teacher certification: the National Educational Technology Standards for Teachers in the USA, and the Professional Standards for Qualified Teacher Status and Requirements for Initial Teacher Training in the UK. Along with similar development as the USA and the UK, in Hong Kong, the information technology Competency in Education for Teachers also came into scene in 1999. Details of such information technology and teacher education competences and standards are described in the following section.

2.2.2 Information Technology and Teacher Education Competences and Standards

As mentioned above, when computers and other technologies were first introduced into education, educational computing was treated as a subdiscipline within computer science (Willis & Mehlinger, 1996). In this way, student-teachers were taught about different types of computer programming languages and hardware (e.g. Kennedy, 1987; Rogers and Moursund, 1983) and competency standards for teachers were related to computer science rather than education. In the late 1980s, teacher educators began to think that educational uses of computers or other forms of information technology should be an important component of teacher preparation programmes and sought to emphasise the application of technology for use in instruction. For example, in the USA, Bitter and Yohe (1989) suggested that teacher education programmes must focus on both long term and short term needs in three ways: teachers need a broad education in order to determine the application of technology to cope with changes and innovations; teachers must be skilful, critical users of current educational technologies; and, teachers must be competent designers of instructional systems which will enable them to assist their student to

become critical thinkers. The USA Association of Educational and Communication Technologies [AECT] (1989) also established some guidelines for the accreditation of programmes in educational communications and information technology. According to AECT, teacher education should include research and instruction in the following areas: (1) systematic design of instruction to meet learner needs; (2) selection of media and interactive technologies; (3) preparation and production of media and interactive technology; (4) utilization of media and interactive technologies; and, (5) operation of media equipment. In 1991, the NCATE contracted the International Society for Technology in Education (ISTE) to develop a set of standards of technology competencies for all teacher education students for the accreditation of teacher preparation programmes. This resulted in some 13 items or competencies (Thomas, 1991) and included the knowledge of ethical, legal and equity implications of information technology, seen as basic competencies of a teacher. On-going development and refinement of these standards resulted in release of the National Educational Technology Standards for Teachers (NETS-T) in 2000. These standards are reported to be used by 80% of teacher preparation institutes nowadays in the USA (ISTE, 2000). The standards are grouped into six categories and 23 performance indicators that all classroom teachers should be prepared to meet. The categories are: (1) Technology operations and concepts; (2) Planning and designing learning environments and experiences; (3) Teaching, learning, and the curriculum; (4) Assessment and evaluation; (5) Productivity and professional practice; and, (6) Social, ethical, legal, and human issues (ISTE, 2000).

In the UK the Government began enforcement of the newly endorsed Professional Standards for Qualified Teacher Status in September 2002. According to this model all teachers should have met all the standards in order to gain teacher certification (DfES, 2002). In order to fulfil the information technology requirements of the standards, the UK Teacher Training Agency (TTA), in collaboration with five educational organisations, developed a set of expected outcomes for teacher training in information technology. This information technology training initiative was sponsored by the New Opportunities Fund²

² The NOF grants funding to a range of education, health and environment programmes in the UK.

(NOF). The document³ of this initiative spelt out 18 indicators grouped into two main sections: (1) Effective teaching and assessment methods; and, (2) Teachers' knowledge and understanding of, and competence with information technology (TTA, 1998).

Until the publication of the document: Levels of Information Technology (IT) Competency, Core Course Elements and Assessment Tools for Teacher Training in IT in Education – The Final Report in 1999, there were no mandatory technology requirements for Hong Kong teachers (Au, Kong, Leung, Ng & Pun, 1999). Rather, responsibility for the design of curricula in such areas for teacher training was left with teacher education institutes. The above report then is intended to serve as a framework for the design of relevant curriculum for the information technology competency in the teacher preparation programmes thereafter. Since then information technology competency became mandatory requirements for all practising teachers in Hong Kong. The report recommends 21 items for the Information Technology Competency in Education for teachers (ITCE); conceptualised into a matrix of four levels and three domains. The four levels are: basic, intermediate, upper intermediate, and advanced. The three domains are: information technology as productivity tools; general integration of information technology in education; and, subject-specific integration of information technology (Au et al., 1999). The report came out as a result of the release of the *Five-year Strategic Plan for Implementation of Information Technology in Education 1998-2003* announced in November 1998 (EMB, 1998) (see, Chapter 1, p. 3). In the document, teacher development and support is one of the four main implementation strategies suggested. It is expected that by 2003 75% of the serving teachers will attain the intermediate level of the ITCE for teachers and 25% of the serving teachers will acquire the upper intermediate level. It is also expected that one or two teachers in a given school will reach the advanced level. The document also spells out the requirements preservice teachers are expected to have achieved the upper intermediate level of the ITCE at the teacher preparation institutes before gaining qualified teacher status from 2001 onward.

Although specific competences and standards for the teaching with information

³ Detailed information can be downloaded from www.canteach.gov.uk/community/ict/nof/nof.htm.

technology have been developed, the success of their implementations depends very much on how student-teachers master the necessary knowledge and skills and the understanding of the concepts of using information technology in teaching and learning during the teacher education programme. Research suggests that the quality of teacher training has a direct impact on the successful transfer of such knowledge and skills, and any changes in teaching and learning in schools (see, e.g., Dupagne & Krendl, 1992; Vagle, 1995; Willis, 1997). Specifically, it is argued that a single course in computer applications is insufficient to empower a student-teacher to become a technology using teacher and to integrate technology into teaching practices (e.g., Byrum & Cashman, 1993; Cuban, 1995; Gilbert, 1996; Hunt, 1995; Kearsley, 1998; Moursund & Bielefeldt, 1999; OTA, 1995; Smaldino & Muffoletto, 1997). The literature recommends that technology should be integrated into the whole teacher education programme and, for example, the USA NCATE includes an indicator stating that: "Faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship" as one of the standards for institute accreditation (NCATE, 2001, Standard III. A). Likewise, in the UK, integrating technology into teacher education programmes is now a government requirement (Robinson, 1992; DfES, 2002). In Hong Kong, a policy of integration is now adopted by most teacher education institutes. For example, the institute in which the present study was conducted launched an integration policy after establishment of its Information Technology Strategic Committee in 1999. Building on this integration requirement or recommendations, various approaches or models have been attempted in many teacher education programmes worldwide. The following section describes some of these approaches or models that are argued to be effective in the literature.

2.2.3 *Information Technology and Teacher Education Teaching Strategies*

Several themes about teaching approaches or models for information technology and teacher education programmes emerge from the literature and these are discussed in turn.

(1) Technology courses: It is reported that the provision of basic hands-on experience in the development of technology skills remains one of the major

components in teaching programmes (see, e.g., Beyerbach, 2001; Cates, 1995; Dell & Disdier, 1994; Faison, 1996; Handler, 1993; Maeers, Browne & Cooper, 2000; Krueger, Hansen & Smaldino, 2000; Wetzel, 1993; White, 1996; Willis, 1997). This is not unreasonable, given that student-teachers need to master basic operation skills for common hardware and software applications before they can apply these skills in classroom teaching. Such basic skills therefore in effect become prerequisites in all teacher education programmes, to, for example, fulfil the teacher qualification requirements in the USA, the UK and indeed in Hong Kong. However, as mentioned previously in this chapter (Section 2.2.1, p. 18), stand-alone technology courses alone are now seen as insufficient. Other strategies in addition to the provision of pure technology courses are included or attempted in a variety of teacher education programmes in order to enhance the understanding and the competency of technology use in teaching practices.

(2) Modelling and demonstration: Section 2.2.1 also reported on the need of role models of technology use in teacher education programmes. In this regard, teacher educators are encouraged to demonstrate the use of technologies (both hardware and software) in their teaching. They are also expected to model the applications of such technologies in the instructional process across courses in their own teacher education programmes (e.g., Brownell, 1997; Cates, 1995; Faison, 1996; Maeers et al., 2000; Wetzel, 1993; Willis, 1997). It is also suggested that the teacher educators bring into, or disseminate, examples of good practice in the application of technology in school teaching in teacher education programmes (e.g., Hunt, 1995; Karla, Hansen & Smaldino, 2000; Maeers et al., 2000; White, 1996). In this way, student-teachers can have the opportunity to see the actual or field-based practices of technology applications in classroom teaching.

Modelling of teaching practice is proposed to be an effective strategy for information technology and teacher education, however, there may be some barriers that limit its use in the teacher education institutes. First, this strategy assumes that institute faculty have reached a certain technological competency level before they can model or demonstrate the use of technologies in the whole teacher preparation curriculum. Second, this strategy also demands all institute faculty share the same belief with the proponents of using technology in teaching

and learning. Such a situation is likely to be difficult to achieve according to Cuban (1986) and Hills (1987); other authors also suggest that it is in fact difficult to achieve a technologically literate cadre of college and university teacher educators (e.g., Ingram, 1994).

(3) Authentic applications: The above strategies will likely help student-teachers master the necessary basic skills and witness actual examples of school practice in using technologies. However, it is also argued that student-teachers should be given opportunities to practice what they have learnt about technological skills and applications in actual teaching situations (Cuban, 1995; Smaldino & Muffoletto, 1997). To this end, Cates (1995) developed a teacher preparation course in a 'technology-rich' environment, modelling the use of technology in instruction and assigning learning activities requiring the use of technology. White (1996) emphasises the importance of a learner-centred or constructivist-based approach to teaching and go on to derive a variety of learning activities that require student-teachers to apply their technology skills learnt from their technology courses. In order to gain appropriate experiences of technology use in actual school practice, in a number of studies student-teachers on their practicum were deliberately placed into schools in which the school teachers have already infused technology in the school curriculum skilfully, and in classrooms 'rich' in the use of teaching technologies (e.g., Beyerbach, Walsh & Vannatta, 2001; Krueger et al., 2000; Wetzell, 1993). In this way, student-teachers were given opportunities to observe the good practice of experienced school teachers and also were able to practice using technologies in their classroom teaching under the guidance of the more experienced teachers.

(4) Critical thinking: Maeers et al. (2000) suggest that student-teachers need to be able to evaluate and discriminate among technological resources, and their pedagogical uses. They stress that any teacher education programme should prepare student-teachers by provision of sound concepts of the 'how', 'where' and 'why' of the use of computer-related technologies, and then be able to evaluate the effectiveness of such applications critically. Maeers et al. consider that conversation among student-teachers, and between teacher educators and student-teachers, throughout teacher preparation programmes - through discussions

and evaluation activities - can help to build up such concepts effectively. Willis (1997) concurs and explains that the theoretical concepts of an instructional planning, along with the use of technologies in one of her courses modelled the use of technologies in the plan. This meant that the student-teachers were required to reflect on the instructor's practice critically, using theories that were brought into the learning process by the instructor. White (1996) and Stuhlmann (1998) went further and required their student-teachers to teach others (both student-teachers and school teachers) about skills required for specific instruction situations, and to share these experiences in the field.

The above review suggests then that a holistic, integrated, curriculum is needed for information technology and teacher education courses (Handler, 1993; Hunt, 1995; Thomas & Cooper, 2000). The literature suggest that student-teachers should be given the opportunities to master the basic computing skills for learning and teaching and should be given the chances to observe the models of information technology uses in actual learning and teaching process. It is also suggested that the use of technology should be one of the requirements in the teaching practice so that every student-teacher should have the chance to gain authentic experiences in using information technology in classroom teaching. Moreover, student-teachers should be given the chance to reflect on and to share their experiences of information technology uses critically in the course of their study.

This section has given an overview of the current state of information technology and teacher education as reported in the international literature and in Hong Kong. The emergence of information technology and teacher education competencies and standards, and recent information technology and teacher education teaching models has shed light on potential effective use of information technology in classrooms and also the professional development of the teachers. However, the success of such expectation is strongly dependent on how teachers learn, and eventually master the concepts and skills in this area. The use of appropriate teaching models or strategies is, therefore, argued to be the important component of an information technology and teacher education course. The following section attempts to examine relevant learning theories that underpin the development of such teaching strategies for the information technology and teacher education course that is the focus of the present study.

2.3 Views of Learning

This section describes two views of learning: the cognitive information-processing model, and constructivism. Based on the above review of the literature for information technology and teacher education courses, these two theories of learning were deemed particularly relevant in that they provide an appropriate framework for the development of the intervention for this study (see Chapter 3, Section 3.6, p. 86). Moreover, theories of learning were seen to be an essential part of the knowledge base required for the DDIM module for the teacher preparation programme in the present study.

2.3.1 *Cognitive Information Processing Model of Learning*

The cognitive information-processing model of learning conceives the learner as a processor of information similar to that of a computer system. In this model information is input through the human sensory channels, such as the eyes and ears, from the environment. It is then 'encoded' and stored permanently in the brain. Atkinson and Shiffrin (1968) propose a multistore and multistage model that explains learning as a process that involves the transformation of outside information to the human memory permanently. In this model, information that arouses a learner's attention is first stored in the sensory register. It is then transferred to the short-term or 'working' memory. Through the process of rehearsal and encoding (Baddeley, 1999), the information is then stored permanently in long-term memory. Such information then becomes part of the 'cognitive structures' of the learner and can be retrieved in new learning and thinking processes. Long-term memory, according to Squire, Knowlton, and Musen (1993) and Tulving (1993), can be divided into three parts: episodic, semantic, and procedural. The episodic memory contains images of personal experiences (Tulving, 1993); the procedural memory stores information about skills; and, the semantic memory stores facts and general knowledge such as understanding and application of concepts, rules, problem-solving skills and learning strategies (Ericsson & Kintsch, 1995). Knowledge is organised in

networks of connected concepts or relationships called schemata (Anderson, 1983, 1995; Rumelhart, 1980) and it is believed that information that fits into an existing schemata is more easily understood and retained in the semantic memory (Anderson & Bower, 1983).

The cognitive information processing view of learning assumes that knowledge is an internal representation of the external reality. Teaching, according to this view, is a process that facilitates the transmission and retention of such representations. Learning in this view is defined as the reconstruction and integration of new schemata through three different modes: accretion, tuning or schema evolution, and, restructuring or schema creation (Rumelhart, 1980; Rumelhart & Norman, 1978). According to Rumelhart and Norman (1978), the development of schemata is facilitated by the use of mnemonic aids. Clark and Wittrock (2000, p. 69) suggested a list of six instructional strategies that aim to reduce memory overload and to facilitate attention during information processing:

- (1) maximise attentional capacity by optimising physiological and motivational states;
- (2) avoid divided attention in training;
- (3) provide cueing to direct learner attention;
- (4) provide advance organisers;
- (5) integrating text and graphics in materials, and;
- (6) use audio to augment visual materials.

From the above list, strategies related to the use of technology are highlighted, for example, it is suggested that the use of audio-visual elements in a well-designed reference documentation or learning aid, can supplement human memory. According to the Dual Code Theory proposed by Paivio (1971), there are two systems of memory representation, one for verbal information and the other for nonverbal information. Studies in the literature suggest that there is a strong connection between the verbal and visual systems. Some authors also assert that the use of visual aids can enhance learning of some verbal materials (e.g., Kosslyn, 1980; Levin, 1983). Sweller and Chandler (1994), Mayer, Bover, Bryman, Mars and Tapangco (1996) and Mayer and Moreno (1998) provide some support for the above proposition and suggest that learning materials containing both visual and verbal information reduce the cognitive load for learners in information processing - thus facilitating later retention in long-term memory. This view is supported by

the finding that learning materials are supported with audio capability, and, for example, in the study of Mousavi, Low and Sweller (1995), a positive effect of enlarged diagrams with explanatory audio on learning outcomes was reported in comparison with a sole explanatory text when students were learning geometry problems.

While there are studies that validate the contribution of the use of instructional media or technology in instruction, there also are studies that show the contrary. To illustrate, Schramm (1977), in a comprehensive meta-analysis of research in instructional media, concluded that learning is influenced more by the content and instructional strategy, than by the quality of the instructional media. Similarly, Levie and Dickie (1973) comment that most learning objectives can be achieved through “instruction presented by any of a variety of different media” (p. 859). Clark’s (1983) review and meta-analysis concluded that the “media are mere vehicle that deliver instruction but do not influence student achievement any more than a truck that delivers our groceries changes our nutrition” (p. 445). He stressed that it is the teaching methods that influence learning - not instructional media. In a book entitled *The ‘No Significant Different’ Phenomenon: A Comparative Research Annotated Bibliography on Technology for Distance Education*, Russell (1999) investigated 355 research studies that provided further support for Clark’s argument⁴. However, in contrast, there are other reports in the literature that showed significant results in learning based on the use of instructional media. Christmann, Badgett and Lucking’s (1997) meta-analysis of the effects on the academic achievement in classes taught by traditional instruction supplemented with Computer Assisted Instruction (CAI), by non-computer-based instruction, and by CAI from previous studies, supports the view that CAI is effective in raising academic achievement. A further meta-analysis conducted by Liao (1998) on the use of hypermedia and traditional instruction in (involving 35 studies) also suggested that hypermedia instruction exerts moderately positive effects on student achievements, and there are persistent reports in the literature that claim significant effects on student achievement as a result if the use of information technology in

⁴ At the time of writing, a post-book website is available at: <http://teleeducation.nb.ca/nosignificantdifference/> for latest entries.

the classroom. A supporting web site⁵ entitled *Significant Difference* was also set up lately after the publication of the “No Significant Difference” web site.

It is worthwhile to note that many of the above studies reporting enhanced academic achievement by use of educational technologies have been criticised for lack of validity. Clark (1983, 1991), for example, points out that instructional media is often mistreated as the focus in many media comparison studies, commenting that the results in most of the reports are confounded by underlying influences. As an illustration, most of the studies reported in the literature failed to control intervening variables such as teaching content and teaching methods. Clark went on to suggest researchers “refrain from producing additional studies exploring the relationship between media and learning” (p. 457). Wenglinsky (1998) shares Clark’s views and stated: “There are some problems with the assertions made by both advocates and critics regarding the relationship between technology and educational outcomes” (p. 7). Like, Clark, Wenglinsky argues that many studies lack sufficient controls on intervening variables – highlighting other potential confounding variable such as such as the background of the learners, the learning environment, the instructional content, the ways of using technologies and the methods of evaluating learning outcomes. Hence, the above discussion suggests that there is no final single view on the effectiveness of educational technologies in different learning achievements. In fact, it seems likely that both instructional media and instructional strategies (or a combination of the two) each may contribute to effective learning.

In spite of the debate in the literature about the effectiveness, or otherwise, of the use of instructional media, it does suggest that instructional media help in information acquisition (Rumelhart, Smolensky, McClelland & Hinton, 1986), and in the formation of memory or cognitive structure, with their bimodal characteristics. Thus, the cognitive information processing model of learning was used here to provide the direction and principles for the selection, design and development of various instructional resources such as the study guide, lecture and self-instructional materials, and so forth (see Appendix D to G) that acted as means

⁵ The companion web site on “Significant Difference” also was available at the time of writing from: <http://teleeducation.nb.ca/significantdifference/> housed by TeleEducation NB.

of scaffolding the learning process for the present study. The information-processing model helps to explain how information becomes part of the memory structure of a learner. However, it is argued that learning is never a simple information transmission and receiving process (Tiene & Ingram, 2001). To view learning as passive receiving and storing of information delivered from the teachers and the instructional media, as inferred by the cognitive information-processing model, over-simplifies the cognition process. It is argued in the literature that for learning to occur, learners have to 'invest' a certain amount of mental effort in the encoding process (Salomon, 1983). The learner should then take part in this process actively. He/she should be active "not just responding to stimuli, as in the behaviourist rubric, but engaging, grappling, and seeking to make sense of things" (Perkins, 1991, p. 20). The learner should also be given the opportunities to interact with and use the information from the instructional media. Thus, appropriate learner-centred instructional strategies should be adopted if effective learning is to be achieved.

2.3.2 *Constructivist Views of Learning*

Constructivism is a broad concept that has many variants. Some constructivists see learning as a process in which a learner builds mental representations of his/her own meaning and develop understandings of reality through experiences and interaction with the outside world (Anderson, Greeno, Reder & Simon, 2000; Duffy & Jonassen, 1992). Knowledge, according to this view, is exclusively 'constructed' by individuals (Guba, 1990; Jonassen, 1991; Phillips, 1995). It can neither be transferred to the human mind passively from the environment nor should it be seen as a direct reflection of the reality. Knowledge exists only in individual people's mind and is idiosyncratic from one another (von Glaserfeld, 1995). There are also other constructivists who believe that there are natural structures in the world and these structures can be discovered in a scientific way. Knowledge is the essence of such discovered structures and can be passed onto the others in a dialectical process. Learning is, therefore, a process to examine learners' constructed meaning critically on the discovered structures of the outside world through active interaction with the environment (Cognitive & Technology Group at Vanderbilt [CTGV], 1991;

Salomon & Perkins, 1998).

One of the important principles of constructivist-based learning is that learning comprises more than rote memorising of information that has been passively transmitted from the information source, whether from a teacher or via instructional media like books, videos, and so forth. Understanding, according to constructivism, is more than just encoding of literal information. Two other features of constructivist-based learning emerged from the above reviews are that the learner is an active agent in constructing his/her own knowledge, and that social interaction is important in the construction of knowledge (Brown & Palincsar, 1989; Bruning, Schraw & Ronning, 1995; Driver, Asoko, Leach, Mortimer & Scott, 1994; Steffe & Gale, 1995; Tobin & Tippins, 1993). It is also suggested that the learning process (both cognitive and social) is context-bound and is dependent on constraints within the community or situation in which the learner is a member (CTGV, 1991; Good, Wandersee & St Julien, 1993). Constructivist-based learning therefore involves both personal construction and social mediation of meaning in a particular learning context. The detail of these personal, social and contextual aspects in constructivist learning is provided in the following sections.

Piagetian Cognitive Development Theory

The cognitive development theory proposed by Piaget (1970) is considered as one of the foundation theories for constructivism. This theory states that the construction of knowledge involves continuous interaction between a learner and the external world through the processes of 'equilibration'. The cognitive structures (similar to schemata as used by Anderson, 1983 & Rumelhart, 1980) always remain in a state of equilibrium as long as they are sufficient in adapting to one's environment. When the learner confronts new and unfamiliar features from the environment, he/she will try to fit these new experiences into his/her existing cognitive structure through a process called assimilation (similar to accretion in Rumelhart & Newman's, 1978). If such process fails, the learner will modify the existing cognitive structure or develop a new one through a process called accommodation (similar to tuning and restructuring according to Rumelhart and

Newman, 1978). The equilibration process makes learners become active agents who continuously explore and rediscover their environment and construct their own new knowledge. This then is the gist of constructivism, however, Piaget proposed that cognitive development of an individual depends on developmental maturity in defined stages from birth to adulthood, including 'concrete' and 'formal operational' stages. He suggested that such stages emerge naturally, and physiological maturity is an inevitable and necessary condition for effective learning. From Piaget's perspective, the learner has the ability to discover or perform something only when a given cognitive stage is reached. On this basis, learning is a process in which an outsider's intervention is not necessary as such and teaching seeks to arrange an environment for interaction, or exploration, according to the developmental needs and characteristics of the learner (Elkind, 1989). In this regard, Gredler (2001) summarised the features of the educational practices from a Piagetian perspective, stating that the learning environment needs to provide rich opportunities for learner to experiment, rediscover or reconstruct the knowledge to be learned, and one in which support the spontaneous research or exploration activities of the learner and should provide conflicting examples that lead to 'equilibration' and hence intellectual growth.

Generative Model of Learning

While the Piagetian's perspective of constructivist learning emphasises the importance of personal construction of knowledge from the environment, it does not address the question on how instruction can enhance such process. Hence in the view of many this 'personal' form of constructivism based on Piagetian thinking is too limited. The generative model of learning (Wittrock, 1974a, 1974b, 1990, 1991, 1994) has its root from the information-processing model of learning with some added constructivist-based views. The basic assumption of this latter model is that in order to learn with understanding, learners must actively construct knowledge by attending to learning events, thus generating meaning from experiences. Learning in this sense is a process of generating relationships or links, rather than storing 'isolated' information. The learner needs to create a model or an explanation to account for his/her new experiences. In this way metacognition and learning

strategies are developed as part of a generative process. Existing experiences (schemata or cognitive structures) may help the learner interpret new knowledge; however, new experiences may also result in the modification of existing cognitive structures or in the formation of new cognitive structures. The model also assumes commitment from the learner; thus personal effort is required. Instruction, according to the generative theory, involves helping learners in this relationship-generating process. Some teaching strategies described in the literature were inspired by the generative model and have been reported to be successful. Strategies include the use of self-generated questions (Andre & Anderson, 1978), note taking (Kiewra, 1991; Peper & Mayer, 1986), and outlining and mapping (Hyerle, 1995; Robinson & Skinner, 1996). Generative learning focuses on the personal creation of meaning by constructing relations between the prior knowledge or experiences and the information, the concepts and principles presented in the instruction process. It also stresses on how direct instruction can facilitate the generation process. However, the social aspect that may help the construction of relations and linkage has not been addressed in this model.

The Piagetian and generative models described above share some common characteristics with constructivist views of learning. In each case the knowledge construction process is seen as an individualised activity. Learners have to engage in mental effort and take up some responsibility in the learning process. Learners' prior knowledge and experiences also contribute to this process. Although the Piagetian and generative models both place emphasis on the personal aspect in the knowledge construction process, Piaget did make mention of the social aspect of the learning process. Piaget (1952) stated that children are born with the capability to build and alter understanding through everyday interactions with their environment. He asserts that, from a psychological perspective, culture plays an important role in cognitive development, stating that culture "gives rise to an active assimilation and uses the same structures and instruments as adaptation 'practical and cognitive which are one' to every reality" (Piaget, 1980, p. 281). Thus, cognitive development is an interactive process in which the learner continuously builds cognitive structures in the inner mind from his/her environment and applies such knowledge in this structure to adapt the ever changing environment. Similarly, Salomon and Perkins (1998) see the generative model as one form of social

learning, claiming that the teacher acts as a social agent assisting in the knowledge construction process. Hence it seems that both the Piagetian and generative models whilst recognising the social aspect of learning do not place adequate emphasis on this aspect of learning. Such thinking led to modifications of learning theories, one of which is the social-constructivist view of learning and this is discussed in the next section.

Social Constructivist View of Learning

The Piagetian and generative models see knowledge as being constructed by the learner rather than being a mere reception of the external information. The social constructivist view of learning builds on such thinking and considers that learning is a social activity. Thus social constructivists consider that learning is not a process that only takes place solely in an individual humans mind, nor is it passive behaviour that is shaped by the environment (McMahon, 1997). Rather, meaning is derived from the context in which the learning takes place, particularly from interaction with others (Greeno, Collins & Resnick, 1996). Knowledge and understanding are constructed socially through talk and activity about shared problems and tasks (Bruner, 1985). Learning is therefore a social activity in which knowledge is actively internalised through conversation and/or interaction between the learner and a more knowledgeable other (Vygotsky, 1978). Resnick (1991) described the social interaction process in this way: “Our daily lives are filled with instances in which we influence each other’s constructive process by providing information, pointing things out to one another, asking questions, and arguing with and elaborating on each other’s ideas” (p. 2). Hence, social exchanges between individuals are seen as the primary source of cognitive growth.

Salomon and Perkins (1998) emphasise the contribution of the social aspects to learning and distinguished six forms of social learning - two of which are particularly relevant for the present study:

1. Active social mediation of individual learning – Learning occurs as a result of active social mediation when an individual is helped by a more knowledgeable

- 'other'. This knowledgeable other may be a teacher, peer or group of peers, considered to be a facilitating agent in the personal meaning construction process. This process is also referred as 'social scaffolding' and involves internalisation and active construction of knowledge in a learning environment (Scardamalia, Bereiter, McLean, Swallow & Woodruff, 1989).
2. Social mediation by cultural scaffolding - In this case, the individual learner is helped to construct meaning by the use of cultural artefacts rather than by a knowledgeable other or others. These artefacts may be in the form of information sources such as books, videos, articles, or other resource materials. Artefacts may also be tools used for handling information such as calculators and computers. Such artefacts implicitly embody shared cultural understandings (Perkins, 1986) and therefore allow learners to acquire knowledge from the accumulated wisdom of a particular culture or discipline (Brown, Collins & Duguid, 1989; Vygotsky, 1978).

'More Knowledgeable Other' and Scaffolding in the Zone of Proximal Development

The concept of what is termed a more knowledgeable other (MKO) stated above comes from Vygotsky's notion of the zone of proximal development (ZPD). Vygotsky (1978) defined the ZPD as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Thus the ZPD is the difference between the difficulty levels of a problem a learner can cope with independently, and the level that can be accompanied with the help of an adult when a learner works on a learning task. The more a learner takes advantage of an adult (or other's) support, the wider is the ZPD in the learning context. It is believed that when a learner is at the ZPD of a particular task, appropriate assistance will help him/her to achieve the task. Once the learner masters the task, the assistance can be removed and the learner will then be able to complete the task again on his/her own. As Vygotsky (1987) put it: "What the child [learner] is able to do in collaboration today he will be able to do independently tomorrow" (p. 211). The assistance provided in the learning process, as mentioned previously, is referred as scaffolding.

Scaffolding is defined as the supports for helping learner to carry out a task (Collins, Brown & Newman, 1989). Greenfield (1984) uses the metaphor of building construction to describe the concept of scaffolding. She states that a scaffold in the learning situation is a teacher's selective intervention that "provides a supportive tool for the learner, which extends his or her skills, thereby allowing the learner successfully to accomplish a task not otherwise possible" (p. 118). Berk and Winsler (1995) similarly describe scaffolding as the process of how an expert can facilitate the learners' transition from assisted to independent performance. To achieve such dependence, scaffolding is more structural at the beginning, subsequently 'fading out' gradually and removed totally at the end of the learning process (Palincsar, 1986; Rosenshine & Meister, 1992). It is worthwhile to note that Vygotsky was writing at a time when advanced technological aids such as calculator and computer were not available. It was thus later that Spencer (1996) and Salomon and Perkins (1998) extended the concept of MKO and scaffolding to include the help derived from powerful aids such as those provided by information and communication technologies. Such aids may be interpreted as the social scaffolding tools, or as cultural artefacts (Salomon & Perkins, 1998) that facilitate the cognitive construction process during learning.

The concept of scaffolding and MKO are relevant to the present study. In the study, various tools in digital form, such as computers, multimedia and the Internet, or text-based such as books and selected articles, were used interactively in a learning environment designed from a constructivist-based view of learning. These tools were used to act in the role of a scaffold, being a physical form of cultural artefacts (Salomon & Perkins, 1998) that either provide the necessary information about the learning content, or assist the access to, and the handling of, such information. In the learning environment, apart from the above scaffolding tools, peers, instructors and the researcher also acted in the role of MKO. Conversations (an abstract form of cultural artefacts as described by Salomon & Perkins, 1998) between a learner and the researcher and peers in a particular learning context also are social exchange processes that facilitate knowledge construction.

While MKO and cultural artefacts are considered important social components for communication, interaction, and scaffolding in the cognitive development process,

social constructivists also place emphasis on the effect of the social environment on such processes. Brown et al. (1989) comment that most learning in class teaching consists of abstract and decontextualised concepts and that knowledge is developed independently of the situations in which it is learned and used. Such knowledge becomes inert knowledge (Whitehead, 1929, cited in Bransford & Vye, 1989) that is never used to solve problems in real-life situations. It is therefore argued that for learning to be meaningful, the cognitive development process should be situated. Brown et al. (1989) claimed that conceptual understanding is developed through social interaction in the culture of the domain or discipline. They assert that learning activity, concept and the situation or culture that learning takes place are interdependent (Brown et al., 1989). Each of these affects the others reciprocally; such an argument brings us to the notion of situated learning in the following section.

Situated Learning

According to Collins (1988), situated learning is “the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life” (p. 2). The tasks or problems in the learning process must be realistic and authentic in the sense that the acquired knowledge and skill are readily applicable in the learning context or the environment resembling to it (Schell & Black, 1997). The theoretical foundation of situated learning is similar philosophically to social constructivism which posits that learners actively construct new knowledge and skills from interaction with the world around them. Collins et al. (1989) use the metaphor of tools to describe the knowledge and skill acquired during cognitive development. They cite differences in the use of chisels (physical tools) between a carpenter and a cabinet-maker, and in the use of mathematical formulae (conceptual tools) between a physicist and engineer to illustrate how different learning situation and culture affects the way of learning about tools and their use. It is argued that the cultures of particular learning situations, for example, the learning within different academic disciplines, are bound by socially-constructed beliefs, concepts and practices within those disciplines. Therefore, learning is similar to an apprenticeship which requires learners to enter the ‘community’ of the

particular discipline and to adopt their cultures. Learning then is seen by Brown et al. (1989) as a process of enculturation; a proposition echoed by Lave and Wenger (1991) who described learning as “an integral part of generative social practice in the lived-in world” (p. 35). Sharing a similar view with Brown et al. (1989), Lave and Wenger argue that learning should take place within a community of practitioners of particular disciplines. According to situated cognition, knowledge grows naturally from daily interactions with the other members of the community. Lave and Wenger (1991, p. 40) term such processes “legitimate peripheral participation”. The novice is seen to move from the periphery of a community at the beginning, proceeding gradually to its centre, and ultimately assuming the role of the expert as a result of the learning process. In this process, the novice begins by observing the work of established members of the community (also referred to as ‘old-timers’), receives advice, learns the ‘language’ or jargon, adopts the cultural norms while he/she is engaged in a task. The theoretical underpinning of situated learning suggests that learning is most effective and meaningful if learners can be placed in the real-life or in an authentic context. The Cognitive and Technology Group at Vanderbilt (CTGV) (1991) also assert that learning is constructive or generative in nature and should be organised around authentic tasks.

Situated cognition gives rise to the development of authentic teaching tasks in teaching with information technology in the present study when the student-teachers and the beginning teachers teach in ordinary primary schools. The concept also informed the design of authentic activities in the course of study in the teacher preparation programme. Authentic activity as described by Brown et al. (1989) means the structured activity that allows the learner to gain access to the standpoint of the practitioners of the culture or discipline. Through such authentic activity, the learner should be able to apply the learned experiences in the real life when he/she encounters a similar situation subsequently in their own classroom (Brown & Duguid, 1993; Roth & Roychoudhury, 1993); namely, in teaching with information technology in schools in the present study.

The theoretical concepts of ZPD and situated learning described above thus point to the importance of social interaction and the social environment in the cognitive development process. These concepts lay the foundation of a variety of

constructivist-based instructional strategies or approaches reported in the literature. The following section describes three such strategies. These strategies are relevant to both teaching with information technology in ordinary classes, as well as learning about teaching with information technology as investigated in the present study. They serve as the knowledge base of teaching with information technology for the student-teachers on one hand and the constituents of the intervention for student-teachers and beginning teachers acquiring the knowledge and skills of teaching with information technology on the other hand.

2.3.3 *Constructivist-based Approaches for Learning and Teaching*

This section describes three instructional approaches based on social-constructivism: (1) cognitive apprenticeship; (2) collaborative and cooperative learning; and, (3) resource-based learning.

Cognitive Apprenticeship

Brown, Collins and Duguid (1989) described cognitive apprenticeship as methods that “try to enculturate students into authentic practices through activity and social interaction in a way similar to that evident in craft apprenticeship” (p. 453). It is argued that through the authentic activities and social interactions with masters or expert practitioners of a particular domain or discipline, concepts are developed in the way similar to the learning of practical skills like painting and sculpting. Collins et al. (1989) and Collins, Brown and Holum (1991) and others identify three instructional strategies for cognitive apprenticeships: reciprocal teaching in reading (Brown & Palincsar, 1989), explicit expert modelling in writing (Scardamalia & Bereiter, 1985; Scardamalia, Bereiter & Steinbach, 1984) and thinking like a mathematician in mathematics (Schoenfeld, 1985), that are seen as successful for teaching in these respective domains. Drawing on the successful elements from these strategies, Collins, Brown, Holum and Newman (1989, 1991) developed a framework of the cognitive apprenticeship model. This framework consists of four dimensions: content, method, sequence, and sociology, that are seen as the main

components of any constructivist-based learning environment.

For the method dimension stated above, Collins, Brown, Holum and Newman (1989, 1991) advocate six teaching strategies as a framework. These strategies fall roughly into three groups. The first group (*modelling, coaching, and scaffolding*) is the core of cognitive apprenticeship. The strategies in this group are designed to help students acquire an integrated set of practical and cognitive skills through the processes of observation and guided practice. The second group (*articulation and reflection*) is designed to help students to focus their observations of expert problem solving as well as to gain conscious access to and finally the development of their own problem-solving strategies. The last category (*exploration*) aims at the development of students' capability of independent problem solving. Students are deliberately led into various problem-solving situations that demand their applications of previous knowledge and skills.

Modelling allows students to observe an expert's practice of a particular domain or discipline and to build a conceptual model of the processes of accomplishing such practice. Practical skills, such as the operation of various technological equipment or computer applications in an instructional situation, can thus be learned through vicarious experiences (Bandura, 1977). Brookfield (1995) suggests that the educators should make use of every opportunity to explicitly communicate their beliefs and the rationales of particular teaching act to the student-teachers. With a similar line of thought, Shunk (2000) puts forward the concept of cognitive modelling, in which the cognitive models (i.e., faculty or other teachers) articulate their thoughts and give reasons for particular behaviours or actions through dialogue or in the form of text. In the present study, these cognitive models were the researcher and competent or knowledgeable peers. Collins (1991) calls this kind of cognitive modelling the *modelling of expert performance*, and places emphasis on making the thought process, such as the pedagogical use of technologies in the present study, explicit to the learners by the cognitive models.

Coaching as described by Collins et al. (1991) is a process that adopts a range of methods or techniques aiming to assist a learner in his/her learning. Such methods may include hints, feedback, reminders and *scaffolding* given to the learner to

support task performance. The concept of *coaching* and *scaffolding* is based on Vygotsky's (1978) theory of ZPD discussed above. These scaffolds are cultural artefacts or social agents that may be in the form of physical or abstract tools, or in the form of conversation in the scaffolding process (Salomon & Perkins, 1998). Zhao and Orey (1999) identified six elements for scaffolding that also are relevant to the development of the scaffolding environment of the present study: (1) sharing; (2) whole task approach; (3) immediate availability of help; (4) assisting the learner in his/her intention; (5) providing an optimal level of help; and, (6) conveying of an expert model. Zhao and Orey (1999) argue that sharing allows the learner to see the values, beliefs and ways of doing things of the MKO. Such a process helps to bring the learner into the cultural practice of a particular domain or discipline more actively. It also reduces the frustration of the learner when he/she sees or hears the tips and tricks of particular tasks shared by the MKO. In the present study, the researcher made use of conversational opportunities to share his experiences in, and thinking about, the use of information technology in teaching and learning by means of tutorials, one-on-one consultation and during interviews. Furthermore, the researcher also acted in the role of an MKO providing immediate and optimal assistance and support to the student-teachers and beginning teachers throughout the study. A whole task approach also was adopted in the present study with the intention of forcing the learner to think more deeply about each detail for a given task. For example, the teaching with information technology project used at the beginning teachers' schools in the present study involved a holistic analysis of the rationale, requirements and limitations in the preparation, implementation and evaluation of the development of a constructivist-based learning environment for primary school students.

Articulation as described by McLellan (1994) is a process used to verbalise the understanding or mastery of the concepts of a particular domain or discipline and the thought processes during learning. It is achieved by various methods such as discussion, presentations, recording journals and short essay writing (in the present study). It is believed that through such explicit articulation, the learner has to begin with a self-evaluation and finally adopts appropriate methods to make his/her learning visible to peers or community members in particular domains or disciplines. This self-evaluation process is actually a reflection process that is

considered as another important strategy in the cognitive apprenticeship model. It is argued that *reflection* allows the learner to monitor and criticise the level of acquisition and the ability of application of knowledge and skill in a learning context as compared with those of an expert or other peers. Such a process ultimately helps the learner build an internal cognitive model of the expertise in the particular domain or discipline.

Drawing on similar theoretical perspective of ZPD, the ultimate aim of cognitive apprenticeship is to enculturate learners, helping them to adopt an expert-like performance in the discipline that he/she is one of the members without any assistance. That is the coaching and scaffolding gradually 'fade out' and the learner is able to solve problems like a normal practitioner in the discipline independently (Brown et al., 1989; Collins et al., 1989). The *exploration* strategy is therefore arranged to provide opportunities for, and to push the learner to, apply similar processes to that of experts in solving problems (Collins, 1991). Rogoff (1990) suggests that the teacher has to transfer the responsibility for exploration to the learners during cognitive apprenticeship. The strategies may include gradually fading out support and giving autonomy to learners for identifying the problems and for trying out their own strategies for solving problems. Furthermore, problem-solving situations should match with those occurred in real-life situations (Collins, 1991; Shunck, 2000).

Collaborative and Cooperative Learning

It is argued in the literature that a collaborative and cooperative approach to learning can bring about greater understanding, increased productivity, enhanced time spent on tasks, higher motivation, and better sense of competence (Johnson & Johnson, 1989; Rysavy & Sales, 1991; Sharan, 1980; Slavin, 1995). Duren and Cherrington (1992) point out that the dialogical process that occur in group activities in such approaches can enhance individual communication and problem-solving skills. Both collaborative and cooperative learning approaches have their roots in Piagetian and Vygotskian cognitive developmental theories (Piaget, 1952; Vygotsky, 1978). As mentioned above, Piaget (1980) asserts that

people build their understanding through the interaction with others. When an individual interacts with other members in a cooperative situation, sociocognitive conflict may occur as he/she is confronted with new or different concepts in the social group (Johnson & Johnson, 1996). Such a situation then creates a state of 'cognitive disequilibrium'. Through the discussion process, the individual enters a state of continuous assimilation and accommodation. Such equilibration processes enables an individual to discover and to comprehend difficult concepts, and resulting in cognitive growth. The dialogical nature of collaborative or cooperative groups also provides a social exchange environment in which cognition can be shared among members. As members come into the group with a different ZPD (Vygotsky, 1978), they may have the chance to act the role of MKO to assist the learning of others for particular tasks, according to their level of expertise. Thus, new concepts are exposed and shared, and misconceptions are challenged and clarified as a result in such social exchange process (Pontecorvo, 1993; Slavin, 1995). Drawing on Piagetian and Vygotskian theoretical frameworks and a constructivist perspective, collaborative learning is a generic strategy from which various techniques or methods can be developed. It exists whenever students are given opportunities to articulate their thoughts and when they are encouraged to share their knowledge and skills within a group resulting in shared learning goals in a more student-centred manner (Bruffee, 1995). However, as well as a cognitive development perspective described above, cooperative learning is informed by social interdependence theory (Deutsch, 1949; Johnson & Johnson, 1989). Unlike a collaborative approach, cooperative learning emphasises individual accountability within a group. Each student can achieve his/her learning goals only if all the other members have achieved theirs. Cooperative learning, therefore, exists only when all the members in the group work together to accomplish shared goals (Johnson & Johnson, 1996, 1999; Slavin, 1996). Moreover, the group should be well structured and managed by the teacher (or faculty) so that active participation of all members ensures (Cohen, 1994). Johnson and Johnson (1996) identified some basic elements that they argue are important components for all effective cooperative groups: positive interdependence; face-to-face promotive interaction; individual and group accountability; appropriate use of social skills; and, group processing.

In the present study, a collaborative approach was adopted in the multimedia design group project that formed part of the assessment requirements for the DDIM module. With clear objectives and requirements given, the student-teachers worked in collaborative groups towards an end product in their own way. Such an approach is also referred as project-based learning by Slavin (1996) and Webb and Palinscar (1996). According to Bransford and Stein (1993), project-based learning is defined as a comprehensive instructional approach that engages students in sustained and constructive investigation. Such an approach usually leads to the creation of a product or performance and, necessitates student-centred strategies during the learning process. Thomas, Mergendoller and Michaleson (1999) described a project-based learning environment as one that includes explicit goals, authentic content, teacher-facilitated activities, students' collaborative learning and reflection. Thomas (2000) in his extensive review of research about project-based learning, identified five criteria that feature in each instance of such an approach. These criteria are: centrality; driving question; constructive investigation; autonomy; and, realism. According to Thomas (2000), *centrality* refers to a project that serves as the central strategy for learning. It means that students learn new knowledge and skills of a discipline via accomplishing the project. The *driving question* is the question or problem that directs subsequent *constructive investigation* and the development of strategies or solutions by the students for achieving the goal of the project. It is also important that students are given the total *autonomy* in the whole investigation and development process. *Realism* means that the outcome or product of the project should be applicable in real-life situation. Such a feature gives the students a feeling of authenticity while conducting projects.

Cognitive apprenticeship and the collaborative project-based approaches described above thus provided a framework for the development of the constructivist-based learning strategies for teaching, as well as for learning to teach, in the present study. As mentioned above, these constructivist strategies included different forms of student-centred activities, in which scaffolding tools were involved. These scaffolding tools also included an abstract forms of scaffolding like conversation or physical forms such as different kinds of instructional media and resources. The following section continues the discussion of the use of such physical scaffolding tools from a constructivist-based perspective.

Resource-based Learning

The concept of resource-based learning is not new and in this view of learning resources are seen as organised information to convey a message, and involving different kinds of instructional media. Traditionally, resources are used to supplement the teacher's instruction in teacher-directed classes and act as a vehicle to deliver information to a learner (Clark, 1983). In teacher-dominated classrooms or learning contexts the content, aims, and ways of using the information are always pre-determined (Doiron & Davis, 1998; Hannafin, Hill, & Land, 1997). However, in constructivist-based teaching, resource-based learning changes the role of resources from a passive role to a more active role that enables students to choose and to access resources for the purpose of assisting knowledge construction (Farmer, 1999). Such a concept is supported by many authors (e.g., Jonassen, 1994, 1996a, 1996b; Land & Hannafin, 1996, 1997; Kozma, 1991; Perkins, 1985) and understanding is seen to evolve through exploration and inquiry in a resource-based learning environment (RBLE) by means of active collaboration with rich databases, tools, and resources. Kozma (1991) emphasises that learning is not a passive information reception process but is "an active, constructive process whereby the learner strategically manages the available resources to create new knowledge by extracting information from the environment and integrating it with information already stored in memory" (p.179). Similarly, Jonassen, Campbell and Davidson (1994) propose a shift of the focus of using resources or instructional media from the view of "learning from media" to a more constructivist-like view of "learning *with* media" in a RBLE. Thus, a constructivist-based RBLE would be "a place where learners may work together and support each others as they use a variety of tools and information resources in their pursuit of learning goals and problem solving activities" (Wilson, 1995, p. 27).

Given that learners are able to access different types of media in a RBLE, Farmer (1999) asserts that the resource-based approach can cater for the different needs of individuals who come into the learning with different learning styles and processing skills. Apart from knowledge construction, Edwards (1995), Doiron and Davis

(1998) believe that problem-solving skills are enhanced through the use of available resources and tools in a constructivist-based learning environment. When computer resources are used in a RBLE, Means and Olson (1995) found that the use of such resources promotes collaborative roles for both peers and teachers. There also are other reports in the literature that provide evidence for increased motivation in learning, changes in attitudes towards learning and using computers among students, when computer resources are employed (see, e.g., Boyd, 1997; Watson, 1993). Teachers also are reported to emphasise the development of creativity and high-order thinking in student-centred activities when such technologies are used (Liu, Macmillan & Timmons, 1998; Pedretti, Mayer-Smith & Woodrow, 1998, Rodrigues; 1997), and may change their attitude toward computers and increase the use of computers in teaching (Boyd, 1997; Sheingold & Hadley, 1990; Wenglinisky, 1998). Knupfer (1991) also argues that when teachers are confident about using teaching technologies in their classrooms, the structure of their teaching changes. Knapp and Glenn (1996) identified a number of common teaching characteristics when teachers use technology in their teaching for an extended period of time:

Teachers using technology in their teaching usually expect more from their students and expect their students to take more care in preparing their work; can present more complex materials; believe students understand more difficult concepts; can meet the needs of individual students better, can be more open to multiple perspectives on problems; are more willing to experiment; feel more professional because, among other things, they spend less time in dispensing information and more time helping students learn. (p. 17)

Researchers have interpreted the above findings as evidence for systemic changes brought about by constructivist-based use of technologies in education (e.g., Liu, Macmillan & Timmons, 1998). Such a view represents a total 'system change' in the teaching and learning process, that involves not only knowledge construction, but includes the influence of technology on people, the teaching and learning process, and also further development and use of resources. Dwyer (1994) also provided support for such a view in the study of the 'Apple Classroom of Tomorrow (ACOT)' project, commenting: "after nearly eight years of studying the computer's effects on classrooms, ACOT researchers have observed profound changes in the nature of instruction, learning, assessment and the school culture itself" (p. 4). The

changes reported include positive attitudes of teachers about the infusion of technology in teaching and learning (Sandholtz, Ringstaff & Dwyer, 1997).

Resource-based learning like cognitive apprenticeship and cooperative learning does not necessarily entail any specific methods or techniques for learning. However, Hill and Hannafin (2001) identified four major components that they believe constitute to RBLE from a constructivist-based teaching perspective: static and dynamic resources; authentic learning context; learners' tools; and, scaffolds. Static resources have stable contents such as printed materials while dynamic resources are interactive and the information embedded in such resources changes frequently to synchronise the current changes of the world. Such resources include interactive digital and web-based materials and Hill and Hannafin (2001) include humans as dynamic resources - specifically experts and peers from a particular domain or discipline. The second component of RBL draws on social constructivist-based learning and suggests that resources should be used in learning activities that engage or anchor learner in an authentic situation. Within such an authentic context, it is believed that learners can achieve maximum benefit from the interaction process with a variety of resources (Hill & Hannafin, 2001; Kozma, 1991; Laurillard, 1993). A social constructivist framework also informs the use of resources, seeing such resources as social agents that facilitate and assist the cognitive development process. Thus learners can take an active role in, for example, selecting appropriate resources as tools for constructing knowledge. These tools may be used for searching and processing information or also be used for manipulating data and in communication. Likewise, an instructor might arrange appropriate resources and use them as scaffolds to assist or facilitate knowledge construction. The above components form a scaffolding environment that may then help in the development of concepts and metacognitive and procedural skills (Hill & Hannafin, 2001).

This section has described two major views of learning: the cognitive information-processing model of learning that posits that knowledge becomes part of a learner's cognitive structure, and constructivist-based view of learning that suggests learners are active participants in the learning process who develop their own mental constructions based on their prior knowledge and experiences and via

interaction with their environment. These theories of learning have acted to inform the design and the development of some learning resources that facilitate mediation between information sources and learners for the present study. It is concluded that learning does not simply occur inside individuals' minds, nor can it be isolated from social interaction and the context in which the learning occurs. Drawing on the theory of zone of proximal development and notion of situated learning, some constructivist strategies for instruction and for the application of technologies in the literature such as cognitive apprenticeship, collaborative project-based learning and resource-based learning have also been discussed. Given that teachers also are learners during their own professional development, the following section continues to explore the issue of teachers' learning. Building on the constructivist-based ideas described above, specific strategies that facilitate the conceptual change of teaching with information technology are now identified and discussed.

2.4 Learning to Teach with Information Technology

This section looks at issues to do with learning to teach with information technology from two perspectives. It starts with a discussion on the effect of past experiences and beliefs on learning to teach, followed by a description of conceptual change theory. Finally, constructivist-based strategies that facilitate conceptual change of teaching with information technology and that constitute the development of the intervention of the current study are presented.

2.4.1 Effect of Past Experiences and Beliefs on Learning to Teach

Beginning teachers and student-teachers, like any learners, hold prior beliefs of teaching developed from their past experiences as students during schooling before they enter the teacher preparation programme (Wideen, Mayer-Smith & Moon, 1998). They also possess past knowledge and skills that may be relevant to their subsequent learning in the teacher education programme (Kagan, 1992; Mahlios & Maxson, 1995). A number of studies of teacher education programmes have revealed that the beliefs of teaching held by the prospective teachers significantly

influence any learning that occurs during the programme (see, e.g., Bird & Anderson, 1993; Calderhead, 1991; Nettle, 1998; Richardson, 1996). Interestingly, some studies suggest that past knowledge and skills as well as being important, can be used as a teaching resource in the process of learning to teach (Collay, 1998; Halliday, 1996; Sikes & Troyna, 1991). In a study of teacher's beliefs, Feiman-Nemser and Featherstone (1992) found a variety of beliefs about teaching; such as beliefs about teaching effectiveness, about teaching and learning, and about the nature of knowledge. For example, many prospective teachers ostensibly see teaching as 'telling' and 'showing', learning as 'absorbing' and 'memorising' (Ball & McDiarmid, 1987; Calderhead & Robson, 1991) and technologies as 'aids' for presenting teaching materials (Lee, Li, Yeung & Ling, 1997; Li, Lam, Li & Wu, 2000; Wang, 2000; Znamenskaia, Guan & Young, 1999). Prospective teachers holding such beliefs will likely think that they can learn to teach simply by being told how to teach. Remarkably, a number of studies suggest that teacher education programmes have little impact on such beliefs (e.g., Chen, Li & Zhang, 1996; Cole & Knowles, 1993; Grundy and Hatton, 1998; Kagan, 1992; Hollingsworth, 1989; Wubbels, 1992), suggesting that student-teachers should be given opportunities to confront alternative experiences that challenge the validity of their prior beliefs. Teaching strategies should then be able to facilitate conceptual change with respect to pedagogy (Feiman-Nemser, 1989; Feiman-Nemser & Featherstone, 1992). In other words, informed by conceptual change theory (see below), some teacher educators focus their activities on the identification of appropriate conditions and strategies that would support conceptual change (e.g., Bird, Anderson, Sullivan & Swidler, 1993; Feiman-Nemser & Featherstone, 1992; Wilcox, Schram, Lappan & Lanier, 1992). The following section explores conceptual change theory in more detail.

2.4.2 *Conceptual Change Theory*

Insofar as teacher professional development for teaching with information technology as investigated in the present study is concerned, conceptual change involves a 'shift' of the concept, and hence the practice, of a didactic teaching approach, to a more learner-centred constructivist-based teaching approach. It thus

implies a reconceptualisation of teaching as ‘facilitating learning’ instead of ‘controlling learning’; the teachers’ role changes to that of a ‘guide’ or ‘facilitator’ from that of an ‘information dispenser’ and technologies use as students’ learning tool rather than teachers’ presentation aid. This section discusses the theoretical background and the conditions raised in the literature for promoting conceptual changes in teaching.

According to conceptual change theory, teachers’ beliefs about teaching and learning change as a result of the recognition of discrepancies between learners’ existing views and new views (Posner, Strike, Hewson & Gertzog, 1982). Conceptual change theory was originally developed for and applied in science education (Posner et al., 1982) and is based on Kuhn’s (1970) views of scientific ‘revolutions’. The theory also is informed by Piagetian cognitive development theory with the two theories sharing a common view about the formation of new knowledge or concept. The conceptual change process starts with a state of ‘crisis’ or ‘disequilibrium’ and ends with a state of ‘assimilation’ or ‘accommodation’ in the cognitive structure of an individuals’ mind. Posner et al. (1982) borrowed the notions of ‘assimilation’ and ‘accommodation’ from Piaget to explain the process of conceptual development and conceptual change respectively. According to conceptual change theory, conceptual change occurs only when existing conceptions or knowledge structures are changed or replaced by new concepts.

Building on the above ideas, Posner et al. (1982) propose four conditions for conceptual change: dissatisfaction with existing conceptions; intelligibility; plausibility; and, fruitfulness. First, a new concept is more likely to be accepted by a learner if he/she feels dissatisfied with his/her current concept. Second, the learner must be able to understand the new or alternative concept based on his/her prior knowledge and experiences (i.e., it must be intelligible). Third, the new concept must be plausible in the sense that the learner is able to see how the new concept can be used to solve a problem or applied in a particular situation. Fourth, the new concept must be perceived as fruitful by the learner. The new concept must help to expand the repertoire of existing knowledge structures and be seen to be better able to solve problems in a variety of new situations.

Hewson, Beeth and Thorley (1998) described the degree of a concept to which a learner knows and accepts as the 'status' of the concept. A concept of higher status means that it is more intelligible, plausible and fruitful and a new concept must be of higher status than the existing one if change is to be occurred. Conceptual ecology is another central concept in conceptual change theory. It consists of all existing knowledge or cognitive structure and the beliefs system that the learner possesses (Posner et al., 1982). Within this 'conceptual ecology', different elements, such as the existing concepts in the knowledge structure, the relationships among these concepts, new knowledge or alternative concepts and the beliefs system, are interacting with each other. This interaction results in the determination of the status of specific concepts (Hewson et al., 1998).

While conceptual change theory has been widely used for research in science education and was seen by many authors as both powerful and influential, it has been subject to considerable criticism in the literature. The theory is seen by some authors as too 'rational' and inadequate; for example, Pintrich, Marx and Boyle (1993) commented that the theory emphasises only the cognitive aspect of the learning process. According to Pintrich et al. (1993) conceptual change theory ignores the affective and social components that are believed to be essential to learning. Strike and Posner (1992) recognised such deficiencies in their original theory and subsequently proposed a revised theory of conceptual change to include affective and social elements as parts of the 'conceptual ecology'. Hewson et al. (1998) further modified conceptual change theory to incorporate a social-constructivist perspective into the theory. Thus, conceptual change is no longer viewed as being influenced solely by cognitive factors and a holistic view including cognitive, affective, social and contextual factors, is argued to be central for fostering conceptual change (Duit, 1999). Teaching according to this revisionist theory of conceptual change, therefore, seeks to create a context involving cognitive conflicts. It also involves diverse constructivist-based strategies that facilitate and scaffold the interaction process in the conceptual ecology.

Drawing on the above theoretical perspectives, Feiman-Nemser and Remillard (1996) propose several conditions that they believed are necessary for inducing

conceptual change with respect to teaching approaches. First, teachers must be given opportunities to examine their values and beliefs associated with constructivist-based teaching practices. One way of achieving this is to provide opportunities for open discussion and reflection on such practices in the course of teacher preparation programmes. Second, teachers should be confronted with situations that bring about discrepancy between a constructivist-based approach and their existing teaching beliefs (assuming that these are not constructivist-based). So, for example, one could let teachers see examples of constructivist-based practices, preferably under realistic conditions. Importantly, teachers must be given opportunities to experience such practices firsthand as 'learners' about teaching (Raymond & Santos, 1995). Finally, persistent conceptual change requires ongoing support and guidance from teacher educators (Kennedy, 1991).

According to Gunstone and Northfield (1992) teacher educators need to adopt constructivist-based rather than didactic approaches in helping the reconceptualisation process of the constructivist conception of teaching with information technology. From the previous reviews in this chapter, it is also seen that the three strategies: cognitive apprenticeship, collaborative project-based learning and the resource-based approach discussed previously (Section 2.2), match well the conditions needed for conceptual change. The following section illustrates two strategies or approaches that are argued in the literature to be effective for learning to teach with information technology. They also fulfil the conditions for conceptual change advocated by Feiman-Nemser and Remillard (1996).

2.4.3 *Constructivist-based Approaches for Teachers' Learning*

This subsection describes two strategies that are specific to teachers' learning in the present study. They are: the provision of reflection opportunities, and the use of a portfolio in the course of teachers' learning.

Reflection Opportunities

As mentioned in the above discussion of the notion of the cognitive apprenticeship (Section 2.2.3, p. 41), reflection is a key strategy to help enculturation during learning (Collins et al., 1991), since reflection can enhance conceptual understanding on the beliefs and practices of teaching and learning in a particular domain or discipline of knowledge. Feiman-Nemser and Remillard (1996) suggest that reflection is an effective means of providing opportunities for prospective teachers to examine their values and beliefs associated with particular teaching practices; in the case of the present work, teaching with information technology for constructivist-based learning. Alkove and McCarty (1992) comment that “reflective practice in teacher education is particularly important since it plays a crucial role in the teacher’s search for congruency between his/her beliefs and practice” (p. 21). It is further asserted that reflection made in or after teaching exerts a positive influence on teachers’ conceptions about content knowledge, and about their conceptions about teaching and learning in a particular discipline (Kogan, 1992; Korthagen & Wubbels, 1995). Feiman-Nemser (1990) and Schön (1983, 1987) also argue that reflection should be seen as a generic professional disposition in education, and should be fostered in any teacher preparation programme.

The notion of reflection in educational practices can be traced as far back as Dewey’s (1933) views of learning. Dewey suggested that reflection is an “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends” (Dewey, 1933, p. 9). Reflection involves both thought processes and action (Hatton & Smith, 1995) and it is a cyclical process that starts with a professional action, accompanied by a thinking process. Such thinking processes then bring about a modified or new action in the same or in another similar situation (Noffke & Brennan, 1988). Moreover, Loughran (1996) stresses that reflection is context dependent and a different context may be associated with different beliefs and practices of particular domain knowledge, the learners’ past experience and affection. This variation in context may affect the reflection process and may result in various reflective actions. With such cyclical, action-oriented and contextual

nature of reflection, Schön (1983, 1987) proposed two forms of reflection: *reflection-in-action* and, *reflection-on-action*. The former is the conscious thought triggered by an action or a problematic situation while in an instructional discourse. Such thought may then result in the modification of the previous action, or in the proposal of a new action and in the implementation of such action instantaneously. Reflection is said to be a means to distinguish professional from non-professional practice since it demands that teachers be capable of immediate application of professional knowledge and practices. The development of such reflection-in-action capability is therefore considered an essential aim for teacher preparation programmes (Feiman-Nemser, 1990; Gore & Zeichner, 1991; Schön, 1983, 1987). Reflection-on-action consists of retrospective thinking about the reflection-in-action, or on the spot action. It aims to evaluate the effectiveness of such action resulting in improvements. Such changes become features of the personal repertoire and professional knowledge and practices that may be called upon in a reflection-in-action situation. Reflection-on-action is also called technical reflection (Killen, 1989) or technical rationality (Hatton & Smith, 1995), when the reflection focuses on the evaluation of the use of pedagogical skills or competencies.

The reflection process, according to Dewey (1933), involves five different phases: suggestions, problem, hypothesis, reasoning and testing. Suggestions are initial solutions or ideas that come into mind when a learner is confronted with a problematic situation or cognitive conflict. Problem is the precise understanding of a situation where the problems or conflicts occur. Hypothesis is the action of a reconsidered suggestion to the identified problem. Reasoning is a process to refine the initial hypothesis so that the final hypothesis can be put up for testing. Through testing, the new reflective cycle begins until an action that brings about an improvement of a situation or a solution to the problem arrives. Hatton and Smith (1995) identified three levels of reflection from their analysis of the written work of student teachers in some teacher preparation programmes: descriptive reflection; dialogic reflection; and, critical reflection. Descriptive reflection involves the description of events or actions and the attempt to provide some explanation or justification for such events or actions. These explanations or justifications are always based on personal judgement or experiences from reading. Dialogic

reflection attempts to explore possible explanations or justifications for events or actions. The reflection is usually more analytical and demands academic accountability to justify events or actions. Critical reflection entails explanation or justification for events or actions from broader perspectives within historical, social-political contexts. The five phases and the three levels of the reflection process as stated above provide a framework for guiding and for the analysis of the reflection activities in the present study.

