8-17-2004

Technology and Teacher Training: The Systematic Design and Development of a Framework for Integrating Technology into Jamaica's Teacher Training Programs

Carol N. Granston
University of South Florida

Technology and Teacher Training: The Systematic Design and Development of a Framework for Integrating Technology into Jamaica's Teacher Training Programs

by

Carol N. Granston

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Secondary Education
College of Education
University of South Florida

Major Professor: James A. White, Ph.D.
Constance Hines, Ph.D.
William Kealy, Ph.D.
Kofi Marfo, Ph.D.

Date of Approval:
August 17, 2004

Keywords: Pre-service Teachers, VIBES action plan, computers, model, proficiency

Dedication

To my parents, Dorothy, Maud and Cyrus, Earl Granston.

Acknowledgements

I would like to take this opportunity to express my sincere gratitude to all those persons who have contributed in some way, tangible or otherwise, to the completion of this project. Most significantly, I would like to acknowledge the contribution of members of my doctoral committee. To my Major Professor, Dr. James A. White, you have been there through every step of this four-year journey. Your insights have exposed to me to novel ways of examining old issues. To Dr. Constance Hines, your dedication to quality and detail has made the product what is currently is. To Dr. Kofi Marfo, thank you for taking the time and providing your expertise in opening my eyes to new ways of looking at my study data. To Dr. William Kealy, you have been a guiding light through the last four years of this journey.

To my family who have been my strength and my light. To Peter, your words of wisdom and encouragement kept me going when the journey seemed endless. To Martha, Darrel, Eric, Ellajean and, Phyllis, I could always call on you for anything.

To the administrators, faculty and students at the colleges that participated in the study, I am eternally grateful to you for taking the time to complete the instruments. Without your help, this product would not have come to fruition.

To all my friends and acquaintances who have touched my life in some way, thank you. I will always remember you fondly.

Table of Contents

List of Tables

List of Figures

Technology and Teacher Training: The Systematic Design and Development of a Framework for Integrating Technology into Jamaica's Teacher Training Programs

Carol N. Granston

ABSTRACT

Over the last five years, there has been an increased number of computers in schools and teachers' colleges in Jamaica. In addition, recently revised national policy documents have indicated the need to infuse technology into the curricula of all schools. Despite these investments in computers, however, there has been little corresponding development in training teachers to use computers and emerging technologies as teaching learning tools.

The purposes of the study were three-fold: (a) to describe the current state of technology integration in Jamaica's teacher training programs (b) assess the extent to which teachers' college faculty and pre-service teachers perceived themselves as prepared to teach with computers, as well as their perceived computer proficiency; and (c) to use data gathered in the study to inform an action plan for integrating technology into Jamaica's teacher training programs.

To gather required data, a survey design was employed because the study required collection of data from a large number of persons located in diverse sections of the island. Data were collected from three distinct groups of participants in three teachers' colleges in Jamaica. These included six teachers' college administrators--two principals and four vice-principals, 121 teachers' college faculty, and 268 final-year pre-service teachers.

Data were gathered through interviews with college administrators and IT faculty, questionnaires administered to college faculty and pre-service teachers, and focus group discussions with pre-service teachers

The results indicate that, in general, teacher training programs in Jamaica have not systematically incorporated technology in the college curricula. In addition, to a large extent, teachers' college faculty and pre-service teachers did not perceive themselves as prepared to teach with computers. These respondents also reported low levels of proficiency with various computer tools.

In response to the urgent need to integrate technology into Jamaica's teachers' college curricula, the author proposes a new VIBES conceptual framework as an *action plan* specifically designed to facilitate technology integration into this setting. VIBES is comprised of five components: Vision, Infrastructure, Behaviour, Experience, and Support, hence the acronym. Each component of VIBES is required in teacher training programs if technology is to be systematically incorporated into the college curricula.