Since reflection is deemed essential for professional development, a variety of strategies and methods have been proposed in the literature to promote reflection. Hatton and Smith (1995) identified the following approaches from the literature: reading of materials from relevant literature (Tama & Peterson, 1991), oral interviews or reflective conversation (Altrichter & Posch, 1989; Smith, 1991), reflective writing such as essays (Gore & Zeichner, 1991; Wellington, 1991), and journals (Bean & Zulich, 1989; Loughran, 1996; Richert, 1990). Other methods reported in the literature include case analysis (Lundeberg & Fawver, 1994; Shulman, 1992), peer discussion (Sutton, Cafarelli, Lund, Schurdell & Bichsel, 1996), and debriefing on model practices (Mayer-Smith & Mitchell, 1997). All these methods suggest that the student teachers and the beginning teachers in the present study would benefit from opportunities to see or to hear examples of constructivist-based teaching with technologies via reading the literature, observing models and conversation or dialogue with the researcher as well as their peers in the course of learning to teach. The methods also highlight the importance of the provision of a scaffolding environment in which the student teachers and the beginning teachers are given opportunities to interact with various resources including the researcher, technical experts and the competent peers. Such a learning environment also would allow the student teachers and the beginning teachers to articulate their reflection by means of written essays and journals and also during conversations in interviews.

The constructivist theme discussed throughout this review of the literature so far has highlighted the importance of an active role by learners in interaction and reflection processes. The following section describes the use of portfolios, proposed as an effective approach in the facilitation and monitoring of constructivist-based learning.

Portfolios and Learning to Teach

The use of a portfolio has been well documented as a powerful tool for learning to teach in recent literature (see, e.g., Diez, 1998). For example, portfolios can help to enhance and develop teaching skills (Collins, 1990), to promote reflection on one's own teaching and to support the teacher as a self-regulated and continuous learner (Borko, Michalec, Timmons & Siddle, 1997; Darling-Hammond & Snyder, 2000; Richert, 1990). In this way portfolios help in the development of a reflective capacity for prospective teachers (Wolf, 1991, 1996; Zeichner & Liston, 1996) and it is believed that portfolios provide evidence to demonstrate student-teachers' growth of competency in the knowledge and skill of teaching (Erickson, 2000). Portfolios, being a record of the experiences and thoughts of a teaching process, can also act as a resource for sharing and discussion among teachers and thus enhance professional development in the field of education (Darling-Hammond & Snyder, 2000; Zeichner & Wray, 2001). Furthermore, through the construction of a portfolio, student-teachers take an active role in monitoring their own learning, determining the choices of evidence and examining their growth and progress of learning (Liebars, 1999). Such a process fits well with constructivist-based learning that advocates learners assuming responsibility for their learning (see Section 2.2). Darling (2000) also considers that portfolio construction is a social practice involving social interaction among people and resources within a particular culture or discipline of knowledge. Hence, the cognitive, social and contextual aspects that feature constructivist-based learning are encompassed in the development of a portfolio during the learning process.

The definition of portfolio is varied. For example, Arter and Spandel (1992) and Paulson, Paulson and Meyer (1991) describe a portfolio as a purposeful collection of student's work that reflects the effort, the progress and achievement in particular domain knowledge. Winsor and Ellefson (1995) say that a portfolio is "a fusion of process and product" (p. 68). It contains the products that document the processes of reflection, selection, rationalisation and evaluation. According to Shulman (1998), a portfolio is defined as "the structured, documentary history of a set of coached or mentored acts of teaching, substantiated by samples of student portfolios, and fully realised only through reflective writing, deliberation, and

conversation” (p. 37). Hence, a portfolio is more than a collection of assignments and involves the documentation of achievements of learning through the illustration or demonstration of products or artefacts of learning experiences. It also entails the articulation of self-evaluation and reflection of learning experiences (Klenowski, 2000). Wyatt and Looper (1999), identify two types of portfolios: the showcase portfolio, and the developmental portfolio. The showcase portfolio consists of selected ‘best’ work of the learner, whereas, the developmental portfolio aims to show growth and development in student learning. The developmental portfolio is generally integrated into the teaching and learning process and when done so may serve as a guide for intensive interactions between learners and the content of their portfolios. Nitko (1996) suggests that portfolio contents should comprise the following characteristics: authentic work; records of conceptual development; and, guided, reflective activity. Snyder, Lippincott and Bower (1998) also suggest that a teaching portfolio should include assigned tasks, records of the observation of others’ teaching, and direct evidence of a student-teacher’s own work. Research also suggests that an effective portfolio may include a combination of prescribed evidence (such as the content and the presentation form like video, journal writing) and the self-selected evidence by a student-teacher (Barton & Collins, 1993).

Given the constructivist-based framework used in the present study, the developmental approach to portfolio development was adopted and a portfolio was used as a scaffolding agent to guide and facilitate the meaning construction process for the student-teachers. The student-teachers were presented with authentic tasks that required the application of knowledge and skills in the use of information technology in teaching and learning. Student-teachers also were given the autonomy to select their own artefacts that could reflect the mastery and understanding of a particular competency area. The portfolio provided clear and explicit instructions, along with prompt questions to guide the production of artefacts and the process of reflection. In order to accomplish the suggested tasks, the student-teachers were required to take an active role in acquiring knowledge and skills by attending lectures and workshops, as well as self-learning. They also were able to seek assistance from various ‘resources’ provided in the scaffolding learning environment – including people and tools such as the researcher, their peers and a variety of technologies (see Section 3.6.2, p. 92).

This section has described how conceptual change theory can be used to help explain student and beginning teachers' changing concepts and beliefs about teaching with information technology. It also explained how this theory informs the adoption of constructivist-based teaching strategies. Further to the three constructivist strategies depicted in Section 2.2, this section has also illustrated the contributions of two constructivist approaches: the provision of reflection opportunities, and the use of portfolios to teachers' learning.

2.5 Chapter Summary

This chapter has described the current state of information technology and teacher education in the literature. It has also discussed relevant learning theories that underpin the theoretical framework of the intervention adopted for the present study. A number of constructivist-based strategies that are significant to both the teaching and the learning to teach with information technology among the student-teachers and beginning teachers also have been discussed. A constant theme to emerge from the literature is that information technology is not necessarily used effectively in school teaching. Teachers commonly adopt a didactic approach in instruction, disregarding technological infrastructure and competency in technological skills. Such background points to a need for a teacher preparation programme that can enhance conceptual change with respect to the use of information technology in a student-centred approach to teaching and learning with information technology. Informed by the information-processing model of learning, a social-constructivist view of learning and conceptual change theory, it is argued here that constructivist-based strategies could well promote the above changes for teacher preparation. It is further argued that these constructivist-based strategies involve cognitive, social and contextual aspects of the learning process and that these elements are significant for the changes too.

Hence, drawing on this review from relevant literature including the notions of cognitive apprenticeship, collaborative learning, resource-based learning, reflective practitioner and portfolio approach in learning, a number of principles governing

the development of different strategies and resources that constitute the intervention for the teaching with information technology in this study are summarised as follows:

1. The intervention should make use of the bimodal features of instructional media or resources for effective communication when selecting, designing and developing respective resources.
2. The intervention should encourage prospective teachers to explore educational issues or to solve problems actively by themselves.
3. The intervention should provide situations that challenge prospective teachers' current beliefs and concepts about teaching with information technology.
4. The intervention should enable prospective teachers to see the role models, exemplars or cases that promote student-centred practices in using information technology.
5. The intervention should enable prospective teachers to share their thoughts and beliefs about using information technology by the cognitive models.
6. The intervention should provide a scaffolding learning environment where learners can seek assistance from competent others and from relevant tools and resources in the course of learning.
7. Prospective teachers should be given tasks that are relevant and authentic, and appropriate for application in real-life situations.
8. Prospective teachers should be given opportunities to articulate their thinking and feeling about the learning process through reflection on the issues concerning the use of information technology in teaching and learning throughout the course of their learning.
9. The intervention should promote a collaborative working relationship among peers and teacher educators.
10. The intervention should provide guidance or prompts for monitoring and documenting the learning process. Thus, the use of portfolio is encouraged.

Building on such a constructivist-based framework presented here, this thesis therefore aimed to explore the effect of such pedagogical strategies and to identify the elements that promote conceptual changes about teaching with information technologies in a teacher education programme in Hong Kong. Three research

questions were generated from this general aim:

1. How does the intervention derived in this study influence novice teachers' use of information technology in the development of a student-centred classroom?
2. What pedagogies enhance novice teachers' conceptual change of use of information technology in facilitating student-centred teaching in the teacher education programme and in beginning teaching?
3. What factors promote or constraint novice teachers' use of information technology in facilitating student-centred teaching in the teacher education programme and in beginning teaching?

Guided by these research questions (Chapter One, p. 13) and the constructivist-based framework, the remainder of this thesis is concerned with the construction of the intervention, and the illustration and evaluation of the effect of the intervention on learning to teach with information technology in the two phases of the study.

Chapter 3

Methodology and Methods

This chapter is divided into four sections. It starts with a discussion about the research approaches and methods currently reported in the literature appropriate for this study. Data collection techniques such as interviews, questionnaires and other qualitative methods are next. The following section provides a detailed description of the research design used for the thesis. Included is a description of the sample, data collection methods, and data analyses strategies employed. Next a description of the intervention employed in the study is provided and the chapter concludes with a discussion of the ethical issues for the study.

3.1 Methodology and Methods in Educational Research

Research in education is a disciplined attempt to address questions or solve problems through the collection and analysis of primary data for the purpose of description, explanation, generalization, and prediction (Anderson, 1990. p. 4).

The above definition provides a clear description of both the 'purpose' (description, explanation, generalization, and prediction) and 'process' (collection and analysis of primary data) of educational research. In Chapter 1 (p. 13), the author provided the research questions for this study. These research questions focused on the exploration of possible solutions to promote the use of information technology as a means of encouraging student-centred teaching in Hong Kong schools. The study is thus applied in nature and the main interest is to develop solutions for specific problems or questions identified in a real life situation (Johnson & Christensen, 2000). The following sections will expand the notion of the 'process' of education research as seen in Anderson's definition. It will discuss different approaches and methods of educational research and describe the establishment of the inquiry

framework for the study.

3.1.1 Positivist and Interpretive Approaches to Education Research

The adoption of a research approach depends on the researcher's philosophical perspective and orientation. A positivist researcher holds an epistemological and ontological view that knowledge exists independently in the world and is a tangible thing that can be acquired. The positivist approach allows a researcher to test a hypothesis, to establish causal relationships for phenomena, and to generate a law or a theory to explain phenomena. Such approach can also be applied to the study of human behaviour (Phillips, 1983). In education research conducted from a positivist stance, primary data may be collected by surveys and the research design may also contain an experimental element. Data gathered are typically transformed to numeric form and undergo statistical analyses seeking to establish quantitative changes, or to observe trends and/or differences, in numerical data (Hooker, 1975 cited in Walker & Evers, 1997). The investigation process is thus empirical with 'standard' procedures and tools and the researchers exert strict control of variables. The results and the inquiry process are considered to be replicable in nature (Cohen, Manion & Morrison, 2000; Neuman, 1997). Much research in science and technology is based on a positivist approach and a positivist approach has also been employed in many educational research studies. For educational research the positivist approach is based on a behavioural and instructivist view of learning and teaching - dominant across the education sector until relatively recently. Many studies of the 'effectiveness' of teaching methods and instructional media adopted a positivist approach at that time. However, the emergence of constructivist views of learning led researchers to query the adequacy and usefulness of this approach in today's educational settings. Constructivists view learning as a highly interactive and dynamic process conducted within a social environment. In the minds of most constructivists, a simple causal relationship inferred from positivist-based research is unlikely to give a full understanding of any educational phenomenon. Opponents of the positivist approach see it as too mechanistic to explain the actual lives of human beings, and, for example, Nesfield-Cookson (1987, cited in Cohen, Manion & Morrison, 2000) criticise positivism as a dehumanised approach believing that the experience of life cannot be weighed and is not measurable. Moreover, a

positivist approach fails to give immediate and useful results for education stakeholders since a highly scientific experimental setting seldom exists in a social world. In other words, a result produced in a ‘laboratory’ may not be applicable to a real life situation (Cohen, Manion & Morrison, 2000).

In contrast with the positivist view, the interpretive researcher considers that social reality is constructed by the individual and believes that knowledge is built from an individual’s own interpretation of the outside world. The main purpose of interpretive research is to uncover in-depth the thoughts and feelings of a person in a particular social phenomenon (Banister et al., 1995) by sharing that individual’s interpretation of particular experiences. Interpretive researchers believe that human behaviour is idiosyncratic and can only be understood from the action of a person (Cohen, Manion & Morrison, 2000). The unfolding process of the true meaning of a person’s behaviour requires intensive discourse with the individual involved in a study. Interpretive researchers thus argue that the experimental and hypothesis-testing nature of the positivist research is insufficient to yield in-depth data about the thoughts and feelings of a person. Instead, interpretivists prefer data to be collected in an exploratory manner through direct interactions and observations with the subject.

In this thesis an interpretive-based approach was adopted to guide the entire research design and inquiry process. By using an interpretive approach, the researcher sought to gain an in-depth understanding of the student-teachers’ thoughts and feelings about their learning and teaching experiences in the use of information technology.

The next section is based on the above discussion of interpretive research, and goes on to discuss two research methods; namely, quantitative and qualitative methods that are used in most research studies reported in the literature.

3.1.2 Quantitative and Qualitative Methods

Quantitative methods rely primarily on the collection of numeric data. Such methods are usually confined to the study of a few factors (dependent and

independent variables) using an experimental design under a controlled or 'laboratory' conditions. Data analysis usually employs well-established statistical procedures and the method overall uses a deductive approach that is confirmatory in nature. Investigation processes typically seek to test the significance of a hypothesis. In contrast, qualitative methods are employed in a natural setting with all relevant data concerning the subject (person) under observation collected in context. The focus of such studies is thus on the person rather than the treatment or experiment. In this case an inductive approach is used for data analysis and qualitative methods are usually exploratory in nature. Investigation seeks to understand the thinking of persons and qualitative data produces themes and patterns. Common tools include unobtrusive observation, participant-observation, interviews, and analysis of documents and artefacts.

It is important to realize that although there are differences between quantitative and qualitative methods, they are not mutually exclusive and a researcher is not necessarily required to choose between methods of inquiry. Rather, in recent times there have been many calls for researchers in education to combine methods and many studies now employed a 'mixed-methods' approach. Proponents of the mixed-methods approach argue that the design enables the researcher to make full use of the potential of each method to deal with different aspects of a highly complicated social setting. Moreover, richer and more valid information can be collected through multiple sources with mixed methods (Crawford & Christensen, 1995; Drew, Hardman, & Hart, 1996; Neuman, 1997; Peshkin, 1993). The research conducted in this thesis combined quantitative and qualitative methods although it should be noted that qualitative methods were the main sources of data. This, the researcher believes is appropriate since the focus of the research was to understanding individual participants' thoughts and feelings. The quantitative methods used in the thesis were mostly used for sample description and comparison, and as a source of triangulation for the qualitative methods.

Triangulation - the gathering of data from different sources - allows the researcher to capture a larger range of data about the phenomenon under investigation. At the same time, this process also enables the researcher to test the consistency of the findings among different data sources (Cohen, Manion & Morrison, 2000). It is argued that through triangulation, the validity of the data used in a study is

enhanced. The use of triangulation has been used here to help overcome the problem of 'method-boundedness', and triangulation thus sought to eliminate the researcher's biases by examining the same human action or behaviour from different standpoints (Cohen, Manion & Morrison, 2000).

3.2 Data Collection Methods Used in the Study

The data collections methods employed in the present study include both qualitative and quantitative types as mentioned above. Qualitative data comprised interviews, classroom observation and examination of written material such as field notes, essays and notes based on the researchers reflections about the study. Quantitative data consisted of questionnaires. The details for the respective methods and the ways in which they were used in the study are presented below.

3.2.1 Interviews

According to Patton (1987), there are four types of interviews; namely, the informal conversational interview, the interview guide approach, the standardized open-ended interview, and the quantitative interview. The quantitative interview is highly structured in nature and the interview protocol consists essentially of a questionnaire in which the respondents must select from a set of prescribed responses. In fact, this type of interview is similar to a written self-completion questionnaire and a quantitative interview can be considered as a form of verbal questionnaire. Because of the highly structured nature of the 'interview', any data gathered are easy to aggregate and compare. A familiar example of quantitative questionnaire is the telephone interview - commonly used for marketing purposes. Upon reflection, this type of interview was deemed unsuitable for the present study because it was felt that it would not enable the researcher to elicit an in depth understanding of the participants' views, given the mechanistic nature of the stimulation and responses process. Moreover, the reliability of the responses from the interviewee is highly dependent on personal interpretation of the questions making it difficult for the researcher to judge what distortion might occur in the data (Patton, 1987). The other three types of interviews techniques are less

structured in nature and are categorized as 'qualitative interviews' by Johnson and Christensen (2000). These three types of interviews differ in the degree of structure and the means of implementation of the interview protocol. Qualitative interviews were preferred in this study because they allow the researcher to enter the inner world of the participants and gather a deep understanding about their thoughts and specific learning and teaching experiences (Patton, 1987). Tuckman (1972) suggests that qualitative interviews allow an interviewer to understand what a person knows, what a person likes or dislikes, and what a person thinks.

The first two types of qualitative interview mentioned above were adopted for this thesis. The informal conversational interview approach was used during conversations between the researcher and school principal, and also in post-classroom observation discussions during school visits. No predetermined questions were prepared and the aim of these interviews was to obtain data about the performance of the teacher trainees' use of information technology in a natural setting. Data from the interviews were recorded in the form of field notes. The interview guide approach was the major interview method used in the thesis. Instead of using highly structured question format as would be used for quantitative interviews, guided questions were employed. The first part of the interview protocol consisted of questions intended to help the participants situate their thinking in a particular event and context (e.g., a lecture or when using a CD-ROM). Follow-up questions of the respective initial questions were also prepared. The questions were followed by follow-up questions designed to more deeply explore specific issues.

The interview guide approach allows the interview to be conducted in a relaxed conversational manner. Participants can express their thoughts freely under the probes and prompts of the researcher. Moreover, the researcher is not confined to a specific sequence of questions or predefined wording for given questions (Johnson & Christensen, 2000). The interviewer can return to a particular question periodically to get more in-depth information or to triangulate with other data during the interview when he/she finds necessary (Savenye & Robinson, 1996) and the guideline is particularly useful in that it allows the researcher to safeguard the completeness of required information for the study. However, in order to gather reliable and objective information, the researcher must be aware of the threats of

interpretive validity in the interviewing process. As pointed out by Bogdan and Biklen (1992), “good interviews are those in which the subjects are at ease and talk freely about their points of view ... Good interviews produce rich data filled with words that reveal the respondent’s perspectives”(p. 97). Such a view emphasizes the value of appropriate interviewing techniques, for obtaining valid and reliable information from an interview.

To avoid any misinterpretation and difficulties in recall of conversations, with the consent of the participants, a tape recorder was used during the interviews. It is argued in the literature that human memory is not reliable, and thus a tool to record exact words for identifying participants’ viewpoints at later stage is necessary (Bernard, 1988). Interviewing is a complex task and the interviewer’s skill is recognized as important factor likely to affect the validity of the inquiry process (Best & Kahn, 1993). In order to sustain the validity of the interviewing data, the skills such as establishing rapport and trust, the use of probes, prompts and redirect questions were practised during and after interviews (Best & Kahn, 1993). Other strategies such as participant feedback (Johnson & Christensen, 2000) and debriefing after interviews (Lincoln & Guba, 1985) also were adopted. During interviews, the researcher summarised some main points of the topics discussed at a regular intervals and participants were invited to provide feedback on these main points with the researcher using questions such as: *Is that what you meant?* Furthermore, after interviews the interview transcriptions were given to the participants for comments, in order to validate the reliability of the transcriptions.

3.2.2 Other Qualitative Methods

The other qualitative methods used in the study are described here. These methods included: field notes taken by the researcher through interviews; classroom observation and daily discourse with the participants; and, examination of written materials including personal documents (such as short essays, lesson plans and reflection notes) obtained from the participants (McMillan & Schumacher, 1993; Johnson & Christensen, 2000). The use of other qualitative methods served two purposes in the study. First, they provided additional data that might have not been obtained from the interviews, and second, they provided further means of data

triangulation (Denzin, 1978).

3.2.3 Classroom Observation Techniques

The classroom observation techniques used in the study were qualitative rather than structured. No specific recording instrument or procedures were employed; instead the researcher took the role as an observer-as-participant (Johnson & Christensen, 2000). After gaining consent from the school principals and participants, the researcher entered the classroom and conducted unobtrusive observation of classroom activities. The main purpose was to observe the use of information technology in the classroom and the main data collection tool consisted of field notes. Post-observation discussions also followed after classroom observation, and these discussions sought to develop and understanding of the classroom activities from the perspective of the participants. Again, data were recorded in the form of field notes and the participants were encouraged to make 'reflection notes' that were subsequently used to aid data analysis and interpretation.

3.2.4 Field Notes

Field notes are used to describe what has exactly happened in a particular context (McMillan & Schumacher, 1993). In the present study, field notes were used extensively: in interviews, during classroom observations, and during daily discourse with the participants. The content of the field notes were guided by the following categories: *When did it happen?*; *Where did it happen?*; *What has happened?*; *How did it happen?*; and, *What has been told about this happening?*

3.2.5 Personal Documents

Participants' personal documents proved a valuable data source providing information on participants' thinking about a number of specific teaching and learning experiences. These "subject's written words" also provided a rich source of data to supplement and triangulate data gathered from other the research

methods employed -particularly classroom observation and interviews (Bogdan & Biklen, 1992). The documents used included, participants' short essays about their perceptions of using information technology during teaching, lesson plans for classroom observation during teaching practice and in the use of the ITRIP (see Section 3.3.3), and participants' reflection notes from their tutorial classes. These documents proved to be a rich information source, and were useful media for understanding the inner minds of the participants about how they made link between theory and practice, thus addressing the central theme of the study - the use of information technology for student-centred teaching.

3.2.6 Questionnaires

Questionnaires were used for similar reasons reported in the science education literature: namely, to provide additional relevant data and as a means for triangulation. There were two apparent advantages of using questionnaires in the thesis. First, the questionnaires allowed the researcher to gather information for a large number of participants in the first phase of the study. During this phase, questionnaires were administered to 133 student-teachers at the beginning of the teaching course, and to a further 162 student-teachers at the end of the teaching course. Second, the use of questionnaires allowed the researcher to collect information about beginning teachers by post. This proved advantageous during the second phase of the study, when it was difficult to arrange interviews with beginning teachers - particularly in the first term. By using questionnaires, the necessary background information, and demographics of the participants could be collected more easily.

Many authors argue that objectivity is an advantage of using questionnaires in education and social science research. However, objectivity depends heavily on the interpretation of the wording used in questionnaires. Research has shown that textual materials, though well organized, often fail to communicate effectively (Newton, 1990). Thus careful design and validation of the wording are necessary for the construction of a reliable questionnaire. Johnson and Christensen (2000) provide 14 principles of questionnaire construction. The questionnaires used in the thesis complied with most of these principles, in part because most of the items

used in the questionnaires were obtained or derived from previously validated instruments (see Section 3.4.6 to Section 3.4.9 for more detail about this issue). In addition, before the final questionnaire administration, draft questionnaires were tested for face validity with student-teachers that did not take part in the intervention. This enabled the researcher to test participants' understanding of the wording used in the items.

The following section provides more detail about the research design used in the study.

3.3 Research Design for the Study

3.3.1 The Two Research Phases of the Study

The research reported in this thesis was conducted into two phases. Phase one was conducted at the Hong Kong Institute of Education while the participants were studying the final year of their teacher-training programme. Phase two was carried out at six primary schools in which the participants spent their first year of teaching. The research activity for phase one occurred in two periods. The first period was in the first semester (September 1998 - January 1999) of the academic year. The second period occurred during the participants' teaching practice (March 1999 - May 1999). Phase two began three months after the start of teaching (December 1999 - June 2000). A detailed description of the implementation of the intervention in each period is provided later (Chapters 4 through 8). Table 3.1 provides a summary of the research activities for each phase of the study.

3.3.2 Sample Selection for the Study

Borg and Gall (1989) point out that in most qualitative research, the sampling is non-random and purposive. As discussed above, the research reported in this thesis is exploratory in nature and the researcher wished to gain an in-depth understanding of complex issues in a highly contextualised setting. Hence, it was

deemed that an interpretive approach was appropriate. Furthermore, a random sampling process was not feasible given that prospective student teacher participants were already grouped and participation in the present study was voluntary. It also was anticipated that the number of participants would change throughout the inquiry process due to attrition in the teacher-training programme. Hence a random sampling procedure like that used in most experimental research studies was not appropriate. Instead, consistent with an interpretive-based inquiry, a convenient sampling method was employed. The researcher identified potential participants at the beginning of the study and then invited the participants to take part in the study on voluntary basis. The sample used for each phase of the study is summarised in Table 3.2 and described in the following sections.

Table 3.1

A summary of the research activities for the two phases of the study

Phase	Activity
(1) At Institute	
September to January 1998 (Course teaching)	<p><i>Collecting data on:</i> The proposed teaching model used in the teaching of the Designing and Developing Instructional Media (DDIM) course <i>by means of</i></p> <ul style="list-style-type: none"> • Questionnaires (before and after the completion of course) • Short essays (before and after the completion of course) • Reflection notes • Interview (after DDIM course)
March to May 1999 (Teaching practice)	<p><i>Collecting data on:</i> The lecturer-supported try-out teaching <i>by means of</i></p> <ul style="list-style-type: none"> • Questionnaires • Classroom observations • Lesson plans • Interview (after Teaching Practice)
(2) At Schools	
December 1999 to June 2000 (Beginning teachers' teaching)	<p><i>Collecting data on:</i> The Information Technology Reinforcement Induction Programme (ITRIP) <i>by means of</i></p> <ul style="list-style-type: none"> • Questionnaires • Classroom observations • Lesson plans • Interviews

3.3.3 Sample Used in Phase One of the Study

The participants for the first phase of the study were final year student-teachers in the two-year *Certificate Primary Education Programme* (1997-1999) at the Hong Kong Institute of Education. These participants were graduates of upper secondary classes and had passed the university entrance examination. Their age ranged from 18 to 25 years. They also were students in the compulsory *Designing and Developing Instructional Media* (DDIM) course. There were 15 groups of student-teachers taking the DDIM module in this semester and the researcher was responsible for teaching two groups. With the consent of the student-teachers taught by the researcher (hereafter called the intervention group), 65 questionnaires (100% response rate) were received at the start of the course. A high response rate was also obtained for the administration of the questionnaire at the completion of the course (97%). In order to provide a baseline for comparison of the performance of the student-teachers in the intervention group with other groups, the questionnaires were also administered to four other groups. Because the response rates were lower for these groups (45%) the number of groups to which the questionnaire was administered was increased for the administration at the end of the course (52% response rate). A profile of the intervention and comparison groups is provided in Table 4.1 (Chapter 4, p. 99). Of the 65 student-teachers in the intervention group, 16 agreed to participate in the qualitative part of the study during DDIM module and 15 participated in teaching practice. Of these 15 student-teachers, only 5 of them participated in the information technology 'try-out teaching' during the period of teaching practice.

3.3.4 Sample Used in Phase Two of the Study

In phase two of the study the participants were beginning teachers who had just graduated from the teacher education programme for the class of 1997-1999. These participants also had participated in the qualitative part of the first phase (see above). Postal questionnaires were sent to the 16 student-teachers who took part in the first phase of this study, from which seven completed questionnaires were obtained, and of these five agreed to participate into the second phase of the study.

The ITRIP was commenced in December 1999 and five participants provided lesson plans for their ITRIP projects. Classroom observations were made for two classes.

Table 3.2
Samples used in the two phases of the study

	Phase one				Phase two
	<i>Before DDIM</i>	<i>After DDIM</i>	<i>During TP</i>	<i>After TP</i>	<i>During ITRIP</i>
Questionnaires (Non-Int)	68	99	-	-	-
Questionnaires (Int)	65	63	10	-	7
Interviews (Int)	-	16	-	15	7 x 1 & 5 x 3
Lesson Plans(Int)	-	-	5	-	5
Observations (Int)	-	-	5	-	2
Short Essays (Int)	16	16	-	-	-
Reflection Notes (Int)	-	16	-	5	-

* Key: Int =Intervention Group, DDIM = Designing and Developing Instructional Media Module, TP = Teaching Practice, ITRIP = Information Technology Reinforcement Induction Programme

3.4 Data Collection Strategies Used in the Study

The sampling methods, research schedule and the respective research activities that were carried out in the thesis were outlined above. Here the procedures and the instruments used in the data collection process including the individual methods are described.

3.4.1 Interview Schedule and Interview Protocols Used in the Study

As mentioned above, an interview guide approach was adopted as the major interviewing method used in the study.

Three main types of questions were used in the interviews: questions about participants' experiences, questions seeking participants opinions, and affective questions. The questions about participants' experiences sought to situate the study in its actual context. The questions seeking participants' opinions, and affective questions sought to elicit participants' thoughts and feeling about their teaching and

learning experiences. A summary of the interview schedule is shown in Table 3.3 and the interview protocol employed for each of the interviews is described below.

In the first phase of the data collection two interviews were conducted. The first interview was conducted during this phase after the completion of the course and the second after teaching practice. The main aim here was to elicit student-teachers' views about the influence of the interventions. The full interview protocol is provided in Appendix A. Some examples of the interviewing questions are stated as follows:

1. Can you tell me something about the DDIM module?
2. How do you feel about them?
3. Has the DDIM module had any influence on your teaching with information technology?
4. What were the conditions or factors for their effective teaching with information technology?
5. In your opinion, what is/are the most important element(s) about teaching with information technology?

There were four separate interviews conducted for each participant in the second phase of the study. The first three were telephone interviews and a fourth was conducted at the researcher's office or the beginning teachers' schools. The first phone interview was informal and sought clarification on the questions that were asked in the questionnaire. The beginning teachers that participated in this interview were also invited to take part in the ITRIP at this time. The second telephone interview was conducted after the ITRIP workshops with the aim of providing assistance to help beginning teachers to establish their ITRIP project. Another aim of this interview was to discuss the beginning teachers' experiences and thoughts about their daily teaching concerning information technology. The third interview was conducted before the implementation of the ITRIP project. The purposes were similar to the second interview. The last interview was more detailed one and, as well as the aims mentioned above, it also collected information about the beginning teachers' view on the impacts of the ITRIP project.

Table 3.3*Summary of major interviewing schedule with interview guide approach*

No.	Phase	Interview Time (Number of participants)
1	1	On completion of DDIM module (n = 16)
2	1	On completion of TP (n = 15)
3	2	Before the ITRIP workshops (n = 7)
4	2	After the ITRIP workshops (n = 5)
5	2	Before the ITRIP project (n = 5)
6	2	At the end of the ITRIP project (n = 5)

* Key: DDIM = Designing and Developing Instructional Media Module., TP = Teaching Practice, ITRIP = Information Technology Reinforcement Induction Programme

As mentioned above, a number of informal interviews were conducted throughout the study. In the first and second phases of the study, such interviews were carried out after classroom observation in the period of the teaching practice and in beginning teaching. In the second phase, an informal interview with a school principal also was conducted.

3.4.2 Classroom Observation

Classroom observation was conducted for the lessons in which information technology was applied. In the first phase of the study, five of the student-teachers agreed to take part in the information technology try-out teaching. These student-teachers prepared extra lessons for the researcher's visit; because the researcher was not the supervisor for their teaching practice. Before the classroom observation, the researcher worked collaboratively with the student-teachers to assist them in preparing their lessons in which information technology was incorporated. There were also five beginning teachers that agreed to be involved in classroom observation for the second phase of the study, that is, teachers that took part in the ITRIP. Again the student-teachers produced lesson plans for their ITRIP projects. However, the researcher was only able to observe two of the teachers' classroom lessons. As explained in previous section, there was no particular protocol used for these observations and the researcher took extensive field notes in which he recorded observations of the classroom activities. These data were then used to supplement the interview data and to help in the data analysis for the study.

3.4.3 Field Notes

Extensive use was made of field notes throughout the study - mainly to aid in data analysis process. During the whole period of the study, the following field notes were recorded:

1. Group presentations of DDIM projects in January 1999
2. Report of successful school projects from two student-teachers in March 1999.
3. Classroom observation during teaching practice in May 1999
4. Report of 'bad experiences' in teaching practice from one student teacher in May 1999
5. Report of teaching diaries from two beginning teachers in June 2000
6. Report of an evaluation record of ITRIP project from one beginning teacher in June 2000
7. Classroom observation in the beginning teachers' classes in June 2000
8. Informal interview with one school principal.

3.4.4 Document Analysis: Examination of Participants' Personal Documents

Examination of personal documents proved a rich source of qualitative data that supplemented and triangulated data from other sources. Three types of personal documents were used in the study; short essays about the student-teachers' perception of the use of information technology during teaching, lesson plans teachers made about the use of information technology in their lessons, and notes recording the teachers' reflections of their tutorial classes. Table 3.4 provides a summary of the personal documents used in the present study (samples can be found in Appendix B).

Table 3.4
Summary of personal documents used in the study

No	Phase	Personal Document (Number of participants)
1	1	Short essays on IT before DDIM (n = 16)
2	1	Short essays on IT after DDIM (n = 16)
3	1	Reflection notes in Tutorial sessions (n = 16)
4	1	Lesson plan in T P (n = 5)
5	2	Lesson plan in ITRIP project (n = 5)

* Key: IT = Information Technology, DDIM = Designing and Developing Instructional Media Module, TP = Teaching Practice, ITRIP = Information Technology Reinforcement Induction Programme

In phase one of the study the student-teachers were given an exercise consisting of a short essay about the use of information technology in the teaching of science. A few guiding questions were provided and the essays were discussed in a session after they submitted their essays. This activity was repeated during the last lesson. The major aim of these activities was to allow student-teachers to articulate their thinking and feeling during the learning process (Chapter 2, p. 61) and at the same time to identify any changes in the views of the student-teachers after the intervention.

Reflection notes were collected in three tutorial classes during the DDIM module and guide forms were given to the student-teachers and they were asked to record their thoughts and comments about the effect of different strategies and resources employed in the course after each tutorial class. These data provided another rich source of information about the influences of the intervention on their learning and offered a means of triangulation for data collected through interviews and questionnaires.

The lesson plans collected in phases one and two provided information about how knowledge and skills learnt from the DDIM module and the ITRIP workshops and were conceptualised through the lesson planning of the participants. These data were used to determine the degree of mastery of the concept of student-centred learning with information technology (details of the framework used are discussed in Section 3.5.1).

3.4.5 Questionnaires Used in the Study

As mentioned above, questionnaires provided a convenient way for gathering information from a large group of subjects. They also contributed useful data to the triangulation of the qualitative data collected by other methods of the present study. Table 3.5 summarises the questionnaires that were used in the present study. The following sub-sections go on to describe each questionnaire in detail.

Questionnaire Used in Phase One of the Study

The *Computer Background Questionnaire* was administered at the beginning and completion of the DDIM module. The questionnaire consisted of three parts. The first part sought demographic data for student-teachers and the state of their knowledge for the use of eight common computer applications. The second part, containing 35 items, gathered information about the student-teachers' perception of their mastery of some information technology skills. A five-point rating scale was used and respondents were asked to rate their skills ranging from 'very comfortable (with it)' to 'know nothing of it'. The final part of the questionnaire contained 15 items used to identify the respondents' attitude towards using computers in teaching. These items comprised statements in the form of a five-point Likert scale with response items ranging from 'strongly agree' to 'strongly disagree'. These statements were adopted from two instruments reported in the literature (Boyd, 1997; Li & Leung, 1997a). Boyd's study consisted of an evaluation of information technology as a means of learning enhancement in a New Zealand high school. Li and Leung's (1997a) instrument was that used in a study of the current state of provision of information technology teacher education in Hong Kong.

The purpose of the first survey was to establish baseline information about the four areas as mentioned above. Changes in these areas could then be identified after the second survey. The full questionnaire is provided in Appendix C1.

Table 3.5
Questionnaires used in the study

Time	Major questionnaire items
<u>Before DDIM</u> N = 65 for Int N = 68 for Non-Int	<u>Computer Background Questionnaire – DDIM (Pre)</u> (Appendix C1) Student teachers': <ul style="list-style-type: none"> • use of common computer applications • perceived Information Technology (IT) competency • perceived attitudes toward teaching with IT <u>Educational Technology Competency Self-evaluation</u> (Appendix C2) <ul style="list-style-type: none"> • Student teachers' mastery of educational technology competency
<u>After DDIM</u> N = 63 for Int N = 99 for Non-Int	<u>Computer Background Questionnaire – DDIM (Post)</u> Student teachers': <ul style="list-style-type: none"> • use of common computer applications • perceived Information Technology competency • perceived attitudes toward teaching with IT <u>Educational Technology Competency Self-evaluation</u> <ul style="list-style-type: none"> • Student teachers' mastery of educational technology competency
<u>During Teaching Practice</u> N = 10	<u>Use of common Instructional Media in school teaching</u> (Appendix C3) Student teachers': <ul style="list-style-type: none"> • time spent in a week in the selected Instructional Media • modes of teaching with the selected Instructional Media
<u>Before the beginning teaching phase</u> N = 7	<u>Computer Background Questionnaire –ITRIP</u> (Appendix C4) Beginning teachers': <ul style="list-style-type: none"> • school IT environment • involvements and experiences in teaching with IT • attitudes toward teaching with IT

* Key: Int = Intervention Group, DDIM = Designing and Developing Instructional Media, IT = Information Technology, ITRIP = Information Technology Reinforcement Induction Programme

The *Educational Technology Competency Self-evaluation Questionnaire* (Appendix C2) was administered at the beginning and end of the DDIM module in the first phase of the study. The purpose of the self-evaluation was two-fold. First, it was a tool to enable the student-teachers to reflect on their knowledge and skills of educational technology¹ required to become a teacher. Second, it provided useful information about the student-teachers' development in educational technology after completion of the DDIM module. Participants were asked to check a box to indicate their perceptions of their mastery of the competency items.

The original source of this evaluation checklist came from the *Inventory of Teacher Competencies Related to Educational Technology* (Ernest & Patricia, 1982). The original checklist was used to compare the perceived importance of educational

¹ The term Educational Technology has been used to cover both the knowledge and skills in using traditional and information technology in the DDIM module in the teacher education programme of the present study.

technology items among educational technology experts, teachers and pre-service teachers. The inventory contains seven categories: (1) *Visual, Aural, Computer Literacy*, (2) *Production Techniques*, (3) *Equipment Operation*, (4) *Communication Principles*, (5) *Evaluation of Instructional Media*, (6) *Selection and Utilization Principles*, and (7) *System Approach and Instructional Design*. Other sources for items included assessment indicators and criteria related to educational technology in the study of teaching assessment as detailed in Andrews and Barnes (1990) and the 13 technology competencies listed by the International Society for Technology in Education (ISTE) (Abramson, 1993). A preliminary version of the questionnaire used in the present study was piloted in a study of student-teachers' perceptions of the importance of educational technology competency by primary school teachers in Hong Kong (Li & Leung, 1997b). The findings from this latter study were distributed amongst colleagues of the researcher who taught the DDIM module. Redundant items were removed and the final version of the questionnaire contained 49 items in six educational technology competency areas. These competency areas are listed as follows:

1. Development and Characteristics of Instructional Media
2. Communication and Human Information Process
3. Design of instructional media
4. Equipment Operation and Use of Computer Application Software
5. Selection and Utilization Principles
6. Evaluation of Media

The *Use of Common Instructional Media in School Teaching Questionnaire* (Li et al., 2000) was used in the teaching practice in the first phase of the study. The purpose of this questionnaire was to collect information about the student-teachers' use of instructional media in teaching during the period of their teaching practice. The instrument used was that used in the survey of 327 Hong Kong primary teachers between 1998 to March 1999 (Li et al., 2000). The questionnaire required primary teachers to respond to items on the time spent in a week and the different teaching modes of using 16 instructional media selected for the survey respectively. The results were also used for comparison between the student-teachers and the practicing teachers of using instructional media. The full questionnaire is provided in Appendix C3.

Questionnaire Used During Phase Two of the Study

The *Computer Background Questionnaire - ITRIP* was the questionnaire used in the second phase of the study was used to supplement the interviews (Appendix C4). In the first year of teaching for the beginning teachers, it was difficult to arrange interviews with individual teachers, especially in the first semester of the year. The questionnaire therefore became a useful tool for data collection. The information gathered at the early stage of the second phase of the study was about the technological environment of the schools, the involvement and experiences of teaching with information technology and the participants' attitudes towards teaching with information technology. Questionnaire items were adopted from Gilmore's (1993) study of a teacher development programme using information technology in the classroom. The questionnaire used in this phase of the study was simple and quite short - this was deemed necessary since during this time the beginning teachers workload was very heavy as they struggled to adapt to their new working environment. Of the 16 questionnaires mailed out, seven were returned and these participants were followed up with short telephone interviews in order to clarify the quantitative information gathered. Subsequently, six of these teachers agreed to participate in the second phase of the study.

3.5 Data Analysis Procedures Used in the Study

3.5.1 Data Analysis for the Qualitative Data

Qualitative data collected in the study included interview transcripts, field notes from a variety of different observational activities, informal interviews and other discourse with participants, along with other written materials including essays, lesson plans and reflection notes. Miles and Huberman (1994) state that qualitative data analysis consists of "three concurrent flows of activities: data reduction, data display, and conclusion drawing or verification" (p.10). The purpose of the reduction process in the present study was to identify patterns, categories or themes, and relationships from the rather voluminous qualitative data gathered. Data

reduction was a ‘recursive’ process that continued until meaningful clusters or categories emerged from the data (Goetz & LeCompte, 1994, 1996). A coding scheme of the respective clusters was established and all the qualitative data were coded according to this scheme. After coding, the number of occurrences of similar codes or categories was then counted and the data displayed in the form of frequency tables or matrices.

The cluster codes or categories were generated by direct examination of raw data using an inductive approach. However, in the analysis of participants’ lesson plans, priori codes were used rather than inductive ones (Johnson & Christensen, 2000). An analysis scheme with pre-set codes (Table 3.6) was developed in advance to reveal the existence of two important elements in the lessons; namely, ‘information technology’ and ‘student-centred learning’. The development of the scheme was informed by the work of Yager (1991) and Brooks and Brooks (1993) who constructed a data analysis framework in order to evaluate the extent of constructivist learning in classrooms, and Kinzer (1986) and Roblyer’s (1999) views about the use technology in teaching. The researcher also drew upon his 10 years of experience in the field of educational technology. The scheme thus sought to describe classroom activities involving the use of information technology and

Table 3.6
A scheme for the analysis of participants’ lesson plans

Classroom activity with Information Technology	Code
Information Technology in the lesson plan has been used as:	
1. Producing traditional resources for teacher’s presentation, e.g., overhead, graphics, word card, and sentence strip etc.	A
2. Producing computing software for teacher’s presentation, e.g., Power Point slide, multimedia learning program etc.	B
3. Producing traditional resources for students’ group work, e.g., work sheet/activity sheet, exercise etc.	C
4. Producing computing resources for students’ group work, e.g., multimedia and learning programs etc.	D
5. Producing traditional resources for individualised learning activities, e.g., work sheet/activity sheet, exercise, etc.	E
6. Producing computing resources for individualised learning activities, e.g., multimedia and learning programs etc.	F
7. Pupils’ tools to access information themselves for small group activities/tasks, e.g., Internet.	G
8. communications tools between teacher and students and among students to support learning	H
9. Pupils’ tools to solve problems or to find solutions to the questions for assigned group activities/tasks e.g. a spreadsheet program.	I
10. Pupils’ tools for presentation of the results of group activities/tasks.	J

looked at the use of technologies in terms of teacher-student interaction; teacher-directed and student-centred activities as described in the 'Oren' model of pathways for classroom change with information technology (Focus Group, 1997). There are two dimensions of continuum in the Oren model. The first dimension is the teaching methods stretching from traditional to student-centred teaching. The second dimension is from "No IT use" to "High IT use". According to the model, teachers' pedagogical change shifts from the traditional teaching method without using any information technology to the more student-centred learning with frequent use of information technology.

3.5.2 Data Analysis for the Quantitative Data

As described above, there were three sets of questionnaires used in the study: The *Computer Background Questionnaire* used both before and after the DDIM module; the *Use of Common Instructional Media in School Teaching Questionnaire* used in the teaching practice; and, the *Computer Background Questionnaire* used before the second phase of the study. The numeric data obtained from the administration of these questionnaires were analysed using the *Statistical Package for the Social Sciences* (SPSS) program. Descriptive statistics in the form of percentages for the given items are reported and comparisons were made between the intervention group and the comparison group, and before and after the DDIM module for the intervention group. Statistically significant differences among these groups were investigated using the non-parametric procedures available in SPSS. The Mann Whitney U Test was used to examine differences between the intervention and comparison groups and the Wilcoxon Signed Ranks Test was used to compare difference between the intervention group before and after the DDIM module. The results are presented in the form of bar graphs and/or tables. Given that the collected data were discrete and ordinal in nature, the above two tests were chosen as they were specially constructed for the test of significance for the non-parametric measurements (Kurtz, 1999).

3.6 Intervention Methods Use in the Study

The above section has provided a description of the research design and data collection procedures used in the study. Here the intervention methods employed for each phase of the study are described. The development of these methods was guided by the constructivist-based principles that were discussed in the summary section of Chapter 2 (p. 61).

3.6.1 *Designing and Developing Instructional Media (DDIM) Intervention*

The DDIM is a compulsory course in the domain of professional studies that every student teacher has to take in order to complete his or her two-year *Certificate of Education* programme. There are 12 two-hour teaching sessions for the course and the goal of the course is to help student-teachers to explore and develop a variety of instructional media², to be integrated into classroom teaching. There were about 550 student-teachers in 15 groups taking the DDIM module at the time of the research study. The course content, schedule and assessment criteria are common for all the groups - although within the above common components individual lecturers have autonomy to vary the sequence of the topics in direct contact times and to adopt different teaching strategies as they see fit. The schedule, an outline of the topics, and sequence of the learning content, are provided in Table 3.7.

The first 45 minutes of the first two-hour session was conducted in the classrooms for each group by the group lecturers. The purpose of this introduction was to allow individual group lecturers to establish relationships with their student-teachers and to establish the logistical arrangements for the course. It also allowed the student-teachers to 'brainstorm' about major issues in the use of instructional media in teaching. The researcher spent about 20 minutes in the above activity. Then, the first short essay writing exercises that formed one of the qualitative data sources for study was conducted. The researcher also made use of this opportunity to introduce the details of the research project to all the

² This course treats information technology as one of the instructional media. However, the major contents of the course has been shifted to computer technologies in line with the current trend of technology advancement and the Government Chief Executive's Policy Address on Information Technology in Education.

student-teachers and invited them to take part in the study. The purpose of portfolio and learning activities employed in the course also were discussed. Finally, all the student-teachers accepted the use of new strategies in the course and were then provided with a portfolio guide. This guide included an outline of the DDIM module, a conceptual framework for the learning areas of the course, the learning schedule, guides for the different projects, and the reflection on the learning areas of the DDIM module (see p. 91).

Table 3.7
The teaching schedule for the DDIM module

Week	Topic
1	Communication, human information processing and common instructional media (ML)
2	Visual literacy and visual design principles, model of using instructional media (ML)
3	Approaches of instruction, selection and evaluation of instruction media, design principles of instructional media (L)
4	Production of a multimedia package (1)(Wk)
5	Production of a multimedia package (2) (Wk)
6	Using information technology for student-centred learning and teaching (L), tutorial (1)
7	Group projects and consultation (1)
8	Group projects and consultation (2)
9	Group projects and consultation (3), tutorial (2)
10	Project presentation and discussion (1)
11	Project presentation and discussion (2)
12	Tutorial (3), test

*Key: DDIM = Designing and Developing Instructional Media Module, ML = Mass Lecture, L = Group Lecture, Wk = Workshop

The first two topics in the teaching schedule were conducted by two senior staff of the course teaching team in the form of didactic lectures. The first topic described some previous research on the contributions of instructional media to learning, the relationship between human information processing and instructional media, theories and models of media communication, and an introduction to the characteristics of some common instructional media. The first hour of the second session dealt with the relationship between human perception and visual literacy, and touched on some visual design principles for the design of visual media. The second hour introduced a model of the use of instructional media. Individual lecturers then taught their own groups for the rest of the sessions.

Session three began with a discussion of the principles and strategies for the

selection and evaluation of instruction media for specific learning situations. During this discussion, the traditional teacher-directed approach and constructivist approach of instruction were both introduced. In the second part of this session design principles were discussed using the teacher-directed approach and cognitive information-processing theories for the production of a multimedia program. This discussion was intended to help prepare the student-teachers for their multimedia project that they were required to do as part of their assignments. At the end of the lecture, the student-teachers were given a brief introduction to a specific authoring tool, *Authorware Professional 4.0TM* (AW4.0) that was subsequently used for their group assignments. The student-teachers were given a concise users guide for using AW4.0. They were also given a task list that required them to apply various information technology skills in instruction. The task list was accompanied by a self-instructional booklet that provided simplified solutions to the tasks. The task list contained two parts. The first part was related to the application of AW4.0 to instructional problems, for example: “According to the instructional design principles, how can you make use of AW4.0 to elicit students’ performance and to provide immediate feedback to the student? Please construct a flow line with the tools provided by AW4.0 and feed in the content selected from your elective subjects”. The second part of the task list was related to the use of basic information technology skills³ in daily teaching. These skills included general *WindowsTM* operations, techniques for searching Internet resources, word processing applications, basic graphic and sound recording techniques for producing visually attractive worksheets, newsletters and narrations in a multimedia learning program. An example is: “When you are building up your presentation or multimedia program, you may need to add some drawings to make your program a special one. How can you draw, for example, a train like the following one using the drawing tools bundled with Microsoft Word or Power Point?” Further instructions for each task were given by the lecturer to encourage the users to explore the answers by themselves and to provide a cue of the position of the respective solution pages of the tasks in the booklet (see Appendix E for more examples). The following two weeks were practical sessions in which the student-teachers were provided with opportunities to practise the tasks given in

³ By the time of the present study, there were not any mandatory requirements for information technology competency in teaching until November 1999, the release of the report on “Levels of Information Technology (IT) Competency, Core Course Elements And Assessment Tools for Teacher Training in IT in Education” by the Education Department of the Hong Kong SAR government.

AW4.0 themselves. During this time they could seek the help from the researcher if needed and after-hours computer facilities were available for independent practice. For the basic information technology skills in part two of the task list, the student-teachers were encouraged to work in groups in their spare time. At the end of these practical sessions, they were given another booklet to be used as the basis for a discussion in the next tutorial session. This latter booklet contained reading material and descriptions of the use of applications of information technology in student-centred learning and teaching. Some guiding questions for discussion were also included.

The first 45 minutes of session six consisted of a presentation about constructivism and related learning theories, and the application of constructivism in instruction. In the following tutorial session the student-teachers, in groups, were given time to organize and share their reflections on the cases in the booklet provided in the preceding session. The main purpose of this session was to allow the student-teachers to gain in-depth understanding of how theories of learning were actually practised in daily teaching situations; in other words, to see how information technology is actually used in student-centred learning and teaching. At the end of this session the student-teachers were told about a web site of resources for the DDIM module and also about a set of self-instructional CD-ROMs on video production available to them. The provision of these resources was intended to provide some resources and support for the student-teachers to help them finish their group projects and portfolio (see Appendix F for samples).

The following two weeks and the first hour of session nine were free of direct instruction and the student-teachers were free to work on their group projects. Computer facilities were arranged and staffs were available for consultation.

The second tutorial class was conducted in the second hour of session nine. The aim of this tutorial was to provide an opportunity for the student-teachers to reflect on what they had learnt so far. A reflection sheet on the topics already taught in the course was given to each student teacher. The following guiding questions were also included in the reflection sheet:

1. What did you learn from these sessions?

-
2. How was information technology integrated in the learning sessions?
 3. What teaching strategies were used in these sessions?
 4. How did these learning experiences with the use of information technology influence your future teaching?

After the students had completed the reflection sheets (these were used as a qualitative data sources, see above), a discussion followed. The third tutorial session was similar to the second in that reflection sheets were also used but this time the focus was on the learning environment. The following questions were used as guide to help focus the student-teachers' thinking:

1. What did you learn from these learning resources and supports?
2. How did these learning resources and supports help in your learning about using information technology in teaching?
3. What learning strategies were used in using these resources and supports?
4. How will these experiences influence or help in your future teaching with information technology?

Two sessions were arranged for the presentation of group projects and each presentation lasted for 15 minutes. The second hour of each session was then used for discussion. This discussion aimed to help the student-teachers to reflect on the design principles and theories of learning that were applied to the development of the multimedia-learning program. Before the first discussion, the researcher worked with the student-teachers to derive criteria for the evaluation of the multimedia-learning program. Some ready-to-use evaluation instruments were also introduced at this time.

In this study, portfolios were used to guide, to record and to monitor the learning of the student-teachers. The student-teachers were given clear and explicit tasks to complete in order to build up their portfolio. These tasks might involve both the applications of technical skills such as to produce a certain teaching materials, and also higher level thinking skills such as commenting on a critical issue of using technology in education. The student-teachers, therefore, had to think retrospectively to examine their present state of competency and to identify their needs at the same time in order to deal with the tasks. A natural reflection process

was then activated. Such process might then lead to the development of their own learning strategies in order to meet the identified needs. These strategies might include a more attentive lecture or workshop and self-directed interactions with some information sources. The student-teachers were then becoming active learners and also monitors of their own learning.

The portfolio of this study was consisted of five parts (see Appendix D):

- (1) content outline and schedule with a conceptual framework outlining the design of the module and its relations with other learning areas;
- (2) suggestions and guides to the learning activities and projects to be completed for the portfolio and the ways of constructing the portfolio;
- (3) the main portfolio section that was used to record and document the learning process;
- (4) a table of grade descriptors that was adapted from Klenowski et al. (1997) to measure the learning outcomes of the module; and
- (5) a self evaluation form containing a list of 49 educational technology competency items grouped into the aforesaid six categories to self-check the mastery of these competencies before they started the instructional technology module.

The main portfolio section was divided into different sub-sections of the each of the competency area. Each sub-section was further separated into three parts.

Part 1: The competency indicators, described what the student-teachers were going to achieve in the specific area;

Part 2: The evidence, were the artefacts that the student-teachers included in their portfolio. They could be pieces of essays or Audio-Visual products that could demonstrate their mastery of the competency area.

Part 3: Reflective statements, were the most important part. They explained the student-teachers' thought of the learning process. Some guiding questions were also given for reference only. Student-teachers were free to write anything that could reflect their own thinking about the learning of the competency area in this section. For the reflection part, guiding questions were given as follows:

1. What have you learnt about this competency area?

2. What kind of teaching strategies have you experienced or what kind of learning strategies have you used in the learning process?
3. What contributions did I make in the group projects?
4. What kind of problems have you encountered and how have you solved them?
5. How will this learning experience help in your future classroom teaching?

3.6.2 *The 'Information Technology Try-out Teaching' Used During Teaching Practice*

Before the teaching practice an extra session for the DDIM module was arranged for the student-teachers. The session talked about the school visits to three primary schools of the *Information Technology Pilot Scheme*⁴ conducted by the researcher and his colleagues. Information collected in the visits included interviews notes with the school principals and information technology coordinators, photographs of schools' network infrastructure and computer facilities. The purpose of this extra session was to strengthen student-teachers' understanding of the potential ways of applications of information technology in primary school teaching and to provide opportunities for critical reflections on them. In the session, student-teachers were given the chance to become familiar with the information technology development in primary school in Hong Kong. They were also helped in reflecting the rationales of various information technology plans of the three pilots schools.

As mentioned above, during the teaching practice five of the student-teachers agreed to take part in the 'information technology try-out teaching'. The try-out teaching was intended to allow the student-teachers to practise using information technology in real teaching situations. The student-teachers that took part in this activity were required to prepare extra lessons for planning and class observation as the researcher was not their supervisor for their teaching practice. During the planning stage individual student-teachers were required to discuss their teaching plan with the researcher. The discussion was occasionally conducted over the telephone because the student-teachers had already started their teaching practice. Advice and support were provided during these discussions. This consisted of helping student-teachers to relate theories of learning to their teaching, making

⁴ There were 10 schools selected for the information technology Pilot Scheme using financial support from the Government based on the Five-Year Information Technology Strategies document.

modifications to teaching plans, help in the location of resources and sometimes producing essential teaching materials for lessons such as computer generated colour overheads. The student-teachers were encouraged to record classroom anecdotes and take reflection notes during the course of their teaching practice (also used as one of the qualitative data sources see above).

3.6.3 The Information Technology Reinforcement Induction Programme (ITRIP) for the beginning teachers

The DDIM intervention focused on student-teachers' learning within a constructivist framework while the intervention in ITRIP is more concerned with teachers' personal professional development. In the previous DDIM intervention, a constructivist and interactive learning environment was developed by the researcher to help student-teachers explore, construct, and strengthen their competency in the use of information technology in the classroom. In the ITRIP intervention, the major purpose was to enhance beginning teachers' ability in applying a constructivist framework for learning with information technology. The beginning teachers - with the assistance from the researcher - sought to develop their classroom-learning environment within a constructivist-based framework. During the ITRIP, the beginning teachers were required to design an information technology project for their students and they were assisted in this task by the researcher. They were also required to identify their own needs and to find ways to achieve such needs. A three-hour workshop was organised for the beginning teachers who agreed to take part in the ITRIP. There were four major parts in the workshop. The first part helped the beginning teachers to develop a clear understanding of the purpose of the ITRIP. The others were concerned with helping the participants to see how they might build a learner-centred classroom. The following objectives of the ITRIP were shared:

1. To facilitate the participants' use of teaching technologies by providing resources and consultation during their induction period as beginning teachers
2. To facilitate the participant to build a learning environment for their own students under the constructivist framework that the researcher established in the DDIM module
3. To help participants reflect on current practices of teaching with reference to the constructivist framework

4. To help participants enhance their capabilities as reflective practitioners and self-learners in their own professional development.

The second section of this workshop helped the beginning teachers to re-examine the constructivist-based framework that the researcher proposed and used in the DDIM module. The relevant theories that underpinned the development of the framework were discussed and the experiences in the DDIM module were shared in a group setting. The beginning teachers also were encouraged to look at case studies involving teaching with information technology for student-centred learning - these case studies were provided in the form of a resource booklet for self-study (Appendix G).

The third section consisted of a discussion of the ITRIP project. Some guidelines and questions for information technology planning were generated during this discussion and a planning guide was subsequently compiled and given to the beginning teachers for reference. An extract from the planning guide (Appendix H) is provided below.

Introduction

You are asked to select a topic from any of your teaching subjects (or cross subjects) then plan a learning activity with the use of information technology under the constructivist framework which has been discussed before.

Guiding Questions

Before your planning, please review what you understand by constructivist learning and its theoretical background then answer the following questions:

1. Is there any need for the teacher to present teaching materials?
2. Is there any need for individualised learning materials for my pupils?
3. Where can I find these resources?
4. Do I need to produce some of them by myself?
5. If needed, what kinds of tools that am I going to use for these productions? Are these resources in the form of presentation software, self-learning package or a web site?
6. What kinds of competencies are needed for these productions?
7. What kinds of competencies do I not know and have to learn?
8. When designing these teaching and learning resources, what sorts of knowledge (design theories and principles) do I have to apply?
9. What kinds of learning activities that the resources are applied?

10. Do your pupils need to finish some projects or tasks in the learning process?
11. Do they need to make presentations of their work?
12. Is it necessary for the activities to be conducted solely in the classroom?
13. If not, how do I arrange such outside activities? Where? When? What sorts of logistic arrangement needed?
14. Do my pupils need to have some pre-requisite knowledge and skills before they can go on with their activities?
15. Do I need to teach them before hand?
16. Do I need to know the knowledge and skills before I can teach?
17. How do I communicate with my pupils throughout the whole process both inside and outside the classroom? Do my pupils and I need any specific communication techniques? Do we need to learn the techniques before hand?
18. How do I observe the learning process and made necessary evaluation of the learning outcomes? Do I have any specific criteria and standards now?

The last section of the workshop allowed the beginning teachers to reflect on their current teaching using information technology and they were encouraged to share their experience in a group setting. Several themes emerged. First, it seems that information technology use was not common in the classrooms; the participants were happy with the rationale behind the ITRIP, and felt that the project was meaningful. In this sharing session, the beginning teachers were also encouraged to identify the constraints of the implementation in the ITRIP project. From the sharing, it emerged that the beginning teachers saw time to be the most crucial factor that would affect the ITRIP project.

At the end of the workshop, the researcher presented a summary and conclusion for the workshop: a brief introduction to the resources booklet, the communication methods (e.g., e-mail, FTP and web server accounts) and the use of the multimedia learning shareware also were given. In the course of the development of the ITRIP project, support was provided through telephone conversations. These individual conversations aimed to provide advice on the projects - both academically and technically - and also to develop and maintain the collaborative relationship between the researcher and the beginning teachers.

This section described the intervention process in detail. A fuller discussion on the effect of these interventions is provided in other chapters (see Chapters 5 to 8).

3.7 Ethical Concerns for the Research Reported in this Thesis

The previous sections described the research methods and interventions for this thesis. The following section addresses the ethical issues and describes how the researcher sought to address these issues during the research. The main ethical issues identified were: obtaining informed consent, assuring participants of confidentiality, avoiding potential harm to participants, and maintaining the integrity of the research.

At the beginning of the study the participants were informed in detail about the research, and the contribution expected of them should they agree to participate. They were also informed that participation in the study was totally voluntary and assured that participation would not influence their assessment in any way. Consent was obtained from the participants prior to any of the research activities (the consent forms used are provided in Appendix I). The participants were also told that they had the right to withdraw from the research at any stage of the study.

The participants were assured that any data collected during the study would be used only for the purpose of this study, and their identities would be kept confidential throughout. The participants were unable to be identified in any of the research materials; namely, the questionnaires, transcriptions of interview data, or other documents. Instead, codes and pseudonyms were used and these were used solely to facilitate cross-referencing of accounts during analysis. Any quotations used in the thesis likewise employed the use of pseudonyms. All the analyses and the transcriptions of quantitative and qualitative data were handled solely by the researcher and analysed and transcribed data - together with the original data - such as completed questionnaires, documents and audio tapes, were kept secure at all times.

The researcher also acted as the teacher for the participants in this study. Consequently, particular attention was paid to the handling of the research data and assessment materials for the course. The participants were assured that their performance during class observations and interviews did not contribute in any

form towards assessment for the course. In order to ensure fairness in the assessment of the course, all the student-teachers (including participants and non-participants) used student registration numbers rather than names on assessment items. Sample assignments were marked by a second marker as far as possible. The researcher also strived throughout to maintain a relaxed, non-hierarchical relationship with the participants and sought to conduct each of the research activities in an informal, friendly and relaxed manner.