Chapter 1

Introduction

In recent years, there has been a significant increase in the number of computers in schools both in the United States and other developed countries such as Canada and Great Britain, as well as in developing countries such as Jamaica. According to a release from the National Center for Educational Statistics (2002), a survey of public schools in the United States conducted between 1994 and 2001 revealed that the number of computers available in public schools has grown exponentially. Results of the survey indicate that approximately 99% of all public schools in the United States were connected to the Internet, an increase from 35 % in 1994. In addition, results from the survey indicate that there has been an improved student/instructional computer ratio and, in general, the ratio of students per computer has fallen from 12.1:1 in 1998 to 6.6:1 in 2000 to 5.4:1 in 2001.

Despite these investments in computers and related technologies, there have been little corresponding changes to the way future teachers are being prepared to teach. The general findings from studies conducted in the United States show that future teachers are not adequately prepared to integrate computers in their teaching (National Center for

Educational Statistics, 2000; Office of Technology Assessment Report, 1995; Swaminathan & Yelland, 2003).

As in the case in the USA, in Jamaica, while educators, curriculum planners and policy makers have made a coherent case for the infusion of technology in education, teachers have been given little attention. According to Peart (1998), professor of Instructional Technology at the University of the West Indies, Jamaica, "While the use of computer technology has been steadily gaining popularity …there has been little corresponding development in teacher education" (p. 195). If computers and related technologies are to be systematically integrated into the curriculum, then teachers must be equipped with knowledge and skills required to teach with computers.

Over the last decade, and especially within the last five years, there has been an increase in the number of computers and related technologies in Jamaican schools. Organizations such as the Jamaica Computer Society Education Foundation (JCSEF) and the Human Employment and Resources Training (HEART) Trust in collaboration with the Ministry of Education and international funding agencies (e.g., World Bank, USAID) have embarked on a number of projects with the primary aim of ensuring that "by the year 2000, all graduates of Jamaican secondary schools, teachers' colleges and community colleges will have access to technology-based education" (Crawford, 1999). In order to accomplish this aim, the JCSEF has installed a number of computer laboratories in schools across Jamaica. Other projects (e.g., Ed-Tech 20/20 Project for Primary Schools) have placed computers in primary schools across the island. As a result of these projects, a large percentage of schools in Jamaica has equipped computer

laboratories. In addition, through The MultiCare Foundation, all teachers' colleges in Jamaica have computer laboratories.

In addition to equipping schools and teachers' colleges with computers, project directors have proposed that staff development opportunities have been offered to teachers' college faculty "so that new teachers being trained to enter the system will already be versed in the use of technology when they begin to work in the classroom" (Crawford, 2001). Despite these developments, however, according to Avril Crawford, Executive Director of the JCSEF (1999), studies indicate that, "teachers and indeed lecturers in teachers' colleges are lagging behind in know-how as it relates to the use of the technology" (p. 9). A 1996 survey conducted by the JCSEF also indicates that, in many instances, some of the laboratories that were donated to teachers' colleges were not being utilized by faculty and pre-service teachers (Crawford, 1999). One of the factors accounting for this under-utilization of the computers is that teachers who had received training left the classroom for more lucrative jobs in the private sector. Another factor is that teachers graduating from teachers' colleges were not equipped with knowledge and skills required to use these computers as teaching tools. As a result, computer labs have become an artifact and the potential benefits of using computers as learning tools have not been realized.

In Jamaica, recently revised national curriculum documents have stressed the need to infuse technology into teaching. Computers and emerging technologies should be integrated into the curriculum for a number of reasons. Firstly, we are living in a society in which technology plays a significant role in everything we do; therefore, for students to function in the 21st Century society, they must be equipped with relevant 21st Century

skills. Secondly, the business community requires that prospective employees be technologically literate; therefore, as part of the education process, students should be equipped with these skills. Finally, integrating technology into the education system is especially significant for Jamaica and other developing countries. If students are to compete on a global scale with their counterparts in developed nations, being technologically literate is essential.

Overview of the Teacher Preparation System in Jamaica's Teachers' Colleges

The teacher training system in Jamaica may best be defined as a dual system where teachers may be trained at either the teachers' college level or the university level. Both systems differ primarily in terms of entry level requirements--candidates who attend teachers' colleges are usually graduates of high schools at grade 11. Those who attend universities, on the other hand, may either be trained teachers who attend one of the universities for re-certification or enter the university directly with their sixth form (Grade 13) qualifications. For the purposes of this study, the focus was on pre-service teachers who were currently attending teachers' college for certification to teach at the early childhood, primary (elementary) or secondary (including grades 7-11) levels.

There are six teachers' colleges in Jamaica offering four types of programs to pre-service teachers. To be eligible for admission to one of these programs, prospective students are required to have successfully completed five years of high school and earn passing grades (grades 1-3) in at least four subjects on external examinations administered by the Caribbean Examination Council (CXC)-- a regional examination for

countries in the English-speaking Caribbean. At the teachers' colleges, students can choose to pursue one of four programs: special education, early childhood education; primary (elementary) education; or secondary education. Recently, different colleges have been designated to provide specialized training in different program areas. Despite differences in programs, however, students are required to complete the same core (education) courses, including a 45-hour Introduction to Educational Technology course. Recently revised policies have resulted in the introduction of two 45-hour courses that now include Information and Communication Technologies (ICT).

To be awarded a diploma in teaching, pre-service teachers in Jamaica's teachers' colleges are required to complete a three-year program of course work and varying amounts of field experience. These field experience activities include early field experience which is comprised of microteaching and observation during the first two years of the program followed by a three-month extended teaching practice (internship) in a kindergarten, primary or secondary (7-11) school. After successfully completing their teaching practice, pre-service teachers become eligible for graduation in preparation for the world of work. Graduates of teachers' colleges make up over 78% of the total number of teachers employed in the Jamaican school system. Therefore, providing this population with the knowledge and skills required to integrate computers in their teaching can have a significant impact on how Jamaica's students are prepared for life in the 21st Century.

There has been a significant amount of research done in the area of integrating technology into teacher training programs in the United States; however, this is an area that is yet to be explored in the Jamaican setting. The present study examined teacher

training programs in teachers colleges in Jamaica and provided a description of the state of technology integration in these programs. The IT_3P is a conceptual framework synthesized from the literature on technology and teacher training. It was designed to be used as the conceptual base for this investigation.

Overview of the Integrating Technology into Teacher Training Programs (IT_3P) Framework

Finding the most effective and efficient ways of preparing teachers to teach with computers is not unique to the Jamaica teacher training situation. An examination of research studies and reports on technology and teacher training, done primarily in the United States, Canada, Great Britain and Australia, show that there are some factors essential to facilitating technology integration. These include the presence of a technology plan (Kimble, 1999; RAND Report, 1995), opportunities for staff development (Jacobsen & Lock, 2004; Office of Technology Assessment (OTA), 1995; Parker, 1997; Sprague et al., 1994), access to resources and infrastructure (Bullock, 2004; David, 1994, Parker, 1997; Surry, 2001), technical and administrative support (Mackenzie et al., 1996; Munday, 1991; OTA, 1995), modeling of computer use by faculty (Barron & Goldman, 1994; Munday, 1991), as well as display a positive attitude towards computers Mutaz, 2000; Parker, 1997; Shafer, 1997), and training and field experience for pre-service teachers (Bullock, 2004; OTA, 1995; Wetzel & Strudler, 2002). These factors have been incorporated into a conceptual framework designed to

describe the state of technology integration into Jamaica's training programs (see Figure 1). A detailed description of this framework is included in chapter 2 of the study.