3.8 Chapter Summary

This chapter began with a discussion of the notion of methodology and research methods open to researchers in science and technology education. An interpretive approach was deemed appropriate for the thesis as the researcher concluded that such an approach was needed in order to develop an in-depth understanding about the development of information competencies in education and their applications for student-centred learning among student-teachers. The nature of quantitative and qualitative methods followed and this was used to develop the research design described in the following section. The research design employed was a mixed-methods approach and this was described next, including a description of the sample used in the study and the specific data collection tools employed in the study. The implementation of the research design was next, and the chapter concluded with a description of the ethical issues for the thesis.

Chapter Four which follows describes the background experiences and perceptions of using information technology in teaching among the student-teachers before the intervention used for this study.

Chapter 4

Student Teachers' Prior Experiences in Teaching Using Information Technology

This chapter describes the information technology background for the student teacher participants in the study (i.e., the intervention group) before they undertook the *Designing and Developing Instructional Media* (DDIM) module. The background information is reported under five categories:

1. Current use of common computer applications;
2. Current state of mastery with computing knowledge and skills in teaching;
3. Participants' attitudes towards using information technology in teaching;
4. Participants' views about information technology in teaching; and
5. Pre-entry state of technological competencies defined by the DDIM module.

The above information was collected through three research activities: a questionnaire, self-evaluation, and the writing of essays. Details of the how these data were collected are provided in Chapter Three (Section 3.4, p. 75). The first four data categories were used to compare the intervention group with student-teachers in the non-intervention group. The purpose of this was to allow the researcher to interpret the research findings as to how the intervention group performed in comparison with student-teachers not exposed to the intervention.

The description begins with a profile of the intervention group, followed by each of the five categories in turn.

4.1 Profile of the Intervention Group

Five groups of final year student-teachers of the two-year Certificate Education Programme - about one third of the population studying in the programme as a whole - were invited to complete the *Computing Background Questionnaire (CBQ)* and an *Educational Technology Competency Self-evaluation Questionnaire (ETCSQ)* at the beginning of the DDIM module. The researcher was responsible for teaching of two of the five groups and a total of 133 questionnaires and 133 self-evaluation forms were collected from the participants. Of the 133 student-teachers, 91% were between 18 to 25 years old, 97% owned a home computer and 80% were female.

Sixty-five of these student-teachers agreed to take part in the study and became the intervention group that participated in Phase One of the study; the remainder (of the 133) formed the non-intervention group. Full details of the profile of the intervention and non-intervention group before taking the DDIM module are provided in Table 4.1. Both the intervention group and non-intervention group had a high proportion of female student-teachers (85% & 73% respectively) and the intervention group were generally less experienced in the use of computers; 22% and 33% respectively had received some computing training before entering the institute, and 8% and 36% respectively had computing training in their first year of tertiary study. The student teachers in the intervention group mostly came from the Arts stream of secondary education (76%, cf. 59 % for the non-intervention group) and 70% of these student-teachers had studied Chinese and English language as their major teaching subjects in the teacher education programme.

In summary, the intervention group was dominated by females with none of them taking computer as their elective teaching subject and few of those that participated in the intervention had received any formal computing training before undertaking the DDIM module (see Chapter 1, p. 8 for more details about the module).

Table 4.1

The profile of the student-teachers in the intervention and non-intervention group before and after taking the DDIM module

		<i>Intervention Group</i>		<i>Non-Intervention Group</i>	
		Pre % (N = 65)	Post % (N = 63)	Pre % (N = 68)	Post % (N = 99)
Gender	<i>Female</i>	85	85	73	80
	<i>Male</i>	15	15	27	20
With PC at home	<i>Yes</i>	97	97	97	92
	<i>No</i>	3	3	3	8
Have computer courses before Teacher Ed.	<i>Yes</i>	22	23	33	37
	<i>No</i>	78	77	67	63
Have computer courses in 1 st Year Study in Teacher Ed.	<i>Yes</i>	8	8	36	35
	<i>No</i>	92	92	64	65
Secondary Education	<i>Science</i>	11	12	26	46
	<i>Art</i>	76	75	59	43
	<i>Commerce</i>	13	13	14	10
	<i>Technical</i>	0	0	1.5	0
Elective Teaching Subjects in Teacher Ed.	<i>Science</i>	2	2	9	13
	<i>Social Studies</i>	26	24	6	5
	<i>Social Studies & Chinese *</i>	26	28	0	21
	<i>English</i>	46	48	3	0
	<i>Putonghua</i>	0	0	16	10
	<i>Physical Education</i>	0	0	33	13
	<i>Music</i>	0	0	8	3
	<i>Art & Craft</i>	0	0	22	21
<i>Computer</i>	0	0	3	12	

* *Double Electives: Student-teachers were allowed to select two teaching subjects in this group.*

4.2 Current Use of Common Computer Applications

The profile of the intervention group suggests that only a small portion of student-teachers in the intervention group had received computing training before taking the DDIM module; however, the questionnaire found that the participants

nonetheless were experienced in the use of a number of common computer applications.

In the second part of the *Computing Background Questionnaire*, respondents were asked to indicate the extent of their current use of computer applications such as email, word processing and so forth; respondents could provide response in the range 'never' to 'more than 6 hours a week'. The responses of the student-teachers are presented in Table 4.2.

Table 4.2

Intervention Group Use of Computer Applications Before Taking the DDIM Module (n=65)

Computer Applications	1	2	3	4
	% (n)	% (n)	% (n)	% (n)
1. Word Processing	5 (3)	34 (23)	47 (30)	14 (9)
2. E-mail	5 (3)	38 (25)	43 (28)	14 (9)
3. Internet	8 (5)	32 (21)	38 (25)	22 (14)
4. Drawing/Graphics	23 (15)	56 (37)	17 (11)	3 (2)
5. Spreadsheets	37 (24)	39 (25)	22 (14)	3 (2)
6. Reference/Encyclopaedia	43 (28)	38 (24)	18 (12)	2 (1)
7. Data Base	48 (31)	40 (26)	11 (7)	2 (1)
8. PowerPoint	51 (33)	34 (22)	15 (10)	0 (0)

Key: 1 = Never, 2 = Very Occasionally, 3 = 1-6 hours a week, 4 = more than 6 hours a week

Word processing, e-mail and the Internet were the three most frequently used applications with few respondents indicating that they never used them (5%, 5% & 8% respectively). The student-teachers reported using all of the other applications to some extent but the other applications were used much less frequently (Table 4.2) and less than 3 % of the respondents used any other application for more than six hours a week. The least used application was Microsoft PowerPoint with more than half of the intervention group (51%) indicating that they had never used this application.

A comparison between the student-teachers who had used the above computer applications in the intervention and non-intervention groups (Table 4.3), shows similar trends with word processing, e-mail and Internet the three most frequently used applications for both groups. Some 73% of the non-intervention group student-teachers reported using Microsoft PowerPoint compared with 50% of the

intervention group and this difference was found to be statistically significant¹.

Table 4.3

Comparison of Student-teachers' Reported Use of the Computer Applications between the Intervention Group (n=65) and Non-Intervention Group (n=68) Before Taking the DDIM Module

Computer Applications	Int % (n)	N-Int % (n)	
1. Word Processing	95 (62)	86 (59)	
2. E-mail	95 (62)	93 (63)	
3. Internet	92 (60)	96 (65)	
4. Drawing/Graphics	77 (50)	67 (45)	
5. Spreadsheets	63 (41)	57 (39)	
6. Reference/Encyclopaedia	57 (37)	56 (38)	
7. Data Base	52 (34)	48 (32)	
8. PowerPoint	49 (32)	73 (49)	*

*Statistically significant at $\alpha = 0.05$ (Mann-Whitney U Test)
Int = Intervention Group, N-Int = Non Intervention group

For other applications, student experiences were diverse ranging from 52% for data bases use to 77% for use of drawing and graphics packages. With the exception of the use of PowerPoint, there were few differences (and none statistically significant) in experience between the intervention and non-intervention groups.

These findings and those mentioned above showed that less than 23% of the student-teachers had received formal computing training, suggesting that both cohorts of student-teachers found out how to use common computer applications by means other than formal training. These findings do not provide data on the skill level or state of mastery of the student-teachers for any of these applications - particularly in relation to their use in teaching. However, the findings provided useful information for the design of a self-learning booklet for information technology and the individual projects employed in the latter stage of the study (see Section 3.6, p. 89).

The student-teachers' mastery of computing applications and their skills used in the use of information technology in teaching is described in the next section.

¹ Mann-Whitney U Test ($p < .05$)

4.3 Student Teachers' Perceived Mastery of Computing Competencies for Teaching

The *Computing Background Questionnaire* also was used to develop an understanding of the student-teachers' perception of their ability or mastery in the use of common computer applications - particularly in relation to the use of such applications in teaching. This part of the questionnaire contained items in which the student-teachers were provided with a list of 35 computing competencies for teaching. These knowledge and skills items were divided into three categories: (1) computing background knowledge in teaching; (2) software applications in learning and teaching; and, (3) basic hardware operation skills. The participants were asked to respond to a five-point Likert scale for each competency with values ranging from 'Very comfortable' to 'Know nothing of it':

- 5 = Very comfortable
- 4 = Comfortable
- 3 = Okay
- 2 = A bit uneasy
- 1 = Know nothing of it

The first section of this part of the *Computing Background Questionnaire* (Category A) sought participants' perceptions of their background knowledge in computing applications and collected data on the student-teachers' basic understanding of the knowledge of computing and its applications in teaching. An example of one item is: "Design teaching and learning strategies incorporating the use of computers". The second section (Category B) asked about some common computer applications used in teaching. This section was divided into four sub-sections to illustrate the use of the applications in teaching. Examples of questionnaire items are provided below for each of the four sub-sections (i.e., B1-B4):

- B.1 For organising learning activities with Internet.
- B.2 For producing teaching materials with a presentation software (e.g., Microsoft PowerPoint).
- B.3 For facilitating daily school administration work with spreadsheet software (e.g. Microsoft Excel).
- B.4 For resources and information exchange such as using

the Internet to access useful information for teaching.

The last section asked about the use of basic computing facilities in daily teaching (Category C). This area was categorised as 'Operation Skill' and used items such as: 'I can install and use educational programmes in a CD-ROM or floppy disk'.

Descriptive statistics were computed for the responses for each competency item. The average percentages for each of the five response groups for each of the information technology competency categories and sub-categories were calculated. The purpose of this was to reduce the data for the 35 items into comparable data groups. The percentages of the 'Comfortable' and 'Very Comfortable' response groups were merged to form a single unit for data analysis. Table 4.4 shows the average percentages of the respective categories after the data reduction procedure.

Table 4.4

Comparison of Student Teachers Who Felt Comfortable and Very Comfortable in Computing Competency Items in Teaching for the Intervention (n=65) and Non-Intervention Groups (n=68) Before Taking the DDIM Module

Computing Competency in Teaching	Int % (n)	N-Int % (n)
A Background Knowledge	9 (6)	16 (11)
B Software Applications		
<i>B.1 for organising learning activities</i>	14 (9)	19 (13)
<i>B.2 for producing teaching materials</i>	13 (9)	20 (14)
<i>B.3 for facilitating daily school administrative</i>	12 (8)	20 (14)
<i>B.4 for resources and information exchange</i>	28 (18)	27 (18)
C Operation Skills	14 (9)	21 (14)

*Int = Intervention group, N-Int = Non Intervention group

The mean frequency of Category A was the lowest (9%) of the three competency areas for the intervention group (i.e., lowest reporting as comfortable and very comfortable) and this suggests that most of the student-teachers were not well versed in the fundamental concepts of the use of information technology in learning and teaching. Although the student-teachers seemed to be more confident about their competency for the other categories (Category B and C), the average response of less than 16% for these categories shows that perceptions of competency among the student-teachers of the intervention group in the respective areas at the beginning of the DDIM module is generally low. Table 4.4 also shows that perceptions of mastery level were lower in the intervention group

compared with the non-intervention group for all categories and sub-categories except sub-category B.4. Statistically significant differences² were found for all sub-categories and such finding is presented in Table 4.5.

Table 4.5 shows that the average difference of the above statements was about 11%; the biggest difference was 20% for sub-category B2 'Use software applications for producing teaching materials with presentation software (e.g. Microsoft Power Point)', and the lowest difference of 3% was reported for category A: 'I can evaluate the effectiveness of a computer instructional program'.

These data point to considerable differences between the intervention and non-intervention group in terms of their perceptions of their mastery of computing knowledge and skills in teaching at the beginning of the study. Reasons for these differences became apparent upon examination of the student-teachers' profile (Table 4.1, p. 100) which revealed that 3 % of the student-teachers in the non-intervention group took computer as elective teaching subjects, compared with 0% of those in the intervention group (Details of the samples selected for the study can be found in Chapter 3, p. 72).

In summary, the *Computing Background Questionnaire* revealed differences in experience with computer applications, and student-teachers perceptions of mastery in computing knowledge and skills in the use of computer applications for teaching between the intervention and non-intervention groups. Overall the level of mastery was low for both cohorts at the beginning of the study. The next section describes the student-teachers' attitude towards using computers in teaching. Their beliefs in the contribution of computing in education and their concerns of using computers in actual teaching situation also are described.

² Mann-Whitney U Test (p<.05)

Table 4.5

Comparison of Student Teachers Who Felt Comfortable and Very Comfortable in Computing Competency Items in Teaching for the Intervention Group (n=65) and Non-Intervention Group (n=68) before Taking the DDIM Module

Computing Competency in Teaching	Int % (n)	N-Int % (n)	Difference %	
A Background Knowledge				
Designing teaching/learning strategies incorporating the use of computers.	7 (5)	18 (13)	-11	*
I can explain common computing terminology.	6 (4)	15 (11)	-9	*
I can evaluate the effectiveness of a computer instructional program.	8 (5)	11 (8)	-3	*
<i>Average:</i>	7	15	-8	
B.1 Use Software applications for organising learning activities with:				
Graphic software (e.g. Paint Shop Pro)	8 (5)	15 (10)	-7	*
Presentation software (e.g. Power Point)	8 (5)	26 (18)	-18	*
<i>Average:</i>	8	21	-13	
B.2 Use Software applications for producing teaching materials with:				
Graphic software (e.g. Paint Shop Pro)	12 (8)	17 (11)	-5	*
Presentation software (e.g. Power Point)	11 (7)	31 (21)	-20	*
Authoring system (e.g. Authorware) to develop a computer assisted learning package for a particular learning situation	6 (4)	14 (10)	-8	*
<i>Average:</i>	10	21	-11	
B.3 Use Software applications for facilitating daily school administrative work with:				
Word processing software (e.g. MS Word)	26 (17)	44 (30)	-18	*
Graphic software (e.g. Paint Shop Pro)	8 (5)	14 (9)	-6	*
Presentation software (e.g. Power Point)	5 (3)	20 (14)	-15	*
<i>Average:</i>	13	26	-13	
C Operation Skills				
Operate an interactive video system	8 (5)	16 (11)	-8	*
Project computer images on a screen with a LCD panel/computer projecting machine (e.g. TV converter)	3 (2)	11 (7)	-8	*
Project computer images on a screen with a computer video projector	5 (3)	19 (13)	-14	*
Install and use educational programs from a CD-ROM or floppy disk.	20 (13)	28 (19)	-8	*
<i>Average:</i>	9	19	-10	
Overall:	9	20	-11	

Key: Int = Intervention group, N-Int = Non Intervention group

* Statistically significant ($p < .05$, Mann-Whitney U Test)

4.4 Student Teachers' Attitude Towards Using Computers in Teaching

The *Computing Background Questionnaire* contained 15 items about participants' perceptions of the usefulness, acceptance, anxiety and also the confidence in using information technology in teaching and any concerns they might have about actual classroom use of computers in teaching. The participants were asked to respond to these items using a five-point Likert scale with options ranging from 'Strongly agree' (SA) to 'Strongly disagree'(SD). The responses were investigated using descriptive statistics and a summary of the findings is provided in Table 4.5 with the 'Agree' and 'Strongly Agree' responses combined for analysis. Of the 15 items, six are negative (items 8, 9, 10, 11,12, and 15) and the responses of these attitudinal statements were coded in reverse order to the other 'positive' items. As a result, all the data were interpreted consistently; in other words a higher percentage represents a more positive attitude (and vice versa) for each of the items. To illustrate, for item 8 'a computer is not suited for teaching', resulted in a figure of 78 % for the intervention group, which means that 78% of the student-teachers in the intervention group considered a computer is suited for teaching (i.e., only 22 % of these student-teachers said they agreed with the original 'negative' item statement).

It can be seen from Table 4.6 that student-teachers in the intervention group see usefulness in using computers in teaching and learning, with high agreement for items one through six. The highest agreement of 88% was for item 2 and it seems that most of the student-teachers in the intervention group believe that the use of computers would make learning more interesting.

Table 4.6

Student Teachers' Attitude Towards Using Computers in Teaching for the Intervention Group (n=65) Before Taking the DDIM Module

Perceived Attitude Statement toward using information technology in Teaching	Int % (n)
1. Computers will improve the quality of student's education.	74 (48)
2. Using a computer in a classroom will make a subject more interesting.	88 (57)
3. Using a computer in teaching can improve students' achievement.	62 (40)
4. Students will be more attentive when computers are used in class.	70 (46)
5. Computers enhance students' self-studies and independent work.	72 (47)
6. Computers enhance students' creativity.	66 (43)
7. Computers will <u>take away</u> the job of a teacher. #	68 (44)
8. A computer is <u>not</u> suited for teaching purposes. #	78 (51)
9. Computers <u>slow down</u> and <u>complicate</u> the teaching process. #	47 (30)
10. The introduction of computers in primary education is just an <u>increase</u> in the teachers' <u>workload</u> . #	34 (22)
11. Students should be <u>kept away</u> from computers. #	80 (52)
12. Using computers in classroom teaching will <u>increase</u> the classroom <u>management problem</u> . #	22 (14)
13. Every primary school child should begin to use computers.	75 (49)
14. I will use computers to help my teaching.	85 (55)
15. Computers are <u>difficult</u> to learn about. #	48 (31)

Key: Int = Intervention group

The responses of these negative statements were recoded such that the higher percentage implies more positive attitude.

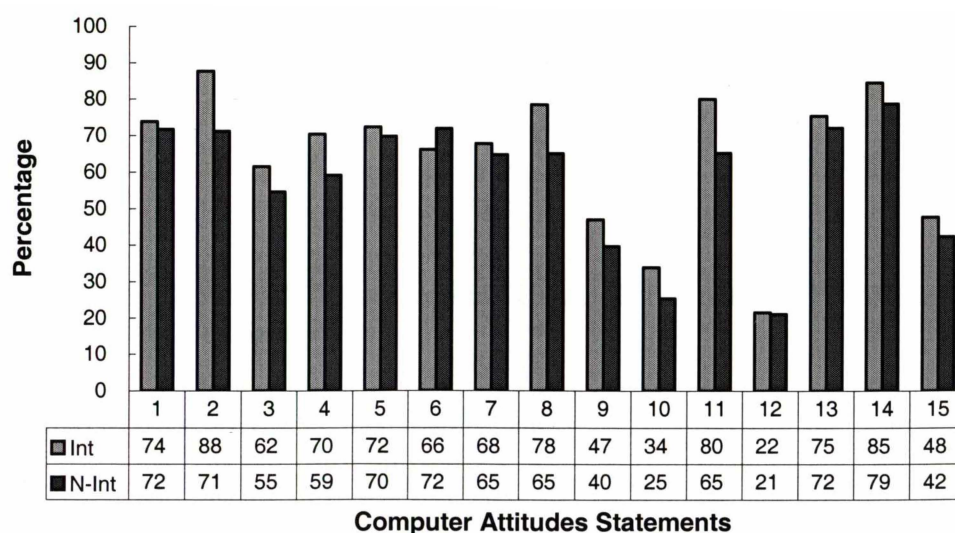
Despite positive attitudes towards the usefulness of using information technology in teaching and learning, it seems that the participants see some problems and felt anxious about actually using computers in the classroom. Such view was reported by the lowest rating for item 12, with only around a fifth of the respondents thinking that the use of computers would not increase classroom management problem. In other words nearly 80% of the student teachers thought it would cause classroom management problems. Similar interpretation of the negative items in Table 4.5 also shows that the second lowest rating was for item 10 with only 34% of the respondents thinking that computer use would not bring an increase in teacher's workload (66% thought the contrary). There were two other items showing that the student-teachers were not too anxious about using information technology in teaching and learning: only about half of the participants (53%) believed that the use of computers would slow down and complicate the teaching process as reflected in item 9 and about one third (32%) were concerned about the impact of computer use in the classroom on job security as shown in item 7.

Interestingly, in spite of some reservations and negative feelings about the use of computers in the classroom, the student-teachers' considered that the use of computers in teaching was inevitable as seen in their response to 14, with about 85% responding in the affirmative. This is consistent with response to items 8, 11 and 13 (78%, 80% and 75% respectively) the high positive response suggesting an overall acceptance of using computers in teaching. However, about half of the participants saw computers as difficult to learn (see item 15).

A comparison of the student-teachers' attitudes to the use of computers in the classroom for the two cohorts is shown in Figure 4.1. These data suggest that overall the attitude towards using computers in teaching was similar for the intervention and non-intervention groups. Items 10 and 12 are the most negative for both groups (25% and 21% for the non-intervention group as compared with 34% and 22% for the intervention group respectively). Classroom management problems and high workload also were the major concerns for the student-teachers in the non-intervention group. The usefulness of using computers in learning and teaching in this group was also positive, as was seen for the non-intervention group.

Figure 4.1

Comparison of Student Teachers' Attitude Towards Using Computers in Teaching for the Intervention Group (n=65) and Non-Intervention Group (n=68) Before Taking the DDIM Module



Key: Int = Intervention group, N-Int = Non Intervention group

Examination of the data in Figure 4.1 shows that the student attitude towards using computers in teaching is more positive for the intervention group than for the non-intervention group for all items (an average of 65% cf. 58%). Statistically significant differences³ were observed for four items as shown in Table 4.7.

Table 4.7

Differences in Student Attitude Towards Using Computers in Teaching for the Intervention Group (n=65) and Non-Intervention Group (n=68) Before the DDIM Module

Perceived Attitude Statement toward using information technology in Teaching¹	Int % (n)	N-Int % (n)	
2. Using a computer in a classroom will make a subject more interesting.	88 (57)	71 (48)	*
8. A computer is not suited for teaching purposes. #	78 (51)	65 (44)	*
10. The introduction of computers in primary education is just an increase in the teachers' workload. #	34 (22)	25 (17)	*
11. Students should be kept away from computers. #	80 (52)	65 (44)	*

Key: Int = Intervention group, N-Int = Non Intervention group

The responses of these negative statements were recoded such that the higher percentage implies more positive attitudes.

* Statistically Significant ($p < .05$, Mann-Whitney U Test)

Although the student-teachers' perceptions of their competency in using computer applications for teaching were low for the intervention group, it seems that they have generally positive attitudes suggesting that the DDIM module at the early phase of the study will be welcomed.

The following section explores the intervention group of student-teachers perceptions of the use of information technology in actual classroom in more detail.

4.5 Student Teachers' Views about Using Information Technology in Classroom Teaching

In the first session of the DDIM module student-teachers from the intervention group were given an exercise in the form of an essay (see Appendix B). The essay writing exercise served two purposes: a learning activity designed for the first session (a discussion session followed the writing), and, as a source of

³ Mann-Whitney U Test ($p < .05$)

qualitative data. In the essay, student-teachers were required to express their opinions about the application of instructional media - including information technology - in classroom learning and teaching. This resulted in 16 essays which were commented on by the researcher and subsequently returned to the participants with the following guiding/clarifying questions.

1. What are instructional media?
2. What is information technology?
3. What are their roles in classroom teaching?
4. What do you know about them?
5. What do you expect to learn in this module?
6. What do you expect in using information technology in your class teaching?
7. Are there any other things you would like to mention?

The essay writing exercise was repeated during the last session of the DDIM module and the essays examined in detail. Six major themes evolved: (A) Role and meaning of information technology; (B) Functions and capabilities of information technology; (C) Knowledge and critics on information technology development; (D) Teachers' teaching with information technology; (E) Students' learning with information technology; and, (F) Teachers' information technology development. The last category was only identified in the second cohort of essays and is discussed in Chapter Five. In the data reduction process, 42 consistent sentences related to the above themes were identified. The percentages occurrences of these sentences for each of the five categories are displayed in the Table 4.8.

Table 4.8

Clusters of Student Teachers' Views (n=42) on Information Technology for the Intervention Group Before Taking the DDIM Module

Categories of Views on IT	Occurrence	
	(n)	(%)
A. Role/Meaning of information technology	11	26
B. Information technology functions/capabilities	17	40
C. Knowledge/Critics on information technology development	2	5
D. Teacher teaching with information technology	10	24
E. Student learning with information technology	2	5

Table 4.8 shows that majority of the sentences (40%) related to the participants' expectations of the function and capabilities of information technology in classroom teaching. These sentences suggest that the student-teachers see information technology as a vehicle for enhancing pupil interest and motivation when compared with more traditional media. Samples of specific quotes arising from this exercise are provided below.

Information technology can arouse interest more than traditional resources. (Amy)⁴

Information technology can attract kids' attention and motivate them in learning and inquiring. (Betty)

The student-teachers also pointed out that they thought information technology would help them to produce teaching materials for their lessons as seen in the following quotations.

Information technology can help produce graphic for class activities. (Sally)

Information technology can produce more interesting and colourful teaching resources. (Jane)

Two comments in the 'functions and capabilities' category related to perceived advantages of information technology in helping students develop self-learning capability in their primary school charges in the classroom.

Information technology can help me teach as it can arouse students' interest and develop students' self-learning capability. (Flora)

Information technology can help students to develop self-learning capability. (Mary)

For theme A, that is, 'role and meaning of information technology' in school teaching, the comments showed that the participants saw information technology to consist of a variety of technologies including computers and traditional

⁴ The name inside the brackets is a pseudonym for the student-teacher participated in the first phase of this study.

technologies. The main role of information technology, according to the participants, is to assist teachers to teach, as seen in the following quotes:

Information technology is another teaching aid just like other traditional resources to help teacher to teach. (Ellen)

Information technology means the use of different technology to access or retrieve information or knowledge. (Doris)

Information technology is one of the instructional media and it will not replace the traditional resources. (Ivy)

Information technology means using computer as one of the instructional media in teaching. (Tracy)

The concept of information technology as a teaching aid of the teachers was dominant in the comments of the student-teachers in the intervention group. This concept was also evident in theme D 'teachers' teaching with information technology'. Most of the responses for this category were written from the perspectives of the teachers' own teaching, as seen in the following quotes:

Information technology can help me to teach more easily with the use of computer presentation. (Nancy)

Information technology can help me collect and search for necessary information that I need. (Ellen)

Information technology can help me keep students' records, to do assessment and to do demonstration in class. (Luke)

Information technology can help me prepare the teaching resources and to collect the necessary information for a topic. (Mary)

Information technology is one of the instructional media that helps me to deliver knowledge to the students in an effective way. (Rita)

Via using Internet, I can provide more new resources to my students on a particular topic. I can also develop my own instructional programme to help me teach in the class. (Oliver)

The data reported in Table 4.8 also show that few of the comments occurred for the other two categories. However, these comments were insightful and critiqued the use of information technology, taking into account the use of information

technology from the pupils' perspective. The following quotations illustrate the participants' views:

Information technology may be good for some students. It may also be a burden to some students and teachers. It may not bring about quality teaching. (Grace)

Information technology does not mean quality teaching; it depends on how the teacher uses it. (Oliver)

Information technology can help student to retrieve and know more about different knowledge and facts in different countries in the world. (Luke)

With the guidance of the teachers, students can access to relevant information of a teaching topic that may help to widen their horizon, to arouse their interests in things surrounding them. In this way, the quality of education may rise as a result. (Flora)

The findings reported here thus suggest that the teachers in the intervention group possessed positive attitudes towards using information technology in teaching and believe that information technology may help them teach better: this is particularly evident in the fact that categories A and B in Table 4.8 contained nearly 70% of all the sentences at this early phase of the study. These findings are also in agreement with those described in Section 4.4 about student-teachers' attitudes towards using information technology in teaching.

In spite of the fairly positive outcomes from this questionnaire and essay writing exercise, it is worthwhile to note that the student-teachers' thinking at this stage of the study was centred on the teacher and the teacher's use of information technology in the classroom. The participants were concerned mainly about how information technology could make their job easier and, for example, focused on the use of information technology in easing administrative work or in the collection and delivery of information (i.e., content for the subject). This kind of thinking was also reflected in the responses in categories A and D.

The last section of this chapter reports on the pre-entry level of the six educational technology competency areas. These competency areas represented the major content of the DDIM module that the student-teachers were required to master. The data presented here thus provides the 'base-line' on which the influence of the

intervention on the mastery of the competency areas among the student-teachers at the later stage of this study.

4.6 Participant Self-evaluation of the Six Areas of Educational Technology Competency for Teachers

As described in Chapter 3, the main goal of the DDIM module was to help student-teachers explore and develop various kinds of instructional media which could be integrated into the classrooms to enhance learning and teaching. The media ranged from traditional to advanced technologies; and included still visual material, video, interactive multimedia, and the latest information and communication technologies. Although the focus of the DDIM module was on more modern technologies, mastery of the use of different traditional media also formed part of the module. It is expected that by the completion of the module, a beginning teacher should be able to use their professional judgement to adopt and use appropriate instructional tools to facilitate effective learning. A teacher also is required to develop appropriate learning materials in different formats for specific instructional purposes. In the DDIM module, the researcher introduced six educational competency areas as the major contents. The rationales and the development of these competency areas are those discussed in Chapter 3 (p. 81).

The state of mastery of the six educational technology competency areas was assessed by a self-evaluation activity. The self-evaluation checklist (see Appendix C2) was administered in the first session of the DDIM module after the completion of *Computing Background Questionnaire* and essay writing activities. The completed checklists, together with the short essays, formed the content for later discussion in the first session of the DDIM module. Completed evaluation checklists were sent back to the student-teachers later so that they could use these materials as records in their portfolios.

There were 49 items in the self-evaluation checklist arranged into six areas A through F. Area D was sub-divided into two sub-categories D1 and D2, the operation of equipment, and the use of computer applications respectively. The

student-teachers were required to indicate which items they believed they had mastered. A summary of the findings is shown in Table 4.9.

Table 4.9

Intervention Group Student Teachers' Self-evaluation of Technology Competency Areas Before Taking the DDIM Course (n=65)

Educational Technology Competency Areas	Have Mastered % (n)
A. Development and Characteristics of Instructional Media	11 (7)
B. Communication, Human Information Processing	10 (7)
C. Design and Production Techniques	25 (16)
D.1 Operation of Traditional Equipment	36 (23)
D.2 Operation of Computer Equipment and Applications	39 (26)
E. Selection and Utilization Principles	4 (3)
F. Evaluation of Instructional Media	9 (6)

Table 4.9 shows that 36% and 39% of the participants considered that they had mastered the operation of traditional and computer equipment respectively (i.e., D1 & D2). The data indicate that about one third of the student-teachers in the intervention group felt that they had already mastered some of technological skills for the operation of traditional equipment and in the use of computer equipment and software applications (i.e., D1 & D2), and about a quarter reported mastery of design and production skills in some instructional media (i.e., C). Four other areas required more conceptual understanding of theories and principles of using instructional media in teaching; for these areas, self-reported mastery was low. The lowest evaluation was found in area E (4%), indicating that the student-teachers felt they lacked the knowledge of the application of instructional media in the actual learning process.

The results of the pre-entry evaluation of the knowledge and skills in educational technology provided useful information for the design of the subsequent learning activities in the intervention process. There was a clear demand for conceptual understanding of theories and principles of using educational technologies in actual teaching contexts.

4.7 Chapter Summary

This chapter began with a description of the student-teachers' prior experience in the use of teaching with information technology before they undertook the compulsory module *Designing and Developing Instructional Media* (DDIM). The intervention group was dominated by female non-computer students and was weaker in computing knowledge and skills than the non-intervention group, but had a more positive attitude towards using computers in teaching. Although the student-teachers in the intervention group did possess different degree of computing experiences, their knowledge and skills of applying information technology into actual teaching situation were still limited. Next was a description of the student-teachers beliefs about their mastery of educational technologies and few participants felt confident in their mastery of knowledge and skills in the selection and utilisation of instructional media for teaching. Concerns raised included worries about increased workload and classroom management problems. The student-teachers attitudes to the use of information technology in the classroom was described next, and there was wide acceptance of the importance of using computers in teaching but considerable lack of confidence in learning computing despite positive attitudes towards using computers in teaching. This was followed by an examination of the student-teachers' thoughts about using information technology which showed that this was highly teacher-focused and consideration of student-centred learning with information technology was rare.

The above findings provided the essential prior knowledge of the student teacher participants in this study. These data were crucial for the development of learning activities and resources in the intervention phase of the study. Based on a constructivist framework, the intervention sought to help student-teachers enhance the technological skills in both computing and other instructional media. The intervention also sought to maintain the positive attitudes toward using information technology in teaching. Most importantly attempted to help the student-teachers develop a better understanding about the integration of

information technology in actual learning contexts and real-life teaching situations and to foster a student-centred learning environment in their classrooms. The next chapter describes the learning experiences among the student-teachers in the first phase of the study in more detail.

Chapter 5

Learning Experiences in the Designing and Developing Instructional Media Module

5.1 Introduction

The previous chapter described the background in the use of computers for the student-teachers in the intervention group for this study. This chapter goes on to provide a description of the impact of the intervention in the *Designing and Developing Instructional Media* (DDIM) module for the primary teacher education programme at the tertiary institution involved in the study.

The research findings reported here are based on data collected by both qualitative and quantitative methods. The qualitative data came from two interviews, one after the completion of the DDIM module and the second after the student's teaching practice. Other qualitative data include short essays for 16 student-teachers from the intervention group. Quantitative data about participants' learning experiences in the DDIM module were gathered through a questionnaire survey and self-evaluation exercise similar to that used at the beginning of the DDIM module; namely, the *Post Computer Background Questionnaire* (Appendix C1) and the *Educational Technology Competency Self-evaluation Questionnaire* (Appendix C2).

The *Post Computer Background Questionnaire* and the *Educational Technology Competency Self-evaluation Questionnaire* were administered in the last session of the DDIM module. Five groups of student-teachers - including the intervention group - completed the two questionnaires and checklists. Of the original student-teachers in the intervention group, 63 completed questionnaires and self-evaluation checklists. In addition, 99 completed forms were obtained from the non-intervention group. The short essay writing exercises were conducted after

the questionnaire and self-evaluation tasks were completed. A total of 16 short essays were collected; the same as collected in the first session of the DDIM module (Section 4.5, p. 110).

In the administration of the *Post Computer Background Questionnaire* there was a small change in response rates (3% less) but examination of the demographic data suggests that the student profile for the intervention group at this administration was much the same. The response rate for the *Post Computer Background Questionnaire* for the non-intervention group was lower and this meant a change to the apparent demographics for this cohort. For example, there were more students who chose computer elective in the second non-intervention group (12% as compared to 3% in the first non-intervention group). However, the major differences in background experiences with computers between the intervention and non-intervention groups remained unchanged from the pre-questionnaire survey (Chapter 4, Table 4.1, p. 100).

Under the constructivist-based framework, the researcher sought to establish scaffolding for the intervention; the resources and support formed part of this scaffolding. These resources included a self-learning booklet of basic skills in information technology, a booklet containing information technology case studies, a website and three CD-ROMs providing guidance for media production. The student-teachers were required to attend whole-class lectures, workshops, and tutorials. They also were expected to work both independently and collaboratively in individual and group projects provided in the portfolio guide. Continuous reflection was expected and learner reflection was assisted by the portfolio (see Section 3.6.1, p.85). The learning experiences in this intervention are reported under two main sections: the influences arising from the intervention, and participants' responses to different features of the intervention.

5.2 Influences on Student-teachers' Development of the Use of Information Technology after the Intervention

This section describes how the intervention influenced the professional development in teaching with information technology among the student-teachers

that participated in the intervention process. The findings are presented in three sections: knowledge and skills of teaching with information technology; student attitude towards teaching with information technology; and, perceptions of teaching with information technology.

5.2.1 *Knowledge and Skills of Teaching with Information Technology*

The influences of the intervention on the student teachers' knowledge and skills of teaching with information technology are discussed here. Quantitative data from the post questionnaire survey and the self-evaluation of the teacher technology competency for the DDIM module were used to develop an understanding of the student teachers' knowledge and skills of teaching with information technology. These are discussed under three headings: (1) Current use of common computer applications; (2) Perceived mastery of information technology competency in teaching; and, (3) Self-evaluation of the technology competencies for teachers.

Current Use of Common Computer Applications

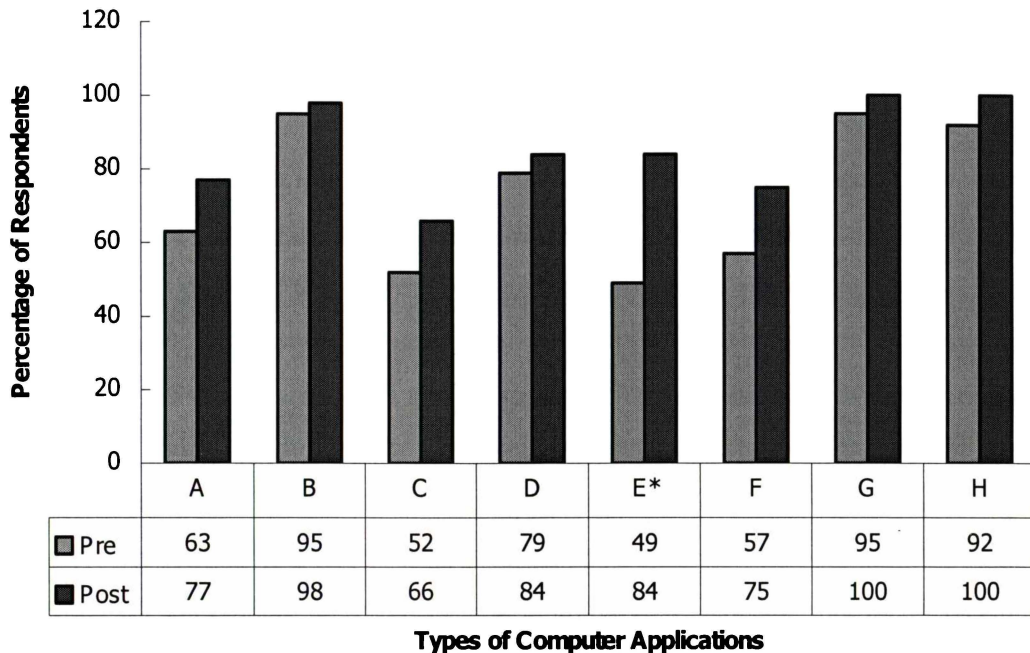
It was shown in Chapter 4 (Section 4.2, p. 100) that the student-teachers from the intervention group possessed some experience with computers at the beginning of the DDIM module, especially for three common computer applications: word processing, e-mail and Internet. At the end of the DDIM module, almost all of the participants had gained some experience in the use of common computer applications (Figure 5.1). The participants also gained experience in five other computer applications to varying degrees; ranging from 5% (79% to 84%) for drawing and graphics programs, to 35% (49% to 84%) for specialty programs like Microsoft PowerPoint. The average increase was 17% increase for the five applications. These data suggest that the DDIM module provided the student-teachers with at least some experience in a number of computer applications. A statistically significant change was observed¹ in the use of Power Point with 84% of the student-teachers reporting the use of this program compared with 49% at

¹ Wilcoxon Signed Ranks Test ($p < .05$)

the beginning of the DDIM module.

Figure 5.1

Intervention Group Student Teachers' Experience in the Use of Common Computer Applications Before (n=65) and After (n=63) Taking the DDIM Module



- A. Spreadsheets B. Word Processing C. Data Base
 D. Drawing/Graphics E. PowerPoint F. Reference/Encyclopedia
 G. E-mail H. Internet

*Statistically Significant ($p < .05$, Wilcoxon Signed Ranks Test)

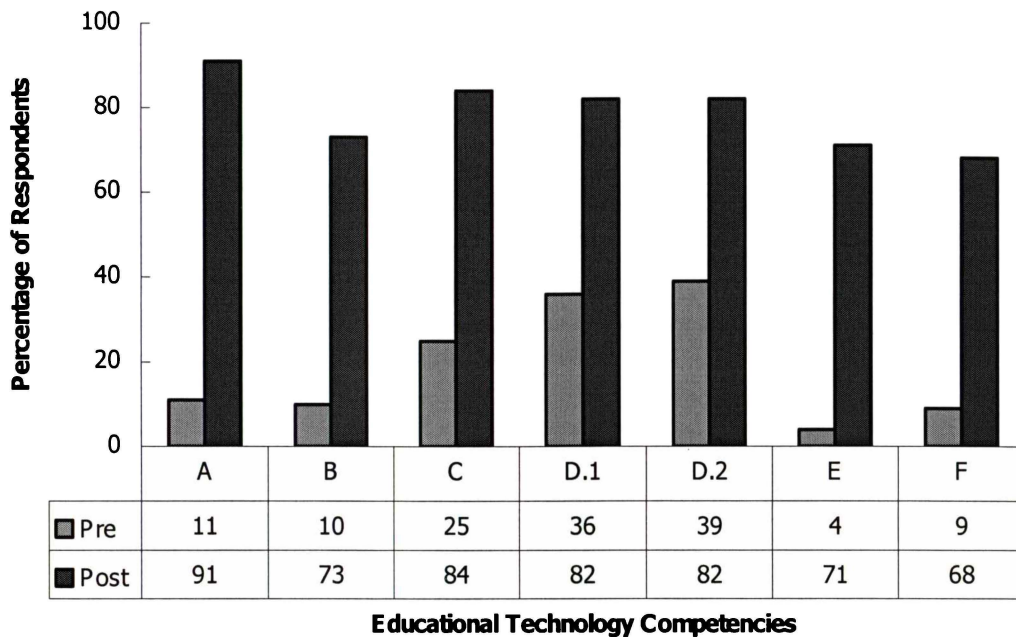
The data in Figure 5.1 show that the greatest increase in experience occurred for the use of Microsoft PowerPoint. It is worthwhile to note at this point that the participants may also have gained experience in the use of computer applications (including PowerPoint) from sources other than the DDIM module. Hence, it is not appropriate to suggest that the increased experience came solely from the DDIM module. They also may have learned computer applications in informal ways - such as being self-taught or learning from peers. Nonetheless, it is reasonable to assume that the DDIM module had some influence, especially in the use of PowerPoint. In which case the large increase in experiences reported in Figure 5.1, are not unexpected. However, it seems likely the tasks requirements (see the portfolio guide in Appendix D) for the DDIM would play some part in initiating the student-teachers' desire to learn about the applications.

Perceived Mastery of the Educational Technology Competencies

As described in Chapter 3 (Section 3.6.1, p. 86), the overall goal of the DDIM module is to help student-teachers explore and develop experience in the use of a variety of instructional media, and to integrate these tools into classroom teaching. The findings from the self-evaluation of educational technology competencies can thus provide useful information about the influence of the learning experiences for participants' perceptions of their abilities as a result of the intervention. This second self-evaluation activity for the educational technology competencies was performed in the last session of the DDIM module. As described in Chapter 3 (Section 3.4.5, p. 80), there were 49 competencies items in the evaluation checklist. These items were grouped into six competency areas, and the aim of the first exercise was to allow the student-teachers to see what they were going to learn in the DDIM module. The first self-evaluation activity showed that the student teachers were not confident about their mastery for all six competency areas (19% reported being confident). The student-teachers felt particularly weak in the area of conceptual knowledge about using instructional media including information technology in teaching at the beginning of the DDIM study. The average percentages of each of the six competency categories in the first and second self-evaluation are shown in Figure 5.2. It is immediately apparent from these data that the student teachers gained significantly in confidence across the whole spectrum of educational technology competencies (average 80% reported mastery). For five of the six competency areas more than seventy percent of the participants reported mastery, and the sixth was sixty-eight percent. Notable rises of mean percentages were also observed in the categories concerning theories and principles such as the selection and utilization principles of instructional media (an increase of 67.0% from 4% to 71%), communication theories (an increase of 63% from 10% to 73%), and the evaluation of instructional media (an increase of 59% from 9% to 68%). In the categories more concerned with skill-based knowledge, prominent growth was also seen, for example, in design and production skills (an increase of 59% from 25% to 84%), the operation skills of traditional equipment (an increase of 46% from 36% to 82%) and the use of computer facilities and software (an increase of 43% from 39% to 82%).

Figure 5.2

Intervention Group Student Teachers' Perceptions of Mastery for Educational Technology Competencies Before (n=65) and After (n=63) Taking the DDIM Module



A. Development and Characteristics of Instructional Media
 C. Design and Production Techniques
 D.2 Operation of Computer Equipment and Application Software
 F. Evaluation of Instructional Media

B. Communication, Human Information Processing
 D.1 Operation of Traditional Equipment
 E. Selection and Utilization Principles

These findings suggest that apart from the growth of information technology knowledge as reported above, the student-teachers in the intervention group consider they have gained improved knowledge and skills in the application of various instructional media in teaching. The average reported mastery in the post-evaluation for the six competency areas was 79%, much higher than reported in the first self-evaluation (59%). Given that the pre-entry perceptions of mastery for the respective areas was low at the beginning of the DDIM module, the results in the self-evaluation show a pleasing, positive effect, in the above learning areas as a result of the intervention.

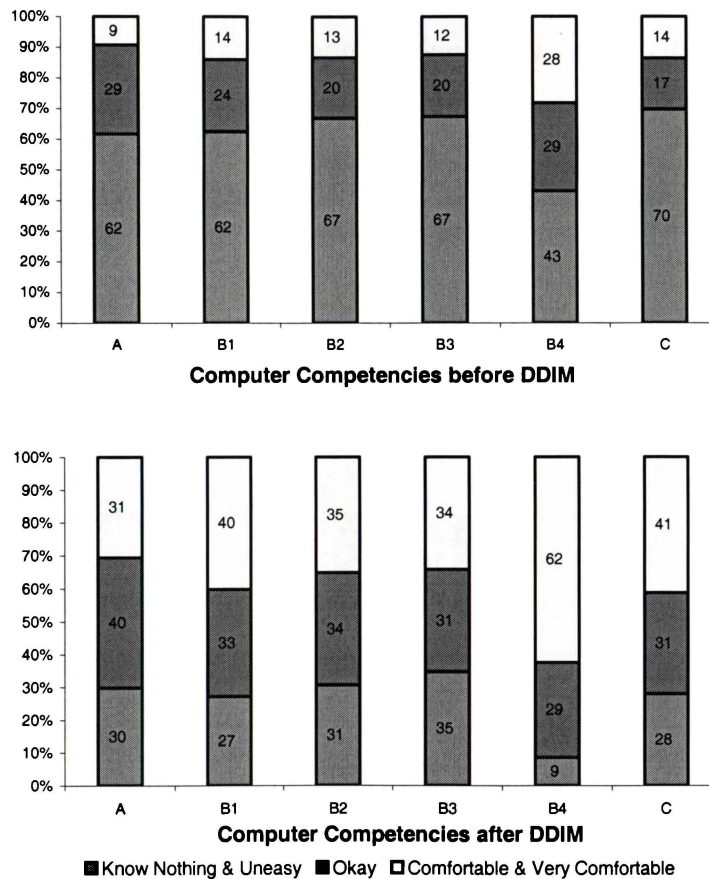
Perceived Mastery of Information Technology Competency in Teaching

As described in Chapter 4 (Section 4.3, p. 103) information technology competencies in teaching were grouped into three categories: (A) background

knowledge; (B) use of software applications in teaching; and, (C) basic hardware operation skills, with four sub-categories identified for category B. The student teachers perceived mastery of the knowledge and skills reported here are represented by a mean percentage for each category or sub-category. The original five data groups were reduced into three categories; namely, ‘know nothing & uneasy’, ‘okay’, and ‘comfortable & very comfortable’. A summary of the findings is shown in Figure 5.3 and Figure 5.4.

Figure 5.3

Intervention Group Student Teachers’ Perceptions of Mastery of Computer Competencies Before (n=65) and After (n=63) Taking the DDIM Module



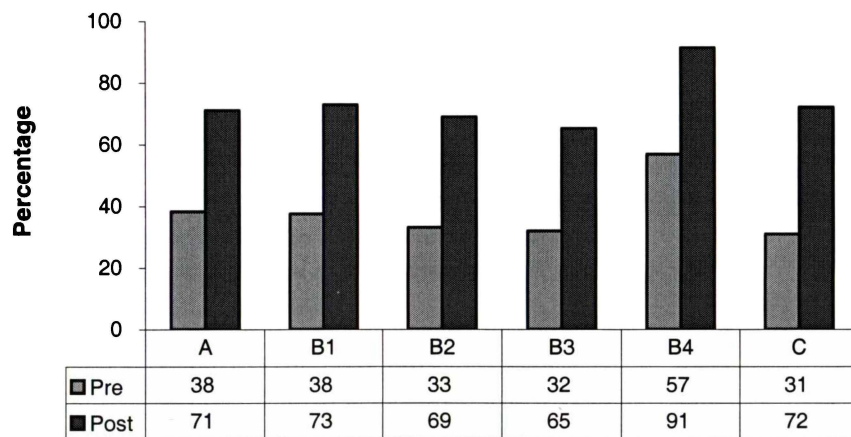
- A. Computing Background knowledge
- B1. For organising learning activities
- B2. For producing teaching materials
- B3. For facilitating daily school administrative work
- B4. For resources and information exchange
- C. Operation skills

Figure 5.3 shows that there was a shift in the responses from ‘know nothing’ and ‘uneasy’ for six of the categories and sub-categories to ‘okay’, and ‘comfortable and very comfortable’. Figure 5.4 indicates that the highest increase is seen for category C. About 41% more (from 31% to 72%) of the student-teachers reported

mastery for different operation skills. The second highest increase was sub-category B2 for which an increase of about 36% (from 33% to 69%) was seen and 35% for planning learning activities in sub-category B1 (from 38% to 73%). The least improvement was seen in category A, and even this showed an increase of 33% (from 38% to 71%) with the student-teachers reporting better mastery for background knowledge in the use of computing in teaching. Lastly, in category B3, there was an increase of about 33% (from 32% to 65%) of student-teachers who were able to apply computer applications in daily administrative work. The highest reported mastery was for sub-category B4 (although the rise of mean percentage was not the highest at 34%) and about 91% of the student-teachers claimed that they could use computer applications for collecting teaching resources and for exchanging information with others after the DDIM module.

Figure 5.4

Intervention Group Student Teachers Who Felt Okay/Comfortable/Very Comfortable with the Categories of Computer Knowledge and Skills Before (n=65) and After (n=63) Taking the DDIM Module



Computer Competencies

- A. Computing Background knowledge
 B3. For facilitating daily school administrative work
 B1. For organising learning activities
 B4. For resources and information exchange
 B2. For producing teaching materials
 C. Operation skills

The changes in student self-reported mastery after the DDIM module for the intervention students were statistically significant² for 22 items as shown in Table 5.1.

² Wilcoxon Signed Ranks Test (p<.05)

The highest increase of 49% from 31% to 80% in self-reported mastery was found for category B1: 'For organizing learning activities with presentation software (e.g. PowerPoint)' and the lowest increase of 29% from 48% to 77% also was for B1: 'For organizing learning activities with E-mail'. The average increase of the overall items with significant changes was about 40% (from 31% to 71%).

Table 5.1

Changes in the Percentage of Student Teachers Who Felt Okay /Comfortable /Very Comfortable with the Items about Computer Knowledge and Skills Before (n=65) and After (n=63) Taking the DDIM Module of the Intervention Group

Computer Competencies in Teaching	Pre % (n)	Post % (n)	
<i>A Background Knowledge</i>			
I can explain common computer terminology.	24 (15)	59 (37)	*
I can evaluate the effectiveness of a computer instructional program.	22 (14)	54 (34)	*
<i>B.1 For organising learning activities with:</i>			
Spreadsheet software (e.g. MS Excel).	34 (22)	70 (44)	*
Graphic software (e.g. Paint Shop Pro).	25 (16)	67 (42)	*
Presentation software (e.g. MS PowerPoint).	31 (20)	80 (50)	*
E-mail.	48 (31)	77 (49)	*
Internet.	38 (24)	81 (51)	*
<i>B.2 For Producing Teaching Materials with:</i>			
Spreadsheet software (e.g. MS Excel).	38 (25)	78 (49)	*
Graphic software (e.g. Paint Shop Pro).	29 (19)	67 (42)	*
Presentation software (e.g. MS PowerPoint).	30 (19)	78 (49)	*
Authoring system (e.g. Authorware) to develop a computer-assisted learning package for a particular learning situation.	14 (9)	52 (33)	*
<i>B.3 For facilitating daily school administration work with:</i>			
Spreadsheet software (e.g. MS Excel).	35 (23)	70 (44)	*
Graphic software (e.g. Paint Shop Pro).	22 (14)	59 (37)	*
Presentation software (e.g. MS PowerPoint).	22 (14)	69 (44)	*
<i>B.4 For resources and information exchange</i>			
Use the Internet to access useful information for teaching.	57 (37)	96 (61)	*
Use the Internet for academic development.	48 (31)	85 (54)	*
<i>C Operation Skills</i>			
Operate a multi-media computer system (including CD-ROM and sound system).	43 (28)	83 (53)	*
Control a scanner with computer software.	28 (18)	74 (47)	*
Operate an interactive video system.	20 (13)	69 (43)	*
Project computer images on a screen with a LCD panel/TV converter.	14 (9)	60 (38)	*
Project computer images on a screen with a computer video projector.	15 (10)	56 (35)	*
Store and retrieve files using a fixed/floppy disk.	51 (33)	82 (51)	*
Average Percentage:	31	71	

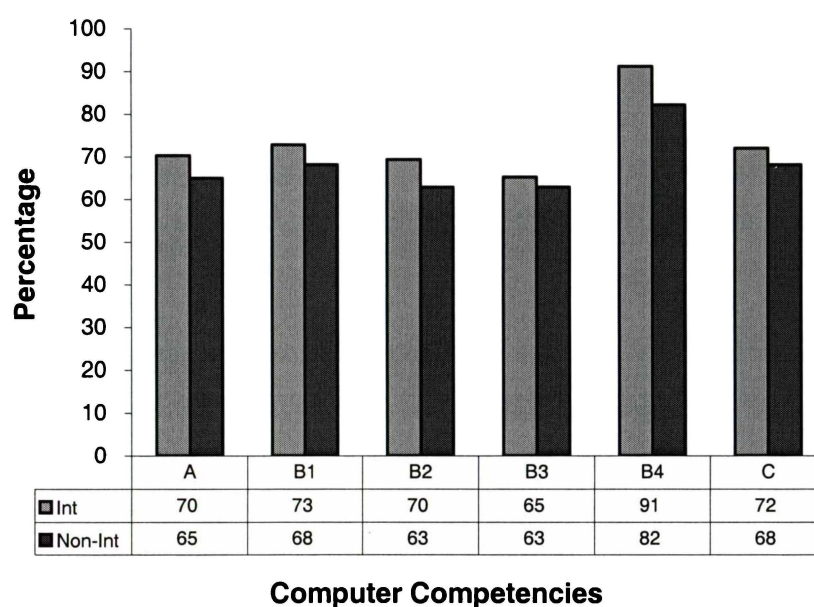
* Statistically significant change at $\alpha = 0.05$ (Wilcoxon Signed Ranks Test)

Differences Between Groups

The above findings show that at the end of the DDIM module, an acceptable level of self-reported mastery of the respective computer competency areas was reached in the intervention group. As shown in Figure 5.5, the highest mastery of 91% was found in sub-category B4. The lowest 65% was reported in B3. The average mastery of all six areas was 74% in the intervention group. This figure was better than that of 68% found in the non-intervention group.

Figure 5.5

Student Teachers Who Felt Okay/Comfortable/Very Comfortable with the Categories of Computer Knowledge and Skills between the Intervention (n=63) and Non-Intervention (n=99) Group After Taking the DDIM Module



- A. Computer Background knowledge
 B1. For organising learning activities
 B2. For producing teaching materials
 B3. For facilitating daily school administrative work
 B4. For resources and information exchange
 C. Operation skills

Figure 5.5 also shows better mastery level of all the six computer competencies areas in teaching in the intervention group. The highest difference was found in sub-category B4. There was nine percent more student-teachers in the intervention group reported the mastery of computer applications for collecting teaching resources and exchanging information. The lowest difference was shown in sub-category B3. Only about two percent more student-teachers in the intervention group claimed the mastery of using computer applications for

administrative work. Statically significant differences³ were also observed for seven items as shown in Table 5.2.

Table 5.2

Differences in the Percentage of Student Teachers Who Felt Okay /Comfortable /Very Comfortable with the Items about Computer Knowledge and Skills Between the Intervention (n=63) and Non-intervention Group (n=99) After Taking the DDIM Module

Computer Competencies in Teaching	Int % (n)	N-Int % (n)	
A Background Knowledge			
Know of major characteristics, advantages & disadvantages of using computers in teaching.	83 (52)	73 (72)	*
Understand the role of Information Technology.	89 (56)	61 (61)	*
B.1 For organising learning activities with:			
E-mail.	77 (49)	74 (73)	*
B.2 For producing teaching materials with:			
Word processing software (e.g. MS Word).	93 (58)	77 (76)	*
B.4 For resources and information exchange			
Use E-mail to exchange ideas with other teachers.	93 (58)	84 (83)	*
Use the Internet to access useful information for teaching.	96 (61)	86 (85)	*
Use the Internet for academic development.	85 (54)	77 (76)	*
Average Percentage:	88	76	

* Statistically Significant Difference at $\alpha = 0.05$ (Mann-Whitney U Test)

Table 5.2 shows that the highest difference of 28% from 89% to 61% between the intervention and non-intervention group was found for category A 'understand the role of information technology' and the lowest difference of 3% (from 77% to 74%) was reported for category B1, 'for organising learning activities with e-mail'. The average difference between the intervention and non-intervention group for the seven items was around 12% (88% cf. 76%). Such differences may have arisen as a result of the different approaches to learning between these two groups. The intervention group placed greater stress on the interaction between the student-teachers and relevant resources about information technology in education whereas the non-intervention group focused more on transmission of knowledge and skills. Furthermore, the intervention group was provided with additional information including case studies of how to apply information technology in different learning situations and thus gained also specific tasks in which they gained experience the use of information technology skills. The majority of the student-teachers of the intervention group stated that they

³ Mann-Whitney U Test ($p < .05$)

considered the case studies helped them broaden their knowledge about the use of information technology in education, pointing out that the tasks led them to see more practical use of their computing skills.

The findings summarised here provide an overall picture of the learning outcomes with respect to student teachers perceptions of their mastery of information technology competencies in teaching. The participants' perceptions of their mastery for all the three categories (namely: background knowledge, use of software in teaching, and hardware operation) was high with an average of about 74% reporting that they felt confident in these categories. The participants also reported significant changes for all categories and the participants from the intervention group felt more confident than the non-intervention group despite more of the latter students being science and computer electives at the beginning of the intervention and DDIM module. Significant differences were also found between the intervention and non-intervention group for other categories with the intervention group claiming better understanding about the role of information technology in teaching and the knowledge of using computers in teaching. This is particularly impressive given their poor background to begin with (see, Chapter 4, Section 4.1, p. 99).

Hence the goal of the intervention for the present study, for two important components, namely, to achieve a 'better understanding of knowledge', and 'better mastery of skills' for information technology in teaching seemed to have been achieved. However, the influences on student-teachers' attitudes towards using information technology in teaching and on the concept of 'paradigm shift' (i.e., towards a more student-centred learning environment) were not uncovered here; these issues are reported on the findings of other research activities, reported below and I describe the student teachers' attitudes towards using information technology in teaching after the intervention in the DDIM module.

5.2.2 *Student Attitude Towards Teaching with Information Technology*

Chapter 4 (Section 4.4, p. 107) revealed that the student-teachers from the intervention group possessed generally positive attitudes towards using

information technology in teaching. Four major themes were reported: usefulness, anxiety, acceptance and confidence in using information technology in teaching. This section describes the changes for these four themes after the intervention of the DDIM module.

Changes Within Group

Table 5.3 shows the percentage of the student-teachers who agreed or strongly agreed with the items about the perceived attitudes towards using computers in teaching before and after taking the DDIM module. The average overall percentage of the 15 items as reported in Table 5.3 was 63% virtually identical to that reported in Chapter 4 before the DDIM module. The highest positive item after the DDIM module was 77% for item one 'Computers will improve the quality of student's education'. The least positive item was 21% for item 12 'using computers in classroom teaching will increase the classroom management problem' which is similar to that before the DDIM module. The data show a tendency that the overall attitudes concerning about the usefulness of using information technology in teaching remained positive as seen in the participants' responses to items one through six given that the lowest reported percentage was 61% in item three within these six items. Low reported percentage in item 12 also shows a trend that the anxiety about the classroom management of using information technology in teaching remained high among these student-teachers after the DDIM module. However, they seemed less anxious about losing a job or facing a complicated process in teaching with information technology (item 7 and 9). Congruent to the findings about the usefulness of using information technology, there was also a drop in the acceptance of using information technology in teaching. This appearance in the decrease in acceptance was reflected in the drop of percentages in item 8, 11, 13 and 14 (1%, 3%, 3% and 11% respectively). However, despite such a drop in percentages, the level of acceptance remained high given the lowest reported percentage was 72% in item 13 and there were still about an average of 75% of the student-teachers showing positive attitude with these four items. There was also a tendency of increased confidence in learning computer. A rise of 8% was found in item 15. More student-teachers in the intervention group believed that computer were not

Table 5.3

Intervention Group Student Teachers Attitudes Towards Using Computers in Teaching Before (n=65) and After (n=63) Taking the DDIM Module

Perceived attitude toward using information technology in Teaching	Pre % (n)	Post % (n)	Change %
1. Computers will improve the quality of student's education.	74 (48)	77 (49)	+3
2. Using a computer in a classroom will make a subject more interesting.	88(57)	68 (43)	-20*
3. Using a computer in teaching can improve students' achievement.	62 (40)	61 (39)	-1
4. Students will be more attentive when computers are used in class.	70 (46)	63 (40)	-7
5. Computers enhance students' self-studies and independent work.	72 (47)	72 (45)	0
6. Computers enhance students' creativity.	66 (43)	72 (45)	+6
7. Computers will <u>take away</u> the job of a teacher.#	68 (44)	72 (45)	+4
8. A computer is <u>not</u> suited for teaching purposes. #	78 (51)	77(48)	-1
9. Computers <u>slow down</u> and <u>complicate</u> the teaching process. #	47(30)	54 (34)	+7
10. The introduction of computers in primary education is just an <u>increase</u> in the teachers' <u>workload</u> . #	34 (22)	33 (21)	-1
11. Students should be <u>kept away</u> from computers. #	80 (52)	77 (49)	-3
12. Using computers in classroom teaching will <u>increase</u> the classroom <u>management problem</u> . #	22 (14)	21 (13)	-1
13. Every primary school child should begin to use computers.	75 (49)	72 (45)	-3
14. I will use computers to help my teaching.	85 (55)	74(46)	-11
15. Computers are <u>difficult</u> to learn about. #	48 (31)	56 (35)	+8
Average	63	63	0

The responses of these negative items were recoded such that the higher percentage implies more positive attitude.

* Statistically Significant Change at $\alpha = 0.05$ (Wilcoxon Signed Ranks Test)

difficult to learn. Table 5.3 shows a drop in the rating for a number of items; for example, of 20% (from 88% to 68%) for item two 'using a computer in a classroom will make a subject more interesting' and the next greatest was 7% (from 70% to 63%) for item four 'students will be more attentive when computers are used in class' and lesser changes for other items. However, the only item for which the changes were statistically significant⁴ was item two, and this is rather surprising given, for example, the power of the Internet as a means of obtaining interesting instructional material.

⁴Wilcoxon Signed Ranks Test ($p < .05$)

Differences Between Groups

A comparison was made between the intervention group and non-intervention group and the findings from this analysis are reported in Table 5.4. The average percentage of all the 15 items in the intervention group was more positive than that of the non-intervention group (63% cf. 54%). On the whole, the intervention group seemed to have more positive attitudes towards using computers in teaching at the end of the intervention. There were also some differences for the two groups. About 14% more student-teachers (77% cf. 63%) in the intervention group believed that computers would improve the quality of education for their students as shown in item 1 and this item also received the highest ranking of all

Table 5.4

Comparison of Attitude Towards Using Computers in Teaching for the Intervention Group (n=63) and Non-Intervention (n=99) Group After Taking the DDIM Module

Attitude Statement toward using information technology in Teaching	Int % (n)	N-Int % (n)	Difference %	
1. Computers will improve the quality of student's education.	77 (49)	63 (62)	+14	*
2. Using a computer in a classroom will make a subject more interesting.	68 (43)	68 (67)	0	
3. Using a computer in teaching can improve students' achievement.	61 (39)	58 (57)	+3	
4. Students will be more attentive when computers are used in class.	63 (40)	65 (64)	-2	
5. Computers enhance students' self-studies and independent work.	72 (45)	70 (69)	+2	
6. Computers enhance students' creativity.	72 (45)	68 (67)	+4	
7. Computers will <u>take away</u> the job of a teacher. #	72 (45)	60 (59)	+12	
8. A computer is <u>not</u> suited for teaching purposes. #	77 (48)	61 (60)	+16	
9. Computers <u>slow down</u> and <u>complicate</u> the teaching process. #	54 (34)	25 (24)	+29	*
10. The introduction of computers in primary education is just an <u>increase</u> in the teachers' <u>workload</u> . #	33 (21)	24 (24)	+9	*
11. Students should be <u>kept away</u> from computers. #	77 (49)	58 (57)	+19	*
12. Using computers in classroom teaching will <u>increase</u> the classroom <u>management problem</u> . #	21 (13)	22 (22)	-1	
13. Every primary school child should begin to use computers.	72(45)	64 (63)	+8	
14. I will use computers to help my teaching.	74 (46)	65 (64)	+9	
15. Computers are <u>difficult</u> to learn about. #	56 (35)	36 (36)	+20	
Average	63	54	+9	

Key: Int = Intervention Group, N-Int = Non-Intervention Group

The responses of these negative items were recoded such that the higher percentage implies more positive attitude.

*Statistically significant ($\alpha = 0.05$, Mann-Whitney U Test)

items by the intervention group after the DDIM module (compared with sixth before the module). The issues related to items 10 'the introduction of computers in primary education is just an increase in the teachers' workload' and 12 'using computers in classroom teaching will increase the classroom management problems', and these remained the major areas of concern for the non-intervention group (24% & 22% respectively). These concerns also were of most concern for the intervention group with few differences seen between the groups (33% & 21% for items 10 & 12 respectively). It is also evident from the table that student-teachers from both groups retained concerns about classroom management and teacher workload when using computers in teaching. There were some large differences seen between the two groups. The largest difference was for item 9 'computers slow down and complicate the teaching process with a difference of nearly thirty percent between the intervention and non-intervention group (54% & 25% respectively). Overall it seems that the student teachers from the non-intervention group were more anxious about using computers than the intervention group (see particularly items 12, 10, & 9) and this proposition is supported by the difference between the two groups for item 15 'computers are difficult to learn' which suggest that the non-intervention group are less efficacious about computers than the intervention group (56% & 36% for the intervention and non-intervention group respectively).

The above data show the trend of the differences between the two groups of student-teachers after the intervention. Statistically significant differences⁵ for the intervention and non-intervention groups were seen for items 1, 9, 10 and 11 only. As discussed above, these differences suggest that the intervention group are less anxious and more accepting of the usefulness and use of computers in teaching compared with the non-intervention group.

⁵ Mann-Whitney U Test ($p < .05$)

Overview of Student Teachers' Attitudes to Computers

On the whole, the student-teachers' attitude towards using computers in teaching and learning when compared with that before the DDIM module did not change much for the intervention group as shown in Table 5.3. The student-teachers retained generally positive attitudes towards the usefulness, the acceptance, and confidence in using information technology in their teaching. Most of the student-teachers saw potential contribution that information technology could contribute to better learning. They accepted the use of information technology in their teaching and were confident of their own learning about information technology. There was also an indication of a change in their views about the usefulness or the contribution of information technology in education. The student-teachers tended to focus on the effect of using information technology on learning process and outcomes rather than that on the learning environment or atmosphere after completing the DDIM module. Such a change was reflected by the shift of percentages in item 2 and 4, to those in item 1 and 6 as shown in Table 5.4. Student-teachers in the intervention group no longer placed emphasis on whether information technology would bring about a more interesting lesson or more attentive class. They started to show more concern about the effect of using information technology on the learning outcomes such as improved performance, creativity, and so on. The shift of percentage in the views about the acceptance of using computer in teaching might be the result from the experiences and understanding of the implementation of a computer-supported learning environment for which greater effort was required than the student-teachers had expected at the beginning of the DDIM course. However, despite the above results, the student-teachers in the intervention group became less anxious and more confident about teaching with computers although anxiety about teacher workload and classroom management with the use of information technology in teaching remained relatively high. The findings also revealed a trend of more positive attitudes towards using information technology in teaching for the intervention group compared with the non-intervention group as reflected in Table 5.4.

The above discussion then points to an improved understanding about the usefulness of information technology in teaching as more concern had been

placed about the learning outcomes rather than the learning atmosphere among the student-teachers in the intervention group. The quantitative data gathered in Section 5.2 also revealed improved understanding of the background knowledge of computing in teaching and the knowledge and skills of using computers in teaching (Table 5.1, p. 127). These data about the development or improvement of the student-teachers were further explored and validated through the qualitative data in the later part of this chapter (Section 5.2.3) and also in Chapter 6 (Section 6.5, p. 187) where student-teachers' perceptions of teaching with information technology are described.

The above discussion also provides a picture of what had and had not changed in terms of background knowledge, concepts, skills and attitudes concerning the use of information technology in teaching for the student-teachers from the intervention group after taking the DDIM module. These participants' thoughts and feelings about their interaction with the intervention adopted in the study, are explored in detail in the next section; looking at qualitative data from the short essays and in-depth interviews. This purpose of the next section is to provide deeper insights into the influence of the proposed module on student-teachers' development in the use of information technology in teaching.

5.2.3 *Perceptions of Teaching with Information Technology*

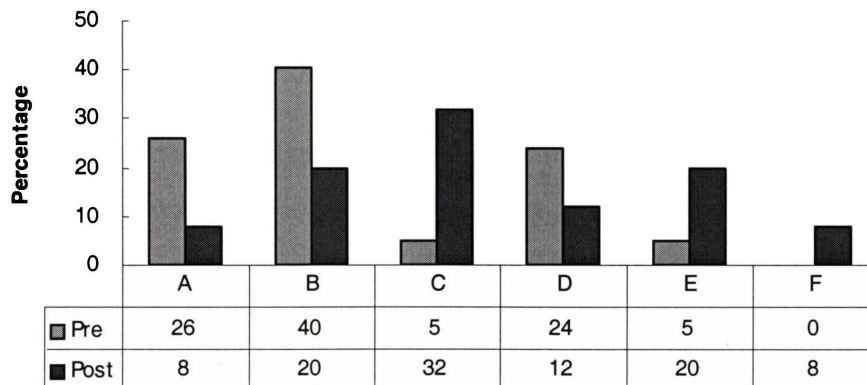
A short essay writing activity was conducted at the last session of the DDIM module and 16 essays were collected and combined with essays collected at the beginning of the DDIM module. Six major themes were subsequently developed as described in Chapter 4 (Section 4.5, p. 110). Finally, 76 useful sentences were clustered into these six categories. The percentages of sentences grouped under these categories before and after taking the DDIM module are provided in Figure 5.6.

The data in Figure 5.6 indicate a clear shift of the focus for the views of the participants after taking the DDIM module. Notable differences are a shift away from categories A, B and D into categories C, E and F. It is worthwhile to note that the sentences described in Chapter 4 were all fairly broad in nature and rather

teacher-centred for these categories; for example: ‘information technology can arouse students’ interests in learning’ and ‘the basic uses of information technology are the production of teaching aids and the access to Internet for teaching resources’. At the beginning of the DDIM module, similar sentences in these three categories (A, B and D) accounted for 90% of the total number of sentences in the essay writing about the use of information technology in teaching. This percentage dropped to 40% in the second essay and the total shift was 50% into categories C, E and F. This suggests that the student-teachers were more able to express their own views from a broader perspective. They also became more critical and analytical about the use of information technology in teaching and such changes were supported in the quotations in the following section (pp. 137-142). The following discussion explores these changes for each of the three categories in turn.

Figure 5.6

Clustered Views on Information Technology from Short Essays of the Student Teachers from the Intervention Group Before (n=42) and After (n= 76) Taking the DDIM Module



Views of Using Information Technology in Teaching

- A. Role/Meaning of information technology B. Information technology functions/capabilities C. Knowledge/Critics on information technology development
 D. Teaching with information technology E. Learning with information technology F. Teacher Development

Enhanced Information Technology Knowledge and Critics on Information Technology Development.

There were 46 relevant sentences in categories C, E and F. These sentences were further categorised into sub-themes as shown in Table 5.5. In Figure 5.6, a sharp rise of about 27% in the relevant sentences in Category C is observed. The

sentences in this category were further categorised into seven sub-themes (Table 5.5). These sub-themes were then put under two sub-categories: Knowledge of information technology in teaching (C1) and Critics on information technology development in teaching (C2). In the first category (C1), some sentences (3/46)⁶ showed that the student-teachers started to explain the use of information technology on a more theoretical basis. For example, instead of just describing information technology as an effective media, student-teachers accompanied their descriptions with reasons and considerably more detail as illustrated in the following quotation: “information technology is an effective media as it provides more interactivity and audio-visual stimulation to my students.” Other student-teachers suggested reasons why information technology might arouse student interest as shown in the following comment: “Information technology is the use of new technologies, for example, computer. Via its multimedia features with text, sound, graphics and so on, it can arouse students’ interests and enhance learning.” One of the student-teachers related the use of information technology with what he/she had been taught: “information technology can be used as the interface to learning and the use of it should go in line with ... e.g. the nine instructional events as learnt in other module.”

The ability to provide an explanation of the use of information technology as shown in the above quotations was absent in the first essays written by the student-teachers. However, after the DDIM module when describing the application of information technology in teaching, the student-teachers were able to identify specific characteristics and principles for the use of various instructional media (5/46) as illustrated below:

Information technology should be one of the instructional media. Information technology and traditional media have their own merits. Example, traditional audio tape and video tape have much greater capacities to hold the audio and images and are handy and easily used, new technologies in this situation can ease the editing work. (Doris)⁷

⁶ The first figure inside the brackets represents the number of sentences found in the essay. The second one is the total number of sentences .

⁷ The name inside the brackets is a pseudonym for the student-teacher participated in the first phase of this study.

Table 5.5

Clustered themes in Categories C, E and F from the student-teachers' essay writing about use of information technology in teaching after taking the DDIM module

Clustered themes in essay writing	Occurrence in essay (n=46)
<i>C1. Knowledge</i>	
Relate theories with the use of information technology	3
See the principles of applying information technology	5
See more flexible learning in terms of time and space	4
See the benefits of enhanced interactivity with information technology	3
<i>C2. Critics on information technology Development</i>	
Comment on administration	5
Comment on teaching strategies	4
Make suggestion on information technology application	1
<i>E Student learning with information technology</i>	
More inclined to use student-centred strategies with information technology	11
More concerned with student's individual needs	4
<i>F Teacher Development</i>	6

When describing how information technology can be used in the classroom, the student-teachers started to see advantages in providing more flexible learning (4/46). For example, they could see that learning need not be restricted to the classroom and specific times:

I believe that in this information age, students should not be restricted to learn within a classroom. Teachers should arrange a suitable learning environment e.g. to provide Internet access opportunities to relevant web sites of a learning topics and derive activities for their own learning. (Jane)

The student-teachers also were aware of the potential to use information technology to enhance interactions between people and resources (3/46):

New technology when is properly used, will enhance learning, as it will increase the interactivity between teachers and students, between students and students, allows peer learning or collaborative learning. (Amy)

With the use of computer, teachers and students can interact and share the information among the others. We can access different resources for our need on the Internet too. (Doris)

Examination of items in Category C1 as discussed above suggests increased knowledge for the student-teachers at the end of the DDIM module. Likewise in Category C2, the student-teachers commented on current problems with the implementation of information technology in teaching (5/46):

The computer facilities in most school, at the present times, are not sufficient. (Amy)

I can perceive that there are still many problems in implementing information technology in teaching. I think that the government is going too fast and lacks planning that leads to waste of resources. (Doris)

Time and manpower are critical factors for effective implementation of information technology in teaching and learning. (Tracy)

Apart from the comments observed about the implementation issues as stated above, the student-teachers provided opinions about current teaching practice in their schools (4/46):

I believe that the traditional didactic ways of teaching will not suit today's societal needs. As a teacher of the new generation, it is our responsibility to provide a suitable learning environment for our students. (Luke)

One of the student-teachers provided a concrete suggestion of how to improve current practice in the use of information technology in the classroom:

The best way of implementation is to wire up all classrooms so that we can use Internet resources or commercially produced or teacher-made computer instructional packages in our teaching in the classroom. (Betty)

More Concerned about the Way Student Learn with Information Technology

Another major shift of focus is observed in Category E. The rise of percentage of sentences ascribed to this category (15%, see Figure 5.6) suggests that the student teachers from the intervention group were more aware of the potential application of information technology for student learning, rather than seeing it simply as a

teaching aid. The student-teachers were more inclined in applying student-centred strategies when information technology was used in their teaching (11/46): “I believe that information technology can bring into learner-centred and interactivity strategies that can enhance learning outcomes and allow our students to learn the most.” (Nancy) They also realised the capabilities of catering individual differences and needs when information technology was used (4/46). For example:

I will have more time to take care of individual needs and have more time in interacting with the students. In the students’ side, interactive multimedia resources provide variations in the ways of learning, and ... increase active participation and initiatives of learning... (Ivy)

More Concerned about Teacher Professional Development

In the second essay, some of the student-teachers (6/46) expressed concern with their development in the area of using information technology in teaching. About eight percent of the sentences expressed this concern but this was not evident in the essays written at the beginning of the module:

For better implementation of information technology in teaching, I think that I have to spend more time in exploring and learning using information technology in my teaching. (Amy)

The preceding discussion reveals considerable development in competencies, in positive attitudes, usefulness, confidence and acceptance in using information technology in teaching. In particular, at the end of the DDIM module, the student teachers no longer saw the role of information technology for making an interesting lesson or attentive class, but they became concerned with issues to do with the quality of learning. They also began to appreciate broader learning outcomes and the above findings show increased knowledge of applying information technology and ability to provide explanation of using information technology in teaching. This included increased flexibility in terms of learning timing, venue and strategies and the participants were confident enough to express their own opinions and ideas about the implementation of information technology

in teaching. Thus it seems that by the end of the DDIM module the student-teachers believe that information technology may facilitate more learner-centred activities and individual learning. A number of barriers to this aim were identified.

The above findings along with the findings reported in Chapter 4 suggest then that the intervention had a positive influence on the development of the information technology knowledge and skills in teaching among the student-teachers in the intervention group. The following section goes on to explore the influences of the intervention on the student-teachers more deeply using the qualitative data gained from the interviews.

5.3 Responses to Different Features of the Intervention

The findings in the second essay writing revealed increased understanding and changes in student teachers' views about the use of information technology in teaching. Here the findings from in-depth interviews carried out after the completion of the assignments of the DDIM module with the student-teachers of the intervention group are provided. The interviews involved the same 16 student-teachers who wrote the short essays described above. One of the aims of the interview was to obtain a deeper understanding of the student-teachers' opinions on the strategies employed in the intervention. The other aim was to establish in what ways the student-teachers interacted with the intervention and at the same time to reveal the influences of the intervention on student-teachers' development about use of information technology in their teaching. In the interviews student-teachers' learning experiences in the intervention were asked the following broad questions:

1. What are your impressions or opinions about the teaching strategies and resources in the module?
2. What were their influences on your learning in the module, and how did they influence your learning?
3. What were the conditions or factors for their effective use?

The following discussion is based on four sections that represent the major themes clustered from the interviewing data about the intervention of the study. They are:

1. Contextual tasks
2. Reflective use of portfolio
3. Interactive learning environment
4. Model sharing

In each section, the responses to the three main questions were summarised in a table before the description of the findings.

5.3.1 *Contextual Tasks*

Independent learning experiences

The DDIM module deliberately incorporated an independent learning strategy as one of the components for the intervention. As shown in Table 5.6, of the 16 student-teachers, 10 accepted this kind of strategy but considered that they could manage this type of learning by themselves (10/16)⁸ with two of the participants saying that they did not want ‘spoon-feeding’: “I think that a student at this level (post-secondary) provided with sufficient resources and clear directions should be able to learn by himself and not to be spoon-fed by the teachers.” (Chris) However, three students preferred step-by-step learning in a workshop designed to develop self-learning for computing skills: “I will prefer to learn step-by-step for the computer software. If time is sufficient, this is a better method for me.” (Nancy), and one other student felt that more help from others was needed: “I think that self-learning is good and will allow deeper learning but I feel that female is rather weak in mastering technical skills and demands more help from others throughout the self-learning process.” (Sally)

⁸ The first figure represents the number of student teachers mentioning the theme and the second the total number of student teachers that participated in the interviews.

Table 5.6

Clustered theme of the student-teachers' learning experiences from the intervention – independent learning (n=16)

Independent learning experiences	Occurrence
<i>General impressions/opinions</i>	
Acceptable learning strategies	10
Prefer to learning step-by-step	3
<i>Influences</i>	
Deeper understanding and mastery	3
Cater for individual differences	5
Learn through problems solving	3
<i>Conditions/factors</i>	
Willingness to devote time	3
Clear assignments or tasks	7
Sufficient time	3

When the student-teachers were asked how the strategy helped their learning, three of them said that the self-learning experience lead to deeper understanding of concepts and mastery of skills (3/16): “The step-by-step strategy may suit the needs of some classmates, but I prefer to have a task with some guides, hints and, enough resources. I think that I will learn more deeply in such a process.” (Peggy)

A reasonable proportion of the student-teachers felt that this teaching strategy could cater for their individual differences (5/16):

The strategies used in this module can at least cater for different needs among us. The tasks provide flexibility for our learning according to our background so that not all of us have to attend workshops that they have mastered for certain skills and some can work by themselves according their needs. (Rita)

Interestingly, one of the student teachers stated that the strategy motivated her to learn independently: “We are motivated and forced to learn more by ourselves. I think that it is an appropriate strategy that provide a good start for us and can cater for our individual need.” (Flora), and three expressed the view that the strategy helped them to learn via problem-solving activities:

I realize that this process can give me a chance to solve problem by myself, to work with others, to see myself building up my knowledge and skills gradually. I think it is more worth than just following a certain steps and finish the predetermined exercise as some of the modules provided by some computers training

agencies. (Peggy)

In response to the question about factors that influenced their learning with the self-learning strategy, three of the student-teachers saw willingness to devote time to the self-learning process to be an important factor:

... but some of them [student-teachers] are reluctant to spend time to build up their basic skills by themselves though sufficient resources such as the resources booklet of basic information technology skills are provided. The success of mastery of the skills really depends on the willingness and initiative of us. (Chris)

Other student-teachers (7/16) claimed that provision of clear assignments or task was a condition that initiated independent learning:

It is important that you assign some tasks for me to complete. In that way, I have to go to find out the resources that I have, for example, note or references about the task, and the required skills that I have to use in order to complete the task. Some of these required skills might be also the targets for my learning, ... I have to learn it by myself first... and I get the skills at last. (Mary)

A few of the student-teachers considered the provision of sufficient time to complete their tasks to be an important factor (3/16):

I have to stress something about the time factor that makes my self-learning possible. It's appropriate that the module is offered in the first semester where examinations were less and we do not feel the pressure from teaching practice. Most importantly, we have a Christmas holiday to finish our assignment too. (Sally)

Summary of the research findings for independent learning

In the DDIM module, the student-teachers were expected to use some basic information technology skills and tools such as basic word processing, searching the Internet and *Authorware*TM in order to complete individual assignments. A booklet for basic information technology skills (see Chapter 3, Section 3.6, p.85) was provided as one of the resources to help the student-teachers learn the necessary skills in their own time. From the interviews, it seems that only a few

of the student-teachers did not enjoy this self-learning strategy, despite being provided with the supporting learning material. However, some proponents among these participants claimed that this strategy helped them to understand and master information technology knowledge and skills better. It appears that this cohort liked the strategy because they were not forced to attend all the workshops and the lectures simultaneously. They considered that such strategy could motivate their learning and provide valuable learning experiences through problem-solving. Three factors were identified as important for the success of this strategy: willingness by the student-teachers to devote time to the tasks, clear instructions and requirements of the tasks; and sufficient time devoted to the tasks. The findings also reveal that the student teachers believed that no one single strategy can help student-teachers to acquire the necessary information technology knowledge and skills.

Group Work Experiences

In the DDIM module, the student-teachers were required to complete a group project as one of their assignments and the participants' views about group work experiences were collected in the interviews. As shown in Table 5.7, two of the student-teachers considered group work to be a valuable experience, appreciated the opportunity to learn from others, and shared ideas among group members (2/16): "Group work is a valuable experience for I can contribute what I know for completing a task. I can also learn something that I do not know from other members too." (Mary)

There opposite opinion also was expressed about group work, with two of the student-teachers feeling that their classmates were too dependent on group members more knowledgeable about technical skills. One of the student-teachers complained that this resulted in an uneven workload among group members:

Table 5.7

Clustered Theme of the Student-Teachers' Learning Experiences from the Intervention – Group Work (n=16)

Group work experiences	Occurrence
<i>General impressions/opinions</i>	
Valuable experience	2
Dependent group member and uneven workload	2
Prepare for future teaching	2
<i>Influences</i>	
Can learn from others	10
Work collaboratively	2
<i>Conditions/factors</i>	
Common goal	2
Argument	1
Responsibility	3
Teacher's intervention in grouping	1

I don't think group work will help the students with weak background in technologies. I feel that most of them are dependent when they find that there is an expert or a member who have mastered some skills very well. They will not have the intention and the need to do self-learning. They will never catch up those skills that are required to complete a task. (Oliver)

A few student-teachers (2/16) considered that group work could develop their ability to implement a similar teaching strategy in their classrooms:

I think that it is a good experience for a will-be teacher. I also consider that this kind of experience is valuable to our students too. They [the students] can learn to co-operate in teamwork. Their communication skill can be enhanced too. (Flora)

When the student-teachers were asked about how group work helped their learning, most (10/16) felt that they could learn from other group members through group work: "I can ask my group members for help sometimes when I have a need. It is a learning process initiated by me." (Amy)

Two of the student-teachers stated that having a common goal in a group project drove them to work collaboratively making them want to make their work better: "I can learn from group members sometimes. Group work allows us to share and express our ideas as we have a common goal to achieve and we want to make it good." (Doris) One student teacher considered that debate or argument within a group to be an important factor in successful group work:

I am very impressed by the group experiences during our group assignments. I start to understand the value of collaboration. I can learn from group members sometimes. I know more about how to handle a group now. I realise that argument is inevitable but I have learnt how to deal with it. Many new ideas in our group project come out from argument. (Sally)

Three of the student-teachers suggested another condition for successful group work, claiming that student-teachers in a group project need to have a sense of responsibility, and going on to suggest that teacher intervention may be necessary to allow appropriate workload distribution:

There may be the case that some classmate does not know how to do an individual assignment. He may give up finally and ask other to help him to do the job. However, in a group work, we have to complete a task together. Everyone should share the same responsibility in order to get thing done. (Rita)

In my group, I see that someone has to do more work than others. The workload can't be allocated fairly. Some members know nothing but are not willing to take any responsibility. They are too dependent on others. This experience tells me that to be effective, the teacher should intervene on the grouping. Members should know their responsibilities clearly. The learning process should be recorded in some ways. I think that I will put this experience to my work as a teacher. (Betty)

Summary of the Research Findings for Group Work

The research findings reported here suggest that most of the student-teachers see group work as an effective strategy for professional development, feeling that they can learn from other group members through discussion and demonstration from more capable members. The authentic experiences gained in these collaborative processes also enhanced their confidence in applying group work strategies in their own classrooms. Although some participants experienced inequalities in workload, they did not deny the advantages of group work and the findings suggest that the participants see a common, shared, goal as a crucial factor in effective group work. It also seems that the participants feel teacher

intervention is necessary in a group activity. For example, indifferent attitudes for a given group member may affect the learning process of other members and teacher intervention may be required.

5.3.2 *Reflective Use of the Portfolio Guide*

In the intervention of the DDIM module, a portfolio was purposively used to guide the entire learning process. Most importantly, it also served as a reflection tool to facilitate the student-teachers' thinking about their learning throughout the module (see Appendix D).

The data presented in Table 5.8 show that nine of the student-teachers appreciated the use of portfolio and found the portfolio to be a useful guide for their learning during the DDIM module. The portfolio led these student teachers to build up relevant knowledge about the learning process. Six other participants also were in favour of using portfolios, believing that the portfolio would provide a good record of their learning, allowing them to have a clear picture of what they had learnt, and what they still needed to learn:

It provides a clear guide to help me build up my knowledge and skills. (Amy)

I think that the portfolio can help me to examine my present competencies and allow me to know my progress. For example, I don't know how to use a digital camera at the beginning. After the learning process, I find that I have already mastered the skills so I have a tick on the checklist provided in the portfolio. (Tracy)

Of the 16 participants, 12 valued the opportunity for reflection provided by the use of the portfolios. They found that reflection enabled them to conceptualise the application of theories and principles learnt in the module:

It is a good design [reflection requirement] as it provides a chance to help me re-examine what I have learnt and help me to think about how I can apply in my teaching. It is different from other module that we are not given any chance to think about how the knowledge and skills are actually applied to teaching. Only theories and principles are taught and we have to memorize the facts for examination. (Mary)

Table 5.8

Clustered Theme of the Student-Teachers' Learning Experiences from the Intervention – Portfolio (n=16)

Use of Portfolio	Occurrence
<i>General impressions/opinions</i>	
A guide to learn	9
A record of learning	6
Opportunities to reflect	12
<i>Influences</i>	
Authentic experiences enhance understanding and confidence	3
Meaningful learning with an integral view	6
Suggested tasks initiate independent learning	4
<i>Conditions/factors</i>	
Students are responsible for their learning	1
Require stimulating questions for reflection	10
Require authentic experiences for high-level reflection	3

Three of the participants pointed out that the portfolio guide resulted in authentic experiences in the contents taught in other modules in their teacher education programme - such as assessment and the use of theories of learning like constructivism - and considered that such authentic experiences enhanced their understanding about theories and principles taught in the programme. These participants also felt the portfolios raised their confidence in trying out activities:

Although we are taught about using portfolio in assessment in other module, it is the first time that I really experience the effect of it. It's a really good experience and I am confident in trying with my students when I am teaching. (Flora)

They [the tasks] are interesting ... I realise that they are so designed that we have to work on ourselves and learn more deeply and of module to experience a constructivist way of learning. (Oliver)

Six of the student-teachers found the framework or concept map provided in the portfolio guide helped them to learn meaningfully commenting that it provided a clear picture of the 'what' and 'why' for their learning in the module. The portfolio also helped them to delineate the relationship among the learning components of the DDIM module, and to see how it integrated with other education modules.

This framework let me have a clear picture of the relationship among different modules that I have learnt in the whole module. I understand why I have to learn so many different modules now as they are inter-related. (Ellen)

A framework is good. It allows me to have a holistic view of what I am going to learn, what I have learnt and the relationship among those things that I have learnt between different modules. It is valuable at least to help us collate the knowledge and skills that we have learnt in a more meaningful way. At least I understand that there is not any overlapping among modules, for example, learning theories about the instructional events in other module is also covered in this module but now I understand that I am actually applying this theory into the design process of my media. (Tracy)

Four of the student-teachers felt that the tasks in the portfolio provided direction and clear expectations for what they were required to achieve in the module commenting that these tasks initiated learning experiences. This occurred since the student-teachers had to evaluate the specific knowledge and skills required by the tasks leading them to examine their own needs in acquiring the necessary knowledge and skills.

If we are not given a task to complete, we may not use the resources as expected. As we are required to find out some topics and do some reflections and send our summary to you, this process forces us to use the resources and to use the technologies in order to complete the task. I know more about the issues on information technology in education after my reflections on the searched topics and learn more about the information technology skills, for example, using the Internet and e-mail in order to complete a task. (Flora)

The student teachers deemed a number of factors crucial for the effective use of a portfolio approach to learning. For instance, one participant felt that the learner should take the responsibility for his/her own learning:

I don't think you are demanding though they [the tasks] take time. I think that it is our responsibility to manage our time for the tasks. You have given us sufficient time but some classmates always spend the time to do other things and do the tasks hastily in a short period of time. (Amy)

Ten of the student-teachers reported that the guided questions provided in the

portfolio stimulated their thinking seeing these questions as essential and pointing out that the reflection process provided opportunities for developing their higher-order thinking skill. There was good evidence supporting this finding with the participants pointing out that their reflection would have been superficial if they were not accompanied by authentic experiences gained through the learning tasks.

It's important and necessary for it [reflection question] helps me to rethink about the problems that I have met in a learning process and to find ways to solve and to improve. (Grace)

The reflection part is good for it provides a chance for me to think about what I have learnt and how the knowledge and skills are learnt ... I think that if I do not have any actual experience of using information technology in teaching, it will be too hard for me to think further about its impact. (Ellen)

One participant commented that high-level reflection required guidance from an experienced other.

The reflections are quite superficial as I usually think about what I have learnt and how it has been mastered only. Seldom do I think about the impact of such learning on me. Perhaps, we need someone like you to guide me through the higher-level reflection process as in this interview. (Pauline)

Summary of the Research Findings for the Portfolio Approach to Learning

The research findings reported above suggest that most of the student-teachers were in favour of using a portfolio approach thinking that such approach provided direction and a means of recording their learning and helped them to conceptualise the application of theories and principles learnt in the DDIM module. Authentic experiences such as collaborative learning and use of information technology tools in the learning tasks, provided within a conceptual framework, were seen to be essential helping to enhance understanding about learning theories and raising confidence about using information technology in the classroom.

5.3.3 *Interactive Learning Environment*

During the DDIM module the student-teachers were required to complete several tasks as individuals or in group settings and were guided in these activities by means of a variety of physical resources and advice from staff. The resources developed in the intervention included a self-learning booklet detailing basic information technology skills, a booklet of case studies in classroom use of information technology, a website and a number of CD-ROM to help in media production. A number of tasks were suggested in the portfolio and these helped the student-teachers' seek relevant resources and assistance. The student-teachers could also make use of technical support provided by the *Educational Technology Unit* and *Office of Information Technology Services* and were able to arrange personal consultation with the researcher throughout the module. These resources and support mechanisms sought to form an interactive learning environment to help the student-teachers accomplish their tasks.

Table 5.9 shows that most of the student-teachers were impressed by the resources and support provided throughout the learning in the DDIM module. Almost all of the participants (15/16) found that the resources useful and sufficient for the tasks. Only one of the student-teachers reported finding the computing facilities inadequate whereas six went out of their way to express their gratitude to the technical staff.

Table 5.9

Clustered Theme of the Student-Teachers' Learning Experiences from the Intervention - Resources and Supports (n=16)

Resources and supports	Occurrence
<i>General impressions/opinions</i>	
Useful and sufficient	15
<i>Influences</i>	
Help to master the necessary skills	6
Help to extend views about application of information technology in education	11
<i>Conditions/factors</i>	
Need and motivation to learn	1
Specific tasks to accomplish	9

One student teacher commented specifically on the importance of the provision of resources and support in the learning process: "Without sufficient resources and

supports, we hardly complete our tasks and to master the necessary skills necessary for them [the tasks].” (Luke)

Another student-teacher talked about her first experience in operating the equipment in the *Educational Technology Unit* (ETU) and computing facilities in the *Information Technology Services* (ITS) commenting on the importance of opportunities given to her for mastering the educational technology skills:

I rarely go to the ETU and ITS in my first year study ... I believe that it is very important to have the first trial of a skill no matter it is an operation of traditional equipment in the ETU or computer software in the computer laboratory. (Rita)

Interestingly, although the participants in general formed a good impression about the resources and support provided in the DDIM module, three students pointed out that they did not use the resources and supports very often due to lack of time: “The resources are enough. However, I think that I cannot spend too much time on the module as I have other modules to go through at the same time.” (Jane)

Two other themes emerged from the interviews when student teachers were asked about the influence of the resources and support on their learning. First, the participants stated that the resources and support could help them to master the necessary skills required for assignments (6/16): “The resources booklets are very valuable and useful, especially the one about information technology basic skills. I can really examine what I have already mastered and what I haven’t by going through the booklet by myself.” (Sally) Second, the resources and support helped the student-teachers develop a broader view about potential applications of information technology in teaching (11/16).

I know more about the ways of using technologies in teaching by the cases book. The resource web is really good and direct for accessing the relevant materials especially for doing the assignments. It also helps to extend my views of today’s teaching and issues about using technologies in teaching and learning around the world. (Betty)

The cases are good samples for reference. At least we can compare and refer what other countries have done on the use of information

technology in teaching. The cases are quite stimulating. The resources web page is helpful for I can search the relevant links about information technology and technologies for my assignment. (Tracy)

I understand that information technology can be a tool for both teaching and learning. Such tools can either be a presentation tools by teachers or tools by the students to learn and to present their ideas. I am impressed by the case of using 'SimCity' in the resources booklet. (Doris)

The case studies help me to think about how the sample activities can be applied to our teaching. They are quite stimulating and inspiring. (Sally)

When the student-teachers were asked about how the resources and support provided in the DDIM module could be used more effectively, one of the participants pointed out that students would need to see a need for them before becoming motivated to learn:

The booklet of information technology basic skills is helpful to some students who have the need and motivation to learn. To me, as I have already known most of the basic skills, I am not willing to spend too much time on it as I have a lot of other work to do. (Ellen)

The above student ostensibly felt that he/she possessed most of the basic skills in information technology and thus felt little need to use this resource. Consistent with this viewpoint, a group of student-teachers (9/16) commented that they found having a set task to be highly motivating with one commenting that this pushed her to learn:

I was scared by your checklist at the beginning of the module to find out that there were too many items that I did not know. But throughout the learning process, I was pushed to master those knowledge and skills as I had to complete the assignments given by you. And it is through this process that I have learnt many from it. (Tracy)

Summary of the Research Findings for Resources and Support

The results from the interviews suggest that the provision of resources and support for the DDIM module was both sufficient and helpful for the student-teachers and illustrated a need for an interactive learning environment in which student-teachers could gain assistance according to individual needs. Three conditions were identified by the student-teachers as crucial to the successful use of resources and support: having specific tasks to complete; being motivated to learn; and, having adequate time to complete required tasks.

5.3.4 *Model Sharing*

As detailed in Chapter 2 (Section 2.5, p. 60), 'sharing of practices' from the cognitive models should be a key strategy for the intervention used in this study. Hence, the student-teachers' views about the practices of using information technology in teaching and learning shared by the cognitive model (the author of the present study) were probed during interviews. The bulk of the student-teachers (11/16) stated that they were impressed by what they had seen and experienced in the module and appreciated the opportunity to observe the implementation of actual teaching strategies:

I think that you have demonstrated what you have promoted in the module. You are different from other lecturers. We are always taught about theories and principles in other education modules but we have never seen how they are done before we try. It is my first time to see our lecturer demonstrating the application of learning theories in an actual learning context and I have a deep feeling of it. I am really impressed. (Amy)

One of the student-teachers commented that in her view the lecturer served as an excellent role model from which she could learn by direct observation of different instructional strategies. Such vicarious experience ostensibly acted as an incentive for her to try out what she had observed in the classroom:

I think that some of the ways or strategies that a lecturer used in the teacher education programme will provide us a role model in our future teaching. For example, your teaching is a good model and I

have another experience in a Chinese language module too. I was impressed by the tutor's strategies to use TV advertisement for analysis since I thought that the lecture would be very boring. I start to realise that there are thousand of teaching methods to teach a topic but the difference is whether it is effective or not. These learning experiences will really affect me. I will try my best to try them out in my future teaching. (Flora)

Another participant commented that role model provided by the researcher allowed student-teachers to see how things work, seeing such experiences as a confidence boost

I can see that your design of this module deliberately provides us with the experiences of group learning, constructivist learning and alternative assessment which is learnt in other education modules too ... I think that these learning experiences are inspiring. At least, I have confidence now in trying new things, maybe teaching methods, maybe technologies in my future teaching. (Tracy)

The above findings suggest that the model sharing strategy had positive influences on the professional development among the student-teachers.

5.4 Chapter Summary

Chapter 5 has described the learning experiences of a group of student-teachers in a information technology and teacher education related module, DDIM, in a teacher education programme in Hong Kong. The finding has illustrated the development in the competency of information technology skills and knowledge for teaching. It has also reported the perceptions of the student-teachers towards the intervention strategies guided by a constructivist-based framework (Chapter 2, p.60).

For the competency of the basic information technology skills for teaching, the findings show increase in the use of some popular computer applications among the student-teachers of the intervention group. Significant increase was also reported in the use of PowerPoint. There was also report of about 80% of the student-teachers who had achieved the course objectives. For the competency of

applications of information technology in teaching, improvement in terms of the understanding of the background of information technology in education, use of software applications in teaching and the operation of some hardware were reported. It was also found that some of the information technology knowledge and skills were significantly better performed by the intervention group. Explanation of such result might go to the different learning approaches adopted in the intervention and non-intervention groups. The former focused on more interaction with resources while the later stressed more on transmission of knowledge and skills. There was also report of perceived positive attitudes towards using information technology in education among the student-teachers of the intervention group. It was noted that student-teachers tended to focus the usefulness of information technology on the effect on learning process and outcomes rather than that on learning atmosphere after the DDIM module. Regarding the perceptions on the teaching with information technology, student-teachers showed their improved knowledge about the meaning and use of information technology in education. They started to be more concerned about the learning outcomes by using information technology and to emphasise the importance of interactivity between information technology and students' learning. Some even felt the need for further development in the field. The findings in this chapter show consistent development in student-teachers' understanding and mastery of the knowledge and skills in information technology and its application in education.

For the perceptions on the intervention strategies, there were no unanimous opinions towards the intervention strategies. However, the majority of the student-teachers expressed that the intervention did have positive influences on their learning. They reported better understanding on the use of information technology in teaching and learning. They expressed that the portfolio guided them to learn and to think. The practical and contextual tasks initiated their learning. The resources provided ample exemplars and independent learning materials. All of them contributed to a scaffolding learning environment in which they could choose their ways of learning. Student-teachers also expressed their improved confidence in applying similar strategies as observed and experienced in the intervention strategies.

Having described the learning experiences in the DDIM module in this chapter, the following chapter presents the findings of the student-teachers' experiences in actual class teaching using information technology during their teaching practice in the first phase of the present study.

Chapter 6

Learning Experiences During Teaching Practice

6.1 Introduction

The previous chapter described the development of the student-teachers' professional knowledge and skills in the use of information technology in teaching. The student-teachers in the study showed an enhanced understanding and mastery of the knowledge and skills as a result of the DDIM intervention. It also appears that they changed their values and views of how information technology can facilitate student-centred learning. This chapter reports on the influence of the intervention model on the student-teachers' experiences of teaching with information technology during their teaching practice.

The teaching practice took place four months after the completion of the DDIM module. As mentioned in Chapter 2, the framework for this thesis is based on constructivist perspectives. Hence, the strategies used in the teaching practice were especially designed to provide the necessary resources and support for the implementation of information technology in a 'tryout teaching' activity during teaching practice. The 16 student-teachers who had participated in the qualitative studies previously (the essay writing and the first interview, see Chapter 3, Table 3.2, p. 75) in the intervention group were invited to attend an extra lecture which comprised a report of the researchers' perceptions of the current situation in using information technology in Hong Kong primary schools. Fifteen of these student-teachers agreed to participate in the next stage of the study during teaching practice. However, although all of these student-teachers were able to attend the interviews after the teaching practice, only 10 of these 15 student-teachers were able to return the *Use of Common Instructional Media in School Teaching Questionnaire* and only five of these 15 student-teachers were able to perform the

tryout teaching using information technology in the classrooms. It is important to note that this exercise was the first time that these five student-teachers actually used the computing facilities *in the classroom* apart from the experiences in the preparation of printed materials like work sheets. This tryout teaching represented an additional lesson in which the researcher conducted class observations for each of the participants of the present study, followed by intensive discussion after each classroom observation. The researcher also provided support in terms of technical advice and resources throughout the teaching practice.

The qualitative data documented in this chapter included reflective journals, field notes in the form of written records of lesson observations during the teaching practice, and interviews conducted after the teaching practice. The *Use of Common Instructional Media in School Teaching Questionnaire* (Chapter 3, Section 3.4, p. 82) was used to identify what instructional media was used by the student-teachers in the primary schools (the full survey instrument is provided in Appendix C3). The research findings reported in this chapter draw on both qualitative and quantitative data. The final data corpus comprised 10 completed questionnaires, eight reflective journals, transcriptions of 15 interviews and field notes from five classroom observations sessions.

The influences from the intervention in the DDIM module and the present tryout teaching under different school contexts in the teaching practice will be described in the following four sections in the remainder of this chapter:

1. Use of information technology in primary schools
2. Vignettes of the class teaching with the use of information technology
3. Reflections on teaching practice experiences
4. Perceptions on teaching with information technology and student-centred learning

6.2 Use of Information Technology in Primary Schools

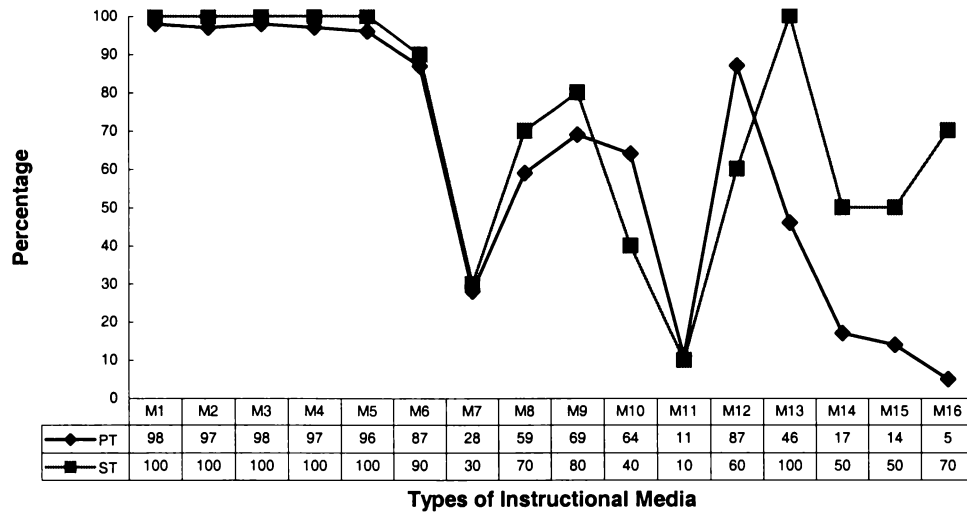
A mail-out survey concerning the current trend of using instructional media including information technology was conducted with 323 practising primary

school teachers four months before the teaching practice, the details of which were described in Chapter 3 (p. 82). The media reported from the survey were categorised into two main groups: traditional media (M1 to M12), and computing technologies (M13 to M16). Given a small number of student-teachers (10) who had responded to the survey, this study did not intend to test any statistically significant difference among the media used between the two groups of teachers (the practicing and student-teachers). The purpose of this survey was mainly to generate a profile of the current use of instructional media in actual teaching practice in primary schools in Hong Kong at the time of the study. Such a profile was then used as a reference when the use of the above media by the student-teachers from the intervention group in this study was described.

Examination of the data of the primary teachers in Figure 6.1 shows that five traditional media items were widely used in primary classrooms at the time of the study (M1 to M5). These media involve simple, uncomplicated equipment, most often used in a traditional classroom where the teacher talks in front of the class accompanied by writing or drawing on a blackboard (or whiteboard), occasionally elaborating content with the use of graphics, textbook diagrams, photos, or wall pictures. In some cases the teachers distribute printed notes or exercises to the students at the end of the lesson. Since these data represent self-reported use of media and not classroom observations, it is not appropriate to comment on the *actual* use of these media by the respondents. Nonetheless, the data show that the student-teachers in this study make similar use of traditional media (compare the trend from M1 to M12 in Figure 6.1) although fewer made use of commercial video (M10) and learning packages (M12). The data also show that the student-teachers make more use of computing technologies than the practising primary teachers (see the trend from M13 to M16 in Figure 6.1). As shown in Figure 6.1, 10 student-teachers who responded to the questionnaire reported using computer texts and graphics, seven had attempted to use the Internet, five used presentation software, and five used computer assisted learning programmes during their teaching practice. It appears that the student-teachers used four types of computing technologies in different ways and to differing degrees.

Figure 6.1

Primary Teachers (PT, N=323) and Student Teachers (ST, N=10) Use Of Instructional Media in Hong Kong Primary Schools



Key: M1=Blackboard/Whiteboard Writing; M2= Blackboard/Whiteboard drawing; M3= Real Object/Model; M4=Graphics; M5=Printed Material; M6=Photo; M7= Slide; M8= OHT; M9= Audio Tape; M10= Video Tape; M11= Tape-slide Programme; M12= Learning Package; M13= Computer Generated Texts and Graphics; M14= Presentation Software; M15= Computer Assisted Learning (CAL) Programme; M16= Internet

Having described the trend of using instructional media in teaching among the student-teachers in this study, the following discussion focuses on how computing technologies were used during their teaching practice. The data were drawn from the interview transcripts of the 15 student-teachers (including those who had agreed to participate in this study but had not responded to the questionnaire) who attended the interviews after the teaching practice (Table 6.1). Five common ways of using the computing facilities were identified from interview transcripts using a scheme for analysis classroom activities with information technology (the details of which are provided in Chapter 3, Section 3.5.1, p. 84). Six of the student-teachers attempted to produce some presentation software for their lessons, one using a graphic browser, *ACDSee™* and the remainder *Microsoft PowerPoint*. Five participants reported using computing technologies to prepare teaching materials for their presentation in the classroom such as graphics programs for making logos, word cards, sentence strips and overhead transparencies. Four reported using the Internet for updating the content for presentations or in group activities. One student-teacher comments about her experiences:

If I have found some updated information and pictures on the Internet for a topic, I will incorporate them into some traditional media such as information sheet for discussion. I have also produced word card, sentence strips for my presentation too. (Amy)¹

Table 6.1

*Student-teachers' experience in the use of computing technologies during teaching practice reported in the interview after teaching practice (n=15)**

Experiences of Using Computing Technologies	Number of Occurrence
1. Produce computing software for teacher's presentation	6
2. Produce traditional resources with information technology for teacher's presentation	5
3. Produce traditional resources with information technology for students' work	15*
4. Produce computing resources for students' group work	3
5. Use ready-made information technology resources for teacher's presentation	7

* Five of these student-teachers did not have the chance to use information technology facilities of the schools.

All 15 participants reported producing traditional resources using information technology for their students' work. The major resource was worksheets for individual or group activities and five noted that their schools did not provide any computing facilities forcing them to rely on personally-owned computing hardware². Another three participants reported using computing resources for group activities with their students. For example, one student teacher prepared digitised video clips on a CD-ROM and another built offline websites using a CD-ROM. One student teacher created hyperlinks to websites and allowed her students to explore these resources using the schools' computer facility:

I have used the computer laboratory quite a number of times. For example, on the topics about the weather and history of Hong Kong, I book-marked some relevant web sites on the Internet and spent a whole lesson in the computer laboratory for students' exploration and finishing the worksheets that I designed for their project. (Mary)

¹ The name inside the brackets is a pseudonym for the student-teacher participated in the first phase of this study.

² The five schools were just at the beginning stage of the installation of the school computing facilities subsidised by the Education Department of Hong Kong.

The data in Table 6.1 also show that seven of the student-teachers reported using the school computing resources and in the interviews they pointed out that other teachers in their schools had produced teaching software using these facilities in the past. The student-teachers were subsequently encouraged to borrow such resources from the school and use them in their classrooms. These resources mostly represented presentation material for use in the classroom. One of these student-teachers describes her experiences: “I use the computer mainly for presentation. The teachers there have developed many attractive presentations and I have used them for my classes too” (Nancy).

The quantitative findings from the survey in Section 6.2 illustrated a general picture about the use of information technology for the teaching for 10 student-teachers during their teaching practice period. These student-teachers apparently used more computing technologies than practising teachers. Supported with the qualitative data from the interview transcripts, the student-teachers had also attempted different strategies with the use of the computing technologies. However, as reported in the subsequent interviews, of the 15 student-teacher participants, only 10 were provided with information technology facilities by the schools in which they did their teaching practice. The next section explores further five student-teachers’ actual teaching practice with information technology in primary schools.

6.3 Vignettes of Classroom Teaching Using Information Technology

This section describes how five student-teachers from the intervention group taught in primary school topics using information technology during their teaching practice. The intention was that the student-teachers would apply what they had mastered from the DDIM module concerning the use of instructional media including to their classroom practice. They also were encouraged to design a lesson for one of their major subjects in the learning domain of *Academic Studies*³ using information technology. The five student-teachers are represented by

³ There are four domains of studies in the Certificate Programme of Primary Education. They are: Professional Studies, Academic Studies, Curriculum Studies and General Studies. DDIM is one of the core modules in the Professional domain. Subjects knowledge falls into the Academic domain.

pseudonyms as: Amy (teacher A), Doris (teacher D), Flora (teacher F), Oliver (teacher O) and Tracy (teacher T). The computing facilities available in the classrooms for which classroom observations were conducted are shown in Table 6.2.

There were no permanent computers or other computing hardware installed in the five classrooms where observations were conducted, nor were there any separate school-based computer laboratories in any of the schools. According to the progress of the 'Five-year Strategy' document (Chapter 1 Section 1.2, p. 3), most schools were at the stage of the installation of the infrastructure of the ED3⁴ project provided by the Education Department of Hong Kong at the time of the teaching practice. Hence, all of the primary schools here should have received at least 15 computers from the Education Department as recommended by the ED1⁵ project. The schools were given the discretion on how these computers were to be used. Thus, if computing facilities were required in class teaching, advanced booking and special set up was needed. Despite these limitations the student-teachers attempted to use information technology (albeit to differing degrees) in their teaching. Four attempted to use computing equipment in their classrooms with two (Amy & Flora) using their own laptop computers in their classes. The other two (Oliver & Tracy) used the computing facilities set up by the schools. However, these two student-teachers had to make advance booking since the school had to arrange a staff for the set up in their classrooms.

Table 6.2

Facilities in the Classroom Observations of the Participants in Teaching Practice

Classroom Facilities	A	D	F	O	T
1. 29" TV	*	*	*	*	*
2. OHP		*	*	*	*
3. Pull down screen		*	*	*	*
4. PA system	*	*	*	*	*
5. Computer set #				*	*
6. Tape recorder					*
7. Own laptop computer	*		*		

* = used/stationed in the classroom in the observation

= request in advance and set up is needed

Key: A=Amy; D=Doris; F=Flora; O=Oliver; T=Tracy

⁴ In ED3 project, each primary school will be provided with a LAN, a computer laboratory, an average of 40 sets of computers with multimedia capabilities, and Internet connection to the laboratory, staff room and library by the end of 2000 as proposed in the Five-year Strategy Plan. (Refer to Chapter 1)

⁵ In ED1 project, the Education Department provided only 15 sets of computers with multimedia capabilities before the launch of the Strategy Plan.

6.3.1 *The Practice of the Use of Information Technology*

Two schemes were developed to help record classroom observations (see Chapter 3, Section 3.5.1, p. 84). The first scheme was used to record the ways the student-teachers used information technology in the classroom, and the second to identify the student-centred learning elements in a lesson (Tables 6.3 & 6.4).

Table 6.3

Student-teachers' Classroom Activities with Information Technology During Teaching Practice

Classroom activity with information technology	A	D	F	O	T
Information technology in the lesson has been used for/as:					
1. Producing traditional resources for teacher's presentation, e.g., overhead, graphics, word card, and sentence strip etc.	*	*	*		
2. Producing computing software for teacher's presentation, e.g., Power Point slide, multimedia learning program				*	*
3. Producing traditional resources for students' group work, e.g., work sheet/activity sheet, exercise, etc.		*	*		•
4. Producing computing resources for students' group work, e.g., multimedia and learning programs, etc.	*		*		
5. Producing traditional resources for individualised learning activities, e.g., work sheet/activity sheet, exercise, etc.					
6. Producing computing resources for individualised learning activities, e.g., multimedia and learning programs, etc.					
7. Pupils' tools to access information themselves for small group activities/tasks, e.g., Internet.					
8. communications tools between teacher and students and among students to support learning					
9. Pupils' tools to solve problems or to find solutions to the questions for assigned group activities/tasks, e.g., a Spreadsheet program.					
10. Pupils' tools for presentation of the results of group activities/tasks.					•

* = occurrence of information technology use in a lesson

• = activity with non computer-based materials

Key: A=Amy; D=Doris; F=Flora; O=Oliver; T=Tracy

Table 6.3 shows that the student-teachers used information technology mainly to produce traditional resources (see first four items) and three teaching 'patterns' for the use of information technology in the classrooms were identified. These patterns are further elaborated with the information provided by the records of the five classroom observations in the subsequent sections (see Appendix J for details).

Information Technology for The Preparation of Traditional Teaching Aids

As shown in Table 6.3, of the five participants, three used information technologies for the preparation of traditional teaching aids particularly in the presentation of lessons. Amy, for example, produced some pictures of the logos or symbols that represent different organisations involved in environmental protection. She used these pictures as probes, asking questions and trying to motivate the students. She went on to explain in more detail and placed word cards she produced on the blackboard. At the end of the lesson she also made sentence strips that summarised the main points of the lesson.

Two student-teachers, Doris and Flora, made use of computer programmes to produce colourful overhead transparencies for their lessons. Doris produced overhead transparencies concerning additional examples about different ways of dispersal of plants that were not covered in the textbook used in the lessons. Large and colourful photos from a reference book were scanned into a series of PowerPoint slides and these slides presented as overhead transparencies using an overhead projector in the classroom.

Flora used a ready-made poster about environmental protection from the school resources room to set up the context of the lesson. She then used colour overhead transparencies printed from a website to present some attractive flowers found in the countryside of Hong Kong. She used this to raise issues concerning the consequences of some inappropriate environmental practices that might harm the environment, encouraging her students to describe more examples and to suggest preventive measures as a group activity.

Using Information Technology for Presentation of Content

Two of the student-teachers used specialist computer software to produce presentations for their lessons. Oliver used Microsoft PowerPoint to provide prescribed content and explanations of some words and phrases used in a Chinese language lesson. He also prepared detailed information about sentence construction using particular sentence structure in the second part of the PowerPoint presentation. In the first part of the PowerPoint presentation, multiple-choice questions were used to test students' understanding of content. He

also made use of the hyperlink feature of the software to provide rapid feedback for each of the options for multiple-choice questions. The presentation was mainly in the form of text, with some clip art, and a few sound effects, with the change of a slide controlled by the student teacher. The other student-teacher Tracy created a slide show about the history of Hong Kong for a lesson in *General Studies* using specialty graphic software *ACDSee*. The slide show comprised mostly photos scanned from a reference book and the change of a slide was again controlled by the teacher. This student teacher used this procedure in an expository manner, using the photos to elaborate on content via a series of question-and-answer interactions.

Information Technology for Teacher-Directed Group Work

Three student-teachers (Amy, Doris and Flora) who used computers to generate presentations also used information technology to produce other resources for student group activities. For example, Doris produced a 'worksheet' to provide instruction and information for the group activities. This worksheet consisted of a matching exercise containing taught content along with additional examples not covered in the lesson (in this case a biology lesson): mainly in the form of text and drawings. Students were then asked to match these items; in the case of this lesson they were asked to match dispersal methods with plants and were also required to provide explanations for their answers. Group representatives from each group were subsequently asked to report their answers in a whole-class activity. The teacher provided feedback and further elaboration from these answers.

Two of the student-teachers used 'new' technologies for group activities in their lessons; Amy digitised video clips in the form of MPEG files onto a CD-ROM and used this as a source of information for student discussions. Each video clip on the CD-ROM sought to promote awareness of environmental protection. The content of the video clips were provided by the Information Department of the Hong Kong government. This student teacher captured these video clips by using a video capture card and turned them into MPEG files with specialist software, recording them onto the CD-ROM. Students were asked to express their feeling and opinions about environmental protection freely after viewing the videos contents from the CD-ROM. There were no instruction sheets or task sheets provided for the activity

as there was only one computer available. Students were asked to do some exercises in their workbooks while they were waiting for their turn on the computer. Flora used an offline Internet browser (*Teleport*) to capture the content of some websites and turn them into local websites on a CD-ROM. The students could then browse these contents as if they were a 'real' website without connecting to the Internet. The topic covered here also was concerned with environmental protection and the websites described environmental protection activities of some government and voluntary organisations in Hong Kong. Students were asked to select content from the 'websites' and to report to their classmates at the end of the activity. While one group of students was preparing their report from the websites, the other groups were asked to discuss ways to protect the environment under three categories: 'sound', 'air' and 'environment'. Each group was provided with an activity sheet about one of these categories, along with a set of overhead transparencies and markers. The students were expected to write down their ideas and to express their ideas with drawings for later reporting.

Table 6.3 also shows that one student-teacher conducted a group activity with her students although no computing facilities were involved for this activity. This student-teacher (Tracy) conducted an expository interaction with her students by using a computer slide-show containing photos relevant to the topic under instruction, and then distributed a set of pamphlets to different groups of students. The pamphlets were obtained from the *Museum of the History of Hong Kong* and the students were asked to report to the class on the content of their pamphlets after the discussion period.

The four group activities in the above lessons all involved the use of some instructional media. As can be seen from Table 6.3, three of these media were produced by the student-teachers using computers (printed media, digitised video clips, and offline websites): the other comprised a set of ready-made information pamphlets collected by the student-teacher in advance of the lesson. Further examination of classroom observation data for these four lessons shows two different ways in which these media were used in group activities. For the first type, media served as a source of information delivery: students were asked to comprehend the given information and to tell the class something about this information when reporting back after this activity. The use of digitised video clips

(Amy), the offline websites (Flora) and pamphlets (Tracy) belonged to this type. The second type sought to reveal learning outcomes after the group activities and this involved the worksheets used in the group activities.

Student-Centred Learning Elements

The 'try-out' lessons of the five student-teachers described above are further analysed to identify the student-centred learning elements using the evaluation items proposed by Yager (1991) as shown in Table 6.4. According to item 9, student-centred learning was seen in the classrooms of Amy, Doris, Flora and Tracy in the form of group activity in which students took action, finding and reporting the answers or information specific to questions or issues defined by the teachers. In these lessons, the student-teachers established the context for the group activities through an expository approach - sometimes with the aid of visual information in the form of printed pictures, word cards and images presented via overhead projectors or computing facilities. Such an expository process helped to build up the 'need' to investigate the particular issues in the subsequent group activities. These four lessons apparently differed from Oliver's lesson for which the student-teacher simply transferred prescribed content from textbook into some form of presentation software (typically Microsoft PowerPoint). Such lesson is not learner-centred since although the students found multimedia features of the programme attractive, they received the information passively without doing any student-centred activity.

Although student-centred learning activities were identified as described above, it was observed that the objectives and the contents of the lessons and even the resources were well-prepared by the student-teachers. The pupils only 'explored' the 'to-be-learnt' materials by using work sheets, digitised video clips, offline websites and ready-made pamphlets described in previous sub-section. Obviously, in these activities, information technology was used as a 'provider of information' but failed to act as a 'tool' towards self-learning in which pupils could explore and develop the knowledge on their own. Hence, upon closer examination, these classroom activities only differed from traditional teaching by their integration of multimedia resources but did little to enhance or develop student-initiated learning

at this stage.

Table 6.4

A Scheme for the Analysis of Student-centred Learning Elements in a Lesson (Adopted from Yager, 1991)

Evaluation Items	No. of observed lessons (n=5)			
1. Who identifies the issue or topic?	*****	Teacher	or	Students
2. Is the issue seen as relevant?		No	or	Yes *****
3. Who asks the questions?	*****	Teacher	or	Students
4. Who identifies written and human resources?	*****	Teacher	or	Students
5. Who contacts necessary human resources?	*****	Teacher	or	Students
6. Who plans investigations and activities?	*****	Teacher	or	Students
7. Are varied evaluation techniques used?	*****	No	or	Yes
8. Do students practice self-evaluations?	*****	No	or	Yes
9. Do students take action(s)?	*	No	or	Yes ***
10. Is it evident that students extend learning outside school?	*****	No	or	Yes

Key: * = one lesson fulfils the respective item with the use of information technology,
 * = one lesson fulfils the respective item without the use of information technology.

The teaching of the five 'try out' lessons was described above. The student-teachers had limited facilities for the use of information technology in their classrooms, and three patterns of the use of information technology in the classroom emerged: as tool for production of teaching materials; as a presentation tool; and, to facilitate group work. The following section goes on to explore the themes developed from the qualitative data. The focus here is to develop an understanding of the student-teachers' perceptions and the factors that influenced their ways of using information technology during teaching practice.

6.4 Student Teachers' Reflections on Teaching Practice Experiences

The findings reported here are based mainly on 15 interviews conducted after the teaching practice with the student-teachers, supplemented by other sources: field notes and records of observations from five classrooms during the teaching practice period; five informal interviews of the post-observation discussions and eight journals.