Integrating Technology into Teacher Training Programs (IT_3P) Framework

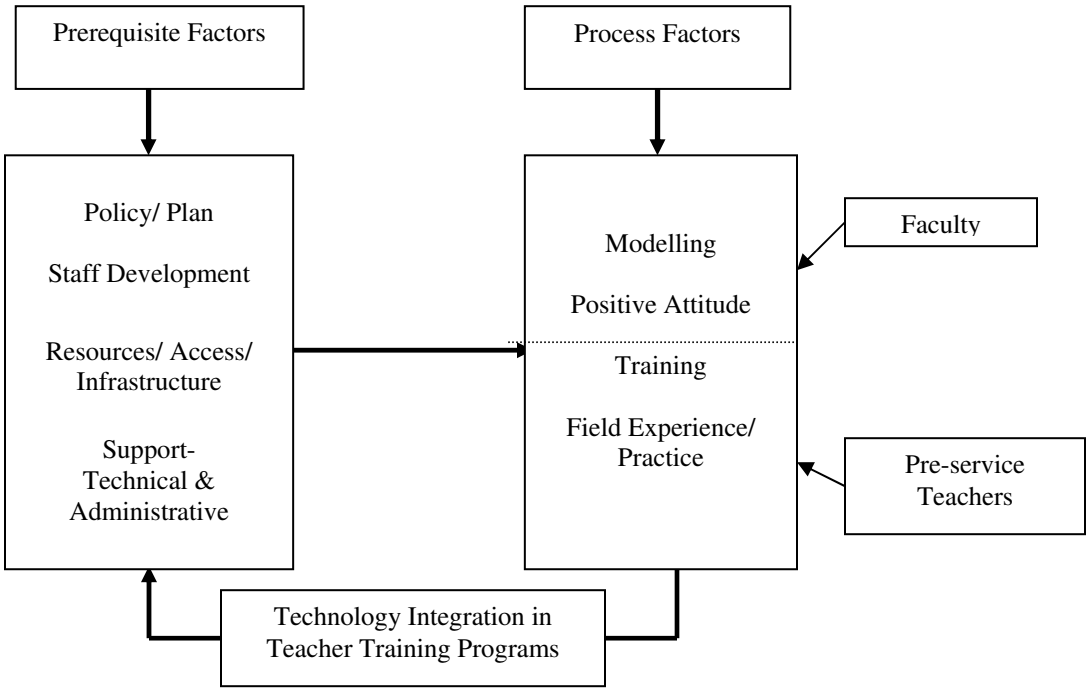

Figure 1: Diagrammatic Representation of the IT_3P framework

The IT_3P is generic and proposes factors that should be in place in colleges of education and practicum settings to ensure pre-service teachers are provided with experiences required to integrate technology in their classes. Factors defined as prerequisite factors are necessary and should be in place to enhance technology integration. Process factors are those that occur while faculty and pre-service teachers interact at the college level. The factors are further divided into two groups: pre-requisite factors and process factors. The IT_3P is comprised of eight factors--(a) technology plan,

(b) staff development, (c) access to infrastructure and resources, (d) technical and administrative support, (e) modeling of computer use, (f) positive attitude towards computers, (g) training, and (h) field experience. While each factor can be viewed as an individual entity, to ensure teachers are prepared to teach with technological tools, there must be an interaction among all factors in this framework. In addition, for teachers to be equipped with knowledge and skills required to integrate technology in their teaching, all variables must exist even at a minimum.

Its development was influenced by the works of Kortecamp and Croninger (1996); McKenzie, Kirby and Mims (1996); Schmidt (1998); and most significantly, by Surry's (2001) RIPPLES model. Further, other areas of research that informed the development of this conceptual framework include:

a) Barriers to integrating technology adoption in teacher training programs (Barron & Goldman, 1994; Cuban, 1998; David, 1994; Parker, 1997; Rosenthal, 1999; Sudzina, 1993).
b) Factors that will facilitate technology adoption in colleges of education (Dasher, 1997; Kimble, 1999; Mann & Shafer, 1997; Munday, 1991; Office of Technology Assessment (OTA) Report, 1995; RAND Report, 1995; Sprague, Kopfman, & de Levante Dorsey, 1998).
c) Effective teacher training programs (Bowman Alden, 1989).
d) Approaches to integrating technology into teacher training programs (Gillingham & Topper, 1999).