After continuous clustering analysis (see Chapter 3, Section 3.5.1, p. 83), several themes emerged from the qualitative data which are now discussed:

1. Unfavourable technology environment
2. Unfavourable attitudes and perceptions about information technology in education
3. Being a student-teacher
4. Influences from favourable school contexts
5. The influence of past learning and teaching experiences
6. Reflecting on experiences during the teaching practice
7. Conversation helps reflections

6.4.1 Unfavourable Technology Environment

Lack of Information Technology Facilities

As alluded to above, eight of the student-teachers reported a lack of information technology facilities in their schools at the time of the study. For example, the student-teachers pointed out that any computing facilities had to be set up at the beginning of lessons, providing little opportunity to become familiar with the equipment or software. Use of information technology was thus limited to the production of text and graphics as teaching aids such as word cards and worksheets. Of the 15 interviewees, only two reported having good computing facilities during teaching practice, and as a result most participants made relatively little use of information technology. The frustration this caused is evident in statements made in interviews: “Most of the staff do not like to set up too much equipment for a lesson. They think that it is time consuming and causes a lot of trouble to other staff” (Chris). The appeared unhappiness with the facilities was due to the fact that most of the schools were still in the stage of installing the infrastructure from the ED3 project as mentioned previously.

A 'Non-technology Culture' in the School

While inconvenience is one reason of limited use of information technology in the teaching among most primary teachers, the data from the student-teacher interviews revealed another common phenomenon about the use of conventional audio-visual equipment in these schools. Twelve student-teachers reported that their schools did not encourage the use of teaching equipment for teaching, again due to inadequate resources:

The audio-visual resources in the school are extremely inadequate. We had even to borrow a tape recorder that was located at one of the classroom only on each floor for just playing an audiotape. I know that the teachers there seldom use it at all. Much audio-visual equipment in the school is out of order and no one will care about getting them repaired. (Amy)

Another student-teacher also lamented the inconvenience of using traditional equipment:

It is difficult even to use an overhead projector. I have to move the overhead projector from another room to my classroom and the class is too crowded. It is hard to find a suitable place for placing the overhead projector in the classroom too. There even isn't any screen in a classroom. (Peggy)

The following examples from the other student-teacher interviews suggest reasons for this apparent indifferent attitude towards using technologies in teaching even when the facilities were available:

There is at least an overhead projector in every classroom in lower primary classes. However, the teachers do not use it so often. When I tried to use it one day, I found that the cover was full of dust. The students were surprised and motivated to see me using the overhead projector. I think that they [the teachers in the teaching practice school] have been using the same traditional teaching for many years ... They talk and use textbooks as the main medium for their teaching ... The students there have got used to this teaching style, quite passive. (Pauline)

There is an overhead projector in every classroom. However, I found that all the overhead projectors were placed at the corner of the classrooms with many other unused things being put on their

surfaces. I had difficulty in removing all the things before I could use one of them. (Sally)

The resources there [in the school] are quite sufficient, but the staff do not use them very frequently. There are at least two overhead projectors on each floor. There are also other portable overhead projectors in the resources room. There are computers in the staff room too. However, seldom did I see any one of the staff use them to prepare materials or to use them in the class during my teaching practice. (Rita)

These comments thus point to a school culture which does not value the use of even rudimentary audio-visual equipment, or basic hardware like overhead projectors, even when available.

A similar situation applied to the use of more modern equipment such as computers. Clearly, lack of availability was a factor (see above), but the rather negative school culture resulted in some student-teachers modifying their use of computers. For example, one of the student-teachers using his own laptop computers in 'tryout lessons' reverted to using the overhead projector and colour transparencies. Two others attempted to use the school computing facilities. All of these student-teachers expressed that the computing facilities were either inadequate or inconvenient for use in their schools. One of the student-teachers explained her reason for using a video clip in a CD-ROM with her own laptop computer instead of using videotape as follows:

The reason is the poor facilities of the school. There isn't any video tape player in my classroom. If I want to borrow one, the procedure is very clumsy. Therefore, I tried to use my own Notebook computer in order to save a lot of trouble during teaching practice. The production and installation are easy and I can manage them by myself. (Amy)

These student-teachers thus encountered an unfavourable environment for information technology in their lessons having to invest their own time setting up equipment. This was seen to impact adversely on teaching time: "I have wasted some learning time, almost 10 minutes or more ... to get the computer up!" (Oliver)

6.4.2 *Unfavourable Attitudes and Perceptions about Information Technology in Education*

Conservative Administration and Staff

The above discussion has highlighted the influence of the lack of a favourable environment towards the use of technology in teaching. Another related factor identified from the qualitative data was conservative attitudes towards technologies among the school principals and more senior teachers. Seven of the student-teachers reported bad experiences when they attempted to use the computing facilities for their teaching from the schools, finding, for example, lack of support from school principals. It seems the administrative staff were more concerned with what damage might occur when such new equipment was used in the classroom:

The school isn't too supportive in this aspect [using information technology facilities of the school]. I was not encouraged to use the information technology facilities by the school principal ... I was told not to damage any computer facilities if I was going to use them. The information technology equipment there was new and the staff were just thinking about how to avoid any damage to the equipment. (Chris)

The school principal and most of the teachers are rather conservative and do not dare to take the risk of trying new things ... For example, I tried to convince the school principal to allow me to use a Notebook computer to connect a TV converter and to the TV for a PowerPoint session. The school principal told me that I could use it if I could guarantee of not breaking down the equipment ... Of course, I was afraid of doing something against the school principal's will during teaching practice. (Sally)

This type of experience was very off-putting to the student-teachers and led them to give up attempts to use computing facilities and revert to using traditional media. Moreover, one of the student-teachers - who did not follow the school instruction - received unfavourable comments in her teaching practice report as a result:

I was not encouraged to use the information technology facilities by the school principal ... I had tried to use the computer in the classroom without informing the school principal as she would not

allow me to do so. However, the school principal knew the incident at last. She asked me to see her and showed her discontent with the matter. I was marked as 'not conforming' to school regulations in my teaching practice report. I am not very happy about that. (Betty)

The above findings appear to be reflective of common practice in primary schools at that time. These conservative attitudes were noted during classroom observations and recorded in field notes and in journal entries about student-teachers perceptions of their school: "The school is wasting too many resources... by buying so many expensive 'vases' [computer facilities] just for decoration." (Betty)

Similar conservative attitudes were evident amongst established teachers in the schools in which the teaching practice was conducted. Six of the student-teachers reported similar experiences with other teachers during teaching practice:

I can tell from my teaching practice experience about it [the common practice of the school teachers]. I was studying in the same school when I was a primary student. I see that many teachers in the school are still using the same old teaching methods as many years ago as I was a student there. They [the teachers] are the ones who oppose to try new things. (Flora)

Given such a conservative attitude among the administration and teaching staff in the schools, they have posted barrier rather than help in facilitating learning about the use of information technology in teaching and learning.

Perceptions about Information Technology in Education

Further examination of interview transcripts for interviews conducted after the teaching practice revealed another factor that affected the use of information technology during the teaching practice. The student-teachers reported that the current school teachers did not believe information technology enhanced learning - rather seeing it as 'indulgence' or as a 'show'. For examples:

Most of the staff in the school prefer and indulge in traditional teaching method ... They perceive that PowerPoint is no different from and no better than a picture in the textbook. (Amy)

It [PowerPoint] makes no difference from traditional overheads or picture presentation. Teachers only present the contents in graphic and text format and lead the question-and-answer routine just like a traditional teaching'. The teachers in my school always express the above queries about using information technology in their teaching. They also express that information technology is for the school principal and the parents. It is only a show for the public only! (Doris)

Lack of emphasis on the learning features of information technology, also was seen as a deficiency in teacher-training courses:

I have talked with my friend, who is an information technology coordinator in a school. She always expresses her discontent about the training courses offered for in-service teachers. Most of the training is unrelated to teaching. Just knowing about new products in the market! Some of them are focused on the mastery of certain skills of the computing software, but none of them talk about application and integration as what I have learnt in your [DDIM] course. (Flora)

Thus it seems that current teachers see the role of information technology to be in replacing traditional media acting in much the same way as traditional media; namely, as a teaching aid.

The above data seem to tell a similar story for the primary schools investigated here: at the time of the present study they were not technologically 'ready', and the current school teachers were teaching in a very traditional manner characterised by talk and heavy reliance on the use of textbooks. These findings thus support the quantitative findings presented in Section 6.2, which suggested that blackboards and printed media were the most commonly used classroom materials. Whilst inadequate facilities and inconvenience might go some way towards explaining the lack of use of technology in these schools, it seems that the crucial factor is indifference and conservative school-wide attitudes towards using technology. These perceptions also are reflected in the journals of two student-teachers.

Further investigation of the qualitative data from the post-observation discussions revealed the existence of some internal factors that affected student-teachers' use of information technology in teaching and these factors are described in detail below.

6.4.3 *Being a Student-teacher*

Concern about Classroom Management

The data from the classroom observations suggest that these student-teachers were instinctively inclined to use a teacher-directed teaching approach, although some element of student-centred learning (e.g., group learning activities) were incorporated in a few lessons. None of the participants attempted a more open approach compared with what they studied and presented in tutorial sessions during the DDIM module. All the learning activities in the teaching practice were directed and strictly controlled by the student-teachers. This issue was discussed at length in post-observation discussions with five student-teachers: two factors emerged. First, was the concern with classroom management and discipline, for which the participants imagined problems might be brought about by using information technology. Not surprisingly, all of the participants saw a 'manageable' class as crucial for their survival during their teaching practice: "I feel more comfortable in the way that I have planned for this lesson" (Flora). This is reasonable for a student-teacher who attempted to use new strategy (information technology) in his/her teaching for the first time. This is understandable in a novice teacher, but given that these participants had some prior classroom experience in previous teaching practice, one might have expected them to be a more adventurous. It seems that the conservative attitude adopted here was related to other facts such as the 'subculture' of being a student teacher (see below)

Student Teacher 'Subculture'

A second important factor identified in post-teaching practice discussions was the 'subculture' of being a student-teacher. This was evident in the notion of apprenticeship with the student-teachers considering that their role was to learn from experienced 'veteran' school teachers and thereby needing to conform adjudged by these veterans:

As a student-teacher in a school, I dare not perform so differently from others and my students have got used to the ways of their teachers too. I am afraid to change so much. (Doris)

I know that I haven't introduced any new teaching method in this lesson. As I am still inexperienced as a student-teacher. I think that this kind of teaching strategies will make me feel more comfortable especially in actual teaching in the school. I cannot deviate much from the normal teaching in the school. (Tracy)

Such an approach is no doubt appealing; one 'fits in' with current school practice and at the same time addresses classroom management issues identified above. There is then strong compulsion to conform, to be seen to comply, fitting in with established school culture - which in these schools was dominated by traditional teaching approaches. This overrode any desire to be more creative or innovative even when encouraged to attempt innovative strategies by their teaching practice supervisors. In the absence of a strong role model of a creative, innovative teacher in the school, the approach taken by the student-teachers is seemingly inevitable. The notion of subculture dominated these post-teaching practice interviews with the bulk of the participants (10/15) describing their school culture as 'very traditional'.

The school is very old-style! Teachers there do not use technologies in their teaching very much. They teach in very traditional ways. Textbooks and blackboard are the only tools that they use in their teaching. The resources provided by publishers such as overheads, wall pictures, etc., are seldom used too. 'Question and answer' is the frequent teaching strategy they use. (Luke)

The above findings paint a rather gloomy picture; but this is somewhat misleading. The post-teaching practice discussions did identify some positive, beneficial experiences and influences during the teaching practice and these are described below.

6.4.4 *Influences from Favourable School Contexts*

Although, as noted above, many of the student-teachers reported inadequate facilities four of the student-teachers were positive about the facilities and the

teaching culture in their schools. For example, in Tracy's school, the resources were adequate and well utilised:

All the classrooms are equipped with overhead projectors and tape recorders. We can also use a notebook computer though we have to do a little set up before use ... The teachers there also use them quite frequently too.

This student-teacher also felt supported by the permanent staff in the school, for example, when setting up the computing facilities and using other resources and media. Similar positive experiences were reported by another student-teacher:

I am lucky that I can have my teaching practice in an information technology pilot school. The computer resources there are sufficient. The school has developed some instructional software using PowerPoint and Authorware. There is a video projector in every classroom. I just need to bring a note-book computer to the classroom, have the video cable connected then I can use my computer at any time in the lesson. I have a lot of chances to practise using them. (Nancy)

This type of experience was, however, rather rare and indeed occurred only in two schools.

Interestingly, the importance of positive support as part of school subculture was evident even in schools where facilities were less than desirable. For example, one of the student-teachers noted that teaching strategies learnt in the teacher education programme were applied in a real-life teaching situation:

The resources and facilities are not sufficient ... [but] I can see that the teachers there did try to use varieties of strategies in their teaching such as group activities and discussion. It was quite different from my past experience in my primary education in which my teachers used very traditional teaching methods. (Ellen)

A similar report was made by other student-teachers, indicating the importance of teacher and school subculture:

The experience of teaching practice has further reinforced my confidence in using information technology in teaching. I think that it is the favourable resources and the culture of trying new things of the school that have given me a chance to have this positive

experience. (Mary)

The above examples, though less prevalent, suggest that a positive subculture can lead to a more positive environment for the student-teachers in which they may feel inclined to take risks and be innovative in teaching, including in the use of information technology.

6.4.5 *The Influence of Past Learning and Teaching Experiences*

In post-observation discussions, one of the student-teachers commented specifically on learning experiences from the DDIM module. She was able to draw upon a specific learning experience to solve a technical problem when using the Internet:

I learnt the techniques [offline browsing] from you. As the classrooms haven't been wired up and my school does not have access to the Internet, off-line browsing is a proper method if I want my students to try searching on a web site. I think that it is similar to a discussion session where I have to prepare lots of reading materials for my student but now all the materials are in the web sites that I have prepared. Students can access to the resources that they need just by clicking a button. (Flora)

The following examples from the interviews after the teaching practice further illustrate the influence of past learning experiences from the DDIM module:

I have really applied what I have learnt in the DDIM module of how to use information technology meaningfully ... on the topics about the weather and history of Hong Kong. I have book-marked some relevant web sites and spent a whole lesson in the computer laboratory for students' exploration and finishing the worksheets that I have designed for their project. (Mary)

I have made a video programme about an interview with the 'Green Power' for my students in teaching practice. The topic is about water pollution and the plan of building a treatment plant in Lamma Island [a government project for reducing water pollution]. I have to organize the visit, to do the taping and editing myself. I think that as I have learnt the skills in the DDIM module, I should try it out as I have time in my teaching practice. (Sally)

Similar views were evident in all of the student-teachers' journals with one of the student-teachers describing the DDIM module as "a useful subject among those I have learnt in these two years." (Betty)

6.4.6 *Reflecting on Experiences During the Teaching Practice*

In the post-observation discussions, all five of the student-teacher participants stated that reflecting on their teaching experiences helped them to evaluate their views about teaching with information technology. They perceived changes both about the usefulness of information technology in the learning, and pedagogical knowledge about teaching with information technology. During the post-observation discussion, five open-ended questions were posed: 'Can you tell me something about your feeling of your teaching?'; 'Can you tell me your explanation about what you have mentioned?'; 'Can you tell me what caused you to use information technology in this lesson?'; 'Can you tell me why you use information technology in this way?'; and, 'Can you make any suggestions about what you want to improve?'. Two themes: thinking about student learning and reflecting on pedagogy were emerged from the post-observation discussion and is now discussed in turn.

Thinking About Student Learning

The data from the second short essay writing exercise conducted at the end of the DDIM module suggested a shift in thinking for the participants, to a perception that using information technology could promote a positive atmosphere in the classroom resulting in a more learning-oriented approach (see Chapter 5, Section 5.2.3). Such a perception also was evident in the post-teaching practice discussions, when the student-teachers were asked about the reasons for using information technology in their lessons:

I think that information technology can convey a clearer message about the learning content of this lesson to the students. For example, I can show the photos of the plants from other reference materials easily. The enlarged diagrams also help my explanation and better understanding of my students. (Doris)

Another student-teacher (Flora) responded to the same question in this way: “I can allow my students to know more about the topic ... My lesson is also a good chance to develop their [the students] information technology skills at the same time [while using information technology].” What is interesting here is that these two student-teachers (Doris and Flora) justified their decision to use technology from the perspective of students’ learning process, and specific learning outcomes. So Doris focused on how technology could enhance better understanding through the media, and Flora was concerned about how technology could expand students’ learning experiences, and provide opportunities for them to practice using information technology and develop their skills.

Reflecting on Pedagogy

The description of the research findings provided here suggests that reflective questions (along with other strategies such as writing of journals) help student-teachers to think more deeply about the usefulness of information technology in student learning. The following discussion focuses on how the student-teachers evaluated their teaching methods and pedagogical practice through this reflection process.

In post-observation discussions, Oliver queried the usefulness of using Microsoft PowerPoint. The objectives of the lesson in which he used PowerPoint were to help the pupils to understand the meaning of some words in a chapter and to make sentences with a prescribed structure in a Chinese Language lesson, and the teacher prepared detailed content and presented these in a pre-determined sequence using PowerPoint. As shown in the classroom observation record of Oliver (Appendix J), he adopted an expository approach with a series of development sequences: ‘Teacher shows information assisted with PowerPoint presentation and asks question’; ‘Student answers question’; and, ‘Teacher gives feedback and elaboration with PowerPoint presentation’. This was followed by an evaluation sequence: ‘Teacher shows problem and asks question assisted with PowerPoint presentation’; and, ‘Student selects answer from PowerPoint programme and receives feedback from computer’. He commented afterwards, that this lesson,

despite appearances, was probably no better for using computer.

This experience tells me that the way I have used with PowerPoint is not too effective. It is not too meaningful that I explain or elaborate certain teaching points first and then reveal what I have talked with the projection of same contents again by pressing a key on the keyboard. I think that this talk-and-click method is not the best way of using the computer technology. Even though I have invited some students to come out and click on their choice of the answers, I cannot see any educational value from this method. (Oliver)

Similar comments were made in post-observation discussions with Tracy who reflected on her use of a graphic browser to present some scanned photos to her students. She stated: "The way I have used with the computer is no different from presenting a wall picture or an overhead transparency to my class. I think that I can use overhead transparency instead next time". These two student-teachers adopted a similar expository approach in presenting the teaching contents by means of computer. They had invested time in setting up the computing facilities (a computer and a video projector) at the beginning of the lesson. Upon reflection, they decided this was not appropriate use of information technology, because they could not see how it improved learning. Hence, according to these participants this pedagogy was not particularly effective. They noted that the learning atmosphere achieved using information technology may have been more exciting or pleasant for the pupils, but clearly doubted it improved learning. This led the student-teachers to think more deeply about the relationship between the use of technology and the choice of teaching strategy.

The experiences in the group learning activities with the use of computing technologies in the lessons of Amy and Flora also enhanced their thinking about appropriate use of information technology after post-observation discussions. These two student-teachers adopted a similar approach in their lessons, working on different activities in small groups. One of these group activities involved the use of a computer in which information was presented in the form of a digital video and a website in a CD-ROM in the lessons of Amy and Flora respectively. It was observed in the two lessons, that the students were instructed to view the video clips and the offline websites. They were subsequently asked to comment on what they liked about the content. Upon reflection these student-teachers felt that they

needed to design specific tasks for their students so that they could interact with the computer resources in a meaningful fashion:

I realise that I have to design something for my students to do after viewing the video files. Just asking them to discuss around a topic is not enough. I should ask my students to make use of the information they have just got and their report should have something related with the use of this information. Some criteria were needed. (Amy)

I realise that I cannot depend much on the resources alone. For example, in this lesson, I have just allowed my students to click on the web site and play on the puzzle [in the web page] without clear focus on what they should do with these materials. I should have thought about how such resources can help my students learn and how can my students use the materials in the learning process with clear objective. (Flora)

Based on these reflective experiences, the two student-teachers were able to examine critically the effectiveness of the way in which they had used information technology in their teaching.

6.4.7 *Conversation Helps Reflections*

The above discussion suggests that reflection, based on actual teaching experiences, helped the student-teachers to reconstruct their thinking about the effectiveness of specific pedagogies in the use of information technology in their teaching. The student-teachers also commented on the value of post-teaching practice discussions. One of the student-teachers expressed her thoughts about the value of this post observation discussion:

A discussion of this kind is valuable and needed, since many other supervisors seldom talk about using technologies in a post-supervision discussion session in this way. This discussion process helps me to reflect on the essence of meaningful learning and the relationship between the teaching method and the use of instructional media. I can get some ideas about some tricks and tips of using technology in my teaching too. (Flora)

This student-teacher thus felt that through discussion with the researcher, she could examine the effectiveness of her choice of teaching strategy and the way in which

she had used technology in her classroom. Questions and ideas raised in the conversation helped her to think more deeply and critically about his issue. A strong theme to come from these conversations was that the student-teachers felt that they needed guidance to achieve more 'high-level reflection processes' about their teaching experiences. Without the benefit of stimulating questions in the post-observation discussions and during interviews, the student-teachers felt that their reflections would be 'superficial' (see Chapter 5, Section 5.3.2, p. 149).

The reflections on the teaching practice experiences were revealed above through interviews, post-observation discussions and journals from the student-teachers. Most student-teachers faced with unfavourable technology environments and adverse attitudes and culture in using information technology in the teaching practice schools. The perception of being a student-teacher might have further hindered the attempt of using new strategies and technologies in teaching. However, the positive model observed in some schools and from the past learning experiences in the teacher education programme, the reflecting activities during post-observation discussion and the conversations during interviews constitute to the conducive factors that help to develop better understanding about using information technology in teaching and learning.

6.5 Perceptions of Teaching with Information Technology to Achieve Student-Centred Learning

Here the student-teachers' perceptions about teaching with information technology are described, looking at their views at to how information technology facilitates student-centred learning after the intervention.

The data for this discussion were derived from interview transcripts of the 15 student-teachers who agreed to use information technology in some of their lessons during their teaching practice (though only 5 of them agreed to take part in the try-out teaching). In these interviews, three questions were asked and the themes explored are described in the following sub-sections. The questions were:

1. In your opinion, what is (are) the way(s) of teaching with information technology?

2. In your opinion, how does information technology facilitate student-centred learning?
3. Here is an example of how a teacher use information technology in his teaching (described by the researcher), please comment on this case?

6.5.1 *Perceptions of Teaching with Information Technology*

The findings of this section came from the responses of the 15 student-teachers to the first question mentioned above. Table 6.5 only shows the themes from those responses with improved concepts of using information technology in teaching from the interviews. From Table 6.5, three of the student-teachers changed their views about the meaning of information technology, from thinking purely of computing technologies, to a broader meaning that included other technologies. These participants began then to focus on the effect of these technologies on learning, rather than the nature of technologies themselves. Additionally, at this stage they no longer distinguished between 'new' and 'old' technologies.

Apart from learning these two software [i.e., Microsoft PowerPoint and Authorware], other instructional media such as OHP, camcorder etc., are worth learning too, as many of these media are still used in most of the schools nowadays. I think that information technology is not equivalent to the use of computers only. I will consider that other traditional media can be called information technology too, only if they facilitate learning. (Tracy)

Table 6.5

Student Teachers' Perceptions of the Meaning of Information Technology (n=15)

Improved Concepts about teaching with information technology	Occurrence*
Meaning	
Broader meaning not confined to computer	3
Computer may not be the best	1
Pedagogy	
Not just to operate an equipment or a software	2
Not just to present information	3
Not just to play with skills	2
Requires interactions	1
Requires clear tasks or projects	1

*The number reflects the occurrence of improved concepts about teaching with information technology only.

One student-teacher commented that information technology might not be the best for learning in any situation suggesting a developing understanding of the relation between the selection of an appropriate technology and the learning requirements for a given situation:

I think that the most important part is about the concept of applying information technology in teaching. I think that most of my classmates got some ideas from the DDIM module ... there are advantages and limitations of a particular technology in teaching. For example, if I am going to present text or picture just for questioning and elaboration by the teacher, an overhead projector would be as effective as a PowerPoint presentation. But if I am going to use the Internet to search for some information on the spot, an overhead projector will not be appropriate. (Flora)

Two of the student-teachers commented on the importance of applying design principles when producing effective teaching materials. It seems they felt that the operation of equipment or computer software was not the major issue when using information technology in their teaching: "I think that I have a clearer concept about designing an instructional medium. I have to consider the design principles too not just only knowing about the operation of the equipment or software." (Luke) The other participant redefined her role of using information technology, changing from a 'user' to a 'producer' of teaching media:

I can say that before the module, my perception of using technologies is only at a user level, i.e., to know how to operate equipment or to use software. That is enough. But now, I start to realise that a teacher should know how to apply technologies in a learning process and may need to be a producer of teaching and learning materials too. (Peggy)

Three of the student-teachers suggested that computer applications could be used for more than presentation of content matter: "My first concept of information technology was confined to computer, Internet and now I realise that it may include many other media. I am also impressed that technologies can be used in many different ways not just as a presentation tool in a lesson." (Pauline) Another student-teacher commented on how she would put these thoughts into practice in the classroom in the future:

I think that I will apply some of the strategies used in this module in

my future teaching. I don't think I will use PowerPoint just to present the facts to my students as I start to feel bored about such kind of passive presentation. I will think more other than just presenting materials if I use PowerPoint in the future. (Flora)

When talking about different ways of using information technology in teaching, two student-teachers commented that the intervention developed in this study (i.e., DDIM) helped them understand the importance of using appropriate strategies as opposed to just developing skills in the use of information technology:

I am not too concerned about what kind of concept that I have got at the beginning. I think that I will be able to apply the skills that I have learnt automatically when I am teaching. The most important thing is to learn as many skills as possible in the module. But I see the importance now that more reflections on the cases about applying technologies can help me a lot and stimulate my thinking of actual application in teaching rather than playing with the skills. (Chris)

Another student-teacher said that she changed her focus in using computer software, starting to think about strategies that could enhance student-student interactions:

I realise that a PowerPoint presentation is not very effective as there is no interaction between the students and the learning material. Students are still passive in receiving information from the PowerPoint only. I will think about more on the interaction strategies now than just about how contents are presented. (Sally)

Another student-teacher shared a similar view, suggesting that students need to be actively engaged in their own learning

Project work is worth doing for upper class students, but I start to realise that very clear guideline especially on the requirements is important. It is also important to make sure that the work is done by the students and let the students know that the results of the project will not affect their normal assessment. (Flora)

She stressed the importance of doing projects while using information technology. However, her experiences told her that guidelines were also important, especially for the primary students. She also suggested that students should not be encouraged to complete a project just for assessment.

The above findings show that despite the unfavourable conditions that the student-teachers faced at the time of teaching practice, some of them were able to reflect on their experiences and showed conceptual change about the meaning of information technology and the appropriate ways of using information technology to facilitate learning.

6.5.2 *Perceptions of using Information Technology for Student-Centred Learning*

The student-teachers also provided ideas about how information technology could be used to facilitate student-centred learning (Table 6.6) and a number of themes emerged from the interviews.

Seven of the student-teachers felt that the use of information technology should serve as a learning resource to help students to build up their own knowledge in their own way:

On the whole, the essence of student-centred learning, though a bit abstract, should be progressive, building up knowledge by students gradually with the help from teachers and the computing resources according to their abilities and characteristics. Learning by doing is, after all, the most important element. (Sally)

Table 6.6

Student Teachers' Perceptions of Student-centred Learning (n=15)

Concepts about information technology and Student-centred Learning	Occurrence
Information technology should enable students to:	
build up own knowledge and skills	7
find out something by themselves	4
learn in groups	2
solve problems	2
Information technology should bring change to teacher's role	1
Information technology should cater for individual differences	3

Four participants talked about using information technology in a student-centred way, as a process in which the students are allowed to explore the information technology resources in particular learning activities:

I think that a teacher need not tell too much in a student-centred way. The most important thing is to provide opportunities for the students to explore and to identify the contents with technical support and information technology resources via various learning activities. (Mary)

Student-centred learning should be something more. The students should find out the knowledge they need in a learning process. Example, students are asked to find out some things on the Internet. It is a process that students have to do it by themselves. (Grace)

Two participants seemed to believe that student-centred learning involved group work, feeling that information technology could provide a supportive environment - similar to what they had experienced during the DDIM module:

I think group work is also an important element of student-centred learning as students in a group can help each others and share the happiness of achieving some goals in a learning process. This is what my experience in the DDIM learning process tells about. (Jane)

Another two student-teachers also recalled learning experiences in the DDIM module, seeing these as examples of student-centred learning. They saw student-student interaction and problem-solving as key elements for student-centred learning:

For example, the experience gained in the DDIM module is a kind of student-centred learning. You have prepared some resources such as CD-ROM, web sites, etc. You have also designed some tasks and workshops to allow us to interact with the resources ... I have learnt to solve my problems by looking for references, asking staff of the ETU [i.e., the Educational Technology Unit] for assistance, and consult you in the tutorial sessions. (Tracy)

One of the student-teachers suggested that didactic teaching is not appropriate in a student-centred classroom:

Another element for student-centred learning is the role of the teacher. The teacher should not be didactic and should allow more freedom for student to explore and express rather than to confine them to some pre-determined questions and answers. (Oliver)

Three other student-teachers felt that teachers need to think about students' prior knowledge, and not focus solely on learning activities: "We have to think more about whether such learning process is suitable, whether the teacher has considered students' abilities, their previous experience." (Peggy)

The above findings further show the effect of field experience on student-teachers' perceptions about student-centred learning and the role that the teachers and information technology can take to facilitate such learning.

6.5.3 *Student-teachers' Views of Cases about the Use of Information Technology*

In the last part of the interview, the student-teachers were presented with two 'cases' involving using information technology during teaching, and were subsequently invited to comment on the cases from a student-centred learning perspective. They were also encouraged to share their opinions about student-centred learning with information technology.

One of the cases put forward for comment was that described from the classroom observations reported in Section 6.3.1 (p. 167). This was the lesson concerning the teaching of words, phrases and sentence structure with a Chinese Language version of Microsoft PowerPoint programme in a Chinese language lesson (Oliver). In the lesson, the teacher prepared all the lesson content in detail and delivered the lesson in a prescribed sequence using PowerPoint. The students were given the chance to select answers to multiple-choice questions using a computer. The other case discussed here was an excerpt from a local newspaper about a video-conferencing activity conducted by two local primary schools (although the schools were not far away from each other). In this activity, students were given the opportunity to talk to each others using *Putonghua* (a common verbal language in mainland China) through the video-conferencing technology provided by a vendor.

None of the student-teachers who responded to the questions considered that the first case to be student-centred learning. They saw the teaching as a 'one-way' activity, although they noted that the students were involved in some interaction via

the computer. The participants thought that this case, despite using information technology, was essentially traditional teaching in which the students were passive recipients of content:

It is not the kind of student-centred teaching. It is similar to a traditional teaching but using different teaching aid for question and answer only. I will consider that a student-centred learning lesson should allow student to participate in the learning process actively and they should feel the need of such learning. (Ellen)

In contrast, all of the student-teachers saw the second case as student-centred learning. They considered this to be student-centred because, as they saw it, the primary school students were actively engaged in conversation when using video-conferencing technology. Through this occasion, these students found the need to use and thus to learn more about Putonghua. However, one of these student-teachers queried the need for information technology, commenting that, whilst this was a student-centred activity, it could also be conducted without using any technology:

To many teachers, it [video-conferencing] is a new and exciting breakthrough of using technology in this way. But to me, I don't think it is really meaningful if it is just only for practising 'Putonghua' between two schools in the same place [Hong Kong] ... Why didn't they arrange a visit to each other? Students could also practise the language face-to-face without the IT ... I think that it will be more meaningful if we can arrange such communication with a school in Mainland China. In that way, the students are really applying the language they have learnt and prepared. They can tell some things about the culture, the characteristics of our city. (Doris)

One student-teacher shared her experience of visiting a primary school in Mainland China, commenting that although advanced information technology had been installed in the school, the teachers used them as 'electronic textbooks'. She did not see any significant contribution made by information technology in such lessons:

I had an experience when I joined a student exchange tour with a primary school in Mainland China this summer. The school is one of the sample schools of using IT. A Chinese lesson was conducted in a computer laboratory which was installed with advanced information technology facilities. I recognised that the teaching

strategy used in teaching an essay with information technology was not effective. Students just sat in front of the computer, watching the texts on the monitor and read them aloud only. The teacher just used the computer as a traditional textbook. Teacher asked questions. The students raised their hands and answered the questions just like a traditional lesson. I consider that it is a waste of money if technology is used in this way. (Flora)

Other student-teachers were of similar opinion, with one commenting that student-centred learning need not necessarily involve the use of information technology. She felt she could achieve student-centred learning in other ways:

Although I don't have the chance to use much information technology in my teaching practice, yet I think that my teaching is still student-centred. I have used other media such as video, and overhead transparencies, as resources in some exploratory activities, allowing my students to think, to discuss and to report. This kind of teaching is not common among the teachers in the school as they are still quite text-book oriented in their teaching. (Peggy)

The above sections have described some perceived changes in the perception of teaching with information technology and its use for a student-centred classroom after the interventions of phase one. Perceived changes of concepts in using information technology were reported. There were reports of boarding meaning about information technology. There was a shift of view of the teachers' role to a designer who develops teaching materials for facilitating student's learning. Some of these student-teachers even emphasised the quality of the teaching media and its effect on student's learning. They were aware of the importance of incorporating design principles while they were preparing such materials. There were also reports of a shift from emphasis on the production of teaching media, to the incorporation of appropriate strategies for meaningful learning. Suggestions such as the adoption of interactive activities and group projects were also made by some student-teachers. The student-teachers also showed their understanding about the role of information technology in facilitating student-centred learning such as being resources for students' exploration and tools for problem solving. They also indicated their ability to identify the elements and to evaluate the effectiveness of a student-centred learning activity.

6.6 Chapter Summary

Chapter Six began with a general description of student-teachers' use of information technology during teaching practice. Although school computing facilities were not satisfactory, some of the student-teachers did attempt using information technology in their teaching. They also used apparently more information technology compared with the practising teachers. Detailed findings of five classroom observations which follow (Section 6.3.1, p. 167) showed three teaching patterns of using information technology: (1) for preparation of teaching aids; (2) for teachers' presentation; and, (3) for preparing materials for group work. Although student-centred activities were identified, they were mostly confined to teacher-directed group work. The factors, both favourable and unfavourable, that influence student-teachers' development in using information technology were identified from in-depth interviews after teaching practice and were described in the following section. It was found that the technology environment; attitudes of practising teachers; administration and culture of a school; past experiences and perception of being a student-teacher; and, opportunities to see role model, to reflect on teaching practice experiences and to communicate with a more experienced person were considered influential in helping student-teachers' learning to teach with information technology (Section 6.4, p.169). The chapter ended with the exploration of the perceptions of teaching with information technology for achieving student-centred learning among the student-teachers. The expressions of a student-centred view of learning were reported. The student-teachers were able to explain the meaning of information technology and student-centred learning. They were also able to express the appropriate ways of using information technology for facilitating student-centred learning (Section 6.5, p. 187). The findings in this chapter further validate the importance of providing authentic experiences in teaching practice which should be considered as an indispensable component in a teacher education programme. Chapter Seven that follows describes the context for the development of an induction programme that aims to reinforce the skills and concepts of teaching with information technology among the beginning teachers in the second phase of the present study.

Chapter 7

The Information Technology Reinforcement Induction Programme for Beginning Teachers

7.1 Introduction

This chapter describes the context for the development of the *Information Technology Reinforcement Induction Programme* (ITRIP) for beginning teachers that participated in the previous phase of the study (see Chapters 4 to 6). This programme aims to support on-going development of the application of information technology in school teaching for beginning teachers. At the beginning stage, the schools environment, the general views of the current application of information technology in teaching, and the needs of the beginning teachers were identified through a questionnaire (see Chapter 3, Section 3.6.3, p. 93) and follow up conversations with the participants. This information was used to develop the main content to be covered in the ITRIP. Pedagogically, ITRIP was based on the constructivist framework developed in the previous phase of this study (see Chapter 2, p. 61). It focused on self-directed personal professional development and its effect is discussed in Chapter 8.

The participants of the phase of the study described here were seven beginning teachers who had just graduated from the 1998-1999 teacher education programme and that had participated in the intervention in the previous phase of the study at the beginning of the ITRIP. The seven beginning teachers are represented by pseudonyms as: Amy (teacher A), Betty (teacher B), Chris (teacher C), Doris (teacher D), Ellen (teacher E), Flora (teacher F), and Nancy (teacher N). To recap, Ellen taught in a government school, Betty taught in a private school, and the others taught in government-subsidised schools. Betty, Chris, Ellen and Nancy taught in whole-day schools¹ while the remainder taught in half-day schools (Amy in

¹ Whole day schools have a teaching timetable from 8:00 AM to 3:30 PM from Monday to Friday. Half-day schools have a timetable either from 7:30 AM to 12:30 PM or from 1:00 PM to 6:00 PM from Monday to Friday and with an alternate morning session on Saturday.

mornings, and Doris and Flora in afternoons). These teachers taught different subjects at different levels, mostly in lower primary classes. Doris and Nancy did not succeed in getting substantiate teaching posts and were temporary teachers for the school year, whereas Chris, Ellen and Flora were members of the 'information technology team' in their schools. However, only Betty and Flora were required to teach information technology in the normal timetable (there was no information technology team in Betty's school). Of the seven participants, three (Amy, Doris, and Flora) had participated the 'tryout teaching' during their teaching practice (See Chapter 6). Before graduation, these participants interacted extensively with the researcher consulting frequently on design and production matters about school projects, and were clearly committed and dedicated to their positions. Betty was the student teacher that received unfavourable comments on her teaching practice report as mentioned in previous chapter. She developed a strong rapport with researcher during her last year study in the teacher education programme. Chris was a highly committed individual that gained a part-time post as instructional programme writer for a primary school. The researcher noted at the time (field notes) that this was reportedly due to learning experiences from the DDIM module that ostensibly built up Chris's confidence.

A questionnaire (see Appendix C4) was mailed to all the 15 participants of the first phase of this study in December 1999, approximately three months after their beginning. Finally, seven of these participants (mentioned above) had responded to the questionnaire. The questionnaire sought the participant's views for the topics listed below: in addition there were spaces for free responses. Follow up interviews also were conducted with the participants in order to clarify and triangulate questionnaire data.

This chapter describes research findings from the questionnaire and the follow up interviews. There are two aspects to this description:

1. Understanding the school contexts
2. Use of information technology by the beginning teachers

7.2 School Context

This section describes the school contexts in which the seven beginning teachers were situated at the beginning of the study. The description includes the school computing facilities and the readiness of using information technology in the school curriculum (Table 7.1).

Table 7.1
Context of Information Technology for Participants' Schools

	A	B	C	D	E	F	N
Computing Infrastructure							
1. Computer to students ratio	1/13*1	1/8*1,*2	1/16*1	1/20*1	1/13*1	1/25*1	1/12*1
2. Computer laboratory	✓	✓	✓*3	✓	✓	✓*3	✓*3
3. Internet accesses at computer laboratory	✓	✓	✓*3	✓	✓	✓*3	✓*3
4. Computer installed in all normal classrooms	-	✓	-	-	✓	-	-
5. Computer installed in some normal classrooms	✓	-	-	✓	-	-	-
6. Data port of LAN installed in all normal classrooms	✓	✓	✓*3	-	✓	-	-
7. Data port of LAN installed in some normal classrooms	-	-	-	✓	-	-	-
8. Internet accesses at normal classrooms.	✓	✓	-	-	✓	-	-
9. Computer installed in other rooms/areas	-	✓*4	-	✓*4	-	✓	-
10. Additional computer laboratory	-	-	✓*5	-	-	✓*6	✓*6
School Readiness							
11. information technology policy implemented	✓	-	-	-	-	-	-
12. information technology as a subject	✓	✓	✓	-	-	✓	-
13. information technology use in other subjects	✓	-	-	-	-	-	-
14. Teaching approach of staff perceived by the beginning teachers *7	6	3	3	5	3	2	3

*1 Number included computers in ED1 and ED3 project for teaching only (administrative or teachers' productivity use were not counted). The ratio is calculated by dividing the total number of computers with total number of students.

*2 Betty's school was a private school. Computing facilities were funded by the school organisation only.

*3 The stated facility was unavailable until the implementation of the ITRIP project of this study. Before that, teachers had to set up their own computing facilities in the classroom whenever they wanted to use it.

*4 With Internet connection.

*5 The computer laboratory was installed with iMac only. The main purpose of the laboratory was for Internet browsing.

*6 It was a temporary computer laboratory. No network and projection facilities were installed.

*7 The number represents the rating on a scale from 1 to 7 in which 1 stands for extremely teacher-directed teaching and 7 for totally student-centred teaching

Key: A=Amy; B=Betty; C=Chris; D=Doris; E=Ellen; F=Flora, and N=Nancy

Table 7.1 provides an overview of the school context identified from the questionnaire survey and the follow up interviews. These data reveal that the schools were at different stages of development in terms of the computing facilities and the readiness for the implementation the *Five-year Information Strategy Plan* proposed by the Education Department of Hong Kong. These different school contexts are described in detail in the remainder of this section.

Computing Facilities and Utilisation in Schools

At the beginning of the implementation of ITRIP, the ED3² project was in the early stages of implementation in the schools of Chris, Flora and Nancy, whereas in the other schools the main infrastructure of the project was completed. The computer-to-pupil ratio varied among these schools as schools were given the autonomy in the allocation of computer resources according to the information technology plans for individual schools. No fixed target in respect of computer-to-student ratio is prescribed in the Five-year Strategy Plan, and it is intended that each school, will determine their own needs (Section 3.3 EMB, 1998). In the calculation of Table 7.1, only the computers provided in the ED1³ and ED3 project used for teaching were included and those used for administrative work were ignored. From Table 7.1, it can be seen that in the schools of Doris and Flora, a number of computers were dedicated to teachers' administrative uses (seven in Doris's and 10 in Flora's school as reported by the beginning teachers in later interviews). In addition to computers used for teaching in dedicated computer laboratories and/or normal classrooms, computers for pupils' access were also provided in the library for Betty's school, along the covered playground of Doris's school, and Flora's school had a computer provided for the teacher in the music room. In Betty and Doris's schools, pupils could gain access to the Internet via the computer stations during their free time.

² In ED3 project, each primary school will be provided with a LAN, a computer laboratory, an average of 40 sets of PCs with multimedia capabilities, and Internet connection to the laboratory, staff room and library by the end of 2000 as proposed in the Five-year Strategy Plan. (Refer to Chapter 1)

³ In ED1 project, the Education Department provided only 15 sets of PCs with multimedia capabilities before the launch of the Strategy Plan.

ED3 and ED1 Projects in Schools

Despite not having networked computer laboratories in the schools of Chris, Flora and Nancy at the beginning of the year, these schools subsequently installed additional computer laboratories, with, for example, a computer laboratory containing some 20 iMac⁴ desktop computers connected to the Internet for Chris's school funded by the school organisation before the ED3 project. However, no other teaching facilities (such as overhead projector, video projector, screen or teacher's station) were provided. Due to compatibility problems with educational software, the laboratory had not been installed with any educational or productivity software and the use of this computer laboratory was dedicated only to Internet browsing, with pupils free to sign in the computer laboratory in recess and after school. Chris reported that this laboratory had not been used for teaching since its installation a year ago.

For Flora's and Nancy's schools, the computer laboratory was a normal classroom containing computers provided via the ED1 project. Flora's school was equipped with 12 PC notebooks (another 3 notebooks were assigned for teacher's use), similarly, Nancy's school had 15 PC desktop computers installed in the classroom. Local Area Network (LAN) and presentation facilities were not included in the ED1 project, meaning that if teachers wanted to project software for teaching purposes, they had to set up a screen and the video projector themselves. Nancy commented that the facilities provided by the ED1 project were not well utilised, pointing out that the teachers seldom used the room for anything other than for administrative work. In Flora's school, the computer facilities were used solely for teaching a computer awareness programme for primary three pupils with other teachers not using the facilities room for teaching or administrative work.

While the ED3 project was in progress, teachers in Chris's school were able to use the computers provided by the ED1 project and in addition purchased 15 laptop computers that were stored in a resource room. These laptops were dedicated to

⁴ iMac computers are not commonly used in Hong Kong schools.

teachers' use in normal classrooms at the time although the equipment had to be set up by the teachers in advance.

A number of the participants commented on the limited use of information technology in their schools at the beginning of the school term with most teachers' conception of using information technology confined to administration. It seems the main reasons were insufficient facilities and inconvenience:

At the beginning of the school year, teachers were reluctant to use the notebooks placed in the computer room. They did not feel the need of using those notebooks as they could use the PC in the general office for ordinary word processing and administrative work. They also commented that the notebooks were too old and inconvenient to use. (Flora)

The resources were far from sufficient when I joined the school last year. As the computer laboratory [of the ED3 project] had not been installed yet, I had to move a whole set of notebooks and video projector to the classroom whenever I wanted to teach with information technology at the beginning of the school term. I started to become reluctant to use the computing facilities again as I felt inconvenient and time consuming for a lesson of 35 minutes. (Chris)

Information technology is not very often used in our school. Some of the teachers have tried to develop PowerPoint materials for the General Studies but it is too time-consuming and it is not convenient too. They have to set up the video projector just for the presentation for that lesson ... as our laboratory is only a temporary one: no network and no video projector for the time being. (Nancy)

Flora felt that the lack of planning for teacher support and training meant that the provision of hardware (15 standalone desktop machines or notebooks) from the ED1 project was essentially a waste of money. In her view, many schools were not well prepared for these 'gifts'. The net result being that computers were just placed in an ordinary classroom or storeroom and not used in school teaching:

When I started my teaching at the beginning of the school term. They [computers of the ED1 project] were just placed on the desks of the will-be computer laboratory. Teachers were free to use them in any way they liked when there was no lesson. However, as far as I know, they were not used so often by the teachers. And now, the

ED3 project has just been completed. These computer notebooks have been put aside and yet their uses are very limited. I think that it's a waste of money. (Flora)

Variation in Use of Information Technology

Table 7.1 shows that the infrastructure was similar in the schools of Amy, Betty, Doris and Ellen, excepting that Doris's school had no Internet access in classrooms. Amy and Doris's schools had a computer workstation in some classrooms (the other rooms had ports for laptop connections) whereas the schools of Betty and Ellen had a computer workstation in all classrooms. Hence, in these schools there were computer laboratories, and teachers had access to computers in all normal classrooms. Teaching software, either via a CD-ROM or retrieved from a school-based server, and Internet access were available in these classrooms. The exception was Doris's school, which used software on non-networked, stand-alone, machines and employed the use of CD-ROM or a programme disks. The output of the computer images were directed to large television screen that was standard equipment in all the classrooms in these schools. However, if a video projector was to be used in a normal classroom, arrangements had to be made in advance of teaching.

Utilisation of Computing Facilities in Well-Equipped Classrooms

Amy pointed out that her school was an 'early adopter' school for information technology in teaching for the school district. She seemed proud to be a staff member of the school, and appreciated the opportunities that she had for using information technology. She commented that, in contrast with her other teaching colleagues in other schools, there had been considerable integration of information technology in teaching in her won school in the first term:

As I compare with some of my friends who are teaching in other schools, I find that my school is much better. We are now talking about integrating information technology in class teaching. For example, we have a well-furnished computer laboratory. We are required to use information technology in our teaching. We have to

teach 'MS Paint' in art lesson. We have to teach general studies in the computer laboratory. Many of us have been using different CD-ROM titles in our teaching and we have computer classes after school. (Amy)

Table 7.1 suggests that the computing facilities in Betty's school were the best of the seven schools, with a high computer-to-student ratio and good computer networks. As a result, teachers in this school could teach using computing facilities at any location in the school. One might expect that teachers would thereby make more use of information technology than their colleagues in other, less well-equipped schools. However, the interview data tell a different story. At the beginning, Betty expected to exercise what she had learnt from the teacher education programme in such a 'technologically-rich' teaching environment. In fact she was rather disappointed and became quite depressed about her teaching in the school, resigning from her position at the end of the school year. At the beginning of the school term, she tried to implement more student-centred activities in her classroom, but this meant that she could not follow the prescribed schedule.

I would like to quote an example to illustrate the situation of my school. I have taught [Microsoft] Excel in the computer lesson and wanted to conduct some activities to allow my pupils to apply what they have learnt in a project. I was scolded by other teachers for I could not catch up with the prescribed teaching schedule. (Betty)

As a consequence, Betty was forced to follow teaching norms in her school and resumed a rather teacher-directed mode of teaching by the end of the first school term. Betty subsequently felt discontented about, in her mind, the lack of utilisation of the computing facilities in the school, commenting that most of them were for 'display' seeing their use as 'very superficial'.

We have Dacta - something like Lego, but it is controlled by a computer ... and a digital piano called Easy piano. They are just used to show off on the open day of the school only and are seldom used in actual class teaching. (Betty)

Doris was the temporary staff member in her school and as a result was not involved in the information technology team or school committee. At the

beginning of the school year, the infrastructure of the computing facilities had just been completed and there was no school policy of how information technology should be used in teaching. As a consequence, utilisation of information technology was minimal and mainly conducted by the information technology team:

In the first term until now, we haven't really started using information technology in education. We have to wait until next school term, before we will start using it. (Doris)

When the school LAN was at the trial stage, the teachers were free to use other computing facilities, such as notebooks, but not the computer laboratory provided by the ED3 project. However, again this required forward planning and setting up of the facilities by individual teachers. As reported by Doris, the utilisation of such facilities was thereby low. She pointed out that many of the teachers in her school were conservative, never having used information technology facilities in their teaching. Some teachers more accepting of new technologies, were bound by a tightly prescribed teaching schedule leaving little time to try experiment with new technologies. As there was no immediate pressure from the school, most teachers waited for further instruction and for the school authority to announce any new policy concerning the use of information technology in teaching.

Hence, although Ellen's school had a comparable infrastructure to the schools of Amy's and Betty's at the beginning of the school term, their utilisation of computing facilities was minimal.

We have about 15 computers in the laboratory. Only a few teachers have used it for teaching at the present times, some of them prefer to set up a computer notebook in the classroom instead of leading their classes to the laboratory in order to save time. (Ellen)

Ellen also commented that few teachers had actually used classroom computers in the classrooms due to the lack of a high-resolution video projector.

There is a computer installed in all classrooms. However, it is output to a TV. The image is too small and not too attractive. We have to move a whole computer set with video projector to the class and to do some set up work before we can have an effective

presentation with the computer. Many teachers feel that it's time consuming and not worth doing. (Ellen)

Few of the teachers in Ellen's school conducted classes in the school computer laboratory and made little use of computing facilities in the classrooms. This was in contrast with Amy's school:

We often use it for presentation such as pictures, diagrams and sometimes CD-ROM titles but we find that the effect is not good as we output the images to a twenty-nine inch TV. The images are too small and unclear when compared with those projected by a video projector in the computer laboratory. Therefore, most teachers will prefer using the computer laboratory instead. (Amy)

Teachers in Amy's school also were dissatisfied with output images in their classrooms but took the pupils to the computer laboratory if they found that the effect of the presentation was poor.

Teacher-Directed Teaching in Classrooms

The beginning teachers also were asked for their general perceptions of the teaching of their colleagues and were asked to respond to a 7 point scale ranging from extremely teacher-directed teaching (1), to totally student-centred teaching (7). The findings reported in Table 7.1 (item 14), point to a perception of a teacher-dominated pedagogy, with the exception of Amy and Doris's schools, which were seen to be student-centred.

Hence, overall the findings reported in Table 7.1 suggests that the schools of Amy, Betty, Doris and Ellen were 'technologically ready' for the implementation of information technology in teaching but that at the beginning of the school term, the utilisation of information technology - except Amy's school - was minimal. These data also show that Amy's school alone had a school policy for the use of information technology in the school curriculum teaching a 'computer awareness' subject as well as integrating information technology into other subjects. In terms of school teaching culture, the schools of Amy and Doris were perceived to have a more student-centred approach to teaching, although the use of information

technology was minimal in Doris's school.

7.3 Use of Information Technology by Beginning Teachers

This section describes the current state of using information in teaching by the seven beginning teachers that participated in this study. These findings are presented under five topics:

1. Commitments to using information technology in school
2. Teaching approaches in the schools
3. Time and types of using information technology
4. Attitudes towards using information technology in teaching
5. Perceived need for using information technology in teaching

7.3.1 Commitment to Using Information Technology in School

Table 7.2 shows that at the beginning of the school year, the beginning teachers' use of information technology was minimal for Doris and Nancy. Nancy, for example, had not tried to use information technology in any classroom teaching. Examination of the situation for these two teachers shows that they were temporary appointments, and hence it is perhaps not surprising that they were not assigned of any information technology duties or activities in their schools. However, these beginning teachers could if they wished use information technology in classroom teaching since in their schools, teachers had considerable autonomy. Doris did try to use the computing facilities of the school irrespective of her status. However, even early on, she commented that she would not try to develop any computer teaching resources by herself, instead choosing to make use of current resources developed by her colleagues: "I do not intend to make any computer resources by my own. I have just tried using the PowerPoint programme developed by the information technology teachers only".

This rather cautious approach is not unexpected given Doris's position. Her status

at the time gave her little sense of 'belonging' to the school and she clearly felt insecure about her career prospects. This meant that she dared not engage in any activity that might be deemed unusual or challenging: in her mind this might adversely affect her chances of obtaining a more substantial post in the coming year. Nancy was also in a similar position and likewise caused her to become somewhat indifferent about school policy and practice.

Table 7.2

Beginning Teachers' Experiences with Information Technology in Participants' schools

Information technology experiences	School						
	A	B	C	D	E	F	N
1. Committee work of the Information Technology Team or Committee of the school.			*		*	*	
2. Establishing classroom management routines for computer work (e.g. menu, guidelines, regulations etc.).		*				*	
3. Recommending computing facilities and resources to be used in your teaching (e.g. Multimedia CD-Titles, application software etc.).		*	*				
4. Producing traditional teaching resources with computers (e.g. coloured overhead transparencies by PowerPoint)	*		*				
5. Producing computer-based teaching resources (e.g. PowerPoint)	*	*	*		*		
6. Teaching a computer literacy/awareness class in normal timetable.		*					*
7. Conducting a computer interest class for extra-curricula activities.		*	*				*
8. Using computing facilities in teaching and learning activities for your teaching subjects.	*	*	*	*	*	*	*

Key: * = have such experience stated in the item

A=Amy; B=Betty; C=Chris; D=Doris; E=Ellen; F=Flora, and N=Nancy

Table 7.2 also shows that beginning teachers Chris, Ellen and Flora were members of the information technology team in their schools and that information technology was a timetabled subject in Betty and Flora's schools⁵. This suggests that some beginning teachers (i.e., Betty, Chris, Ellen & Flora) might make greater contribution to the use of information technology in their schools. However, a closer examination of the data in the table does not reveal significant involvement in the use of information technology for Ellen. Follow up interviews revealed that although the school possessed good computing facilities and teacher support (e.g.,

⁵ There was not any mandatory information technology curriculum in the primary education at the time of the present study.

teachers could share a notebook computer), the information technology team had no clear plan for the use of information technology in the school curriculum. Members of the information technology team adopted ready-made resources provided by book publishers along with resources developed by teachers from other schools. Indeed, there seemed to be little change to the use of information technology in these schools since the completion of the ED3 project. The computing facilities were treated as additional resources or teaching media in the school and the teaching practice remained much the same with limited use of information technology facilities. Ellen comments on her experiences in the use of information technology in her school:

Very rarely [did I use information technology in my teaching] ... I can just quote an example about using a PowerPoint software that was developed by teachers of other school on the teaching of 'least common multiples and highest common factors' in one or two mathematics lesson[s] ... just for presentation only. Some questions were shown on the PowerPoint and pupils were asked to respond. There was feedback from the programme when the pupils chose an answer ... We [Ellen and members of the information technology team] haven't thought of developing any software by ourselves. It was too time consuming. (Ellen)

Chris and Flora involvement in the use of information technology was greater than that of the other teachers, with the exception of Betty (see later), as both were members of the information technology team of the schools. Although Chris was a new member of the information technology team, the well established team was supportive. The team had developed many rules and regulations for the use of school computing facilities and they had already been administering the school computer laboratory (with iMac computers) for a year. The team also developed teaching software although the utilisation of these resources was rather limited (the ED3 project was undergoing implementation at the time, making it inconvenient to set up computing facilities in classrooms). As can be seen in Table 7.2, Chris was committed to the use of information technology in the school, undergoing a variety of experiences in the first three months of his teaching. This also was evident during his interview.

I have asked my pupils to do Internet browsing on selected URLs and then asked them to answer some questions.

We [Chris and other information technology team members] have selected and compiled some information technology resources such as CD-ROM titles provided by the publishers and recommended other teachers to use them. We are also helping the subjects to produce some PowerPoint programmes for sharing among subject teachers too. (Chris)

In the case of Flora, the information technology team had only been in operation for a year; nonetheless, she also had been involved in a variety of experiences using of information technology. This was mostly teaching contributions to the classes in information technology and in extra-curricula activities. Flora commented that because she had not received training as to how a computer lesson should be taught she followed the methods of other team members.

I teach them [i.e., computer skills] step-by-step and assess their skills by pencil and paper test; just like what I have seen in some workshops that I have attended. However, I found that my pupils had difficulty in identifying the correct procedures of booting up the computer in last examination even I had given them notes about it. (Flora)

Upon reflection, Flora made a number of suggestions to the members of the information technology team but she met considerable resistance from the team leader in what she described as 'personnel problems'. This she found unpleasant:

I suggested an activity about searching information for a lesson in General Studies⁶ but I was objected by the team leader with the reason that Internet search has not been covered until the computer class in primary four in the information technology subject. Therefore, the Internet search activity was excluded in other subjects below primary four ... My panel even said that I would disturb the teaching schedule [of information technology subject] for pupils would have nothing to learn about searching the Internet in primary four ... They [the other information technology team members] have no such idea [about integration] yet ... But as you know, I am too new to argue with my panel. (Flora)

This comment suggests that Flora has started to think about the value of teaching

⁶ General Studies is one of the key learning areas in the primary school curriculum in Hong Kong.

information technology skills in the school curriculum and that her experiences gained during her teacher education programme impacted upon her thinking. Further questions in the interviews sought her views about the teaching of information technology, and this revealed that Flora, despite some off-putting experiences, maintained a positive attitude.

I think that computer skills should be applied to other subjects. Otherwise, the pupils will have no opportunities to practice their actual usage. It is a concept that we have been introduced while we are still in the Institute [of Education]. Some teachers or even the principal have over-emphasised computer as a 'subject' to be learnt. I think that we are not going to train computer experts. My view is that most new teachers are competent to teach simple information technology skills. Pupils can also learn the skills easily provided you have sufficient resources and time for practice. The most important point is how these skills can be applied to other learning ... Although the concept is simple, yet I haven't thought of the problems and barriers that I have had met in the past few months.
(Flora)

However, this type of thinking was not particularly evident in her actual teaching when she first started teaching. Examination of her teaching behaviour suggests that she was a 'follower' and her teaching was teacher-dominated. The above comment points to conflicts and pressures on her, and she naturally tended to conform to school norms.

Betty also encountered many experiences in the use of information technology in the first three months of her teaching. She was involved in making recommendations about the use of computing facilities and resources although she was not a member of the school information technology team. In fact, there was no formal information technology team in the school. It seems that there was no staff member prepared to be accountable for promoting the use of information technology: as a consequence, duties were taken up on an informal basis. This flexibility was not particularly helpful, since when Betty wanted to try something 'new' (at least in the minds of other teachers) she faced the risk of getting behind with her teaching schedule and was subjected to criticism from colleagues. As mentioned above, this teacher had problematic relations with her colleagues. In spite of this she did try some other activities in her lessons:

As I teach the primary one in other subjects. I usually ask my pupils to draw pictures to present their findings. For example, I asked my primary one pupils to collect information about the names, food, and living environment of some animals in Chinese lessons, and their height, period of pregnancy, etc., in the mathematics lessons. I have also shown some relevant information from the Internet in the classroom. They were then asked to write or to draw to present their findings in a project ... I found that they were interested in doing their work in this way and were highly motivated and enjoyed the lesson. (Betty)

Amy, though not involved in any formal way in the use and implementation of information technology in her school, tried to produce her own teaching resources and to design activities with using information technology. She was able to successfully implement these in some lessons:

I have tried [to develop information technology resources] but not too often to produce some PowerPoint programmes for my English lessons at the beginning of the school year. But now, my colleague and I usually use ready-made resources, as we are too busy in our work for the time being. (Amy)

In Section 7.2 it was pointed out that a generally favourable environment existed in Amy's school, where teachers were encouraged to try new teaching methods and encouraged to develop student-centred activities using information technology. Although the use of computing facilities among the staff was not particularly high at the beginning of the year, the teachers there were not opposed to new technologies. In this respect, Amy's school was different to the other schools in the study, and Amy was not pressured to conform when she experimented with new teaching approaches. Indeed she received strong support from her colleagues and a sharing culture had already been established in the school. Her feeling of being supported and her appreciation of the opportunity of being one of the members of the school were well reflected in dialogue during her interviews:

We can teach in the computer laboratory with whatever topics that the teachers feel comfortable in any subject for the time being. We will then share our experiences in the last panel meeting among the staff. (Amy)

The above research findings have revealed the different experiences with information technology for the beginning teachers in the first three months of teaching. Those involved formal and informal school information technology team members were generally more involved, and the study also pointed to a number of bad experiences for some beginning teachers (notably, Betty & Flora). Interestingly, bad experiences did not necessarily put these novice teachers off, and they still felt committed to the use of information technology to enhance students learning (this is described in more detail in Section 7.3.4). The following section provides details about teaching approaches adopted by the beginning teachers along with factors that influenced their choice of teaching approach.

7.3.2 *Teaching Approaches in the Schools*

Table 7.3 compares the teaching approach of the beginning teachers with that of their colleagues - as perceived by the beginning teachers. These data were collected through the questionnaire survey (see Chapter 3, p. 83 and also Appendix C4). It is interesting to note that in most cases the participants rated themselves much the same as their colleagues. The two exceptions of teacher being Amy who rated herself slightly less 'student-centred' than her colleagues, and Chris who rated himself more 'student-centred'.

Table 7.3

Perceived Teaching Approach between Self and Colleagues among the Beginning Teachers

	Teacher						
	A	B	C	D	E	F	N
Rating of teaching approach of <u>colleagues</u> of the beginning teachers at the beginning of the school term. (1 to 7)*	6	3	3	5	3	2	3
Rating of teaching approach of the <u>beginning teachers</u> at the beginning of the school term. (1 to 7)*	5	3	5	5	3	2	3

* 1 = extremely teacher-directed teaching; 7 = totally student-centred teaching

Key: A=Amy; B=Betty; C=Chris; D=Doris; E=Ellen; F=Flora, and N=Nancy

As shown in Table 7.3, the views of these latter two beginning teachers were also borne out in the interviews:

In my English class, I often ask my pupils to write their sentences on an overhead transparency after a group discussion. Pupils are happy to show their ideas in front of the class using the overhead transparency and at the same time, I can help them to refresh and to consolidate their ideas while constructing their own overhead transparencies before and during presentation. (Amy)

When Amy was asked why she rated herself as less teacher-directed in approach compared with her colleagues, she said that her colleagues were already familiar with student-centred learning activities, claiming that student-centred learning was part of the school culture - although little use was made of advanced technologies at that time. She clearly felt inexperienced and felt that she could learn much from her more experienced colleagues.

Although Chris rated the teaching approach of his colleagues as more teacher-directed, he reported using many student-centred activities in his classroom: asking his students to present their results to the class after group discussion; and, making use of a variety of information sources such as pictures, over head transparencies, videos and learning kits for group activities. Of the seven participants, he was least inclined to conform to the norm in his school, instead adhering to his own teaching strategy. Chris reported two groups of teachers in his school: one group was willing to accept changes and new teaching methods, and the other group was more traditional in outlook and resistant to change. The data in Table 7.3, suggest that there were more of the latter in his school.

Of the five beginning teachers who rated their colleagues and their own teaching approach the same, Doris still perceived her approach to be quite student-centred:

I often ask my English class to build their own sentences after group discussion and then to present them in front of the class. I have also tried to ask my pupils in English and general studies classes to do projects on assigned topics with a sketch-book. Other materials such as pictures, video and audiotape are often used as information sources for group discussions in my lessons too. I have even asked some of my pupils to produce an audiotape for a story to be used in a weekly assembly. (Doris)

Doris also felt that the rating represented a balance between two different teaching

approaches in her school, similar to the view expressed by Chris above. Doris described the school situation as follows:

Actually, there are two different groups of teachers in my school. One group is very traditional and conservative. Another group is very active and likes to use information technology in their teaching ... If we have time, some teachers including me will try something new and derive some student-centred activities. (Doris)

However, unlike Doris's school, it seemed that in Chris's school there were more teachers that used a teacher-directed approach as shown in Table 7.3.

From Table 7.3, it can be seen that Betty and Flora rated their teaching approach as teacher-directed, like that of their colleagues: the relationships between these two beginning teachers and their colleagues suggest reasons for this. Betty struggled to meet the demands of a tight teaching schedule and when she attempted to introduce some student-centred activities she attracted criticism:

Although I have tried some activities, yet I used traditional teaching methods most of the time at the beginning of the school term, as I didn't have sufficient time at all. I didn't want to be scolded again by other teachers. (Betty)

As noted above, Flora encountered some 'personnel problems' in her school and her unhappiness with these experiences were highlighted in interviews:

I think that there is always personnel problem in a school. Maybe, I lack the experience to deal with this kind of problem. I remember that in the last term test, we [the panel members and Flora] disputed very vigorously about setting the questions for a test paper in subject ... Until now, whenever I produced something new [with PowerPoint], some of them always think that I am showing off. They even criticise that I have produced something complicated and the effect is not good. (Flora)

Flora thus came under pressure from her colleagues and sought to conform, adopting the same teaching approach as her colleagues in order to avoid further conflict:

I am very textbook oriented in the first term. For example, in

mathematics, I have given notes and fill-in-the blank type exercises for their practice and most of the test questions come from the notes and these exercises. I follow exactly as what other teachers do in the school in order to avoid trouble. (Flora)

Although Betty rated herself as relatively teacher-centred in the questionnaire, in the interviews, she indicated that she had attempted to incorporate student-centred activities in her teaching whenever she could find time in her teaching schedule. Betty was very keen to conduct student-centred teaching activities and soon became unsatisfied with her teaching environment.

Sometimes I will leave the OHT that I have used in the class for my pupils for revision in recess and sometimes these materials will be a kind of questions or exercise. My pupils have to finish them for presentation in coming lesson. I will use the work done by my pupils for checking their understanding or further explanation, for example, sentence re-writing exercise and word puzzle for Chinese lesson. (Betty)

When the remaining beginning teachers (i.e., Ellen & Nancy) were asked similar questions about their use of student-centred activities, they responded that they had rarely conducted such activities. The main reasons offered were: lack of time; being new to the school environment; no knowledge of access to resources; and, a desire to conform in order to 'play safe'. One senses a strong feeling of insecurity amongst these beginning teachers as they started their teaching careers.

Maybe, I'm lazy ... But I think that I am new. I dare not to try too many new things that are different from the others of the school ... The teaching schedule is very tight. I spend most of my time in marking the assignments and can hardly find any time to prepare my lessons. (Ellen)

I can't find any resources to try student-centred activities at all. (Nancy)

It seems then that these beginning teachers were concerned with coping and went into the 'survival mode' in the first few months of their career and striving to conform. Amy had no problem fitting in, her school appropriately resourced, and supportive in culture. For Doris, although the school culture was not particularly supportive, she found support from a group of teachers of similar philosophy. Betty

and Chris were in favour of student-centred teaching and attempted to apply what they had learned in their teacher education programmes, but Betty's approach was resisted and Chris gained some support from colleagues in his information technology team. Flora attempted to resolve personnel problems that she faced in her school but eventually conformed to school practice although she retained strong views about using information technology in teaching. Finally, Ellen and Nancy, tended to be passive and followed the same approaches as more senior colleagues resulting in a highly teacher-directed teaching approach.

7.3.3. *Frequency of Use and Types of Information Technology Used in Beginning Teachers' Classrooms*

The frequency of use of various information technologies in class teaching was measured using a five-point rating in which the beginning teachers rated their use from 'never' (1), to 'in every lesson' (5) (see Table 7.4). The questionnaire items were extracted from the *Scheme for the Analysis of Classroom Activities with Information Technology* described in Chapter 6 (Section 6.3.1, p. 167). These items were designed to produce a description of teaching scenarios using information technology, ranging from teacher-directed to student-centred. So item 1 is the most teacher-directed strategy; a strategy in which the teacher simply used information technology for the presentation of content. Similarly, items 2 and 3, though involving student participation, require students to work on content prepared by the teacher. Finally, items 4, 5 and 6 require student initiative and contents or results that are not pre-determined. Items 1 to 3 sought to describe information technology as teachers' teaching tools while 4 to 6 as students' learning tools.

The findings in Table 7.4 are generally consistent with the interview data and the data presented Table 7.2. For example, Table 7.4 suggests that Nancy made little use of information technology in her teaching, consistent with her lack of commitment concerning the use of information technology in teaching seen in Table 7.2. Likewise, Amy, Betty, Chris and Doris spent more time preparing lessons for both teacher presentations and student-centred learning activities (see

items 1 to 4 in Table 7.4). Ellen and Flora followed closely to the trend of their schools, adopting a ‘textbook-oriented’ approach. These beginning teachers made little use of information technology even though they were members of the information technology teams in their schools. Table 7.4 provides information on the nature of the student-centred activities for Amy, Betty, Chris and Doris. These data show that teacher-directed group work and individual assignments or class work were the most common student-centred activities (items 2 & 3). It is also clear that at this stage of their careers there were few attempts to engage pupils in more active and student-initiated strategy with the use of information technology (items 5 & 6). Nevertheless, the above findings suggest that Amy, Betty, Chris and Doris adhered to their philosophy about the value of using information technology and student-centred learning and were willing to invest a considerable amount of their time in their daily practice.

Table 7.4
Frequency of information technology use in daily teaching

	Teacher						
	A	B	C	D	E	F	N
1. As teacher’s aids to present the contents of the lesson.	4	3	3	3	2	2	1
2. As teacher prepared information source or materials for small groups activities.	4	4	3	4	2	2	1
3. As teacher prepared information source or materials for individualised learning.	3	5	3	4	1	2	1
4. As pupils’ tools to access information themselves for small group activities, e.g., Internet.	3	2	3	1	1	2	1
5. As pupils’ tools to solve problems or to find solutions to the questions for assigned small group activities, e.g., a Spreadsheet programme.	1	1	1	1	1	1	1
6. As pupils’ tools for presentation of the results of tasks/projects	1	1	1	1	1	1	1

Key: 1 = Never, 2 = Very Rarely, 3 = Sometimes, 4 = Quite Often, 5 = In Every Lesson

The above findings point to the influence of the school culture on beginning teachers’ teacher teaching approaches. The next section continues to explore the beginning teachers’ attitude towards using information technology in their teaching within their different school contexts.

7.3.4 Attitudes Towards Using Information Technology in Teaching

In another part of the questionnaire, the beginning teachers were asked their views of using information technology in their teaching for the following three areas: degree of satisfaction, beliefs, and confidence.

Not Satisfied with Current Use of Information Technology in Teaching Approach

The data presented in Table 7.4 above show that Amy, Betty, Chris and Doris invested more time in the use of information technology than their counterparts. However, when these beginning teachers were asked if they were satisfied with their current use of information technology in their teaching, their answer was a resounding 'no'. Written comments in the questionnaire suggest that the main reasons were 'lack of time' and 'tight teaching schedule'. Other teachers also were dissatisfied with their use of information technology in teaching: major concerns being 'lack of appropriate resources', and a perception of 'incompetence in using information technology'.

A Belief that Information Technology Can Help Student Learning

When the beginning teachers were asked whether their beliefs about their values and expectations of using computers in teaching had changed, all of the participants reported no change. This was confirmed in the interviews:

I think that computer presentation can help me to deliver the lesson well and can help me better to explain concepts visually. It can really enhance teaching and learning. I have tried it and I could see that my pupils were very happy and enjoyed the lesson. (Amy)

I still believe applying information technology in our teaching could arouse the interest of students and the experience is valuable ... I hope it could be widely used in different aspects in order to increase students' self-awareness [of using information technology]. (Betty)

I think that applying information technology in teaching can enhance students' learning but it demands quite a lot of workload.

(Chris)

The Influence of School Contexts on Beginning Teachers' Confidence

The beginning teachers' confidence about using information technology in the classroom was also measured using the questionnaire. A five-point rating scale from 'not at all confident' (1), to 'very confident (5), was used in an attempt to ascertain the participants' confidence. Of the seven beginning teachers, Amy and Ellen were 'quite confident' whereas Betty, Chris, Doris and Nancy rated themselves 'moderately confident'. Flora was the least confident among the seven and was less confident than when she was immediately after completing the DDIM module (see, Section 5.2.2, p. 130). This change is most likely related to these beginning teachers' teaching experiences (Section 7.3).

Table 7.5

Beginning Teachers' Confidence about Using Information Technology in Teaching

	A	B	C	D	E	F	N
Level of confidence in using computer facilities and resources at the beginning of school term. *	4	3	3	3	4	1	3

Key: A=Amy; B=Betty; C=Chris; D=Doris; E=Ellen; F=Flora, and N=Nancy

* 1= Not At All Confident; 2 = Not Very Confident; 3= Moderately Confident; 4=Quite Confident; 5= Very Confident

The findings reported here suggest that even though these beginning teachers were not particularly satisfied with their use of information technology they retained a belief on the value of information technology for student learning with most reasonably confident about using information technology in the classroom.

7.3.5 Perceived Needs for the Use of Information Technology in Teaching

The last part of the questionnaire contained an open question asking the beginning teachers to state their needs for further development in the use of information technology in teaching. The responses were placed into three categories: knowledge of skills; knowledge of pedagogy; and, support (Table 7.6).

Table 7.6 shows a variety of responses about perceived needs for knowledge and technical skills in the use of information technology. Responses include: “I need to update my computer knowledge continuously” and other responses about practical applications of information technology use in the classroom teaching: “I would like to know more [about] how to make use of information technology in teaching efficiently.” Five responses related to a desire for more support at work: “I want to know more resources like CD-ROM, and websites.”

Table 7.6
Information Technology Needs of Beginning Teachers

	A	B	C	D	E	F	N
<i>Knowledge of Technical Skills</i>							
1. To update my computer knowledge	*	*	*	*	*	*	*
2. Knowledge of networking					*		
3. Knowledge of making a web site		*	*				
<i>Knowledge of Pedagogy</i>							
4. Knowledge of efficient teaching with Information Technology	*			*			
5. Tips or ideas on effective use of computers in the classrooms of HK context		*					
6. Reference reading materials		*					
<i>Support</i>							
7. More time for preparation					*		
8. Knowledge of access to ready-made resources		*	*		*		
9. More computing facilities in the school			*				

Key: * = have expressed the need stated in the item

A=Amy; B=Betty; C=Chris; D=Doris; E=Ellen; F=Flora, and N=Nancy

The findings suggest that all of the beginning teachers were concerned about their computer knowledge. This may be related to an announcement from the *Information Technology Competency Requirement for Teacher*⁷ documented in the Government's *Five-year Strategic Plan for Information Technology in Education*. School principals are required to report to the Education Department on information technology competency requirements for their schools as part of the aforesaid governmental strategic plan. The findings here also inform the development of resources and support for the intervention in the second phase of the study that is described in the following chapter.

⁷ There are four levels of information technology competency for teachers. All teachers are expected to achieve the 'basic level' by 2000-01, 75% of teachers at 'intermediate level', 25% of teachers at 'upper intermediate level' and one or two teachers in a school at 'advanced level' by 2002-03.

7.4 Chapter Summary

Chapter 7 provided an overview of the use of information technology by seven beginning teachers at the start of their teaching careers. The primary schools were at different stages of development with regards to the computing facilities, policy and use of information technology at the beginning of the school term. The reported use of information technology among teaching staff was minimal except for Amy's school and the beginning teachers had different involvement in information technology in terms of administrative work and teaching. Some of the beginning teachers retained a teaching philosophy developed during teacher training and attempted to teach in a student-centred way and to use information technology to assist teaching and group learning activities in particular. Other beginning teachers adhered to school practice teaching in a fairly conservative, teacher-dominated fashion although they maintained positive beliefs about the value of information technology in education. The participants were generally confident about using information technology in classrooms, but school culture militated against this in some cases, and supported it in other cases. The findings reveal different school cultures and concomitant responses from the beginning teachers towards these cultures. It is noted that in a 'positive' school culture (e.g. Amy's school), staff are willing to try new teaching methods and are open to changes in teaching approach: a sharing culture is a key feature in these schools. A school with a 'struggling' culture (e.g., Chris & Doris's schools) is a school in which there are conflicting views about teaching; with two cohorts of teachers with widely differing views, both towards the use of information technology, and towards teacher-centred versus student-centred learning. School of 'negative' culture is the one in which there is no clear policy to deal with change (e.g., Ellen's school) and for which teaching staffs were highly conservative and resistant to change (e.g., Betty & Flora's schools). This latter type of schools seems to be the most prevalent amongst those described here.

Chapter Eight which follows, contains a description of the research findings of the influences of this induction programme on beginning teachers' professional development in the area of information technology in education with reference to the different school contexts as stated above.

Chapter 8

Beginning Teachers Experiences of the Information Technology Reinforcement Induction Programme

8.1 Introduction

This chapter reports on the interactions and the influences of the *Information Technology Reinforcement Induction Programme* (ITRIP) on the professional development for beginning teachers. The seven beginning teachers who had responded to the questionnaire survey and follow up interviews in Chapter 7 (Section 7.1, p. 197) were invited to take part in the ITRIP during follow up interviews. A three-hour workshop for the ITRIP was conducted one month after the follow up interviews of the questionnaire survey. The beginning teachers were then encouraged to develop information technology projects, and to try them out before the end of the academic year (i.e., June 2000). Support and resources in the form of phone conversations, a website and reading materials, were provided throughout this process. Finally, five of these seven beginning teachers agreed to take part in the information technology project. A detailed description of the implementation of this constructivist-based ITRIP is provided in chapter three (Section 3.6.3, p. 93).

The data for this part of the study came mainly from interviews with five beginning teachers (Amy, Betty, Chris, Doris and Flora), supplemented by examination of the lesson plans and field notes from class observations of the beginning teachers who had attempted the information technology projects.

8.2 Journeys Through the Information Technology Reinforcement Induction Programme

This section describes the planning and implementation of the beginning teachers'

information technology projects as they participated in the ITRIP.

8.2.1 *Development of the Beginning Teachers' Information Technology Plans*

As mentioned above, the beginning teachers were encouraged to design an information technology project for their pupils before the end of the school year. Throughout the planning process the beginning teachers were encouraged to raise questions or problems they encountered in the preparation of their information technology projects. They were also advised to interact with the resources that supported the development of the information technology plans. The interaction between the beginning teachers and the researcher and resources provided during the preparation period is described below.

Clarifying Objectives of Using Information Technology

The beginning teachers were unsure about the nature of their information technology projects at the preparation stage, and sought guidance from the researcher. For example, at the beginning of the planning stage, Chris had no real idea about his project and only had a vague notion of using Microsoft Excel to teach his Primary 4 class how to calculate averages and present data in the form of a chart. Discourse with the researcher enabled him to clarify the purpose of using information technology and to identify potential difficulties that he might face in his project (e.g., trying to achieve too much in one project). Such influence is reflected in the following dialogue:

Interviewer¹: You must consider the topic you are teaching. You can use Excel in statistics, but how can you use Excel in teaching averages?

Chris: We can use Excel to find the average using formula.

Interviewer: But there's no relation in doing a chart! It doesn't help to teach the concept of 'average' too.

Chris: When I am teaching the pupils how to find average, I shouldn't involve other topics. I mean I shouldn't teach them to build chart, should I?

Interviewer: I think that you have to make your objectives clear.

Chris: I hope to use Excel in teaching average numbers so I can also

¹ The interviewer is the researcher of this study in all the quotes.

talk about statistic.

Interviewer: So why don't you think of using the calculator? That's not much different. You should think of a way to bring out the concept of average number, maybe designing some activities or PowerPoint, to make your pupils understand. That's better than using Excel. Just because it is a tool for calculation if you are going to teach mathematical concepts.

The above dialogue suggests that Chris had no clear objective about how information technology should be used for his project; instead he was too focused on using a specific software package (Excel in this case). Through the conversation he started to think about how he could use information technology to enhance student understanding. By the time of the second interview, Chris, now clear on what he was trying to achieve, was able to produce more detail about his project. He decided to produce a PowerPoint programme for a lesson about bar graphs. He explained his reasons: "I can use PowerPoint in teaching instead of Excel ... It's simpler. It is easier for student to see the relation between graphics and number in a bar chart." The researcher suggested making the PowerPoint presentation capable of displaying changes in bar graphs as the numbers changed. This feature was subsequently incorporated into the presentation and Chris decided to create a website so that students could download file along with other on-line resources. At this point he identified a need to learn about how to build a website.

Emphasising Evaluation of Projects

During the ITRIP workshop the researcher emphasised the importance of evaluating teaching activities such as the information technology projects. Most of the beginning teachers felt that such evaluation could provide useful information about the effectiveness of their projects. During the preparation stage of the ITRIP, strategies for evaluating teachers' project were covered in-depth during conversations between the researcher and beginning teachers. For example, Amy intended teaching fractions in a Primary 3 class, and decided to use PowerPoint to promote group discussion session and to complement a paper-folding activity for her project. She intended comparing pupils' achievement before and after the project and across two classes.

- Interviewer: How about the evaluation? Did you draft any interviewing questions with your pupils or other methods?
- Amy: I will use the recess time for interview.
- Interviewer: What sort of problems do you think you will ask?
- Amy: I will test whether they will have problems with the topic.
- Interviewer: Will there be any comparison before and after lesson?
- Amy: Yes, I will test them before the lesson.
- Interviewer: How will you compare the result with other classes?
- Amy: I teach English but not mathematics in another class, so I can give similar questions to this class and see whether there will be any differences too.

In this way, the beginning teachers of this study were guided to develop their evaluation strategies for their projects and such attempt was always missed out in their previous experiences such as during teaching practice. The respective methods and the results of these evaluations will be reported in the remainder of this chapter.

Advice about Using Information Technology Resources

The beginning teachers involved in this part of the study were provided with different resources such as reading materials, CD-ROMs, and web-based resources (see Chapter 7, Section 7.3, p. 207, for details). All of the beginning teachers found such resources useful. For example, Betty indicated that she was inspired by reading materials and tried to develop similar activities:

- Betty: The project about a trip to Europe was very successful. My pupils could present very good work in the project. They could use all the information technology skills that I have taught like Word, Excel, search engine, and e-mail... Some of them could even use the skills learnt from other books - the skills that I haven't taught before... It's a P6 [i.e., Primary 6] information technology lesson. They could even use the PowerPoint to present their final work with narration.
- Interviewer: Where do you get the idea about this activity?
- Betty: From the reading materials you have given me. I changed the target of the trip from Washington [suggested in the reading material] to Europe but followed the similar activities as suggested in one of the articles.

It seems obvious that Betty spent some time reading the cases provided by the researcher in the reading material. However, not all the beginning teachers did so

and Chris, for example, instead focused on other resources he found more helpful with materials about the development of teaching software:

The CD-ROMs you have given me are very useful. I have used them as reference as I didn't want to infringe the copyright of others' work. I have adopted some of the ideas from the CD-ROMs and made my own presentation. For the reading materials, I am sorry to say that I do not have time to read them all. (Chris)

Chris was thus concerned with producing teaching materials, rather than developing learning activities. This was likely due to the fact that Chris was a member of the information technology team of the school and was charged with the duty of developing teaching materials for colleagues. He commented in his last interview: "I have learnt something, such as building a home page. I have a clear task and specific objectives, and I can find my way to get the task done. Your resources, advice and frequent conversations were very helpful." The other beginning teacher made similar comment feeling that the activities in the ITRIP were particularly suitable for in-service teachers working with information technology: "Clear objectives, specific task with sufficient support and resources and the provision of consultant service like what I have experienced in the project are important." (Doris)

The above findings highlight the importance of teacher-student (in this case beginning teacher-researcher) interaction in self-directed learning projects. Dialogue between the beginning teacher and the researcher as reported here helped these beginning teachers identify clear goals of using information technology in their lessons, and then identify their needs for achieving these goals. The beginning teachers then choose the relevant resources that were either provided, or recommended to them by the researcher. With clear goals and sufficient support in the form of the consultancy and material resources, the beginning teachers sought ways to achieve their goals, and to satisfy their needs according to their own styles and in their own time. The development process of the information technology plan thus represented a valuable learning process for these beginning teachers.

8.2.2 *School Context at the Time of Implementation of Beginning Teachers' Plans*

Chapter 7 provided a description the school context for the beginning teachers at the beginning of the ITRIP. Most of the beginning teachers' information technology plans were implemented in June 2000 - about six months after the launch of the ITRIP. Hence, it is useful to provide a brief description of the school context at the time of the beginning teachers' plans.

At this time Chris and Flora's schools were ready to use their information technology for any project, as all hardware and software was installed and operational. The other schools were in much the same position as they were when ITRIP was implemented (see Table 7.1, p. 196). Hence, all the beginning teachers were in a position to use the computing facilities at the time of the implementation of their information technology projects.

Flora reported increased use of information technology in the teaching practice in her school. More of the young teachers became active in using the computer laboratory as a result of the announcement of the *Information Technology Competency Requirement for Teacher* (Section 7.3.5, p. 220) by the Education Department. In her case, the rating of the teaching pattern in her school was raised from two to four (on a scale of 1 -7, with 1 being teacher dominated and 7 being student-centred – see Chapter 7, Table 7.1, p. 199), meaning that in her school there had been a shift towards student-centred teaching. She also noted that the younger teachers were keen to try new teaching methods and willing to accept new things although they lacked confidence at the time. However, in other schools, for example, Chris's school, there was little change in terms of the computing facilities and teaching pattern. There were relatively few new extra-curricula activities using information technology enacted: one example being a competition to design greeting cards. For Amy's school, in which the use of information technology in teaching was already high, the situation remained much the same. The school did, however, have some plans to install computer workstations in all classrooms over the next two years. Finally, for Betty and Doris's school, no obvious changes were seen in either information technology policy or teaching pattern.

The above findings, though not exhaustive, thus provide a tentative status of

information technology in education in Hong Kong at this phase of the study. The computing facilities were improving, more teachers, especially the young teachers, were willing to accept new policies and directions, and new teaching methods using information technology. This is particularly evident in the case of some schools such as Flora's school which had moved from the rather negative 'struggling' teaching culture described in Chapter 7. Nonetheless, there were still two 'types' of teachers with opposing attitudes towards innovations in most schools:

We have two groups of teachers. One group of teachers like to talk about their teaching and are willing to share. The other group of teachers are rather conservative in their traditional way of teaching and resist in sharing their experiences too. Sometimes, they even consider us showing off our responsibility and enthusiasm if you talk in front of them. (Flora)

Having given the changes in the schools contexts, at the time of implementation of ITRIP, the practice of using information technology in the ITRIP at this phase of the study is now described.

8.2.3 The Practice of the Use of Information Technology During the Information Technology Reinforcement Induction Programme

The researcher was provided with five plans in the week before their actual implementation in June 2000. The participants having just begun their first year teaching were busy, and so these plans were not particularly detailed, but additional detail was obtained by communication in the form of e-mail and telephone conversations. A summary of the beginning teachers' plans is provided in Appendix K and the following discussion is based on these plans.

Beginning Teachers' Information Technology Plans

As described in Appendix K, Amy used information technology to teach a topic in fractions in her Primary 3 class. The main activity involved was a presentation and she also used information technology to produce some course material for use in group activities. She prepared some paper card circles for a 'dividing pizza' game

in the first group activity and asked her pupils to cut the paper 'pizza' into equal segments using instructions provided on a worksheet. The second activity did not involve any information technology at all; students were asked to carry out a paper folding activity, and to record their results as instructed in the worksheet. After these activities, Amy invited the pupils to describe their results verbally leading pupils towards a verbal description of the fractions that they had constructed in the group activities. In the last activity of the first lesson, Amy asked the groups to construct their own questions that following the structure used for the other activities. The pupils from one group could then use their questions to 'challenge' the pupils from another group. Amy also prepared a PowerPoint presentation in her second lesson, and in the first part of this lesson she made use of animations and multimedia effects programme to help the pupils revise what they had learnt in the activities in lesson one. Through an expository approach, she helped her pupils construct a mathematical representation of a fraction in written form using her PowerPoint presentation. In the last part of this presentation, the pupils were invited to answer multiple-choice questions, and she provided feedback in terms of animation and sound response to the pupils' choice of the answers. Amy also made use of the school intranet to conduct some after class activities. She posted her PowerPoint presentation on the school intranet and asked her pupils to do revision exercises adding a link to an Internet website called *User-friendly Flexi-Information Technology Approach for Education* (UFIA²), that provided more examples and exercises about the topic.

Betty used a proprietary graphics programme Microsoft Paintbrush in a cooperative drawing activity. She began with a lesson about cooperation in a Chinese language in her Primary 1 class. She told the pupils a story related to the topic of the lesson, but deliberately stopped the story without providing an ending. She then asked her pupils to finish the story by providing an ending using the graphics programme. She helped the pupils understand what she meant by first providing an example in a demonstration lesson. The pupils were required to complete this task using the classroom computers in the recess over the next week. Subsequently, she used a Chinese language lesson to let the pupils share their 'ending' with their classmates using the classroom computer.

² <http://ufia.hku.hk/> updated as at 1 February 2003.

Chris taught a Primary 4 class about the use of bar graphs using two data sets. The objective of the lesson was to for him to see what his pupils had learnt about the statistical concept of a bar graph in earlier lessons. He used a group activity getting the pupils to build their own bar graphs in groups. Chris used PowerPoint to build the bar graph in the group activity and in his first lesson, he demonstrated the method on in the school computer laboratory. He also prepared a template file which he provided on the school server so that the pupils individual could practice after his demonstration. The pupils were then required to download the file from the server, and to complete the exercise as described in a worksheet. The group activity occurred in the second lesson, and before this lesson he gave the pupils a list of suggested topics as well as a worksheet in which they could collect information for their graph. The pupils were required to present their results to the class at the end of the lesson.

The information technology plan of Flora was similar to that of Chris. Flora also taught her pupils bar graphs, but used a single data set in her Primary 3 class. Her objective in this lesson was similar to that of Chris. However, she chose to use Microsoft Excel to build the bar graph rather than PowerPoint. Flora conducted the first part of her lesson in the classroom, and was able to use the school computer laboratory for the group activity. In the first part of the lesson, she helped the pupils to revise what they had learnt about a simple bar graph through questioning and used overhead transparencies to assist her explanations. She then demonstrated the use of Excel building a simple bar graph, and then initiated a group activity similar to that of Chris.

Doris invited pupils from her English class to participate in an extra-curricula group activity as her project. The major goal of her project was to arouse the interest of the pupils who were indifferent about learning English. She built a web site with the proprietary software Dreamweaver™ and used this to develop some interesting resources for English grammar on a web site. These resources then acted to extend her pupils; for example, she encouraged her pupils to compose a few sentences using the grammatical structure 'must' and 'mustn't' that she taught in earlier English classes. She tried to motivate her pupils by letting them use the computing facilities of the school to add photos or graphics to their written work.

She began by demonstrating the use of the computing facilities, and also showed them how to access to the web site. In the remainder of the project, she collected her pupils work and posted it on the website.

The researcher observed two of these lessons (those of Chris & Flora) at the end of the school year and observed the group activities conducted in the computer laboratories. The two teachers adhered to their plans quite closely and the use of the computer applications first, followed by helping the pupils to revise mathematical concepts during the construction of the bar graphs. The pupils followed the steps at their workstations, and answered questions posed by the teachers. They then worked in their groups to build bar graphs with the information they had collected before the lessons and using the instructions provided on their worksheets. The pupils were attentive in the demonstration and seemed to enjoy the group work. During the group activities, the teachers talked to individual groups, and also provided more intensive assistance to individual pupils as required.

The above description has provided a general picture about how information technology was used with different teaching strategies among the beginning teachers. The following section seeks to identify common teaching patterns and to develop an understanding of student-centred learning elements derived from the beginning teachers' information technology plans. Comparisons were also made between the teaching practice and beginning teacher phases.

Differences in the Practice of Beginning Teachers' Use of Information Technology

A scheme to describe classroom use of information technology was developed in Chapter 3 (Section 3.5.1, p. 83). This scheme has been adopted here to describe the beginning teachers' use of information technology in their classrooms and the data are presented in Table 8.1. Comparison of the situation at the time of teaching practice (i.e., 12 months before the ITRIP), shows that by the time of the ITRIP, all the beginning teachers had tried to use some computer software for classroom presentations or demonstrations (item 2), including, Microsoft Paintbrush, PowerPoint, Excel, and Dreamweaver™.

Table 8.1

Beginning teachers' classroom activities with information technology during their teaching practice and during the Information Technology Reinforcement Induction Programme

Classroom activity with information technology	Teacher					Occurrence	
	A	B	C	D	F	TP# (n=5)	ITRIP (n=5)
Information technology in the lesson has been used for/as:							
1. Producing traditional resources for teacher's presentation, e.g., overhead, graphics, word card, and sentence strip etc.					*	3	1
2. Producing computing software for teacher's presentation, e.g., Power Point slide, multimedia learning program etc.	*	*	*	*	*	2	5
3. Producing traditional resources for pupils' group work e.g. work sheet/activity sheet, exercise, etc.	*		*		*	3	3
4. Producing computing resources for pupils' group work e.g., multimedia and learning programs etc.		*		*	*	2	3
5. Producing traditional resources for individualised learning activities e.g. work sheet/activity sheet, exercise etc.							
6. Producing computing resources for individualised learning activities e.g. multimedia and learning programs etc.	*		*	*		0	3
7. Pupils' tools to access information themselves for small group activities/tasks e.g. Internet.				*		0	1
8. communications tools between teacher and pupils and among pupils to support learning				*		0	1
9. Pupils' tools to solve problems or to find solutions to the questions for assigned group activities/tasks e.g., a spreadsheet program.							
10. Pupils' tools for presentation of the results of group activities/tasks.		*	*	*	*	1	4

* = Occurrence of information technology use in a lesson

TP = Observed lessons in Teaching Practice

Key: A=Amy; B=Betty; C=Chris; D=Doris and F=Flora

As the computing facilities in the schools became more advanced (see Section 8.2.2, p. 228), the beginning teachers had more opportunities to make use of information technology in their teaching, either in computer laboratories, or in their classrooms. This situation no doubt contributed, in part, to a shift from the use of traditional presentation resources such as word cards, picture and sentence strips, to the use of computing software (Table 8.1, item 1). The improved technological environment also allowed the beginning teachers to use network and communication tools, and enabled them to attempt more student-centred learning activities. For example, as mentioned above, Amy posted her PowerPoint presentation on the school intranet allowing her pupils to attempt revision exercises in their own time. Chris likewise stored some learning resources in the school intranet allowing his pupils to download materials during class exercises and for after classes revision purposes.

Doris constructed a web site on the school server giving her pupils the opportunity to share their work and to communicate with classmates through the web site (items 6, 7, & 8). Thus, through the use of information technology, pupils in these beginning teachers' schools could gain access to a variety of learning materials after classroom lessons: these strategies were notably absent when these teachers were doing their teaching practice.

Table 8.1 also shows that all of the beginning teachers incorporated group activities in their information technology plans. Traditional resources produced with the use of information technology, such as worksheets, were prepared by Betty, Chris and Flora. The shift towards student-centred activities from teaching practice to their beginning teaching is clearly evident in changes in practice for Betty, Doris and Flora. These teachers all employed presentation software for the purposes of demonstrations during group activities (item 3 and 4). This on its own is not particularly student-centred – although it was used to stimulate and aid group activity. However, the beginning teachers' project plans incorporated *student* presentations as activities in the classroom lessons in which the pupils were required to present the results of their collaborative work using the computing tools. This is very different in nature to the more traditional group work practiced during teaching practice, in which pupils were simply required to answer questions (item 10).

In a further attempt to identify elements student-centred learning, the scheme adopted from Yager (1991) was used to analyse teaching practice and beginning teachers' classroom practice (Table 8.2). It is interesting to compare these findings of the beginning teachers with the five lessons observed during teaching practice (Table 6.4, p. 172). Comparison of these data suggests that the beginning teachers attempted more student-centred learning activities in their lessons than the student-teachers during their teaching practice. For example, elements in items 4, 7, 8 and 10 were not identified in the student teachers' lessons during their teaching practice.

Table 8.2

Analysis of elements of student-centred learning during teaching practice and ITRIP (after Yager, 1991)

Evaluation Items	Occurrence						TP (n=5)	ITRIP (n=5)
	TP (n=5)	ITRIP (n=5)	Teacher	or	Students	TP (n=5)		
1. Who identifies the issue or topic?	5	5	Teacher	or	Students	0	0	
2. Is the issue seen as relevant?	0	0	No	or	Yes	5	5	
3. Who asks the questions?	5	5	Teacher	or	Students	0	0	
4. Who identifies written and human resources?	5	3	Teacher	or	Students	0	2	
5. Who contacts necessary human resources?	5	5	Teacher	or	Students	0	0	
6. Who plans investigations and activities?	5	5	Teacher	or	Students	0	0	
7. Are varied evaluation techniques used?	5	2	No	or	Yes	0	3	
8. Do pupils practice self-evaluations?	5	4	No	or	Yes	0	1	
9. Do pupils take action(s)?	1	1	No	or	Yes	4	4	
10. Is it evident that pupils extend learning outside school?	5	1	No	or	Yes	0	4	

Key: TP = Teaching Practice, ITRIP = Information Technology Reinforcement Induction Programme
Number represents the number of occurrence in the stated item.

The information technology plans of the beginning teachers reported here show that the pupils were given opportunities to identify specific resources on a web site or from the school intranet (item 4). Betty, Chris and Flora also attempted to incorporate different strategies to evaluate the effectiveness of their lessons. As shown in Appendix K, Amy's evaluation consisted of questions from which she elicited verbal feedback from her pupils in after-class interviews. She also evaluated her pupils' understanding of the topic via homework and tests comparing the test results for her class with other classes. Chris and Flora also used after-class interviews as evaluation strategies and Flora prepared a detailed transcript of her interviews (Appendix K). Other evaluation methods employed included student self-evaluation, conducted by Chris, and evaluation of pupils' performance in their presentation from group work activities also conducted by Chris (items 7 & 8). In four lessons, pupils were given the opportunity to extend their learning outside school. For example, Betty and Doris required their pupils to complete group work after class. Students of these two plans were given freedom to complete their projects at their own times and in their own ways. Students in Chris and Flora's projects were also given the chance to collect information for their group work

outside the schools (item 10).

The above findings show that more information technology was used in the beginning teachers' information technology lessons than in the five observed lessons during teaching practice. It was also identified that the beginning teachers had attempted more student-centred learning strategies in their plans than during teaching practice. Furthermore, the beginning teachers were better able to articulate their reasons for specific pedagogies in their information technology plans. These explanations are described in the following section.

Rationale behind Beginning Teachers' Information Technology Plans

The above discussion suggests that the beginning teacher made a serious attempt to incorporate different strategies involving the use of information technology in their projects. So, Amy mainly used information technology for presentations, Betty and Doris used information technology for student presentations, and Chris and Flora for demonstration purposes and for analysis. In the interviews with these beginning teachers, they were able to provide explanations for their choice of strategy. For example, Amy said she used digitised video clips on a CD-ROM in a lesson during teaching practice because of the lack of the equipment and inconvenience in obtaining video equipment in her school (Section 6.3.1). She had no clear educational intentions here; rather she was focused on pragmatics at this stage. However, her reflections in post-observation discussions after the lesson were insightful. In the ITRIP she provided a detailed description of the rationale behind her use of a PowerPoint presentation. Now her focus in using information technology was to help to convey more clearly the 'message' of an abstract mathematical concept (i.e., fractions). This she reasoned might be better achieved using the powerful visual effects available in PowerPoint. She also identified common problems amongst her pupils usually before beginning her lesson:

I try to figure out the problems ... Pupils always mix up the position of the nominator and denominator. They also read the fraction wrongly ... I also find that, pupils are weak in relating the figures in a fraction and the whole number 'one'. For helping the pupils to see the relationship, I will arrange a group discussion session in the lesson to encourage the pupils to get used to some terms about

fraction, e.g., half, half of a half, a quarter of a watermelon, etc., and the expressions in writing and reading ... I will also arrange a paper folding activity for my pupils. Pupils will be asked to evenly divide a pizza, drawn on a piece of paper card in circular and rectangular shapes. Through this activity, pupils can find out that the number of selected portions is the nominator and the number of total divided portions is the denominator. I think that they can easily see the relationships between the fraction and the whole in this way. (Amy)

Clearly, Amy was at this stage thinking more deeply about her teaching approach, and was able to apply principles learned in her teacher education programme and reinforced in the workshop part of the ITRIP. She seemed to be working from a student-centred, constructivist-based perspective, and, for example, did not convey content directly to the students; rather she allowed them to explore the pattern or relationships through group activities. She was also confident about producing an attractive and effective PowerPoint presentation that helped the pupils to grasp the mathematical concepts more easily. She commented about this aspect of her teaching during in a telephone interview: "I think that I can manage to produce the PowerPoint for that lesson." Below, in Figure 8.1, is one of the PowerPoint slides that she had used at the end of her project. Amy created a number of animations and accompanying sound effects. She also added narration of the presented text, so that her pupils could hear an explanation for each of the slides when they were revising independently via the school intranet.

Betty felt that her collaborative drawing activity, conducted after normal lessons, provided her pupils with opportunities to foster cooperation: one of her key objectives for this lesson. She felt that information technology in the form of Microsoft Paintbrush provided the pupils with an opportunity to be creative and uninhibited in producing pictures, thus increasing their confidence (Section 8.3.1). Doris also conducted an after class activity, explaining that her project (construction of a 'learning' web site) was intended to help her pupils to revise English grammar after class. She also felt that it would motivate her students who



Figure 8.1

A PowerPoint slide from Amy's presentation

she felt were rather apathetic about studying English. Similarly, Chris and Flora felt that if their pupils could master computing tools, PowerPoint and Excel respectively, they could then use these tools to construct different charts, and to conduct analysis more efficiently. They felt that using the computing tools allowed their students to learn via trial-and-error:

I expect that my pupils will master the relation between the quantities of the data and the visual displays more quickly and I will have more time to help them analyse different sets of data instead of just teaching them to construct a bar graph like other classes. (Flora)

Flora felt that her pupils could now apply the same skills in other lessons: "After the mastery of the skills [i.e., constructing a bar graph] learnt from this lesson, my pupils may be able to apply them in other subjects such as 'general studies' too."

It seems that on-going interactions between the researcher and the beginning teachers, including the provision of support and resources along with improvements in the computing environments in the schools, has resulted in more effective use of information technology in the beginning teachers' projects. This scaffolding enabled the beginning teachers to use different computing tools in their

lessons, and helped them incorporate student-centred learning strategies in their classrooms. The findings also show that the beginning teachers had an in-depth understanding about the value of using information technology in a learning process. They also showed their concerns about the effect of using information technology on students' learning.

8.3 Reflecting on the ITRIP Experience

This section continues to explore the themes identified from interviews with the beginning teachers about the impact of the ITRIP experiences, with a particular focus on their reflections.

8.3.1 Changes to Classroom Learning as a Result of Information Technology Projects

Amy and Flora were satisfied with the academic performance of their pupils. They based this evaluation on a comparison of test results of their pupils with pupils from other classes that did not include the use of information technology, Amy comments:

My pupils performed better than other classes in the section on fractions in the same examination paper. I observed that my pupils were confident in this section and had finished all the questions in the section... For other classes, fractions were not their favourable choice and some of the pupils did not answer the questions at all. I also found that pupils who are weak in mathematics in my class also performed better in this section. They almost finished all the questions and seldom made mistakes in it. (Amy)

Flora offered her thoughts as to why her pupils performed better than other pupils:

I think that some elements in constructing a bar graph such as scaling, selection of starting point and construction of a title were better performed by my class. It is because the other classes had never gone through the whole construction process using the traditional methods. (Flora)

Betty likewise felt that her information technology project had a positive effect on

her pupils' attitudes and behaviour. For example, she observed that during the project week, her pupils cooperated well, the net result being a very good 'ending' for the story they worked on together. She felt that the group work would not have been successful without using the computing facilities:

They really knew how to cooperate. I observed that my pupils became more considerate towards others and there was less dispute among them too ... I think that information technology is a good tool that facilitates their learning in this project. They could use the tool freely without any hesitation such as dirtying the places or school uniform while they were drawing ... They were more confident in drawing any shapes and lines in a computer as they could erase them very easily than in an ordinary paper ... and they were attracted and motivated by the computer programmes too.
(Betty)

Chris also felt that his pupils were more motivated and attentive when doing the project. He was very impressed by the way the project developed, seeing what he felt were apathetic pupils actively engaged in group work:

The use of information technology could arouse the interest of my pupils in learning. They appeared to be more motivated and attentive than other classes ... and throughout the project, I could experience the importance of group work. For example, I could see that some of the pupils who were apathetic towards mathematics previously, had also put effort in building a bar graph in the lesson. They were attracted and motivated as they were given the chance to actually operate the building of a graph, rather than just listening and seeing the demonstration of the teacher. (Chris)

Doris did not compare the academic achievement of her pupils with other pupils, because she felt that "the time of the project was too short to see any effect on the pupils' achievement". Nonetheless, she was very satisfied with the performance of her pupils, seeing the project as successful because she felt that her pupils were actively engaged in the project. She also was impressed by the quality of the pupils' work commenting that the information technology project had motivated her pupils who were indifferent about learning English:

I have just received some work from my pupils. I am very happy to see that their work was so divergent and creative. Some of them sent in their work with a floppy disk. Some sent by e-mail and one of them even sent me a CD-ROM. I guess that this student might have

got the help from his family ... but I consider it a learning process too ... I think that the project was quite successful. Pupils could master some information technology skills by their own learning strategy, e.g., self-learning, asking the more competent peer for help, etc., and they could produce varieties of work using information technology. My pupils really enjoyed the learning process. (Doris)

Amy had the same feeling in her project feeling that information technology motivated apathetic pupils in her mathematics classes:

The pupils were more active and willing to participate in the class. The apathetic pupils were also motivated too ... They were more cooperative and compliant to my instructions ... and appeared to have less misbehaviour in other lessons that were taught by me too. (Amy)

The above findings thus suggest that these beginning teachers felt that their information technology projects had positive effects on student learning including, in some cases, improved academic performance. The biggest influence seems to be in terms of a more pleasant learning atmosphere with students seen as better behaved, more attentive, more motivated and, importantly, actively involved in their own learning.

8.3.2 *Effects on Beginning Teachers' Professional Development*

This section continues to describe the influences on the professional development of the beginning teachers from the ITRIP experiences.

Development of Information Technology Knowledge and Skills

All the beginning teachers felt that the ITRIP provided a good opportunity for them to learn the required information technology skills for their information technology projects, thus contributing to their professional development: "I have at least learnt something about building a home page." Flora commented that she would have hesitated to use information technology in her lessons without the benefit of the ITRIP. The specific tasks in the information technology project of ITRIP allowed the beginning teachers to practice the skills that they had mastered during their

training: "I have learnt more deeply about Excel, as I have to teach my students to use it in the lesson in the information technology project." Amy's response summarizes the general feeling about the influence of the ITRIP experiences on the development of the beginning teachers' knowledge and skills in information technology:

ITRIP had given me a chance to reflect on what I was insufficient and what I had to master before the implementation of my task. I could plan my own learning strategies with the help from you and the resources that you have provided ... I think that it was also a good opportunity to practise what I had learnt previously and at the same time to push me to learn new things such as web-based learning. I am more confident in using information technology than before. (Amy)

The above findings are consistent with those in Section 8.2.1 about the use of resources in the development of information technology plans. With clear and specific tasks for completing the information technology projects, the support and the provision of resources from the researcher, the beginning teachers either learnt the new information technology knowledge and skills or improved their present ones that were used in their information technology projects.

Commitment to a Student-centred Teaching Approach

Amy valued her experiences in the ITRIP commenting that the process helped her "understand more about the values and impacts of a student-centred learning strategy". Such an expression was reflected in her explanation about how she developed her information technology project. She believed that the group activities and multimedia capability of the presentation programme helped her pupils understand the mathematical concepts behind fractions more effectively. The ITRIP experience also reinforced her commitment to group activities: "I start to understand more that mere talking [by the teacher] is not a good strategy". Such experiences also reinforced her thinking about the value of different ways of using information technology, such as presentations and after class revision activities:

The experiences could really help me to think more about using different strategies in teaching. For example, the PowerPoint

programme that I had developed was uploaded to the server of our school after the lesson. I asked my pupils to open the file after school. I have mentioned that the computer laboratory is opened after school. My pupils could revise what they had learnt and at the same time they could click on the related links that I have added at the end of the programme, for example, the UFIA web site [see p. 230]. (Amy)

As a result of her positive experiences during her project, Amy indicated that she would use similar strategies in her future teaching.

Betty also appreciated the opportunity of the drawing on the examples provide during ITRIP. She found the materials “inspiring,” and felt that her experiences with the ITRIP reinforced her belief about student-centred learning strategies:

It is the student-centred strategy adopted by a teacher that influences learning. Information technology is only one of the tools that help me to implement the learning activities but I find that information technology is a very useful tool indeed. (Betty)

Her strong belief in student-centred learning is reflected in her teaching behaviour as reported throughout the ITRIP. It was pointed out in Chapter 7 (Section 7.3.1, p.204), that for Betty, her school principal and colleagues were not very supportive of changes to teaching practice. In fact Betty was required to adhere to the schools' normal teaching schedule to avoid complaints from her colleagues: this situation remained the same at the end of the ITRIP. However, even though Betty left her teaching position at this school, she still strived to incorporate student-centred learning elements in her lessons whenever possible. She quoted a number of examples during interviews. For instance, she talked about a lesson about the addition and subtraction of numbers in her primary one class:

I have derived an activity called ‘Caterpillar’. MS Paintbrush was used in the lesson ... Actually the idea of drawing caterpillars was raised by my pupils. I asked my pupils to draw the caterpillars with the MS Paintbrush and then printed them out with a colour printer. The pupils were then asked to write questions about addition and subtraction of numbers on a piece of coloured paper and then stuck these papers on the caterpillars that they have drawn with Paintbrush. We finally compiled all the pieces to become a book. I was impressed by the work they have done using the MS Paintbrush. They were creative and I found that they enjoyed learning with this

kind of activity. (Betty)

The examples provided by Betty reflect her belief and her understanding about the use of information technology in teaching. Information technology in these lessons such as the 'caterpillar in mathematics' and the 'trip to Europe' in the information technology class described in Section 8.2.1 (p. 224) of this chapter and the 'cooperation' in the Chinese language of the information technology project were mainly used as a learning tool that was integrated into the student-centred learning activities for different subjects.

As mentioned in Chapter 7, Flora encountered some personnel problems at the beginning of the school term and decided against teaching differently from her colleagues (see, Section 7.3.1, p. 207). However, she valued the opportunity to try new strategies during the project part of the ITRIP, commenting that without the encouragement and support from the researcher, she would not have engaged in the use of information technology in her school practice:

The information technology project has provided me a chance to think more deeply, and to try using information technology for student-centred learning ... I planned my teaching carefully from the perspective of my pupils. For example, when building a bar graph from some data, I had considered the problems and questions that the pupils might meet and ask such as the selection of data for X and Y-axis, the scaling of the Y-axis ... etc. I had emphasised the explanation on these parts in the demonstration process. Before that, I used to follow the teaching steps as suggested in the textbook, just like the other teachers did. (Flora)

Chris pointed out that his ITRIP experiences allowed him to think more deeply about his teaching and to practise what he had learnt about student-centred learning strategies and the use of information technology. During his project he was guided towards a number of student-centred learning strategies. His use of PowerPoint as a construction and analysis tool for the bar graph exercise was a direct result of his discussions with the researcher during the development stage of his information technology plan. He commented that he had gained a number of "insightful ideas" and finding his interaction with the researcher reassuring especially at the beginning of the school year.

Doris felt much the same as Chris about the impact of the ITRIP experience on her professional development: "I could apply the knowledge and skills that I have learnt from the teacher education programme. The ITRIP provided me a chance to practice the knowledge and skills again and to reinforce my understanding about student-centred learning". She further commented that the ITRIP provided an opportunity for her pupils to master the information technology knowledge and skills through the student-centred activities she enacted. She felt that the school curriculum should be such that pupils could be able to apply information technology in a variety of learning activities:

I think that my pupils need these [i.e., information technology] skills for their future and I should provide chances for them to learn and to use in my teaching. I think that it is more important than just allowing them to learn happily with the use of information technology. I think that the other strategies and other learning activities can also enable our pupils to learn happily without using information technology ... I expect that every student should master information technology skills and integrate their use in daily life naturally and seamlessly just like using a piece of paper, a pen, a calculator. (Doris)

As well as seeing information technology as a valuable tool to facilitate student learning via student-centred learning activities, Doris also felt that information technology should be a major content area in the school curriculum. Hence, in her view, student learning experiences should allow pupils to develop information technology skills at the same time as learning other content and skills. Doris also commented that the focus of teacher development in the information technology in education area "should not be on the mastery of information technology skills, but on how these skills can be helpful in teachers' daily teaching and how the teachers can provide the opportunities for the students to use in daily life".

Section 8.3 has described the influence of the ITRIP experiences on pupils' learning and the professional development of beginning teachers. Better academic achievement and higher motivation were reported. The above findings also suggest that these beginning teachers gained or consolidated information technology knowledge and skills when doing their projects. The ITRIP experience also reinforced beginning teachers' belief about the value of using information technology and student-centred learning strategies.

8.4 Factors Influencing Beginning Teachers' Professional Development

This section explores factors arising from the school context that effects beginning teachers' professional development in the area of information technology in education. Two major themes were identified from the interviews: workload, and support from teaching colleagues and school principals. These are discussed in turn.

8.4.1 *Workload*

The beginning teachers clearly valued the opportunity of participating in the ITRIP. However, they were faced with a dilemma: on one hand they were keen to practice what they had learnt from the previous phase of the study, but on the other hand they had real concerns about their workload. All of the beginning teachers felt that the content in the school curriculum was too heavy. Chris, for example, stated that he was "always under pressure" and feared that he "could not finish the prescribed schedule assigned by the school". Concerns about a tight teaching schedule also were expressed by Flora: "My timetable is too tight. I always rush into other class immediately after a lesson. I have no time to rest in between". In fact, Flora's description is a fair depiction of daily life for a primary school teacher in Hong Kong (and perhaps elsewhere). Hong Kong primary teachers teach about 30 lessons out of 35 scheduled lessons each week. Clearly, such teachers must commit a considerable amount of time outside normal teaching hours, if they are to become involved in any additional projects such as ITRIP. The comments of Flora reflect the common feeling among the beginning teachers who participated in the ITRIP.

I think that we have to be realistic. My experiences tell me that we can hardly have time to think about student-centred activities. We are occupied in many trivial, non-teaching, jobs apart from daily teaching and marking of pupils' assignments³. If I was not invited to do this project, I will never think about the way of using information technology in my teaching as in the present project. (Flora)

³ The teacher to student ratio in Hong Kong primary schools is about 1:35.

Amy taught in a school with a 'favourable' culture, with good support and in which student-centred learning was common practice. However, even given this 'technology rich' environment and strong support from teaching colleagues, work-load was still an issue. She comments: "Time is a crucial factor" for professional development in the area of information technology in education, going on to say "the school curriculum is too tight" meaning that teachers "can hardly produce any learning materials for individual pupils".

8.4.2 *Support from Colleagues and School Principals*

All the beginning teachers saw support from the colleagues and the school principal and the colleagues as crucial for successful implementation of any innovative teaching activities in their schools. Of the five beginning teachers in this phase of the present study, three - Amy, Chris and Flora, found their schools to be supportive. As mentioned in Chapter 7, the acceptance of using information technology in teaching among the teachers in Amy's school was high, and a sharing culture was well established in the school. This clearly impacted upon Amy's feeling about teaching: "My principal is very supportive in using information technology in our teaching. My colleagues are supportive too and we like to share our experiences among ourselves". The supportive and sharing culture was also reflected in her ITRIP experiences. She was very satisfied with her information technology project, and felt it was well received by her colleagues: "Some of my colleagues have observed my lesson [of her information technology project]. They felt good and were impressed by the learning atmosphere ... and they will try to teach with the PowerPoint programme and the same strategy next school year". Chris also was supported by a group of colleagues of similar age, beliefs and attitude towards using information technology in teaching (Section 7.3.2, p. 213). The school principal in Chris's school was very supportive about using information technology in teaching: "Despite the conservative attitudes of the elder colleagues, my school principal is very supportive. He always encourages us to use computer in our teaching". Flora also found her school principal supportive but did not feel this was realised in the implementation of information technology in the school. This apparent dual-position resulted in some conflict between new teachers and veteran teachers:

She [the principal] is supportive but she knows very little about information technology at all. Therefore, she tends to be not too radical and aims to meet the basic requirement from the Education Department only ... However, she is not too good in her leadership in this aspect [implementation of information technology in school teaching]. She has even exerted pressure on some new staff who have tried to develop some PowerPoint software. She hadn't been tactful enough to avoid the bad feeling from other staff members when she praised the work of these staffs in front of all the teachers in a meeting ... I am one of them who are criticised as 'showing off' and a 'wall' is built up between these teachers and me. (Flora)

Under these rather trying circumstances, Flora received little support from her teaching colleagues, especially after an argument with her information technology subject panel (see, Section 7.3.1, p. 207). This proved troubling for this beginning teacher and her colleagues excluded her from some school activities, meaning that she drew upon the researcher for support that might normally have been provided by her colleagues: "I like to talk with you. I feel supported for I do not have the chance to vent out my thinking in the school". She became quiet and inactive, and eventually followed the practice of other teachers:

I have learnt to be realistic. I dare not to say anything about my ideas on integrating information technology in teaching and learning for the fear that other teachers will reject me. It is not the right time to discuss the teaching about information technology as most teachers do not have the experience to share with you and will consider you showing off. (Flora)

The other two school principals were seen as 'authoritarian' or 'inactive' by the beginning teachers. Betty found her principal very demanding and authoritarian, expecting teaching staff to follow her instruction strictly:

She [the principal] will require you to do more [computer projects] and seriously so that the work can be shown on the school web site in order to promote the school. In her eyes, fame of the school is more important than the actual benefits that pupils can get from the learning process of using information technology, and she will never mind about the workload and feeling of the teachers. (Betty)

Betty felt unsupported by her colleagues and thought that there was no 'sharing' culture in her school. Her colleagues were used to their traditional teaching

approach, and were resistant to new teaching methods feeling that these methods were 'safe' and not keen to take on any extra work. Betty also was unhappy about the authoritarian attitude of her school principal and teaching colleagues. However, Doris, although finding her principal 'inactive': "He just follows the instructions of the school board and asks the senior teachers to implement the policies. He doesn't need to be very active", felt supported by teaching colleagues of similar beliefs.

In summary, two crucial factors related to the implementation of the ITRIP were identified. The present condition in the primary school concerning about the teaching workload is not favourable for teacher professional development in the area of information technology in education. The second factor concerned perceptions of lack of support for beginning teachers. These beginning teachers were willing to try new teaching methods, provided they felt supported by their colleagues, school principals or both. The findings suggest that the beginning teachers were more easily able to adapt to the school culture if school teaching practice was similar to their own views of teaching and learning.

8.5 Chapter Summary

The first section of Chapter 8 described how the constructivist-based intervention helped the development of the information technology plans in ITRIP. The findings here suggest that such a development process is a learning process that enhances understanding and mastery of information technology skills and knowledge in teaching. The section which followed illustrated the improved computing facilities and the prevailing cultures of the schools of the beginning teachers in this study. Then the details of the information technology plans of five beginning teachers were described. The findings show increased use of information technology and student-centred activities. Next, the themes emerged from the reflections on the ITRIP experience were presented. Beginning teachers showed improvement in analytical thinking, appreciated the opportunities given in ITRIP, and commented positively on its effect towards student achievement and beginning teachers' professional development. The last section identified two factors: workload and feelings of support that are considered crucial to the professional development in the use of information technology in teaching.

Chapter 9

Discussion, Conclusion and Implications

9.1 Introduction

The initial profile of the participants of this study before the subsequent intervention processes in the teacher education and beginning teaching phases was provided in Chapter 4. The participants of the intervention group were less competent in computing knowledge and skills than the non-intervention counterparts (Section 4.3). The participants were positive about using information technology in teaching and learning, despite worries about the workload and management problems induced from the use of information technology. They rated the usefulness and contribution of using information technology in teaching highly, but lacked the confidence about learning computing skills early on (Section 4.4). Despite these positive attitudes, the participants saw teaching with information technology as similar to traditional teacher-directed approaches, and student-centred learning was rare (Section 4.5).

The findings of the present study show that the participants underwent a professional development process of learning to teach with information technology. This process resulted in gains of information technology skills and conceptual change about applications of information technology in teaching and learning. It is argued here that such a development process was influenced by the interventions developed in this study and that were informed by constructivist views of learning. Constructivist views of learning see learning as both cognitive and social mediation processes, that take place in a situation where the learnt knowledge and skills are applied (Section 2.3.2).

This chapter begins with a summary and discussion of this professional development that the researcher argues supports the argument of this thesis. Then,

based on these findings and the discussion, suggestions are made about learning to teach with information technology. The chapter concludes by considering the limitations of the study, and presents suggestions for further research.

9.2 Summary and Discussion of the Findings

This section summarises and discusses the main findings of the present study under three headings (answering the research questions presented in Chapter 1): (1) development of learning to teach with information technology for a student-centred classroom; (2) a pedagogical model for learning to teach with information technology; and (3) factors influencing learning to teach with information technology.

9.2.1 The Development of Learning to Teach with Information Technology for a Student-centred Classroom

The following subsections summarise and discuss professional development concerning teaching with the use of information technology in three areas: (1) information technology skills; (2) attitudes towards the teaching with information technology; and, (3) conceptual changes of teaching with information technology for student-centred learning.

Information Technology Skills

Despite the somewhat disadvantageous background of the participants compared with their non-intervention counterparts, the findings reported here show increased use of common computer applications and better mastery of information technology and other instructional media on completion of the DDIM module from the teacher education programme. A significant increase was reported in use of Microsoft PowerPoint, and some of the above knowledge and skills were significantly better for the intervention group (Section 5.2.1). The findings indicate high usage of information technology among these participants

and it was different from the current trend of practising teachers observed during teaching practice at the time of this study (Section 6.2). It is also noted from the class observations that information technology skills, such as off-line browsing technology and the production of a VCD, were practised during the 'try-out lessons' in teaching practice (Section 6.3). In the second phase of the study, the skills of using computer applications such as the Microsoft PowerPoint, Excel and Paintbrush were reinforced in the preparation and implementation of the information technology projects of ITRIP while the participants were teaching in their primary schools after graduation from the teacher education programme. Construction of web sites also was reported at this stage (Section 8.2.3). A dominant theme that emerged in learning about the information technology skills throughout the course of the study: the majority of the participants under the guidance and with the provision of sufficient support in a resource-based learning environment, were subsequently able to learn independently the necessary technology skills that were used to address the problems or requirements of tasks in the intervention processes (see the portfolio approach and the information technology project described in Section 3.6).

The researcher, and some of the student-teachers along with peers and the technical support staff of the Educational Technology Unit and the Information Technology Services of the teacher education programme, acted as 'more knowledgeable others' (MKO) (Vygotsky, 1978) assisting the learning process. The researcher modelled and demonstrated the relevant technical skills about using computing applications in lectures and workshops. The participants then practised these skills while completing the assigned tasks, and were assisted and supported by the researcher, group members and technical staff in their teacher preparation stage (Section 3.6.1). In the teaching practice and in the beginning teaching, the researcher acted as the MKO (see, for example, Section 3.6.2, p. 92 about the preparation of the tryout teaching and Section 3.6.3, p. 93 the development of an information technology project through class discussion and phone conversation) and during these phases of the study, the use of information technology in school teaching was rare (Section 1.3.1). Role models or MKOs in the application of information technology in teaching and learning also were rare in schools. The constructivist-based environment of the interventions also involved the use of various tools and resources. In the course of this study, self-

learning materials about using certain computing applications in the form of booklets and web sites were given to the participants in the two phases of the study. These materials served as cultural artefacts (Salomon & Perkins, 1998) or scaffolds (Collins, Brown & Newman, 1989) that assisted the independent learning process. The computing skills learnt through these demonstration workshops and the self-learning materials then served to help participants complete some of the assigned activities, such as the presentation of a group project about using instructional technologies in the DDIM module (Section 5.1), the use of a off-line browser for a tryout lesson in teaching practice (Section 6.3.1), and a web authoring tool for an information technology project in the beginning teaching (Section 8.2.3). Collaborative group projects were deliberately assigned in the DDIM module in order to help the student-teachers learn the computing skills through social exchange processes (Pontecorvo, 1993; Slavin, 1995). Through these assigned tasks, or project-based activities, the participants then built up the necessary information technology skills gradually throughout the study.

Attitudes Towards the Teaching with Information Technology

The findings show that the participants possessed generally positive attitudes towards using information technology in teaching at the beginning of the present study. They saw the usefulness in the use of and felt that information technology could contribute to their pupils learning. They also were accepting using information technology in their teaching (Section 4.4). These positive attitudes remained unchanged during the study, although their beliefs of the usefulness and contribution of using information technology shifted towards learning (e.g., in independent learning) and achievement, rather than on the learning atmosphere (e.g., a more interesting class) after the intervention process in the first phase of the study (Section 5.2.2). The findings show improvement in confidence for the student-teachers, along with an increase in actual use after the completion of the DDIM module (Section 5.2.2). However, the findings reveal a lack of support from colleagues and principals, affects this confidence such as was seen in the case of Flora in her beginning teaching phase (Section 8.4.2). Workload and classroom management problems induced from the use of information technology

in teaching were the major concerns among the participants, both before and after the DDIM module, and during teaching practice (Sections 5.2.2 & 6.4.3). However, in the second phase of the study, a heavy workload and a perceived lack of support from colleagues and school principals, became the main concerns among the beginning teachers about using information technology in their teaching (Section 8.4).