The first prerequisite factor, technology plan, refers to a document that outlines the strategies for incorporating technology into teacher training programs. In addition to the presence of a technology plan in teachers' colleges, there must be opportunities for staff development to equip teachers' college faculty with knowledge and skills required to use computers to enhance their practice. Similarly, both faculty and pre-service teachers must have access to resources and infrastructure required to facilitate technology integration. There should also be support-both technical and administrative-to facilitate technology integration. Technical support refers to the availability at least one faculty member who is knowledgeable in both technology and pedagogy to provide colleagues with assistance as they try to incorporate computers in their lessons. In addition, there should be support staff within each college to maintain and update computers and other technological devices as these become necessary. Administrative support, on the other hand, alludes to support from administration in terms of encouragement and release time for faculty for professional development.

The IT_3P includes four process factors: modelling, positive attitude, training for pre-service teachers in the use of computers, and practice using computers during their college experience and during their field experience. Faculty should model computer use to their students as a way of vicariously exposing pre-service teachers to ways in which computers can be integrated into specific content areas. In addition, research suggests that faculty should model positive attitudes towards computers as this will, in turn, influence pre-service teachers' attitudes towards computers (Dasher, 1997; Sprague et al., 1998). If technology is to be integrated in the teachers' college curriculum, pre-service teachers must be taught how to teach with technology--therefore, training is essential. Similarly,

pre-service teachers must be provided with opportunities for practice as ongoing practice builds their confidence in technology use. The outcome of the interaction between prerequisite factors and process factors is the integration of technology in the college curriculum.

The IT_3P provides a framework that can be used to describe and assess the state of technology integration in teacher training programs and provide practitioners with guidelines regarding how to integrate technology in teacher training programs. It is comprised of characteristics or features that can be studied and used as the basis for future research.

Different stakeholders in the education system influence and are affected by the model at different levels. Stakeholders include curriculum decision and policy makers, administrators of colleges of education, faculty, pre-service teachers, and more indirectly, students and the business community--the consumers of products of the education system. Each group, in some way, impacts or is influenced by what happens in teacher training programs; obviously, some more directly than others. However, this does not diminish the role others play. The issue of stakeholders will be revisited in subsequent sections of the discourse and addressed as their roles relate to specific aspects of the model.

Purpose of the Study

The purposes of the study were three-fold: (a) to provide a description of the current state of technology integration in teacher training programs in Jamaica and to assess the extent to which components of the IT_3P framework are evident in these

programs; (b) to assess the extent to which teachers' college faculty and pre-service teachers perceive themselves as prepared to teach with computers, as well as their perceived computer proficiency; and (c) to use data gathered in the study to inform an action plan for integrating technology into teacher training programs in Jamaica.

Research Questions

The following four research questions were used in the study:

1. To what extent are components of the IT_3P evident in teacher training programs in Jamaica?
    a. What are administrators' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?
    b. What are faculty's perceptions of the extent to which components of the IT_3P framework are evident in teacher training programs?
    c. What are pre-service teachers' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?
    d. Are there differences, across colleges, in the perceptions of (a) teachers' college faculty and (b) pre-service teachers regarding evidence of components of the IT_3P framework in their teacher training programs?
2. To what extent are teachers' college faculty in Jamaica prepared to integrate computers in their teaching?

a. What are faculty's perceptions of the extent to which they are prepared to integrate computers in their classes?
b. What are faculty's perceptions of their levels of proficiency with computer productivity, communication and research tools?
c. Are there differences across colleges in faculty's perceptions of their preparation to teach with computers?