It is argued that through the interactions between the participants and the researcher, as well as the teaching examples shared with and presented to the participants in a constructivist-based environment, positive attitudes such as beliefs about the usefulness and contributions of information technology, general acceptance and the confidence in using computers in teaching and learning were further reinforced throughout the course of the study. Concerns about classroom management and workload are likely due to the fact that the student-teachers in the teacher preparation programme were at a very early stage of their teaching career. They were at the stage of 'selves' in the stages of concern for teacher development suggested by Hall, George, and Rutherford (1986). At this stage, student-teachers are mainly concerned with 'survival' in the classroom. Consequently, consideration of how students might learn with information technology was likely of relatively low importance. Dwyer, Ringstaff and Sandholtz (1991) see such a situation as typical for the entry level of using technology in classroom teaching. At this level, teachers know the usefulness of technology in the classroom, but fear to confront difficulties and challenges that are brought about by using technology.

Conceptual Change of Teaching with Information Technology for Student-centred Learning

The participants showed improved knowledge about the concepts of the pedagogical use of information technology in education gradually throughout the course of the study. Such conceptual change is reflected in two ways: changes in views about teaching with information technology; and, changes in the participants' actions in teaching with information technology. Compared with highly teacher-focused use of information technology, such as in the collection

and delivery of subject content at the beginning of the study (Section 4.5), the student-teachers held more diverse views about using information technology in teaching after completion of the DDIM module. They started to see the application of information technology in teaching from a broader perspective, and, for example, saw that information technology could provide more flexibility in learning, and promote various student-centred learning activities. They became aware of, and more critical about, current developments in information technology in teaching and learning (Section 5.2.3). The student-teachers also saw the importance of the quality of the design and the production of teaching media with information technology and its effect on student's learning. Likewise, the incorporation of appropriate student-centred strategies was perceived as vital for the effective use of information technology after their teaching practice (Section 6.5.2). Such views were put into practice through the actual implementation of information technology during the ITRIP project. It is noted here, that although the student-teachers showed a rather student-centred view of using information technology in teaching as stated above, at this stage they were inclined to actually use more teacher-directed strategies during their teaching practice. Information technology was mainly used in the form of rather traditional teaching aids, such as for presentation, and for teacher-directed group work (Section 6.3.1). A shift of the above practice was observed only in the beginning teaching phase, in which more student-centred strategies using information technology were identified (see Tables 8.1 & 8.2). The participants in this phase also showed improved understanding of applications of information technology in education, and were able to articulate the rationale behind their choices of technologies and strategies in their information technology project (Section 8.2.3). It is evident from these findings that the participants had moved from the 'entry level' to the 'adaptation' stage of using technology in classroom teaching (Dwyer, 1991). At this latter stage, teachers start to accommodate technology in their planning, and try to use technology in their teaching.

The student-teachers' preconceptions of teaching with information technology were consistent with those reported in the literature. The student-teachers possessed a strong image of teaching as 'telling' and 'showing' and learning as 'absorbing' and 'memorising' (Ball & McDiarmid, 1987; Calderhead & Robson, 1991) and technologies were thus mostly used as information delivery tools (Li ,

Lam, Li & Wu, 2000). According to conceptual change theory, such concepts were attributed a high 'status' within their 'conceptual ecology' (Posner, Strike, Hewson & Gertzog, 1982) at the beginning of the study, until a state of disequilibrium occurred. This disequilibrium only occurred when the student-teachers were confronted with cognitive conflict (Duit, 1999) in the form of shared experiences from the researcher, and a variety of cases of student-centred use of information technology in teaching and learning. Conceptual change was consolidated by use of reflective activities during the interventions; such as discussions of various cases or samples in the tutorial sessions, presented during the DDIM module (Section 5.3.3). The reflective writing assigned in the portfolio guide (Section 5.3.2), discussions about the 'tryout teaching' in the post-observation interviews during teaching practice (Section 6.4), and conversations throughout the development of the information technology projects during ITRIP also contributed to conceptual change (Section 8.2 and 8.3). The findings also show that these reflective activities were effective in facilitating conceptual change, and further validate the effectiveness of various strategies suggested in the literature (see, for example, the 'cognitive apprenticeship' mentioned in Section 2.3.3 and the 'approaches for teachers' learning' in Section 2.4.3). The above reflective activities involved the researcher who acted as a 'cognitive model' (Collins, 1991), who modelled and shared his experiences about the application of information technology for student-centred learning (such as the intervention strategies employed in the present study and in other projects that the researcher had been involved). These modelling and sharing activities as explained by Zhao and Orey (1999), allowed the participants to see values, beliefs and ways of applying information technology for student-centred learning. Also, guided by the five phases (Dewey, 1933) and three levels (Hatton & Smith, 1995) of the reflective process (Section 2.4.3), the researcher acted as a 'coach' (Collins, 1991) and also the MKO (Vygotsky, 1978), assisting in the reflection process. Furthermore, booklets and the web sites of the selected cases and samples of student-centred use of information technology acted as 'cultural artefacts' (Salomon & Perkins, 1998) and as 'cognitive conflicts' (Duit, 1999) that triggered the reflection process, leading to conceptual change.

The above discussion has illustrated some influences the researcher believes have contributed to the process of learning to teach with information technology, based

on constructivist views of learning. The following sub-section attempts to draw together the above strategies and activities to facilitate the change process in the interventions of the two phases, into a model that helps to answer the second research question stated in Chapter 1.

9.2.2 *MIRACLE - A Pedagogical Model for Learning to Teach with Information Technology for Student-centred Learning*

A pedagogical model, named ‘Model-sharing, Interactive, Reflective and Contextual Learning Environment’ (MIRACLE), for learning to teach with information technology that summarises the activities employed in the interventions of the present study is illustrated in Figure 9.1. MIRACLE represents the four main strategies used in this study: *Model sharing*; *Interactive resources and support*; *Reflective opportunities and activities*; and, *Contextual tasks*. These four strategies then constitute a *Learning Environment* that scaffolds the learning-to-teach process.

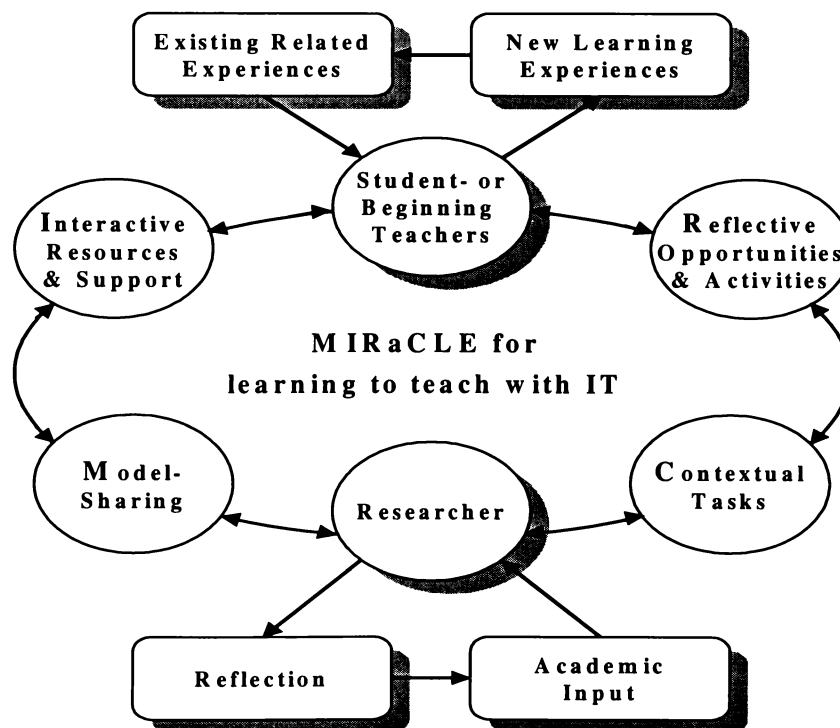


Figure 9.1

Model-sharing, Interactive, Reflective and Contextual Learning Environment (MIRACLE) model for the learning to teach with information technology

The MIRACLE model attempts to explain the cognitive, social and contextual aspects of teacher development informed by the constructivist framework of this thesis (Section 2.3.2). It is noted that the student-teachers or beginning teachers who came with their existing concepts and skills about teaching with information technology, were subsequently guided to interact with the various components of this learning environment. New learning experiences, such as the acquisition of information technology skills and the concept of student-centred use of information technology, were the result of such interactions, and became part of the cognitive structure or the schemata in the minds of the participants of this study. The researcher in this model arranged the scaffolding learning environment on one hand, and acted as the cognitive model and the coach (Collins, 1991), assisting and guiding the participants through the interventions of the thesis.

Model Sharing

The strategy *model-sharing* of the MIRACLE model arose from suggestions for the development of a scaffolding environment by Zhao and Orey (1999) (see Section 2.3.3 on 'cognitive apprenticeship'). In the present study, 'explicit sharing of practices' from the cognitive models was one of the key strategies of the interventions. It is argued here that the explicit articulation of the experiences and thoughts about the professional practice of a more knowledgeable (or competent) other enhances participants' understanding about the rationale behind such practices from an academic perspective (Brookfield, 1995; Shunk, 2000). For example, the concept of a student-centred use of information technology in a specific instructional situation was shared through social exchange activities in the tutorial sessions of the DDIM module, post-observation interviews after the try-out lessons during the teaching practice, and conversations that occurred while developing the information technology project in ITRIP. Based on the constructivist framework of this study, the researcher explained his thoughts by telling participants about his experiences gained in various projects with schools, and his analysis of some of the selected cases presented in a booklet for independent study. In the workshop part of the ITRIP, a session was organised to

help the beginning teachers to re-examine the constructivist framework promoted by the researcher. The researcher introduced the framework of this thesis openly, and led a discussion about the ways of developing a constructivist-based learning environment in the information technology projects for the participants (Section 3.6.3).

Interactive Resources and Support

The provision of a resourceful and supportive learning environment was another major strategy in the interventions of this study. The purpose of such a strategy *interactive resources and support* of the MIRACLE model was to provide a set of tools and scaffolds for assisting knowledge construction (see Section 2.3.3 on resource-based learning). It is also argued from the constructivist framework of this study, that understanding is achieved only through active exploration and inquiry in such a resource-based learning environment (Farmer, 1999). Thus, the arrangement of various learner-centred activities that enacted the interaction process between the participants and the scaffolding environment is seen as indispensable. These interactive activities then became one of the strategies (i.e., contextual tasks) of the MIRACLE model, discussed in the remainder of this section. In the first phase of this study, the resources prepared for the DDIM module included: a set of CD-ROMs; a module resources web site; a booklet about the learning of an authoring program for the production of multimedia learning package; basic information technology skills; and, a booklet containing selected cases of using information technology for student-centred learning and teaching. Apart from the above learning resources, lectures, workshops, tutorials and consultations were arranged to support the student-teachers' mastery of the necessary concepts and skills of the DDIM module. The student teachers could also seek the help from competent others, for example, support staff in services departments such as the Educational Technology Unit and the staff from Information Technology Services. The resources specific to the second phase of this study were collated in the form of reading materials on current issues and exemplars of applications of information technology in education; three CD-ROMs containing shareware of learning programmes developed in the teacher education programme and the updated web resources, were developed in the first

phase of this study. Furthermore, each beginning teacher was given an account on a FTP server, and was granted the right to store and download teaching materials in their assigned locations. They were also given accounts on a web server allowing them to create personal web sites for their projects. A template for the construction of a personal web site was also provided (see Appendix E, F, and G for examples of these resources). The beginning teachers were expected to enter and modify the contents of the web pages provided in the web template. Moreover, the researcher also provided support through a workshop and the continuous (telephone) consultations during the development of information technology projects. The beginning teachers were encouraged to interact with these supports and resources when they found a need while they were developing their information technology projects.

Reflective Opportunities and Activities

Reflection as discussed in Chapter 2 (Section 2.4.3) is a key strategy to help the professional development for novice teachers. In the MIRACLE model, various *reflective opportunities and activities* were embedded in the interventions. Reflective opportunities and activities in the interventions included: discussions of various cases or samples selected in the resource booklet and the web site in the tutorial sessions during the DDIM module; reflective writing activities assigned in the portfolio guide; discussion of the 'tryout teaching' in the post-observation interviews during teaching practice; and, the teaching diaries and telephone conversations throughout the development of the information technology projects during ITRIP. Moreover, it is observed from the MIRACLE model that the researcher also could gain in academic knowledge through the cyclical reflection-on-action process (Schön, 1983, 1987) of the experiences from the study. Such knowledge was then further shared in MIRACLE, and this in turn assisted the empowerment of the learning to teach with information technology.

Contextual Tasks

Building on the theories of situated and collaborative learning discussed in Chapter 2 (Section 2.3.2 and 2.3.3), it is argued here that learning is at its most effective and meaningful, if the process is enacted in a real-life or authentic situation. Also, learning is enhanced through dialogical discourse in group activity, in which ideas or concepts are shared. Thus, a variety of authentic tasks and collaborative group activities relevant to school teaching (contextual tasks) were assigned throughout the intervention processes. For example, the individual project of building up a resource site allowed the student-teachers to perform an Internet search and to send e-mail messages about the results of their Internet search to group members and the researcher, to assist the construction of web site of resources. Such learning experiences therefore enabled the student-teachers to master the necessary technical skills (such as using a search engine and e-mail) and at the same time to evaluate relevant web resources that could be used in their future teaching. The group project of a final presentation about the learning of the use of particular instructional media in the DDIM module allowed better understanding of the design principles and theories of learning for the development of multimedia-learning programme among the student-teachers (see the Portfolio Guide in Appendix D). Such strategies, as stated above, proved to be effective as seen from interviews data after the DDIM module (Section 5.3.1). Authentic and collaborative activities were also observed in the 'tryout lessons' during teaching practice, and the information technology projects ITRIP. In such activities, the researcher worked together with the participants in the planning of lessons integrated with information technology. Experiences were shared and assistances provided in a collaborative relationship.

The following section summarises the factors that influence this professional development in the two phases of this study.

9.2.3 Factors Influencing Learning to Teach with Information Technology for Student-centred Learning

Identified factors affecting the professional development of teaching with

information technology in this study include: time and workload; computing facilities and 'technology-using culture' of the schools; the subculture of being a 'new comer' to the education field; support from the school principal and colleagues; and, school leadership.

Time and Workload

In the intervention of the DDIM module, the student-teachers reported that time was a crucial constraint in their interactions with resources and people in their particular learning environments. Given the limited module hours (2-hour sessions for 12 weeks, see Section 3.6.1) and various tasks (see the Portfolio Guide in Appendix D), the participants of this study had to employ extra effort and time to complete their assigned tasks in the form of independent study, and out of classroom work. There was also concern about inadequacies in training workshop in the use of, for example, authoring applications for multimedia production. The researcher also observed constraints in dealing with some student-teachers, who appeared indifferent to learning, or who had encountered difficulties in the course of their study (Section 5.3.1). The situation was not resolved and became worse in the beginning teaching phase. The beginning teachers were busy with their very tight teaching schedules, and heavy workloads (Section 8.4.1). Such practices (i.e., tight teaching schedules and heavy workloads) in primary schools of Hong Kong, caused difficulties in both communication and classroom observation activities of the intervention in this study.

Computing Facilities and Technology-using Subculture of the Schools

At the beginning of this study, the computing facilities of most primary schools in Hong Kong were unsatisfactory, compared with the end of the study (see Sections 6.3, 7.2 & 8.2.2). However, despite the advancement of the computing facilities, there was little evidence of improved integration of such facilities into teaching and learning among the primary school teachers (except for Amy's school, see Section 8.2.2). This finding is consistent with the views of the Centre for

Information Technology in School and Teacher Education (2001). Increased computing facilities do not necessarily result in improved use, or enhanced teaching and learning (Section 2.2). Such a finding may be explained by two other factors identified in this study: inconvenience, and a lack of a 'technology-using subculture' in schools. In the first phase of this study, the student-teachers had to invest their own time setting up the necessary computing equipment in the classroom if they wanted to teach with information technology. They did not encounter role models of teaching with information technology, as most of the permanent school teachers were indifferent or possessed conservative and resistant attitudes towards using computers (see Sections 6.4.1 & 6.4.2). In the second phase of this study, despite improvements in computing facilities, this 'non-technology-using culture' remained a major factor affecting the use of information technology in teaching and learning for four of the five schools in the investigation (see Section 7.2 and the cases of Betty and Flora in Chapter 8). The apparent effect of school subculture was well documented by the student-teachers who contrasted this with the positive experiences and assistance they had gained during their teaching practice (Section 6.4.4). These examples point to the importance of school subculture towards professional development in this aspect.

Subculture Thinking of Being a 'New Comer'

Further to the above rather unfavourable school subculture, the subculture thinking of being 'new comers' to the education field among the participants also affected the way in which they used information technology in teaching and learning. In the first phase of this study, a perception of being student-teachers during teaching practice made the participants conform to, and comply with, the school culture dominated by a lack of technology use and traditional teaching approaches. Such factors may well explain the reason of the adoption of the more teacher-directed use of information technology at this stage (Section 6.4.3). In the second phase of this study, being new teachers to the schools, the beginning teachers dared not engage in any activity that would be seen as different from the normal practice of the schools, for fear that they would receive criticism from veteran teachers. Such a perception was evident in the cases of Doris and Nancy who were on temporary appointments in their schools. Betty and Flora also learnt

to conform after the unpleasant experiences in which they encountered conflicts in the views of teaching compared with their colleagues (Section 7.3.1).

Collegial Support and School leadership

The research findings of this thesis suggest that the different forms of support received from MIRACLE assisted the professional development in teaching with information technology for the participants throughout this study. The participants also felt that the on-going support from the researcher was helpful in this aspect. For example, the reflective activities guided by the researcher in the interviews throughout this study proved to be supportive measures, providing insights and giving confidence in the use of information technology in teaching (see Section 6.4.6 on the reflection about teaching practice and Section 8.2.1 on the development of information technology project). Likewise, the support from some student-teachers' colleagues during their teaching practice (Section 6.4.4), and from colleagues in beginning teaching (such as Amy whose school had established a sharing culture, and Chris and Doris who had received support from their colleagues with similar beliefs in using information technology in teaching and learning, Section 7.2) also received similar support. Furthermore, support from school principals was seen as useful (see, e.g. Amy, Chris & Flora's experiences in Section 8.4.2). However, despite supportive principals, leadership was seen as a major factor affecting the effective implementation of information technology in teaching and learning. This was reflected, for example, in the case of Flora who reported that the result of an unpleasant relationship with senior teaching staff at her school was due to the unsatisfactory leadership of her school principal. The case of Betty was particularly concerning in that she finally left her teaching job because of her perception of the authoritarian leadership of her school principal (Section 8.4.2).

It is argued that the constructivist-based learning environment provided in this study proved effective in assisting participants' professional development in teaching with information technology. However, the above factors in the school context such as computing facilities, working time, workload, school subculture, collegial support and school leadership identified in this subsection were also

highly influential. Such a finding is consistent with similar research in the literature (see, e.g. Mouza, 2002; Mumtaz, 2000) and also research in teacher development (e.g. Meyer-Smith & Mitchell, 1997; Vonk & Schras, 1987); the literature highlights the importance of school culture on teacher development. This subsection also points to the influence of a conforming subculture of being a 'new comer' to the education field. Student-teachers and beginning teachers tend to follow the norm of the school culture and practice.

9.3 Implications and Suggestions

This study aimed to identify a course for information technology and teacher education that may help to enculture the use of information technology for student-centred learning in classroom teaching. Relevant course content in line with the six competency areas identified in this study for learning about teaching with technology were constructed for the DDIM module (see Section 3.4.5). These six competency areas arose from a review of literature at the time of the present study, before the release of the mandatory information technology competency requirements for teachers enforced by the Hong Kong Government (Section 2.2.2). Apart from curricula content, this study also has identified a pedagogical model, MIRACLE that the researcher asserts proved to be helpful for the mastery of technological skills and for the transformation of a technology-using culture. Thus, the research reported here adds to the existing literature in the development of a quality course for information technology and teacher education worldwide, and also contributes to knowledge base for teacher education. Furthermore, the factors identified in this study also inform the practitioners about the integral relationship among the curricula contents, the pedagogy and also the school context for successful implementation of the course for information technology and teacher education and for achieving a technology using culture society as expected in the education reform document (Section 1.2). Details of the implications of the findings in this study and the suggestions that enhance the process of learning to teach with information technology are discussed in this section under two headings: (1) revisiting the curriculum for instructional technology – the six technology competency areas for teachers; and, (2) towards a technology using culture through MIRACLE.

9.3.1 Revisiting the Curriculum for Instructional Technology– The Six Technology Competency Areas for Teachers

Chapter 1 provided a description of the development of the instructional technology related curriculum in a teacher education programme in Hong Kong (Section 1.3.2). The technology elements have been embedded into the educational technology curriculum, and evolved into the DDIM module in the teacher education programme. As described in Chapter 1, the original curriculum of the DDIM module was heavily focused on teaching ‘about’ instructional technology the skills for operation of technological equipment, and computer software. The six areas of technology competency for teachers developed for this study therefore attempted to provide a generic framework for the teaching ‘with’ instructional technology which includes the use of traditional technology and information technology (Figure 9.2). This curriculum framework covers most major points about information technology and teacher education raised in the literature and embraces the three domains (productivity, general integration, and subject-specific integration) stated in the mandatory information technology competency requirements for teachers in Hong Kong (see Section 2.2.2).

The six areas of technology competency for teachers are:

- A. Knowledge of the development and characteristics of instructional technologies
- B. Communication theories and visual design principles
- C. Design and production of instructional technologies
- D. Equipment operation and use of computer application software
- E. Selection and utilization principles of instructional technologies
- F. Evaluation of instructional technologies.

Figure 9.2 shows the relationships among these competency areas and the integral nature of using instructional technology in an actual instructional process. In Competency Area D, teachers are expected to operate various instructional tools, such as overhead projectors or computers. These operation skills also are necessary for the production of instructional materials, for example, using Microsoft PowerPoint software to produce colourful transparencies or a presentation programme of a particular topic in a lesson. These basic ‘know-how’ skills are important, but should not be the sole learning content of an instructional

planning phase: the ‘pedagogical strategies’ that applies particular ‘instructional technologies or resources’ in an activity to achieve certain learning objectives of a particular ‘content knowledge’ in a specific learning context (described by the three integrated circles in Figure 9.2). It is noted that a more teacher-directed strategy may lead to the selection or production of instructional technologies that act simply as aids to the teacher, while a more student-centred strategy may result in student tools to facilitate their own learning. The pedagogical strategy employed also affects the design of particular instructional material. For example, the instructional material for a teacher’s presentation and for student’s independent learning may require the application of different design principles. These represent important issues in Competency Areas C and E. While the instructional design theories and principles guide the organising and sequencing of the learning contents in the design process, student-teachers also need the knowledge of how the information of such contents is encoded for effective communication through an instructional material. Choices such as sound, text or graphics and their attributes such as the voice level, and the colour, size and composition of the text and graphics of the specific content also are fundamental elements to be considered. These kinds of competencies are therefore categorised as ‘communication theories and visual design principles’ in the framework. Finally, for Competency F, student-teachers should be able to derive appropriate strategies to evaluate the effectiveness of the use of particular technology as in teaching and learning based on the principles and theories discussed in other competency areas. It is argued here that the curricula framework suggested in this study provides a holistic and clearer picture for the development of instructional technology course that integrates the over-emphasised training of technical ‘skills’ and the learning about the ‘concepts’ of technological applications for enhancing students’ learning.

9.3.2 Towards a Technology-Using Culture Through MIRACLE

The findings from this study support the view that the MIRACLE model identified in this study facilitates the process of learning to teach with information technology. It is argued that the MIRACLE model allowed the participants of this study to become immersed in a technology-using environment, to examine, and to

share the theories and principles behind various applications of information technology in teaching and learning based on constructivist views of learning promoted in this study. Such learning experiences gained through MIRACLE may influence the participants' teaching behaviour at the school level, and may bring changes to the school culture of using technology in teaching and learning as a result. Furthermore, the findings documented in this study may provide a role model for modules in other curriculum areas of the teacher education programme, and thus help to build up a technology-using culture at the institutional level. The following subsection describes these implications and makes suggestions that may enhance the process of learning to teach with information technology for student-centred learning.

MIRACLE at the School Level

The learning experiences in the two phases of this study have some implications for school teaching in primary schools in Hong Kong and internationally. Prospective teachers, having conceptualised the underpinning theories (e.g., constructivist-based views of learning), and having experienced the benefits and values through actual implementation (e.g., the information technology project in ITRIP) governed by the MIRACLE model, may change their conception about teaching with technology. The teachers may then bring these concepts and experiences into their own teaching, and thus attempt a more student-centred approach informed by the MIRACLE model. For example, drawing on the value of the strategy 'contextual tasks' of the model, the teacher may attempt more project-based learning activities in his/her teaching with information technologies. Also, the notion of resource-based learning may inspire the teacher to create a learning environment with 'interactive resources and support' modelled by MIRACLE, with the aim of assisting individual learning. It is through the implementation of such strategies that pupils may have more opportunities to develop information technology skills, and to apply such skills in solving problems and sharing ideas with others through completing a project. It is also through using information technology that individual care and independent learning activities become more feasible. Furthermore, informed by the MIRACLE framework, teachers may deliberately choose a variety of information

technologies for teaching, with an aim of modelling the authentic application of such technologies in achieving a task. It is through such vicarious experiences during schooling, that prospective teachers, who also were students before entering the teaching profession, may have the chance to perceive teaching differently from those described in current literature (see, Section 2.4.1). All of the above practices then contribute to the development of a technology-using culture at a school, and may develop technology-using citizens, and the technology-using teachers as a result. Hence, in addition to a role of being a facilitator for student-centred learning, the prospective teachers also become change agents (Fullan, 1991), who will bring about a cultural change in using information technology in schools. Reflecting on the MIRACLE model, the researcher while important is only part of the whole learning environment created. It is expected that different domain or discipline of knowledge requires different expertise or academic input from researchers for this model so any teacher or educator who has mastered the idea of the model and follows the constructivist principles addressed in this study (Chapter 2, p. 61), may act as this central person to arrange the learning environment based on the MIRCALE model and to establish appropriate conditions for facilitating such implementation.

Nurturing a Technology-Using Culture at School Level

The findings in the case of Amy in this study (Section 8.4.2) suggest that school culture is important in changing the pedagogical use of information technology for student-centred learning. Amy was immersed into a risk taking, and collaborative and sharing culture in her school, and was proud of the achievement of her school in the area of integrating information technology into the school curriculum. It was also evident in Amy's case, that good leadership is essential for fostering such a culture. Given the positive experiences in the case of Amy in this study, the following suggestions are made:

1. School leaders such as principals and senior teachers in charge of information technology and school curriculum development, need training in order to bring about conceptual change in using information technology in teaching and learning as promoted in this study.
2. School leaders need to conduct self-evaluation for the implementation of the

Five-year Information Technology Strategy (EMB, 1998) with reference to four dimensions: (1) the infra-structure and connectivity; (2) the resources and support for hardware maintenance and teaching; (3) the status of technology use in school curriculum; and, (4) the status of teachers' professional development in using information technology. The following criteria for an Information and Communication Technology (ICT) capable school suggested by Kennewell, Parkinson and Tanner (2000) may provide a useful reference for such evaluation activities. In a capable school, "teachers will see:

- i. pupils with a positive attitude towards ICT, and a disposition to apply ICT to relevant curriculum tasks and to evaluate the outcomes of their use of ICT;
 - ii. pupils planning and applying ICT to tasks, describing and evaluating their work with ICT, with a high level of knowledge, skill and understanding in relation to their age;
 - iii. a strong role for ICT in the teaching and learning culture of the school, so that frequent opportunities are planned and provided for pupils to develop their skills in applying ICT to worthwhile tasks;
 - iv. teachers helping pupils to develop their ICT capability whenever there is an opportunities to do so, and provision for pupils to work on purposeful ICT tasks beyond the standard teaching times" (p. 13).
3. School leaders need to develop clear policies and strategies to motivate and facilitate teachers' use of information technology in their schools. For example, each subject could be required to submit and implement at least one teaching plan that integrates the use of information technology for enhancing students' learning in a academic year; peer observation and sharing sessions of such technology plan should be encouraged; and, awards given to innovative plans, and to any outstanding performance of teachers using information technology.

MIRACLE at the Institutional Level

The ultimate goal of an instructional technology course in a teacher education programme is to prepare teachers to use instructional technology for facilitating student-centred learning. The above discussion points to some implications about

the development of technology using culture at school level, if prospective teachers are empowered with the expected capabilities (both technical and conceptual) of using information technology through the experiences from MIRACLE in a teacher education programme. Supported by the findings of this study, MIRACLE may act as a model for learning modules in a teacher education programme. Building on the theoretical framework of the MIRACLE model, the teacher educators of other learning modules may build a technology-using environment in which prospective teachers can see various models of authentic application of information technology by teacher educators - such as the use of presentation software for lectures, e-mail for communication, and web platforms for individual learning. Prospective teachers can be given opportunities to use a variety of technologies as tools for doing assignments or completing group projects. They may also be guided to use a variety of resources (both traditional and digital) and be given sufficient communication opportunities, in which advice and support can be sought from competent others such as peers, technical experts and teacher educators (e.g., while completing assignments or projects through collaborative work, face-to-face consultations, e-mail, and electronic fora). It is also useful to note that reflection opportunities are essential for inducing conceptual change. Thus, the use of a portfolio which guides student-teachers to reflect and to document their use of information technology in a particular domain of knowledge could also be incorporated as one of the assignments in a particular learning module. Most importantly, a contextual environment in which prospective teachers can test out their skills and concepts of applying information technology in teaching could be arranged. Hence, during teaching practice, the student-teachers could be expected to incorporate information technology in their teaching as one criterion for fulfilling the field experience requirements of the teacher education programme.

A Holistic Model for Information Technology and Teacher Education in a Teacher Education Programme in Hong Kong

In order to realise the above implications at institutional level as stated above, this study proposes a holistic model for using technology in teacher education programmes in Hong Kong (Figure 9.3). This model suggests a compulsory

learning module about the use of technology in teaching and learning is necessary for a teacher education programme in Hong Kong context. Given that the integrated model currently suggested in the literature demands role modelling from teacher educators in a teacher education programme (e.g., Cates, 1995; Willis, 1997), the success of such an integration rests much beliefs and understandings, and capabilities of using information technology among the teacher educators who do not have any relevant background (like those involved in the area of instructional technology). It is argued here that a lecturer who is not teaching the student teachers about using technology, will most likely not able to articulate any rationale of using technology in teaching and learning, since he/she may not be technological literate enough, and may even reject using technology (Cuban, 1986 and Hills, 1987). Thus, to achieve successful integration, a technology-using culture at the institute level becomes a prerequisite. However, the literature suggests such technology-using culture is not yet established in the teacher education institute in Hong Kong (see Chapter One, Section 1.3.2). It is therefore suggested that all student-teachers should go through the learning experiences based on the MIRACLE model promoted in this study, in a compulsory ITTE module like the DDIM module described in this study.

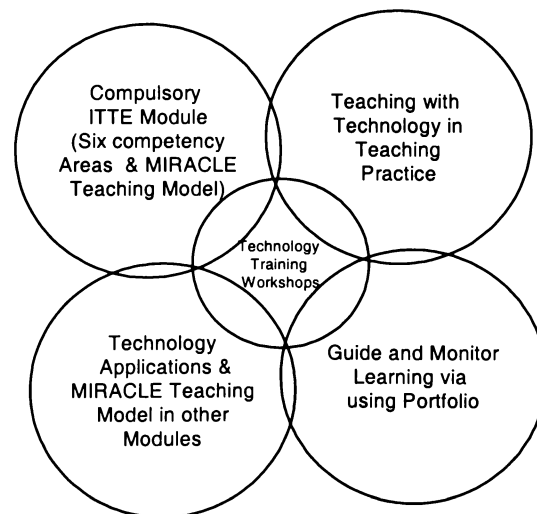


Figure 9.3

A holistic model for empowering prospective teachers' use of technology in teaching and learning in a teacher education programme in Hong Kong

As described in Section 9.2.2, the MIRACLE model requires student-teachers to interact with various resources and support by completing different teaching and learning tasks with the use of information technology. It is therefore of particular

importance that student-teachers be given the opportunities to receive training in the skills for relevant technologies that are to be used in completing the required tasks of the compulsory ITTE module, or other modules that seek to integrate information technology requirements into learning activities or assignments. The literature suggests that teachers who have received training about the concepts of using information technology in teaching and learning, and at the same time received training in information technology skills, are more prepared to apply such technology in their teaching (e.g., Trotter, 1999, cited in Mouza, 2002). It is therefore suggested that a series of workshops for different information technology skills should be arranged in order to equip student-teachers with the necessary skills for their applications in the learning activities in the course of study in the teacher education programme.

The above suggested compulsory module, and the provision of technology training workshops, are seen by the researcher the first step for preparing technology using teachers. It is suggested that student-teachers, having mastered the necessary information technology skills, should be provided with authentic experiences, requiring them to actually practise such skills in real-life applications, such as completing learning tasks in the teacher education programme and in school teaching. It is through such practice that relevant theories and principles about using information technology in teaching and learning, can be further conceptualised and reinforced. Thus, it is suggested that the incorporation of information technology use in the learning activities in the learning modules in a teacher education programme and in the class teaching during the teaching practice period be regarded as a standard requirement, so that student-teachers have the opportunity to link what has been learnt with actual practice. Furthermore, the findings in the teaching practice phase of this study highlight the importance of a positive technology-using culture on student-teachers (Section 6.4.4). It is therefore suggested that school placement for teaching practice should pay special attention to this aspect.

With the release of the mandatory requirement of the Information Technology Competency in Education for teachers (ITCE) (Au, Kong, Leung, Ng & Pun, 1999) (Section 2.2.2), it is suggested that a list of more comprehensive competency items, combining those in the ITCE document, and those in the six

competency areas proposed in this study, should be made. Student-teachers should then be required to construct a portfolio that records and shows their development and achievements with respect to the competency items in the list. It is expected that with the assistance of the reflective guidelines and instruction in the use of portfolio, and through the construction process of the portfolio, student-teachers will have the chance to integrate and reflect on their understanding and mastery of concepts and skills of teaching with information technology. Such a practice is argued to be important for transforming our student-teachers into technology-using teachers.

The above suggestions may shed some light on the professional development of teaching with information technology among prospective teachers. However, success depends as much on whether a technology using culture has been established in the teacher education institute, as on training. It is therefore suggested that teacher educators also need to see themselves as learners, and to receive training that may result in their own conceptual change about teaching with information technology. They also need to have an open mind, and to attempt new teaching and learning activities that can model and facilitate the use of information technology for student-centred learning in the teacher education programme.

9.4 Limitations of the Study

This research was conducted at the time when the teacher education institute of this study had just moved to a new centralised campus (for one and a half years). It is important to note that the computing facilities at that time were less sophisticated compared with today. Moreover, most of the primary schools were equipped with standalone computers (see Sections 6.3 & 7.2, ED1 project) only at the time of teaching practice in the first phase of this study. Using computing facilities in teaching at that time thus required complicated set-up procedures in the classroom. Fortunately, in the second phase of this study, most of the schools were equipped with better computing facilities, and the beginning teachers were able to implement their information technology plans of the ITRIP. However, at the time of this study, there was a severe lack of role models in schools who could

serve as a supporting teacher or mentor for the student-teacher participants in the primary schools. It is also noted that there was a lack of technology-using culture both at the institutional and school levels. Furthermore, schools were facing many changes in almost all aspects of school life such as school management, school curriculum, assessment and pedagogies that were brought about from the request of educational change by the government. Teachers complained about their tremendously increased workload both in teaching and administration. They also felt very strong pressure in adapting to such vigorous changes. Given such a context, there are likely some limitations for the findings for this study. For example, the researcher was unable to find any local examples of 'good practice' that could be used as cases for analysis and reflection, and therefore had to rely on those from other, typically Western countries, where the context is somewhat different from Hong Kong. Such a situation may have lessened the impact of the MIRACLE model on participants' learning of using technology in teaching and learning. Furthermore, there were also problems in obtaining accurate information about the performance of teaching with information technology during teaching practice and ITRIP, given the restrictions in such a context. For ethical reason, participants were given autonomy to take part in the research activities, and be allowed to object to providing any information about their pupils if they so desired. Such an issue may create difficulty in maintaining a stable sample for the study. For example, of the 16 participants who agreed to take part in the in-depth qualitative inquiry activities, only five student-teachers had attempted the 'tryout teaching', and 15 of them had attended interviews during and after teaching practice respectively; and, only five beginning teachers had committed the ITRIP project, in the second phase of this study respectively (see Section 3.3.4 for details). This is not an unexpected scenario given that these beginning teachers were confronting different stress while they were adapting to different school environment and would most likely to avoid addition workload like participating into this study (Cohen, Manion & Morrison, 2000). Furthermore, there also was a lack of evidence about student achievement. This occurred since the researcher was not able to receive samples of students' work from the beginning teacher's classroom in the ITRIP project.

With respect to the design of this study, there is the possibility of a 'Hawthorne effect' induced by the dual role of the researcher. In this study, the researcher also

acted as the lecturer rendering the interventions of the research, and teaching the DDIM module at the same time. The participants were also well-informed about the purpose of the research (as was required for ethical approval, for the thesis). Such a situation may result in a tendency that the participants are motivated to report the desirable responses, favourable to the research in surveys and interviews conducted by the researcher. Given the possibility of the occurrence of such bias, a number of measures were taken; including establishing trust and rapport with the participants, and conveying a clear message about the aims and the natural enquiry process of the research to the participants. Other measures to minimise bias that may be induced from objective observation and interpretation included participant validation of the translated and transcribed data. For example, samples of the transcribed interviewing data were returned to the participants to verify the validity of the content.

Finally, this study was conducted in a particular timeframe and context in Hong Kong, when a time at which the computing facilities were just installed in the schools, and where traditional teaching with less use of technology was dominant in most primary schools. The findings of this study, therefore, can be generalised for this particular context only, and may not be applicable to other contexts where computing facilities and teaching culture may be different.

9.5 Suggestions for Further Research

This study was conducted about four years ago when the computing facilities in Hong Kong primary schools were minimal and less advanced both at the institutional and school levels, and when the teaching culture was rather traditional and the use of information technology was rare. It is therefore suggested that further research, based on a similar theoretical framework, could be conducted in order to compare the three research questions stipulated in this study (Section 1.5) with the present. With the advancement of information and communication technologies, many resources and support can now be obtained online on the Internet. This implies a change in the form and ways of providing resources and support in any new intervention. The promotion of education reform in recent years may also have induced changes in school culture. Such a

situation may bring about different findings. In order to strengthen the case for analysis and reflection with a local context, other studies could be conducted in local schools, so as to produce a repertoire of good practices of applying information technology in teaching and learning. The findings of such studies might then act as resources, helpful for sharing and reflection on activities in the new intervention.

This study has also identified school culture as one of several factors influencing the use of information technology in teaching and learning. It is suggested that an in-depth field study in two types of schools: 'positive' culture such as was seen in Amy's school, and the 'negative' culture seen in Betty's school, may provide valuable data for professional development of using information technology in teaching and learning.

The findings of this study have shown the effect of role models on learning to teach with information technology for the teacher educators. This study also points to a need for a holistic model of integration for learning to teach with technology at the institutional level, for promoting a technology-using culture at this level. Therefore it is suggested that studies could be conducted to: (1) explore the background of the beliefs and technology competencies among teacher educators in the teacher education institute; (2) identify the relationship between such background and the manner in which technology is used among these teacher educators; and, (3) investigate factors that lead to the promotion of the holistic integration model at the institutional level.

9.6 Conclusion

Given the described limitations and the thick qualitative data (53 interviews, 10 lesson plans, seven classroom observations, 32 short essays and 21 field notes) collected in this study, the result seems to show a positive effect on the mastery and understanding of information technology skills and also the concepts in teaching with information technology through the intervention described by the MIRACLE model. Factors that promote or constraint student-centred learning with the use of information technology are also identified. It is expected that the

result derived from this study may act as a good reference for the professional development in teaching with information technology. The result also provides a clear direction for the development of an information technology and teacher education course in a teacher education programme.

Appendices

Appendix A	Interview Guide for main interviews in the study
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Appendix K	A Summary of the IT Plans of the Beginning teachers in the ITRIP

Appendix A
Interview Guide for main interviews in the study

Interview 1 – After the DDIM course in Phase 1

1. We have incorporated some new elements in the DDIM course. Can you tell me something about them? How do you feel about them?
Probe: What are your impressions or opinions about the module?
What kinds of resources? What kind of teaching methods or strategies?
(IT case studies, self-learning materials, additional readings, resource Web; CD-ROMs; lectures, tutorials, workshops, projects, reflections, portfolio etc.)
2. Has the IM course had any influence on your teaching with IT?
Probe: What are they? How?
3. What were the conditions or factors for their effective teaching with IT??
Probe: Why and How?/Why not?
4. In your opinion, what is/are the most important element(s) about teaching with IT?
Probe: Why?

Interview 2 – After the Teaching Practice in Phase 1

1. Can you tell me something about the teaching facilities of the schools in which you had your Teaching Practice? Do you have any comments about your situation?
Probe: What did you think about the IT facilities? How were they used? Your feeling? Any comments?
2. How was IT used in your teaching during Teaching Practice?
Probe: Why did you use them in that way?
3. How did this teaching experience affect you in your future teaching with IT?
4. What were the conditions or factors for effective teaching with IT in your Teaching Practice?
Probe: Why and How?/Why not?
5. In your opinion, what is (are) the appropriate way(s) of teaching with IT?
Probe: Your concepts? Any examples?
6. In your opinion, how does IT facilitate in student-centred learning?
Probe: Your concepts? Any examples?
7. Here is an example of how a teacher use IT in his teaching (described by the researcher), how will you comment on this case?
Probe: How IT is used? How students learn with IT? What are your comments? If positive comment then why? If negative comments then why not?
8. Do you have any other views that you want to express? What are they?

Interview 3 – After the ITRIP Workshop in Phase 2

1. How is your ITRIP project going?
Probe: What can I do for you?
2. How is IT used currently in your school?
Probe: How do your colleagues use IT in their teaching? How do you use IT in your teaching? Do your school have any IT plan or policy? Do you have any comments on currently use of IT in your school? What are your comments and why?
3. Can you tell me something about any event(s) that you considered to be successful in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them successful?
4. Can you tell me something about any event(s) that you considered to be unsuccessful or discouraging in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them unsuccessful or discouraging?

Interview 4 and/or 5 – During ITRIP in Phase 2

1. How is your ITRIP project going?
Probe: What can I do for you?
2. How is IT used currently in your school?
Probe: How do your colleagues use IT in their teaching? How do you use IT in your teaching? Do your school have any IT plan or policy? Do you have any comments on currently use of IT in your school? What are your comments and why?
3. Can you tell me something about any event(s) that you considered to be successful in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them successful?
4. Can you tell me something about any event(s) that you considered to be unsuccessful or discouraging in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them unsuccessful or discouraging?
5. Did you observe any changes concerning the use of IT in your school?
Probe: e.g. IT facilities? Use of IT in teaching in your colleagues and yourself? Students' performance? School IT plan or policy?
If there were changes, what were the possible causes? If no, why?

Interview 6 – After ITRIP project in Phase 2

1. How is IT used currently in your school?
Probe: How do your colleagues use IT in their teaching? How do you use IT in your teaching? Do your school have any IT plan or policy? Do you have any comments on currently use of IT in your school? What are your comments and why?
2. Can you tell me something about any event(s) that you considered to be successful in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them successful?
3. Can you tell me something about any event(s) that you considered to be unsuccessful or discouraging in applying IT in your teaching? How do you feel about it?
Probe: What was it / were them? Why was it / were them unsuccessful or discouraging?
4. Did you observe any changes concerning the use of IT in your school? How do you feel about it?
Probe: e.g. IT facilities? Use of IT in teaching in your colleagues and yourself? Students' performance? School IT plan or policy?
If there were changes, what were the possible causes? If no, why?
5. Can you tell something about your ITRIP project?
Probe: What was your plan? What have you prepared for it? How did you implement the plan?
6. What are the comments and feeling about the ITRIP?
Probe: Were the objectives achieved? Were the strategies appropriate? Were the resources useful? How? Why? Why not?
7. Were there any impacts on your teaching from the ITRIP experience?
Probe: What were they? What were the possible causes?
If no impacts, why?
8. Were there any influences on students' performance after the ITRIP project?
Probe: What were they? How did you know? What were the possible causes?
If no influences, why?
9. Did you observe any changes yourself after the ITRIP?
Probe: What were they? What were the possible causes?
If no changes, why?
10. Was there any effect on your colleagues with the ITRIP?
Probe: What were they? What were the possible causes?
If no effect, why?
11. What are your overall views on the development of IT in education in Hong Kong?
Probe: What are the reasons behind these views? Do you have any suggestions?

Appendix B1Views on Instructional Technologies in the module DDIM(98-99) (Pre/Post)

Group: _____ Student Name: _____ Ref. No: _____

You are invited to write a short essay about your thinking of using instructional media in classroom teaching. The following guiding questions may be useful for your writing. (You are encouraged to use Chinese.)

1. What are instructional media?
2. What is Information Technology?
3. What are their roles of the above technologies in classroom teaching?
4. What do you know about them?
5. What do you expect to learn in this module?
6. What do you expect in using Information Technology in your class teaching?
7. Are there any other things you would like to mention?

You can continue writing on the back of this sheet.

Appendix B2
Reflection Guides for tutorial sessions in the module DDIM (98-99)

Tutorial 1– Teaching and Learning with Information Technology

Group: _____ Student Name: _____ Ref. No: _____

Discussion on case studies

Please write your opinions about the following questions/statements concerning the use of Information technology in teaching and learning after reading the cases and articles in the booklet for your independent study. Then use about 30 minutes to discuss your opinions with your group members.

(a) What did you learn from the cases and articles in independent studies about using IT in teaching?

e.g. Teacher characteristics? Roles of teacher?

e.g. Teaching and learning environment? Computers set up?

e.g. Software issues? Selection of ready-made software? Evaluation criteria? Use of application software (e.g. Word, PowerPoint, Excel etc) and development of teacher-made instructional software?

(b) How did the case studies help or influence your future teaching?

Tutorial 2 - Some reflections about the lectures (I) Group: _____ Student Name: _____ Ref. No: _____

Please write some notes in each topic you have learnt so far.

Q1 = What did you learn from this lecture?

Q2 = How was Information technology integrated in this lecture?

Q3 = What teaching strategies was used in this lecture?

Q4 = How did this learning experience with Information technology help or influence your future teaching?

Topic	Q1	Q2	Q3	Q4
Communication, human information processing and common instructional media				
Visual literacy and visual design principles				
Model of using instructional media				

Approaches of instruction, selection and evaluation of instruction media				
Design principles of instructional media				
Workshop of the production of a multimedia package				

Using information technology for student-centred learning and teaching				
Group projects and consultation				

Other Thoughts or Comments

Tutorial 3 - Some reflections about the resources/portfolio Group: _____ Student Name: _____ Ref. No: _____

Please write down some notes in each item you have experienced so far.

Q1 = What did you learn from these resources /Portfolio?

Q2 = How did these resources /Portfolio help in your learning about using Information technology in teaching?

Q3 = What learning strategies were used in using these resources /Portfolio?

Q4 = How will these resources /Portfolio influence or help in your future teaching with Information Technology?

(A) Some reflections about the resources

Item	Q1	Q2	Q3	Q4
Resource booklet (I) - Cases and theories of using IT in teaching and learning				
Resource booklet (II) – IT Basic				
DDIM resources web				
CD-ROMs on video production and editing				

(B) Some reflections about the Portfolio

Please answer the following questions in each item concerning the Portfolio you have completed.

Item	Q1	Q2	Q3	Q4
The conceptual framework				
The module outline				
The projects				
The reflective statements				

Some reflections about your learning strategies that you have used in the learning process – just write down what you think here

Q1 What sort of learning strategies you have used in the learning process?

Q2 You have experienced using IT as both the learning and teaching tools. How?

Q3 Did the lecturers and the teaching strategies of the DDIM module show a model of using IT as both the learning and teaching tools. How?

Appendix C1

Teaching with Information Technology Questionnaire – (Pre/Post – Phase 1)

QUESTIONNAIRE

Ref. No.: _____

This questionnaire is part of the study of the evaluation of teaching strategies via using information technology in a module named Designing and Developing Instructional Media (DDIM). The purpose is to improve the teaching strategies that may help student teachers to teach with Information Technology in classroom teaching. This is not a test, so there is no *Right* or *Wrong* answers. It is important to have your true reactions to the questionnaire included in the following pages.

The questions that follow ask you about your attitudes towards using computers in **teaching**, your previous experiences with computers, and your present knowledge about using computer. It is important that we get information about **your own** attitudes and experiences only.

You will be assigned a number that may be used for cross-reference purpose in the later stage of the study. All the information you provided here will be held **in complete confidence**. Individual will not be identified in any report from this study. It is also stressed that the information collected in this questionnaire will not be used for your assessment.

Please answer **all** questions in this questionnaire by following the instruction in each section and/or write in the space provided.

Part A:

Please supply the following personal information by placing ticks in provided:

1. Your major elective subject is: A1
 Science 1 Social Studies 2 English Language 3
 Putonghua 4 Physical Education 5 Music 6
 Art & Design 7 Computer 8 Others: _____ 9
2. Gender: Female 1 Male 2 A2
3. Your age: under 20 1 21-24 2 25-29 3 30 or above 4 A3
4. Your highest major academic qualification: A4
 GCSE/HKCEE 1 AS Level 2 A Level 3
 Certificate 4 Higher Certificate 5 Diploma 6
 Higher Diploma 7
5. The main stream that you studied in your secondary school: A5
 Science 1 Art 2 Commercial Studies 3 Technical 4
6. The type of computer that you most likely use: A6
 IBM/IBM Compatible 1 Apple 2 Others _____ 3
7. Please respond to the following five questions by ticking the appropriate choice:

	Yes ₁	No ₂	
Do you own a home computer?	<input type="checkbox"/>	<input type="checkbox"/>	A7
Do you use the institute computers?	<input type="checkbox"/>	<input type="checkbox"/>	A8
Have you attended a computer course during your first year study in the initial teacher education programme?	<input type="checkbox"/>	<input type="checkbox"/>	A9
If yes, Please describe the topic(s)/natures of the course here.			

Did you have any computer training before enrolling into this institute?	<input type="checkbox"/>	<input type="checkbox"/>	A10
If yes, Please describe the topic(s)/natures of the training here.			

8. Do you use a computer for any of the following?

	Do not use	Use very occasionally	Use 1-6 hrs a week	Use more than 6 hrs a week	
Spreadsheets	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A11
Wordprocessing	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A12
DataBase	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A13
Drawing/Graphics	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A14
PowerPoint	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A15
Reference/Encyclopedia	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A16
E-mail	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A17
Internet	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	A18

Part B: Perceived Comfort

For each of the item listed below, concerning the knowledge and skills about teaching with Information Technology, we need to know **how comfortable** you feel with your **present level of mastery** of them when you are asked to use computer in class teaching.

Please indicate how you feel the following items by using the scale below. Draw a circle around the number that corresponds to how you feel about each statement.

- 1 = know nothing of it
- 2 = A bit uneasy
- 3 = Okay
- 4 = Comfortable
- 5 = Very comfortable

Perceived Comfort :
 1 = know nothing of it
 2 = A bit uneasy
 3 = Okay
 4 = Comfortable
 5 = Very comfortable

1. Know of major characteristics, advantages & disadvantages of using computers in teaching.	5	4	3	2	1	1
2. Understand current and expected developments in telecommunications /computers area.	5	4	3	2	1	2
3. Understand the role of Information Technology.	5	4	3	2	1	3
4. Design teaching/learning strategies incorporating the use of computers.	5	4	3	2	1	4
5. Use a spreadsheet software (e.g. Excel)						
a) to organize learning activities.	5	4	3	2	1	5
b) to produce teaching materials.	5	4	3	2	1	6
c) to facilitate daily school administration work.	5	4	3	2	1	7
6. Use a word-processing software:						
a) to organize learning activities.	5	4	3	2	1	8
b) to produce teaching materials.	5	4	3	2	1	9
c) to facilitate daily school administration work.	5	4	3	2	1	10
7. Use a data-base software (e.g. Access):						
a) to organize learning activities.	5	4	3	2	1	11
b) to produce teaching materials.	5	4	3	2	1	12
c) to facilitate daily school administration work.	5	4	3	2	1	13
8. Use a computer graphic software (e.g. Paint Shop Pro):						
a) to organize learning activities.	5	4	3	2	1	14
b) to produce teaching materials.	5	4	3	2	1	15
c) to facilitate daily school administration work.	5	4	3	2	1	16
9. Use a graphic presentation software (e.g. PowerPoint):						
a) to organize learning activities.	5	4	3	2	1	17
b) to produce teaching materials.	5	4	3	2	1	18
c) to facilitate daily school administration work.	5	4	3	2	1	19
10. Use an authoring system (e.g. Authorware) to develop a computer-assisted learning package for a particular learning situation.	5	4	3	2	1	20
11. Use E-mail to exchange ideas with other teachers.	5	4	3	2	1	21
13. Use E-mail to organize learning activities.	5	4	3	2	1	22
14. Use the Internet to access useful information for teaching.	5	4	3	2	1	23
15. Use the Internet for academic development	5	4	3	2	1	24
16. Use the Internet to organize learning activities.	5	4	3	2	1	25
17. Use networking facilities for daily administration work.	5	4	3	2	1	26
18. I can :						
a) operate a multi-media computer system. (including CD-ROM and sound system.	5	4	3	2	1	27
b) control a scanner with a computer software.	5	4	3	2	1	28
c) operate an Interactive Video system	5	4	3	2	1	29
d) project computer images on a screen with a LCD panel/computer projecting machine.	5	4	3	2	1	30
e) project computer images on a screen with a computer video projector.	5	4	3	2	1	31
f) store and retrieve files using a fixed/floppy disk.	5	4	3	2	1	32
g) install and use educational programmes in a CD-ROM or floppy disk.	5	4	3	2	1	33
19. I can explain common computer terminology.	5	4	3	2	1	34
20. I can evaluate the effectiveness of a computer instructional program.	5	4	3	2	1	35

Part C:

For each of the following items, you are asked to indicate the level of your agreement with the statement made. Please read carefully before deciding your answer. Five possible answers, ranging from strongly agree to strongly disagree, are shown in code alongside each statement. Please circle one code that indicates your level of agreement for each statement.

Code	Definition	
5 =	I strongly agree with the statement	
4 =	I agree with the statement	
3 =	I neither agree nor disagree with the statement	
2 =	I disagree with the statement	
1 =	I strongly disagree with the statement	
1.	Computers will improve the quality of student's education.	5 4 3 2 1 1.
2.	Using a computer in a classroom will make a subject more interesting.	5 4 3 2 1 2.
3.	Using a computer in teaching can improve students' achievement.	5 4 3 2 1 3.
4.	Students will be more attentive when computers are used in class.	5 4 3 2 1 4.
5.	Computers enhance students' self - studies and independent work.	5 4 3 2 1 5.
6.	Computers enhance students' creativity.	5 4 3 2 1 6.
7.	Computers will take away the job of a teacher.	5 4 3 2 1 7. *
8.	A computer is not suited for teaching purposes.	5 4 3 2 1 8. *
9.	Computers slow down and complicate the teaching process.	5 4 3 2 1 9. *
10.	The introduction of computers in primary education is just an increase in the teachers' workload.	5 4 3 2 1 10. *
11.	Students should be kept away from computers.	5 4 3 2 1 11. *
12.	Using computers in classroom teaching will increase the classroom management problem.	5 4 3 2 1 12. *
13.	Every primary school child should begin to use computers.	5 4 3 2 1 13.
14.	I will use computers to help my teaching.	5 4 3 2 1 14.
15.	Computers are difficult to learn about.	5 4 3 2 1 15. *

** Note: Items with asterisks will be recoded inversely in the data analysis process.
(This statement is not noted in original questionnaire)*

-END OF QUESTIONNAIRE-

THANK YOU FOR YOUR PARTICIPATION!

Appendix C2

Self Evaluation Checklist for Educational Technology Competencies for Teachers

This checklist aims to help you to reflect on your present knowledge and skills of using educational technology in teaching. The information gathered will also help our department to improve the curriculum of Designing and Developing Instructional Media module. You will be assigned a number that may be used for cross-reference purpose in the later stage of the study. All the information you provided here will be held in **complete confidence**. Individual will not be identified in any report from this study. It is also stressed that the information collected in this checklist will **not be used for your assessment**.

IM in the following checklist stands for Instructional Media. Please respond to **all** items in this checklist. Thank you.

Competencies

A. Development and Characteristics of Instructional Media (IM)

Mastery
Yes ₂ No ₁

I can:

- | | | |
|--|--------------------------|--------------------------|
| 1. demonstrate understanding of the development and trends of using various types of IM for instruction including traditional ones such as still visuals, projected visuals, audio, motion media, multimedia, computer and the latest information technology | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. demonstrate understanding of the roles of IM and the roles teachers in using IM to enhance teaching | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. consider the characteristics of various IM in the selection and utilisation process | <input type="checkbox"/> | <input type="checkbox"/> |

B. Communication, Human Information Processing

I can:

- | | | |
|---|--------------------------|--------------------------|
| 4. apply the theories and principles of communication and human information process in the design and production of various IM. | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. apply Audio-Visual design principles in the design and production of various IM for effective communication. | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. use various IM to support interaction in the instructional process. | <input type="checkbox"/> | <input type="checkbox"/> |

C. Design and Production Techniques

I can design and produce:

- | | | |
|---|--------------------------|--------------------------|
| 7. graphic visuals e.g. cartoons, diagrams, graphs, posters etc. | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. notes, worksheets, work cards | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. photographs and Slides | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. overhead transparencies (OHT), | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. a storyboard or script to illustrate the use of the concepts and principles of programmed instruction in the design of programs of various formats. | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. audio program | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. video program | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. tape-Slide program | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. computer presentation program | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. interactive multimedia program | <input type="checkbox"/> | <input type="checkbox"/> |

D. Equipment Operation and Use of Computer Application Software

I can use a (an):

- | | | |
|--|--------------------------|--------------------------|
| 17. laminator | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. copier machine for making stencils and OHTs | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. SLR Camera and copying accessories | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. slide Copier | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. overhead Projector | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. filmstrip Projector | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. slide Projector | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. tape player/recorder | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. compact disc player or Mini-Disc player/recorder | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. video Camera | <input type="checkbox"/> | <input type="checkbox"/> |
| 27. video Editor | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. video Cassette Recorder (VCR) and TV | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. video Disc Player and TV | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. digital Camera | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. digital Scanner and images scanning program | <input type="checkbox"/> | <input type="checkbox"/> |
| 32. word Processing – MS Word 97 | <input type="checkbox"/> | <input type="checkbox"/> |
| 33. charts and graphs application software – Excel 97 | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. computer multimedia authoring program – Authorware 4.0 | <input type="checkbox"/> | <input type="checkbox"/> |
| 35. video capturing software | <input type="checkbox"/> | <input type="checkbox"/> |
| 36. digital sound recording software – Sound Recorder in Window 95 | <input type="checkbox"/> | <input type="checkbox"/> |
| 37. e-mail software – MS Exchange | <input type="checkbox"/> | <input type="checkbox"/> |
| I can: | | |
| 38. setup a stand alone multimedia personal computer | <input type="checkbox"/> | <input type="checkbox"/> |
| 39. connect a video output device (e.g. LCD panel or Video Projector) to a computer | <input type="checkbox"/> | <input type="checkbox"/> |
| 40. perform Basic Windows 95 operation and files management | <input type="checkbox"/> | <input type="checkbox"/> |
| 41. access to the Internet and World Wide Web - Netscape | <input type="checkbox"/> | <input type="checkbox"/> |
| 42. search on the Internet – Yahoo, Altavisa etc... | <input type="checkbox"/> | <input type="checkbox"/> |
| 43. install and use ready-made educational software and computer assisted learning software in disks or CD-ROM | <input type="checkbox"/> | <input type="checkbox"/> |
| E. Selection and Utilization Principles | | |
| I can: | | |
| 44. apply principles and selection model in the selection of IM. | <input type="checkbox"/> | <input type="checkbox"/> |
| 45. derive teaching and learning strategies incorporating learning theory and the use of IM | <input type="checkbox"/> | <input type="checkbox"/> |
| 46. apply ASSURE model for systematic use of IM | <input type="checkbox"/> | <input type="checkbox"/> |
| F. Evaluation of Media | | |
| I can: | | |
| 47. identify criteria and standards for evaluation of various types of IM. | <input type="checkbox"/> | <input type="checkbox"/> |
| 48. derive instruments and methods for the evaluation | <input type="checkbox"/> | <input type="checkbox"/> |
| 49. make recommendations and improvements in the design, production and utilisation of various IM. | <input type="checkbox"/> | <input type="checkbox"/> |

-END-
THANK YOU!

Appendix C3

Use of common instructional media in school teaching Questionnaire

USE OF INSTRUCTIONAL MEDIA IN SCHOOL TEACHING QUESTIONNAIRE
(You can use Chinese to fill in this form.)

This questionnaire aims to seek your opinions and experiences of the use of instructional media (IM) in your current teaching. Please spend about 5 minutes to complete it. This is not a test, so there is no *Right* or *Wrong* answers. It is important to have your true reactions to the questionnaire included in the following pages. All the information you provided here will be held **in complete confidence**. Individual will not be identified in any report from this survey.

Key: (A) Time used with IM in a week (B) Modes of IM use

1 = Never Use
2 = Less than 1/4 time
3 = Between 1/4 to 1/2 time
4 = Between 1/2 to 3/4 time
5 = More than 3/4 time

1 = Teacher's Presentation
2 = Group Learning Activity
3 = Individual Learning Activity

Types of Media	(A) Time in a week	(B) Modes of use
<u>Traditional Media</u>		
1. Blackboard/Whiteboard Writing	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
2. Blackboard/Whiteboard Drawing	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
3. Realia (Real Object)/Model	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
4. Graphics	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
5. Printed Material	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
6. Photo	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
7. Slide	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
8. Overhead Transparency	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
9. Audio Tape	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
10. Video Tape	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
11. Tape-Slide Programme	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
12. Learning Package	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
<u>Computer</u>		
13. Computer Generated Texts and Graphics	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
14. Computer Presentation Programme	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
15. Computer Assisted Learning Programme	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
16. Internet	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>

-Thank you for completing this questionnaire-

Appendix C4
Computer Background Questionnaire - ITRIP

Code:

INFORMATION TECHNOLOGY IN THE PRIMARY CLASSROOM - TEACHER QUESTIONNAIRE

(You can use Chinese to fill in this form.)

This questionnaire aims to seek your opinions and experiences of the use of Information Technology in your current teaching. Please spend about 10 minutes to complete it. This is not a test, so there is no *Right* or *Wrong* answers. It is important to have your true reactions to the questionnaire included in the following pages. All the information you provided here will be held **in complete confidence**. Individual will not be identified in any report from this survey.

Name of School: _____

Type of School: 1 Government School 2 Aided School 3 Private School

No. of classes: _____

No. of students: _____

Subject(s) and (level) taught: 1 English (P._____) 2 Chinese (P._____))3 Mathematics (P._____) 4 General Studies (P._____))5 Others: _____ (P._____))

(1) In a seven-point scale, how will you rate the general teaching approach of your colleagues?

Extremely								Totally								
Teacher-directed	<input type="checkbox"/>	1	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5	<input type="checkbox"/>	6	<input type="checkbox"/>	7	<input type="checkbox"/>	Student-centred
	----- ----- ----- ----- ----- -----															

(2) What type(s) of access do you have to the computer facilities and resources in teaching?

1 = No Access or No such facility

2 = Have been installed in all classrooms

3 = Have been installed in some of the classrooms

4 = Have been installed in computer laboratory

5 = Require Special arrangement for set up (can have more than one choice)

Facilities**Type(s) of Access****Other way(s) of access**

Computer for the teacher

 1 2 3 4 5

Computer(s) for pupils *

 1 2 3 4 5

Internet Access for teacher 1 2 3 4 5 _____

Internet Access for pupils 1 2 3 4 5 _____

* Pupils' access to computer

- If there is/are computers installed in all/some of the normal classrooms:

The no. of computer(s) installed in a classroom - _____

No. of classroom(s) installed with computer (s)- _____

- No. of Computers installed in computer laboratory - _____
- No. of Computers installed in other special rooms e.g. Art Room (please specify) -
_____ (), _____ ()

- (3) What type(s) of experience do you have with the use of Information Technology in your teaching? (Can have more than one choice)

- 1 Establishing classroom management routines for computer work (e.g. menu, guidelines, regulations etc.).
- 2 Recommending computer facilities and resources to be used in your teaching (e.g. Multimedia CD-Titles, application software etc.).
- 3 Producing traditional teaching resources with computers (e.g. coloured overhead transparency by PowerPoint).
- 4 Producing computer-based teaching resources (e.g. PowerPoint presentation).
- 5 Teaching a computer literacy/awareness class in normal timetable.
- 6 Conducting a computer interest class for extra-curricula activities.
- 7 Deriving teaching and learning activities involving the use of computer facilities for your teaching **subjects**.
- 8 Deriving teaching and learning activities involving the use of computer facilities for **cross curriculum** subjects or school activities.
- 9 Other (please specify)

- (4) How confident do you feel with the use of Information Technology in your teaching?

- 1 Not At All Confident 2 Not Very Confident 3 Moderately Confident
4 Quite Confident 5 Very Confident

- (5) Are there any gains in your computer knowledge and skills after the completion of the Instructional Media module in the initial teacher education programme till now?

- 1 No 2 Yes

If 'Yes' please describe the nature _____

If 'No' please explain why not _____

- (6) Do you have any changes on your beliefs about the values and expectations of using

computers in teaching since your teaching in this school?

1 No 2 Yes

If 'Yes' please explain the changes _____

If 'No' please explain why not _____

(7) In a seven-point scale, how will you rate your own present teaching approach?

Extremely										Totally
Teacher-directed	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/>	<input type="checkbox"/>	Student-centred
										

(8) How often is Information Technology used in the following scenarios in your teaching?

1 = Never
 2 = Very Rarely
 3 = Sometimes
 4 = Quite Often
 5 = In Every Lesson

Scenario	Usage	
1. As teacher's aids to present the contents of the lesson.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	1.
2. As teacher's aids to demonstrate a skill or procedure.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	2.
3. As teacher prepared information source or materials for small groups discussion/activities/tasks	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	3.
4. As teacher prepared information source or materials for individualised learning.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	4.
5. As pupils' tools to access information themselves for small group discussion/activities/tasks e.g. Internet.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	5.
6. As pupils' tools to solve problems or to find solutions to the questions for assigned small group discussion/activities/tasks e.g a Spreadsheet programme.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	6.
7. As pupils' tools for presentation of the results of tasks/projects	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	7.

(9) Are you satisfied with the current use of Information Technology in your teaching?

1 No 2 Yes

Please explain why _____

(10) What are your present needs for your own development in using Information Technology in your teaching?

(11) Please provide the information of the units/topics that you may plan for your project:

Subject	Unit/Topic Title

-Thank you for completing this questionnaire-

Appendix D
Portfolio Guide for the DDIM module (98-99)

**Designing and Developing
Instructional Media
(DDIM) 98-99**

Student's Portfolio Guide

Group: _____

Name: _____

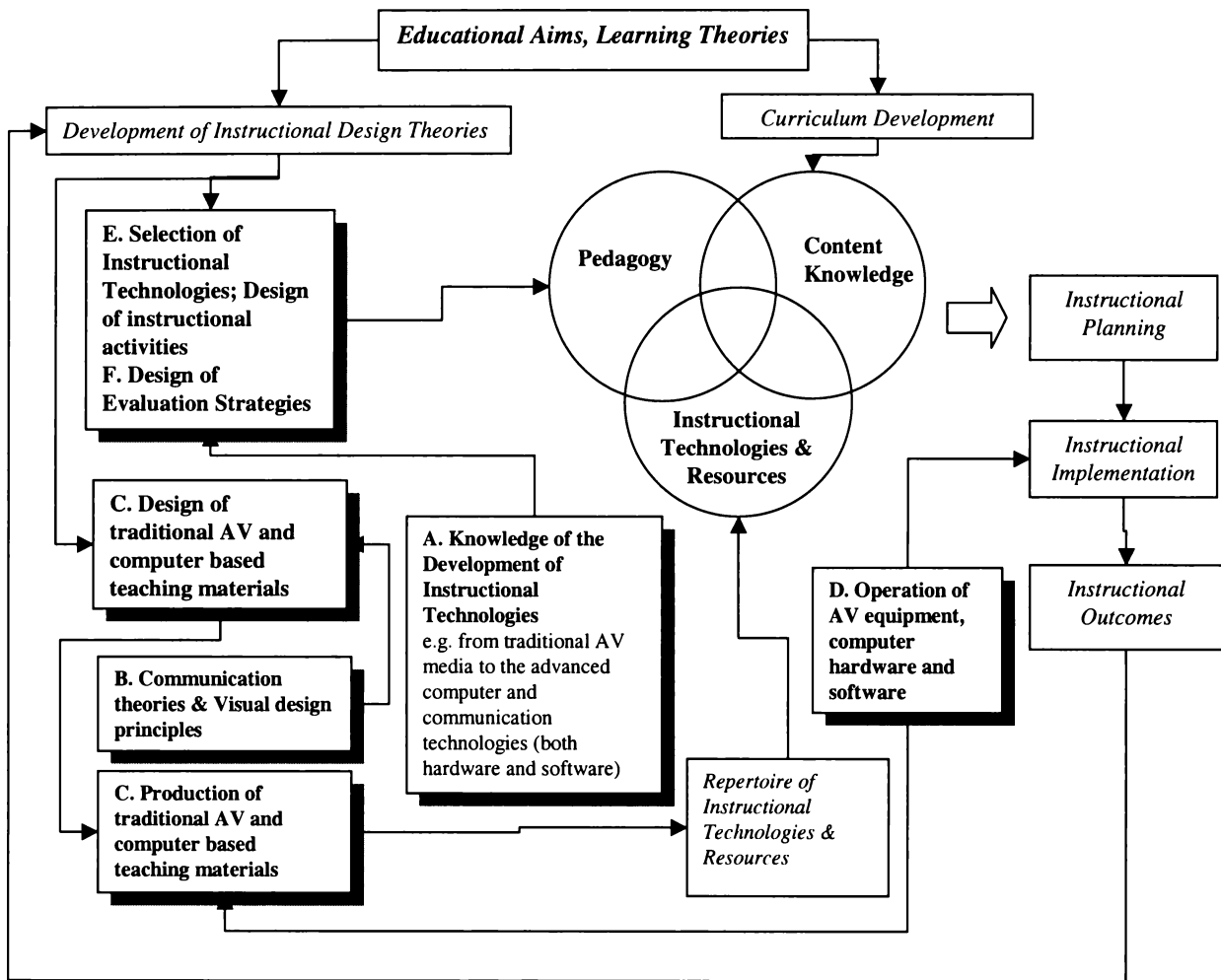
Phone: _____

e-mail: _____

Introduction

This portfolio guide is designed to allow you to have a clear picture of what you are going to achieve in the IM course throughout the learning process. Every piece of work documented in the portfolio reflects your mastery and growth of the knowledge and skills in using instructional media for effective learning and teaching. This guide has provided some suggested projects that can prove your mastery of the competency areas. You can also propose your own work if it can evident your mastery of the competency areas. You can accommodate your items and this portfolio guide with an A4 clear pocket and submit it to your lecturer one week after the completion of the course for assessment. This Portfolio Guide includes:

- Course Framework
- Course Information
- IT Cases Study Guide
- IT Projects Guide
- Learning Diary
- Course Competencies Areas and Reflection
- Course Grade Descriptors and
- Course Competencies Checklist



A Conceptual Framework of the Six Areas of Technology Competency for Teachers in an Instructional Process

Course Information of Designing and Developing Instructional Media (DDIM) 98-99

Domain: Professional Studies
Course Title: Designing and Developing Instructional Media (IM)
Course Code: PSP006-2
Course: 2PC2
Status: Compulsory
Credit Value: 2 Credit Points

Lecturer: Mr. LI Kai-ming
Department of Curriculum and Instruction
Hong Kong Institute of Education
Room D1-1/F-32, Block D1
Phone: 29487539
e-mail: kml@ci.ied.edu.hk

Course Synopsis

This course aims to introduce student teachers to the *systematic* method of applying instructional, learning and communication theories to the design and production of *instructional materials*. It covers the *selection, design, production, evaluation* and *integration* of various types of media, ranging from traditional to advanced technology, such as still visual, models, audio-visual, motion pictures, interactive multimedia and the latest information technology.

Course Objectives

On completion of the course, student teachers should be able to

1. apply communication theories and perception principles in the design and production of instructional media;
2. analyse the advantages and limitations of various types of instructional media;
3. plan systematically for the use of media;
4. design and produce instructional media to serve specific objectives and
5. conduct evaluation on the effectiveness of various instructional media.

Assessment

Personal Portfolio (90%)

- Group Projects (50%)
- Individual Projects (20%)
- Media Evaluation & Other Reflective statements (20%)

Test (10%)

**IT Cases Study Guide of Designing and Developing Instructional Media (DDIM)
98-99 Course**

From the given articles in the booklet - Use of Information Technology for Student-centred Learning and Teaching, make some reflective statements on them.

This booklet includes some articles taken from two journals: Learning and Leading with Technology and Interactive. Article (1) to (7) are cases of how some educational software (e.g. Electronic Storybooks) and some non-instructional software applications (e.g. Spreadsheet) are integrated into daily classroom teaching. Article (8) discusses some ethical issues concerning the use of Information Technology.

As part of your portfolio, you are required to write some reflective statements after reading the examples. Here are some guiding questions for you reference. Of course, you are free to write anything that you think appropriate. You may bring back this part for a discussion in tutorial session.

1. What did you learn from these cases and articles?
2. How were the computer software used in the cases different from computer-assisted learning (CAL) programs?
3. How did these cases differ from traditional teaching?
4. How was constructivist approach of instruction implemented in these cases?
5. How did these cases and articles help or influence your future teaching?

Reflective Statements

Project Guide of Designing and Developing Instructional Media (DDIM) 98-99 Course

This guide aims to help you to construct a list of the necessary competencies learnt from the workshops on using information technology as learning and teaching tool and the necessary contents and resources that may be required for your projects before you can go on.

Individual Project

Project 1 Build up a resource site on the Internet (1) (10 marks in Personal Portfolio)

Task:

You may notice that a resource web site on Using Instructional Media in Class Teaching has been set up. We need your contributions to make the web site resourceful as it is named. Therefore, your job is to find some relevant information on the current trends and use of Information Technology (e.g. influence on student-centred learning) in class teaching from the Internet and send it to me via e-mail so that I can compile for publishing on the web. Your short annotation or comment is needed to support the value of the information to be published. You can send your annotation or comment as the message and the downloaded information as the attachment via your e-mail account. (Hardcopies can be included in your portfolio.)

Your Tool Kits:

What tools that I can use or I have to learn? What contents that I am going to deliver? Where can I find the help and necessary resources? How can I get the task done? Are there any other things to be considered? So write them down here before you proceed.

* This project will contribute 10 marks to your portfolio.

If you think that a plan or schedule is necessary, you are welcome to do so. So make your notes at the back of this sheet.

Project 2 Build up a resource site on the Internet (2) (10 marks in Personal Portfolio)

Task:

Again you are invited to make contributions to the aforesaid web site. This time, we are going to build up some links to relevant URLs. Your job is to suggest a list of URLs, select at least one of them and to make a brief evaluation on it. You can send your list and brief evaluation as the message via your e-mail account. (Hardcopies can be included in your portfolio.)

Your Tool Kits:

What tools that I can use or I have to learn? What contents that I am going to deliver? Where can I find the help and necessary resources? How can I get the task done? Are there any other things to be considered? So write them down here before you proceed.

* This project will contribute 10 marks to your portfolio.

If you think that a plan or schedule is necessary, you are welcome to do so. So make your notes at the back of this sheet.

Group Projects

You are going to complete the following projects in a group of four persons. During the learning process, you are required to access to various materials that you think relevant to your projects. A resource list has been included in your Student Menu for your reference. You are also welcome to ask me questions concerning the projects by visiting me, or via telephone or e-mail. Please write down the names of your group members. I suggest you write down the contact e-mail and telephone numbers too for better communication.

Name 1: _____ e-mail: _____ phone: _____

Name 2: _____ e-mail: _____ Phone: _____

Name 3: _____ e-mail: _____ phone: _____

Name 4: _____ e-mail: _____ phone: _____

Project 3 Teach us how to master the instructional tools via using Information Technology (1) (20 marks in Group Projects)

Task:

A session is allotted to your group to teach us how to produce some instructional materials and to operate the required equipment set up in the Educational Technology Unit. You will have fifteen minutes for your teaching. To make your teaching more attractive, you are suggested to make use of the multimedia features of Information Technology. You are going to teach us to produce any two of the teaching materials in the following list. So make a check along the items you have chosen here and then go on thinking about your plan.

Graphic Visuals

Photographs and Slides

Storyboard or Script Writing

Video Program

Notes, Worksheet, Work Cards

Overhead Transparencies

Audio Program

Tape-Slide Program

Your Tool Kits:

What tools that I can use or I have to learn? What contents that I am going to deliver? Where can I find the help and necessary resources? How can I get the task done? Are there any other things to be considered? So write them down here before you proceed.

If you think that a plan or schedule is necessary, you are welcome to do so. So make your notes at the back of this sheet.

**Project 4 A presentation of an evaluation on a computer instructional programme
(10 marks in Group Projects)**

Task:

You are going to evaluate the computer instructional program that your group has produced and make a presentation to your classmates. To make your presentation more clear and understandable, you are suggested to incorporate some tables and graphs of your findings. You will have ten minutes for your presentation.

Your Tool Kits:

What tools that I can use or I have to learn? What contents that I am going to deliver? Where can I find the help and necessary resources? How can I get the task done? Are there any other things to be considered? So write them down here before you proceed.

If you think that a plan or schedule is necessary, you are welcome to do so. So make your notes at the back of this sheet.

Project 5 Build up your electronic portfolio (Optional)

Task:

This is an optional and individual project. This project aims to help individual students to build up an electronic portfolio according to his or her interest and progress under the guidance of the lecturer. You will be put into groups and the lecturer will assist you on digitizing your media sources. You are going to build up and present your portfolio in your own ways.

Course Reflections of Designing and Developing Instructional Media (DDIM) 98-99

This portfolio aims to keep a record of your personal development in the area of using instructional media in classroom teaching. It is semi-structural. It provides suggestions on the evidence to demonstrate the mastery of certain competency area. However, you are welcome to discuss with your lecturer of your choice that you think confident and relevant.

The competencies of the course are grouped into six categories. You can check your mastery of these competencies before you start the DDIM course and at the end of the course. (A checklist is attached at the end of this portfolio guide.)

Each competency area is divided into three sections:

1. The competency indicators – they describe what you are going to achieve in the specific area;
2. The evidence – these are the artefacts that you have included in your portfolio. They can be pieces of essays or AV products that can demonstrate your mastery of the competency area.
3. Reflective Statements – this is the most important part. It explains your thought of the learning process. Some guiding questions are given for your reference only. You are free to write anything that can reflect your own thinking about the learning of the competency area.

The guiding questions:

1. What have you learnt about this competency area?
2. What kind of teaching strategies have you experienced or what kind of learning strategies have you used in the learning process?
3. What contributions did I make in the group projects?
4. What kind of problems have you encountered and how have you solved them?
5. How will this learning experience help in your future classroom teaching?
6. Others?

A. Development and Characteristics of Instructional Media (IM)

Student teachers should be able to:

- Demonstrate understanding of the development and trends of various types of instructional media and their contributions to education;
- Demonstrate understanding of the roles of teachers in using instructional media to enhance learning
- Consider the characteristics- their advantages and limitations of various types of instructional media in the selection and utilisation process.
- Others

Evidence

Suggested examples:

- A short paragraph (within 200 words) illustrate your perception of IM and views of the roles of teacher and IM in teaching;
- Annotation or comment of articles from the Internet (hardcopies attached for reference);
- Annotation or comment of given articles from the Resource Booklet
- Lesson plan and reflective statements on how the characteristics of the selected IM have been considered.

Your selected evidence:

Reflective Statements:

* You can continue writing at he back of this sheet.

B. Communication and Human Information Process

Student teachers should be able to:

- Apply theory and principles of communication and human information process in the design of various instructional media;
- Apply audio-visual design principles in the design and production of various im for effective communication.
- Communicate effectively through various im to support interaction in the instructional process.
- Others

Evidence

Suggested examples:

- Products of group projects
- Micro-teaching.
- Reflective statements in independent studies and micro-teaching.

Other selected evidence:

Reflective Statements:

* You can continue writing at he back of this sheet.

C. Design and Production Techniques

Student teachers should be able to:

- Produce various instructional materials with effective quality for specific learning situations.
- Others

Evidence

Suggested examples:

- Products of group projects
- Video diaries describing the production process of the projects.

Other selected evidence:

Reflective Statements:

* You can continue writing at the back of this sheet.

D. Equipment Operation and Use of Computer Application Software**Student teachers should be able to:**

- Operate various hardware or equipment and use of computer application software in the production and use of various instructional media for specific learning situations
- Others

EvidenceSuggested examples:

- Products of group projects
- Video diaries describing the production process of the projects.
- Download and e-mail pieces of select material(s) from the Internet to your lecturer.

Other selected evidence:**Reflective Statements:**

* You can continue writing at the back of this sheet.

E. Selection and Utilization Principles

Student teachers should be able to:

- Consider the factors affecting the selection of media for specific learning situations;
- Implement the assure model of using instructional media for specific learning situations.
- Derive strategies that facilitate student-centred learning.
- Others

Evidence

Suggested examples:

- Write or select lesson plan(s) and analysis of how the ASSURE model and student-centred strategies have been applied.
- Reflective statements in independent studies and micro-teaching.
- Annotation or comment of articles from the Internet (hardcopies attached for reference).

Other selected evidence:

Reflective Statements:

* You can continue writing at he back of this sheet.

F. Evaluation of Media

Student teachers should be able to:

- Identify criteria and standard for evaluation of various types of instructional media
- Derive instruments and methods for the evaluation
- Make recommendations and improvements in the design, production and utilisation of various instructional media.
- Others

Evidence

Suggested examples:

- A summary of result and an evaluation instrument of an evaluation implemented in a group of your classmates.
- A presentation of group project

Other selected evidence:

Reflective Statements:

*You can continue writing at the back of this sheet.

Course Grade Descriptors *

Grade A Distinction

- The evidence selected for the portfolio is of outstanding and exceptional quality in all aspects surpasses the objectives for the course.
- Products are of excellent quality and originality and can reflect high degree of mastery of the contents and skills.
- Reflective statements demonstrate deep and original thinking, interpretation, critical thinking and synthesis. Cogent arguments are used and supported by well-selected references.
- The grade is an expression of the confidence in the ability of the student to progress as an independent learner.

Grade B Credit

- The evidence selected for the portfolio surpasses the objectives for the course.
- Products are of good quality and originality and can reflect sound understanding of the content and good mastery of skills.
- Arguments are used in the reflective statements to support the student's point of view with appropriate references.
- The grade is an expression of confidence in the ability of the student to progress with some supervision and guidance.

Grade C Pass

- The evidence selected for the portfolio achieves the objectives for the course.
- Products are of average quality and demonstrate an adequate grasp of the content and mastery of skills.
- There is little evidence of independent reflection in the reflective statements. Support with references is minimal. Arguments are superficial with a minimum attempt at analysis and/or synthesis.
- The grade is an expression of confidence in the ability of the student to go further with normal supervision and guidance.

Grade D Fail

- The evidence selected for the portfolio does not adequately meet the objectives for the course.
- Products are of poor quality or are clear duplications and cannot demonstrate the mastery of the contents and skills of the course.
- Reflective statements are a simple recall of facts.
- The grade is an expression that the student may resubmit but will find higher level work difficult. (Students granted a supplementary assessment can qualify for no more than a Pass Grade of C).

Grade E Clear Fail

- The evidence selected does not achieve the objectives for the course and demonstrates little understanding of the content and mastery of necessary skills.
- No substantive reflective statements are included.
- Work is unorganized and with frequent mistakes.

* Adapted from Valentina, K. et al. (1997). *Portfolio use in initial teacher education: A student guide*. Research Project of the Department of Curriculum and Instruction, Hong Kong Institute of Education.

Course Competencies Checklist of Designing and Developing Instructional Media (DDIM) 98-99

IM Competencies

Mastery

A. Development and Characteristics of IM

Yes

I can:

1. demonstrate understanding of the development and trends of using various types of IM for instruction including traditional ones such as still visuals, projected visuals, audio, motion media, multimedia, computer and the latest information technology
2. demonstrate understanding of the roles of IM and the roles teachers in using IM to enhance teaching
3. consider the characteristics of various IM in the selection and utilisation process

B. Communication, Human Information Processing

I can:

4. apply the theories and principles of communication and human information process in the design and production of various IM.
5. apply Audio-Visual design principles in the design and production of various IM for effective communication.
6. use various IM to support interaction in the instructional process.

C. Design and Production Techniques

I can design and produce:

7. graphic visuals e.g. cartoons, diagrams, graphs, posters etc.
8. notes, worksheets, work cards
9. photographs and Slides
10. overhead transparencies (OHT),
11. a storyboard or script to illustrate the use of the concepts and principles of programmed instruction in the design of programs of various formats.
12. audio program
13. video program
14. tape-Slide program
15. computer presentation program
16. interactive multimedia program

D. Equipment Operation and Use of Computer Application Software

I can use a (an):

- 17. laminator
- 18. copier machine for making stencils and OHTs
- 19. SLR Camera and copying accessories
- 20. slide Copier
- 21. overhead Projector
- 22. filmstrip Projector
- 23. slide Projector
- 24. tape player/recorder
- 25. compact disc player or Mini-Disc player/recorder
- 26. video Camera
- 27. video Editor
- 28. video Cassette Recorder (VCR) and TV
- 29. video Disc Player and TV
- 30. digital Camera
- 31. digital Scanner and images scanning program
- 32. word Processing – MS Word 97
- 33. charts and graphs application software – Excel 97
- 34. computer multimedia authoring program – Authorware 4.0
- 35. video capturing software
- 36. digital sound recording software – Sound Recorder in Window 95
- 37. e-mail software – MS Exchange

I can:

- 38. setup a stand alone multimedia personal computer
- 39. connect a video output device (e.g. LCD panel or Video Projector) to a computer
- 40. perform Basic Windows 95 operation and files management
- 41. access to the Internet and World Wide Web - Netscape
- 42. search on the Internet – Yahoo, Altavisa etc...
- 43. install and use ready-made educational software and computer assisted learning software in disks or CD-ROM

E. Selection and Utilization Principles

I can:

- 44. apply principles and selection model in the selection of IM.
- 45. derive teaching and learning strategies incorporating learning theory and the use of IM
- 46. apply ASSURE model for systematic use of IM

F. Evaluation of Media

I can:

- 47. identify criteria and standards for evaluation of various types of IM.
- 48. derive instruments and methods for the evaluation
- 49. make recommendations and improvements in the design, production and utilisation of various IM.

G. Others

- END -

Appendix E

Self-instructional booklet for basic authoring and information technology techniques

Designing and Developing Instructional Media

(DDIM) 98-99

Using Information Technology in Classroom Teaching

Toolbook (I)

Basic Authoring Techniques
with Authorware 4.0

macromedia®
AUTHORWARE®4



This programmed workbook aims to provide an opportunity for student teachers to solve problems that may be encountered when some basic authoring techniques used in teaching situations.

On completion of the workbook, student teachers should be able to demonstrate understanding of basic authoring techniques with the use of Authorware 4.0 (AW4) for:

1. building an interactive and multimedia slide show
2. developing a simple computer assisted learning package incorporating branched learning contents and multiple choice questions and matching items for exercises and assessment.

This workbook consists problems and tasks that are usually encountered. If you have already had some computer background, you can go through them as exercises to reinforce what you have learnt before. If you do not know how to solve the problems, you are advised to explore the relevant application software by yourself or working in pairs. You may also follow the steps suggested in various frames of this programmed workbook or refer to the AW4 template files in our P: drive (Public drive in our intranet).

Part A Interactive Slide Show

(reference file: Slide Show.a4p)

1. In our teaching, we often show pictures of particular contents to our students. How do we make use of the function of 'framework' icon (結構圖示) of AW4 to build an interactive slide show so that our students can also view the multimedia contents at their own pace and time?

 2. How do you add pictures with text in a slide? What icon is used in the flow line of the working window of AW4?

 3. How do you add narration which is controlled by an interactive button in a slide (i.e. when a student click on the button, a narration explaining the content of the slide will be heard)? What icon is used in the flow line of the working window of AW4?

 4. What is the use of the 'clear' icon, 'wait' icon and the 'map' icon in designing an interactive slide show?

 5. What other tool is used in order to add a colourful background in a slide?

 6. What other tool is used in order to exit the programme?
-

Part B Simple Computer Courseware

(reference file: Branching.a4p)

A teacher may need to produce some self-learning materials that can cater for individuals' needs and capabilities sometime. How can we use AW4 to develop an interactive self-learning package so that individual students can choose their own learning contents, assess their own learning outcomes and were provided with feedback that helps their learning?

Appendix E

Self-instructional booklet for basic authoring and information technology techniques

Designing and Developing Instructional Media

(DDIM) 98-99

Using Information Technology in Classroom Teaching

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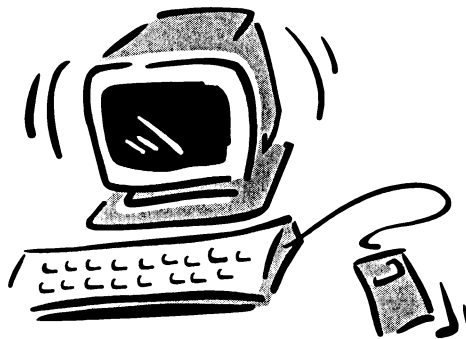
-
7. According to the instructional design principles, a student should be prepared for a new learning. For example, he/she should be well informed about the goals and objectives of the new learning; the relevant background knowledge to be applied; and he/she should be motivated to learn. How does AW4 do the jobs? What icons are to be used?
-
8. How is the 'interaction' icon to be used in order to allow the students to select the learning contents of their preference?
-
9. According to the instructional design principles, how can you make use of AW4 to elicit students' performance and to provide immediate feedback to the student? Please construct a flow line with the tools provided by AW4 and feed in the content selected from your elective subjects.
-
10. How do you use 'interaction' icon to develop a series of multiple choice and matching questions with appropriate feedback from an selected answer? (reference file: Branching.a4p and Matching.a4p)
-
11. What is the use of the 'calculation' icon and what sorts of functions and variables of AW4 are used in your programme?
-

Designing and Developing Instructional Media

(DDIM) 98-99

Using Information Technology in Classroom Teaching

Toolbook (II) Basic Information Technology Techniques



This programmed workbook aims to provide an opportunity for student teachers to solve problems that may be encountered when some basic Information Technology tools are used in teaching situations.

On completion of the workbook, student teachers should be able to:

1. demonstrate understanding of basic Windows operation;
2. incorporate Internet resources into teaching;
3. perform various formatting in a word processor;
4. produce visually attractive worksheets, newsletters etc.

This workbook consists problems and tasks that are usually encountered. If you have already had some computer background, you can go through them as exercises to reinforce what you have learnt before. If you do not know how to solve the problems, you are advised to explore the relevant application software by yourself or working in pairs. You may also follow the steps suggested in various frames of this programmed workbook.

Part A Basic Windows 95 Concepts

12. How does the computer communicate with the user?

13. What is WYSIWYG?

14. What is GUI?

15. Windows 95 allows multitasking operation. What is multitasking?

16. How to switch between different programmes?

17. What is the use of Windows Clipboard?

18. What is an object in most Windows applications?

19. How does the Windows Clipboard relate to the [Print Screen] button on the keyboard?

20. What can you do with the [Print Screen] button on the keyboard?

21. What is a "Select-and-do" concept?

22. How to select an object (e.g. an icon, an image, a sound and video object) so that you can do some editing on it?

23. How to select a file, a range of files in the windows explorer so that you can perform some file management operation (e.g. deleting, copying, renaming or moving file(s))?

24. There are different types of files e.g programme file, document file, sound file etc.... How can we recognize the types of files in the Windows?

Part B Browsing on the Internet

25. What is an Internet browser?

26. Can you name some of them?

27. What is an URL?

28. How is a URL written?

29. Can you describe some ways to locate an URL?

30. What is a search engine?

31. Can you name some of them?

32. What is the difference between an Internet browser and a search engine?

33. What can you do if you want to go back to previous location in an Internet browser after you have visited several web sites on the Internet?

34. If you find a useful web site that you will most likely to visit very often in the future, what will you do?

35. If you find an image or some texts that may help you to derive useful teaching materials, you will download and save them as files. How can you do it?

-
36. How can you send the above saved images or texts to your lecturer through e-mail?
-
37. The following image is downloaded from a web page on the Internet. Can you try to copy other image and put it into a word document?



Part C Using an application software - Word Processing Basic

When we perform some operation in an application programme, we can select the operation either from the menu or from the relevant tool bar. The menu contains full and comprehensive functions of the application programmes but the operation involves more steps than the clicking of an icon button. Therefore, some icons are displayed in the groups of tool bars so as to simplify the action of an operation. A common tool bar that appears on almost every Windows application is the Formatting toolbar.

38. Can you identify the Formatting toolbar?
-
39. Can you identify and name other common tool bars that you know?
-
40. If a tool bar disappears on the programme window, how can you relocate it and make it appear again?
-
41. When we complete a task with a Windows application programme e.g. Word 97, we will save the task as a file and print out a hardcopy as the outputs of the programme. How can you perform these jobs (to save and print a file)?
-
42. What is the different between to “save” a file and to “save as” a file in the File menu?

Very often, we will change the font, size or style of some texts in a word document. We call it “text formatting” in word processing term. When we do the formatting, the “select and then do” concept is also applied. We select the necessary texts first and then do the formatting.

43. How do you select a range of text in your document?
-
44. How do you select a single word in your document?
-
45. How do you select a paragraph?
-

46. How do you select the whole document?

Sometimes, we may need to change the format of a particular paragraph to make it stand out from the rest. We call it paragraph formatting. Two kinds of formatting are required- indentation and justification.

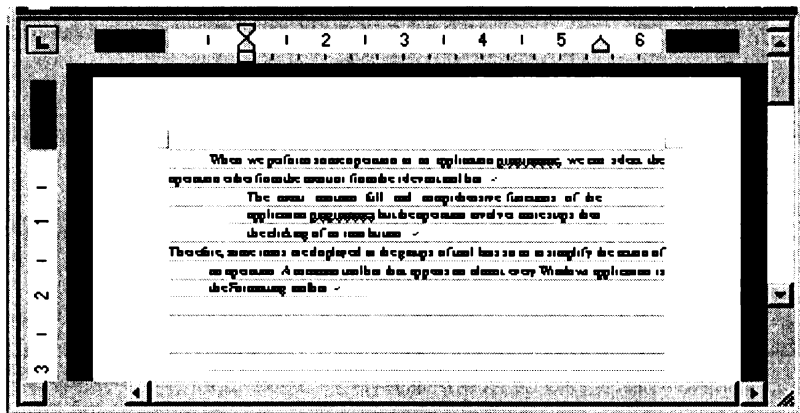
47. What is the definition of a paragraph in word processing?

48. What is a hard return?

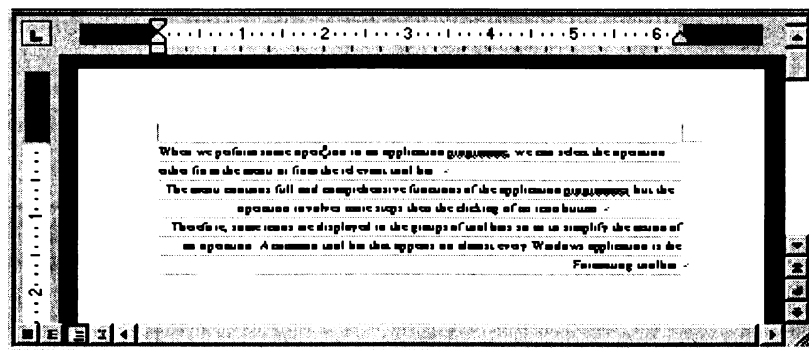
49. What is a soft return?

50. What is the different between a hard return and soft return when we perform paragraph formatting?

51. Which of the following paragraph is an indentation format and which is justification?



(A)



(B)

-
52. How can you use the icons on the formatting toolbar and the upper ruler to do the above formatting?

One may notice that the formatting of the above paragraph (A) and (B) can be achieved by spacing the paragraph using the [tab] and [space bar] on the keyboard. However, by doing so, you are just using the word processor as a typewriter rather than real word processing. Also, by doing so, you will find it very difficult to do further formatting.

53. The following paragraphs are typewriter formats rather than a word processor formats. Why?

When we perform some operation in an application programme, we can select the operation either from the menu or from the relevant tool bar.

- (1) *The menu contains full and comprehensive functions of the application programmes but the operation involves more steps than the clicking of an icon button.*

Therefore, some icons are displayed in the groups of tool bars so as to simplify the action of an operation. A common tool bar that appears on almost every Windows application is the Formatting toolbar.

-
54. A word processor user can identify the formatting status including codes such as hard return, soft return, tab and space etc easily. How can he do it?

-
55. How can you correct the above paragraphs with appropriate formatting procedures?

-
56. What is a “first line indent” paragraph? Can you give an example? How can you do the formatting?

-
57. What is a “Hanging indent” paragraph? How can you do the formatting?

-
58. What is a “right justified” paragraph? How can you do the formatting?

-
59. What is a “centered” paragraph? How can you do the formatting?

-
60. When we design a worksheet or an examination paper, the following paragraph formatting is always adopted. How can you do it? There are at least two ways to perform the same task. What are they? The following paragraphs are formatted with two different methods. How can you identify them?

1. *When we perform some operation in an application programme, we can select the operation either from the menu or from the relevant tool bar.*
 2. *The menu contains full and comprehensive functions of the application Programmes but the operation involves more steps than the clicking of an icon button.*
-

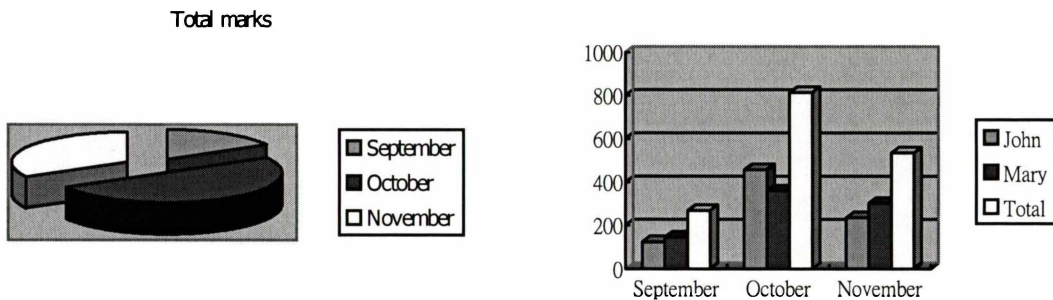
61. When we format a page e.g. adjusting the margins, adding header or footer and page number, changing the page size or orientation etc., you are changing the layout of the whole document. If we want to have different layouts within a document, we can divide the document into different sections so that each section contains its own layout. How can we do it?

62. What is the difference between a section and a document?

63. A word processor user finds that using a table is more convenient than using tabs to display information. Why?

64. Can you construct the following table? The total of each column is calculated using the formula function in the Table menu. How can you do it?

	September	October	November
John	123	456	234
Mary	145	358	300
Total	268	814	534

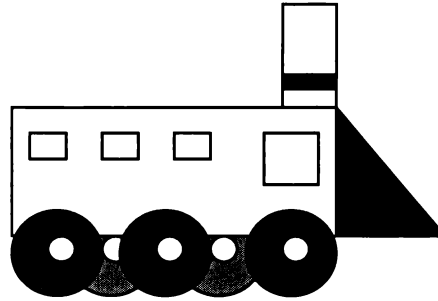


65. The information in the above table can be displayed visually in the form of chart as above in Word 97. How can you do it?

66. Sometimes, we will draw or add graphics in a worksheet or a newsletter of your extra curricula activities. A word processor user knows how to draw graphics or insert Word Art and graphics into the document. How about you? It is noticed that such tools are also appeared in other MicroSoft application such as PowerPoint. What is the tool bar that can perform such function then? How can you locate this tool bar?

67. For example, the following picture is drawn with the above tool bar. Can you reproduce one by yourself? The drawn picture involves several basic concepts that are common in most drawing programmes- “selection and then do”, “Grouping and Ungrouping”, “Stacking” (i.e. the position of the layer occupied by an object, “Rotation and Flipping”, “a perfect circle or square”...etc.

A beautiful train
A beautiful train



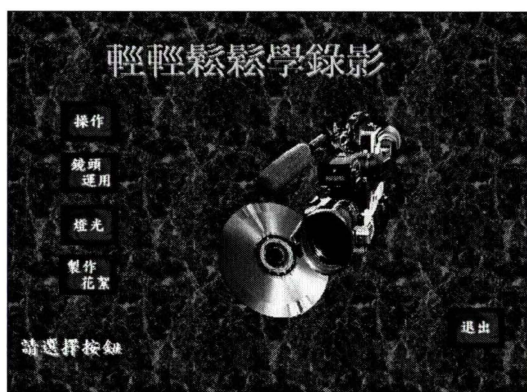
Appendix F

Samples of Web Resources and CD-ROMs used in the study

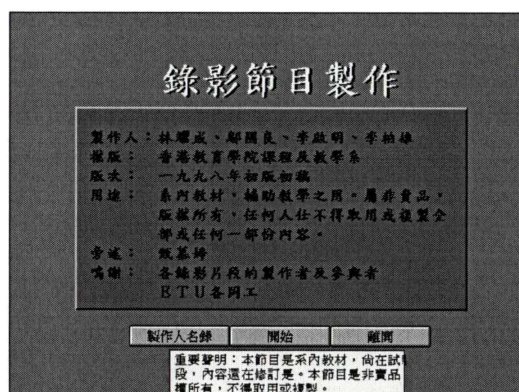
Samples of Web Resources and CD-ROMs used in the 1st phase of this study

The screenshot shows the homepage of the DIM Resources Web Page. At the top left is the logo of The Hong Kong Institute of Education (香港教育學院). Below it, the text reads "Department of Curriculum and Instruction". The main heading is "DIM Resources Web Page" and "Welcome to DIM !!". A navigation menu on the left includes: Home, Department Structure, Staff, Teaching Areas, Staff Publication, Hot Links, Download Shareware, and HKIED. The main content area has a section titled "What's DIM?" with a brief description of the DIM module and a link to "Check here to know more about DIM Module". At the bottom, there is a link to "DIM Home | DIM Module | Resources & Links | Teaching & Learning Activities" and a feedback form.

A web site of learning resources for DDIM module



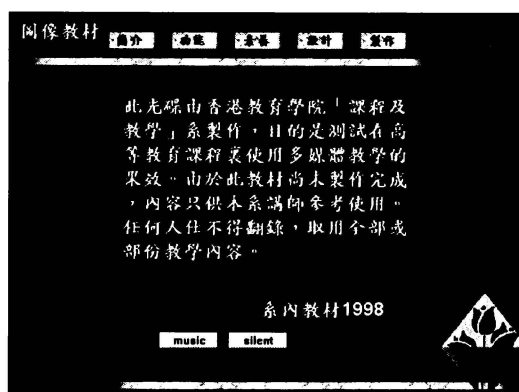
Video Production Series-I (CD-ROM)



Video Production Series-II (CD-ROM)

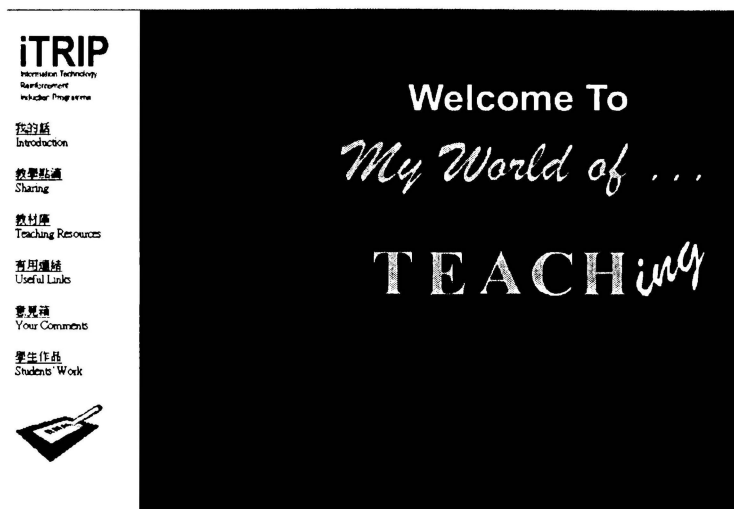


Video Editing (CD-ROM)

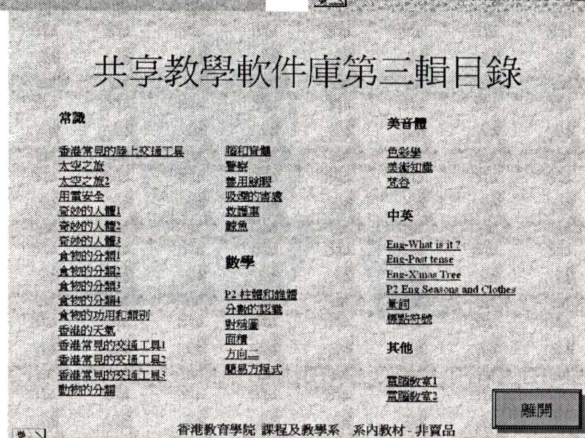
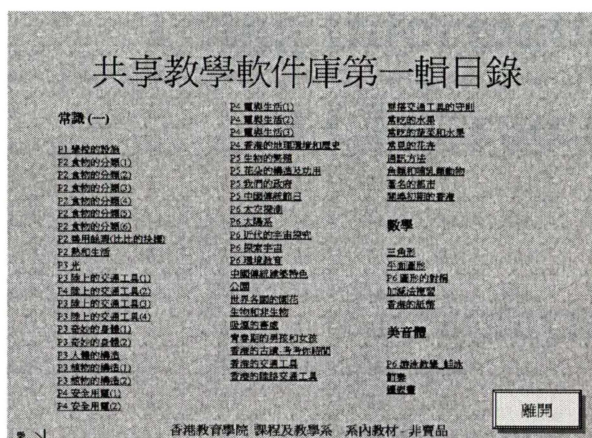


Visual Materials For Teaching (CD-ROM)

Samples of Web Resources and CD-ROMs used in the 2nd phase of this study



A template for the construction of a personal web page for self-reflection



Teaching Materials Shareware Series (I-III) (CD-ROM)

Appendix G1

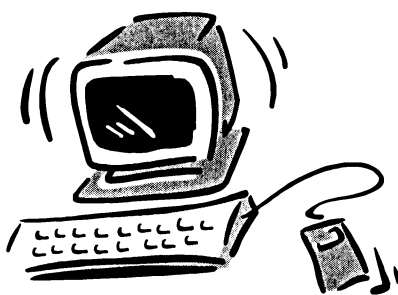
Resources booklet for using information technology in education for student-teachers

Designing and Developing Instructional Media

(DDIM) 98-99

Using Information Technology in Classroom Teaching

Resources book



This booklet includes some articles taken from two journals: *Learning and Leading with Technology and Interactive*. Article (1) to (7) are examples of how some educational software (e.g., Electronic Storybooks) and some non-instructional application software (e.g., Spreadsheet) are integrated into daily classroom teaching. Article (8) discusses some ethical issues concerning the use of technology.

As part of your portfolio requirements, you are required to write some reflective statements after reading the examples. Here are some guiding questions for your reference. Of course, you are free to write anything that you think appropriate.

1. How are these computer software applications different from some computer-assisted learning (CAL) programmes?
2. What do you learn from these articles?
3. How useful are they in helping you to use information technology in your future teaching?

Reflective Statements

* You can continue writing at the back of this sheet.

*1 You may photocopy this page and include it in your portfolio.

*2 The articles included here are for your reference only and are not for public circulation. You are strongly advised to read those journals in the main library for most updated information.

Reading materials used in this booklet:

1. Teague, B. & Teague, G. (1995). Planning with computers: A social studies simulation. *Learning and Leading With Technology (September)*, 20-22.
2. Glasgow, J.N. (1996). It's my turn! Motivating young readers. *Learning and Leading With Technology (November)*, 20-23.
3. Murphy, V., & Thuente, K. (1995). Using technology in early learning classrooms. *Learning and Leading With Technology (May)*, 8-10.
4. Hamilton, P. (1997). The morning announcements- elementary students publish the daily announcements in a TV-news format using their school's close-circuit AV network. *Learning and Leading With Technology (April)*, 20-21.
5. Goldsworthy, R. (1997). Real-world field trips. *Learning and Leading With Technology (September)*, 26-29.
6. Rouse, C. (1997). Reading comparisons. *Interactive (April/May)*. 17-19.
7. Holmes, E.D. (1997). The spreadsheet absolutely elementary. *Learning and Leading With Technology (May)*, 6-8.
8. Brown, M.J. Technology ethics. *Learning and Leading With Technology (March)*, 38-41.

Appendix G2

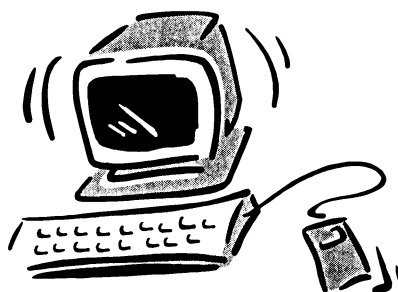
Resources booklet for using information technology in education for beginning teachers

Information Technology Reinforcement Induction Programme

ITRIP

Using Information Technology in Classroom Teaching

Resources book



Reading materials used in this booklet:

- 1 ITRIP guide (Chinese Version)
- 2 Learning tools and resources
 - 2.1 Notes of how to use 'FTP' on the Internet
 - 2.2 Some useful URLs on the Internet
- 3 Table of content of the CD-ROMs of 'Shareware for teaching and learning'
- 4 Translated cases of using information technology in teaching and learning from:
 - 4.1 Document - 'Five-year Strategic Plan for Implementation of Information Technology in Education' (Education Manpower Bureau, Hong Kong Special Administrative Region, 1998);
 - 4.2 Journal - 'Learning and Leading With Technology'; and,
 - 4.3 Book – 'Integrating educational technology into teaching' (Roblyer & Havriluk, 1997)
- 5 Newspaper clippings concerning the use of information technology in education in Hong Kong
- 6 A booklet about the use of information technology in teaching and learning (Education Department¹, Hong Kong Special Administrative Region, 1998)
- 7 Reading materials:
 - 7.1 Harris, J. (1998). Curriculum-based telecollaboration: using activity structures to design student projects. *Learning and Leading with Technology*. 26(1), 7-15.
 - 7.2 Watson, L., & Ross, K. (1998). The use of information and communications technology (ICT) in education: a constructivist perspective. In M., Littledyke & L, Huxford (Eds.). *Teaching the primary curriculum for constructive learning*, (pp. 93 – 106). London: D. Fulton.

¹ The Education Department of Hong Kong Special Administrative Region has been merged into the Education Manpower Bureau in 2003.

Appendix H
A Guide to the Information Technology Reinforcement Induction Programme
for Beginning Teachers (ITRIP)

A. Objectives

1. To facilitate participants to use technologies in teaching by providing resources and consultant in the induction period as beginning teachers.
2. To facilitate participants to rebuild a teaching and learning (T/L) model that the researcher has established and they have experienced in the IM module in the initial teacher education programme.
3. To facilitate participants to reflect on their current practices of teaching with reference to the T/L model within the constructivist framework.
4. To facilitate participants to build up their own capacities in becoming reflective practitioners and self-learners for own professional development.

B. Strategies

1. Workshop:
Time: about 3 hours
Contents: rebuilding the T/L model in previous IM module via talk back, reflection on past experiences, introduction to the teaching resources, discussion on learning strategies on the topics identified in preliminary survey and the strategies on observing and reflecting self class teaching.
2. Teaching resources: CD-ROM of teaching shareware & on-line web page of relevant links and communications (only confined to some topics in General Studies), and consultancy via e-mail or telephone.
3. Journal reading: selected journal papers concerning the application of technologies (focus on teaching strategies and curricula integration) will be compiled and sent to the participants.
4. Development of an IT plan for trailing.
5. Teaching diary: reflection on daily teaching with IT
6. Classroom observation and post observation discussion: academic inputs and reflections.

C. Schedule

Period: about five months

Preparation: February to March, 2000

Implementation: April to June, 2000

For any enquiry, please contact Mr. Li KM at 2948 7539 (Off) e-mail :
kmli@ied.edu.hk

Planning a constructivist learning activity with the use of IT

You are asked to select a topic from any of their teaching subjects (or cross subjects) to plan a learning activity with the use of IT under the constructivist framework which has been discussed before.

Before your planning, please review what you understand by constructivist learning and its theoretical background.

Then answer the following questions*:

- Is there any need for teacher's presentation materials?
- Is there any need for individualised learning materials for my pupils?
- Where can I find these resources?
- Do I need to produce some of them by myself?
- If needed, what kinds of tools that I am going to use for these productions? Is it a presentation software, a self-learning package or a web site? What kinds of competencies that are needed for these productions? What kinds of competencies that I do not know and have to learn?
- When designing these teaching and learning resources, what sorts of knowledge that I have to apply? Principles of Instructional design? Communication and visual literacy theory?
- What kinds of activities that are needed? Do your pupils need to finish some projects or tasks? Do they need to make presentation of their work?
- Are they teacher-directed activities or pupils-initiated activities?
- Is it necessary for the activities to be conducted solely in the classroom?
- If not, how do I arrange such outside activities? Where? When? What sorts of logistic arrangement needed?
- Do my pupils need to have some pre-requisite knowledge and skills before they can go on with their activities?
- Do I need to teach them before hand?
- How do I communicate with my pupils throughout the whole process both inside and outside the classroom? Do we need any specific communication techniques? Do we need to learn the techniques before hand?
- How do I observe the learning process and made necessary evaluation of the learning outcomes? Do I have any specific criteria and standards now?

Resources provided:

Three CD-ROM discs distributed to the participants. The copyright of the programmes was stated. The participants could use them for reference only, no public presentation would be allowed.






Each participant was given a location in a FTP server. They were granted the right to store and download their teaching materials in their assigned locations. They were also given a space in a web server to create their personal web sites for their projects. A template of a personal web site was also given, which is consisted of the introduction, reflective journals, useful links, teacher's resources, pupils' work and comments pages. Participants were expected to enter and modify the contents of these pages.

*Questions were developed from discussion session in previous workshop.

Teaching Diary

You are encouraged to write at least three teaching diaries. The main purpose is to reflect on the use of IT in your daily teaching. The incidents for reflection may be your real experiences in your teaching or from reading articles or news in the field. Your analysis may focus on the impact on your professional growth or the implications for the field of IT in education.

The followings are suggested contents in your diary (you may produce it in audio format):

-  Date
-  Time
-  Brief description of the incident
-  Problem or issue raised in the incident
-  Your reflection (immediate feeling, analysis and suggestions)

Appendix I1
Consent form for participating in the present research

Dear Student,

You are invited to participate in a research titled "Learning to teach with Information technology - a case in a primary teacher education programme in Hong Kong". The study focuses on the building of an effective teaching model for the professional development of using Information Technology in classroom teaching.

You will be asked to attend two interviews while you are studying in the institute: after the completion of the DDIM module and after the Teaching Practice. You are expected to present a lesson integrated with the use of information technology with the help of your peers and the lecturer during teaching practice. The lecturer will visit you and discuss with your teaching afterward. Please note that this visit will by no means contribute to any assessment in your Teaching Practice. As a module requirement, you are required to produce a portfolio for your module assessment. The materials in the portfolio are valuable data and will be copied for analysis. Complete and detailed guides will be given in the course of study.

It is stressed that the data collected will only be used for the purpose of this study and will not in any way contribute to the assessment of the program. All data will be quoted anonymously and personal details will be kept confidential. Your support is very much appreciated. If you have any queries concerning the study, please contact me at 29487539 or Room D1-1/F-32.

Please write your name and contact telephone number here if you agree to participate in this study.

Name: _____ Student Number : _____

Tel No.: _____ Date : _____

Appendix I2
Consent form for class observation

X X X校長:

本人乃香港教育學院課程及教學系講師，現正進行一項名為「新入職教師應用資訊科技教學」之研究。研究以新入職教師為對象，目的在探討他們在運用資訊科技教學時所遇到的困難及所需的協助，研究以觀課(上課時間校內進行)及訪問(課後校內進行)方式進行。貴校 XXX及XXX老師已概允為本研究對象，現特函徵詢閣下同意玉成此事。觀課及訪問所得資料一概保密，除用作研究分析外，絕不外泄，一俟研究完成，資料將全數銷毀。另外，本人將確保研究在不妨礙教師教學及學生的學習的情況下進行，茲將計劃詳情形羅列於下:

觀課日期: XX/XX/XXXX 時間: XXXX-XXXX

如有任何疑問，請賜電XXXXXXXX與本人聯絡，對於閣下熱心教育，為教育研究提供協助謹致萬二分謝意。

李啓明

XXXX年X月X X日

Appendix J

Classroom Observation Records of Student-teachers in Teaching Practice

Classroom Observation Record of Amy

Teacher: Amy

35 minutes, 12 May 1999

P.6, General Studies: Environmental Protection (E P)

Classroom facilities: TV only, teacher's own Note-book computer

Media: computer generated word cards (C-word card), worksheet (C-worksheet) & sentence strips (C-sentence strips) and pictures with logos (C-graphics), digitised video clips (DV)

Start Up: T ask question with C-graphics (logos of various E P organisations); T ask S to answer (named/choral)

Development 1: T ask question with C-graphics & C-word card (logos and names of various E P organisations); T ask S to answer (named/choral)

Development 2: T instruct group activities with use of DV & C-worksheet (one group viewing DV in turns, others doing individual worksheet); T ask S to report; T give feedback; [T ask question; T ask S to answer; T give feedback/elaborate (to clarify points made in report when necessary)]; [repeat next reporting cycle]

Round Up: T give summary with C-sentence strips (stick main points on blackboard); T give home assignment.

Classroom Observation Record of Doris

Teacher: Doris

35 minutes, 11 May, 1999

P.4, General Studies: dispersal of plants

Classroom facilities: TV, OHP, pull-down screen and Public Announcement (PA) system

Media: text and pictures in textbook; worksheet (C-worksheet); coloured overheads produced from PowerPoint (PPT-OHT)

Start Up: T ask question with PPT-OHTs; T ask S to answer (named /choral)

Development (1): Task question with PPT-OHTs; T ask S to answer (named /choral); T explain; [repeat for Development (2)];

Development (3): T lead group activities with C-worksheet (matching exercise of ways of dispersal); T instruct S discussion (justifications for the matching); T ask question; T invite S (group representative) to answer; T give feedback/explain with PPT-OHTs; [repeat with other groups].

Round Up: T give summary; T instruct/give home assignment.

Classroom Observation Record of Flora

Teacher: Flora

35 minutes, 13 May, 1999

P.6, General Studies: Environmental Protection (E P)

Classroom facilities: TV, overhead projector, pull-down screen and PA system, teacher's own Notebook computer

Media: textbook; poster, computer generated worksheets (C-worksheet), coloured overhead produced from PowerPoint (PPT-OHTs), hand written/drawn OHTs, off-line web site materials (C-off-line web)

Start Up: T ask question with PPT-OHTs; T show topic with poster on blackboard;

Development: T instruct group activities with use of puzzle in C-off-line web, OHTs & C-worksheet (different tasks for different groups, swap for off-line browsing: one group playing puzzle with use of Notebook computer, others discussing questions in worksheet and preparing OHT for reporting); T ask S to report ; T give feedback/elaborate; [repeat next report cycle with other gorups]

Round Up: T give summary with PPT-OHTs; T give worksheets as homework.

*Classroom Observation Record of Oliver***Classroom Observation Record****Teacher: Oliver**

35 minutes, 12 May, 1999

P. 5, Chinese: Comprehension of text and sentence structure

Classroom facilities: TV, overhead projector, pull-down screen, Note-Book

Computer connected with a video projector (on request; set up required)

Media: Presentation programme with PowerPoint (PPT-prog)

Start Up: T ask question with PPT-prog (Revision, MC question); T ask S to answer (named /choral); T give feedback with PPT-prog; T invite S to select answer from PPT-prog (Hyperlinks in PPT-prog to show answers); [repeat revision cycle]

Development 1: T ask question with PPT-prog; T ask S to answer (named /choral); T give feedback /explain; T give main points with PPT-prog; [repeat for Development (2)]

Development 3: T show examples with PPT-prog (building sentences); Task question & explain (sentence structures); T ask S to make sentences; T invite S to write sentences on blackboard, T give feedback /elaborate

Round Up: T give summary; T give home assignment.

*Classroom Observation Record of Tracy***Teacher: Tracy**

35 minutes, 15 May, 1999

P.4, General Studies: History of Hong Kong

Classroom facilities: TV, overhead projector, pull-down screen, teacher's own note book computer and Video projector (on request, set up required)

Media: textbook; pamphlets, computer generated worksheet (C-worksheet), pictures in a graphic browser in a computer note book (C-graphics)

Start Up: T ask question with C-graphics; T ask S to answer (named/choral); T give feedback & tell topic of the lesson.

Development: T ask question with C-graphics; T ask S to answer (named/choral); T give feedback/elaborate; [repeat next development cycle]; T instruct group activity with use of pamphlets & C-worksheet; T ask S to report; T give feedback/elaborate; [repeat next report cycle with other groups]

Round Up: T give summary & read the text in the textbook.

Key: T = teacher; S = student

Appendix K
A Summary of the IT Plans of the Beginning teachers in the ITRIP

	Amy	Betty	Chris	Doris	Flora
Subject	Maths	Chinese Language	Mathematics	English Language	Mathematics
Class	P.3	P.1	P.4	P.5 (extra-curricula activity)	P.3
Topic	Fraction	Cooperation	Bar graph (two data series)	“Must and mustn’t” and Guided Writing	Simple bar graph (one data series)
Resources	Game Card, PowerPoint Programme (PPT), Picture, School intranet	Paper, glue, scissors, cloth, Picture, Software: MS Paint	PowerPoint programme (PPT), worksheet, File/Web server for downloading	Digital Camera, Scanner, Computer, Web server, software: Dreamweaver	PowerPoint programme (PPT), overhead transparency (OHT) worksheet
Time	2 x 35 minutes (minutes).	After class (1 week)	3 x 35 minutes	After class (3 weeks)	35 minutes + 15 minutes recess
Venue	Classroom with computer	Classroom with computer	Computer laboratory	No fixed location, School intranet, classroom with computer for sharing at the end	Classroom and Computer laboratory
Activities	<p>Theme 1: How to describe a number less than one? S play game card (Dividing a paper pizza and Paper folding); T invite S to present (describe the results as instructed in the game card); S construct their questions about dividing fruit for other groups.</p> <p>Theme 2: What is a fraction? T exposition with PPT (consolidate the concept and introduce the mathematical representation); T ask questions with PPT; S answer (as evaluation); T feedback; T give class work. S revise with school intranet</p>	<p>Theme 1: Making a banner about cooperation S group activity with paper, glue, scissors; T invite S to present</p> <p>Theme 2: Clean our classroom together S group activity with cloth (for cleaning)</p> <p>Theme 3: What is the end of the story? T tell story with picture (without ending); T invite S to complete story; T demonstrate the group activity with MS paint; S group activity with MS paint (draw the ending)</p> <p>Theme 4: T invite S to present completed story with MS paint; T feedback.</p>	<p>Theme 1: Use of PPT to create a bar graph T demonstration with PPT; T ask S to practice with worksheet & PPT (students download resources from school file server)</p> <p>Theme 2: Build your own bar graph T invite S to collect information with worksheet (before the lesson with suggested topics); S group activity with PPT (to complete a bar graph with collected information; T invite S to present with PPT. S revise with school intranet.</p>	<p>Theme 1: Ms Chan’s Home Page T create home page with School web server (extended contents of the topic)</p> <p>Theme 2: Students’ Home Page T demonstrate activities using Ms Chan’s Home Page); T invite S to write sentences with illustrations (not restricted to using computer); T scan some students’ work; T post student’s work on the web site; T invite S to present; T feedback.</p>	<p>Theme: Use of Excel to create a simple bar graph</p> <p>Theme 1: T ask questions with OHT); S answer; T feedback/elaborate (about the use of 1 to represent 10 in a graph)</p> <p>Theme 2: T demonstration with PPT; T instruct S on group practice with use of worksheet & PPT (use template in prepared disks to create a bar graph); T invite S to show result; T feedback</p>
Evaluation	Evaluation in classroom; after class interview with student; homework and test result; comparison with other class.	Observation	Students’ presentation of the PPT; students’ self-evaluation, student interview.	Observation	Observation, Students’ presentation, interview with students; homework result

Key: T = teacher; S = student

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