3. To what extent are Jamaica's pre-service teachers prepared to teach with computers?
    a. What are pre-service teachers' perceptions of the extent to which the training they received during their college program prepared them to integrate computers in their teaching?
    b. What are pre-service teachers' perceptions of their levels of proficiency with computer productivity, communication and research tools?
    c. Are there differences across colleges in pre-service teachers' perceptions of their preparation to teach with computers?
4. What do study participants propose as specific factors required to facilitate technology integration into Jamaica's teacher training programs?

Operational Definition of Terms

Pre-service Teachers: Teachers currently enrolled in teacher training programs which lead to teacher certification. These individuals may have had some teaching experience, but the majority of them have not spent time in the real classroom setting.

Technology: Within the classroom setting, technology can embody a wide range of audio visual and other instructional tools used to augment instruction. Within the context of this study, technology is limited to computers and related technologies such as the Internet.

Technology Integration: Computers used as instructional tools to facilitate the development of knowledge and skills acquisition, for communication, productivity and research.

Technology Productivity Tools: Computers used to facilitate learning, enhance and promote productivity, and to develop creativity and problem solving skills. These include word processing, web publishing, spreadsheets, databases, presentation software and programming software.

Technology Communications Tools: Computers used to facilitate communication and collaboration with peers and other audiences separated in time and place.

Technology Research Tools: Computers used to gather data and information from multiple electronic sources.

Significance of the Study

In recent times, there has been a significant increase in the teacher turn-over rate in Jamaica. Trained teachers have been lured to more lucrative opportunities for employment in the United Kingdom, Canada and the United States. As a result, there are

always vacancies for trained teachers in many schools across the island. Efforts at preparing in-service teachers to integrate computers in their classes are usually in the form of ad hoc workshops conducted intermittently and only with selected schools.

Each year, approximately 850 teachers graduate from the six teachers' colleges across the country; this is an ideal setting where a large number of persons can be reached within an organized setting and be taught how computers can be integrated in their teaching.

This study is significant for two primary reasons: (a) the Joint Board of Teacher Education (JBTE), the body that certifies teachers in Jamaica, is currently revising the existing Instructional Technology curriculum in teachers' colleges in Jamaica. Findings from this study may be used to inform these revisions, and (b) this is the first study of this nature to be conducted in Jamaica and results can provide curriculum policy makers with a description of the current state of technology integration in teacher training programs. In addition, since a conceptual framework was developed from data gathered in the study, curriculum policy makers can be provided with an action plan for ensuring technology becomes incorporated in the college curriculum. The implementation of a technology integration action plan will have long-term effects in determining the extent to which Jamaican teachers, and indirectly students, will be equipped with knowledge and skills that will enable them to function effectively in the 21st Century as well as compete on the global market.

Limitations

One of the purposes of this study was to gather data regarding participants' computer proficiency. Since some study participants may have received computer training on their own prior to or during their college experience, this may influence their perceptions of computer proficiency and in effect, the outcome of the study.

In addition, study data were primarily based on perceptions of study participants. Despite the fact that multiple sources of data gathering methods were used to corroborate findings, there is an inherent weakness in using individual perspectives of participants as they may under or overestimate perceptions of themselves.

Another limitation of this study is that pre-service teachers included in this study participated prior to their extended teaching practice experience (internship). Therefore, data were gathered prior to an extended amount of practice in the real classroom setting. Perceptions may have been different if data were gathered after their extended practice teaching activity as they would have had additional experience during their internship.

Delimitations

The present study was conducted with pre-service teachers enrolled in teachers' colleges in Jamaica. Therefore, findings from the study are not generalizable to other populations such as teachers who receive their training outside of the teachers' college system or to in-service teachers. In addition, since the study was conducted in Jamaica, findings may not be generalizable to other settings outside this context.

Similarly, only three teachers' colleges were used in this study. While these colleges, in some way, comprise features which should also be evident in other colleges, each college will have features and situations unique to those institutions. Therefore, findings may be limited to those colleges used in the study.

Chapter 2

Review of Related Literature

This chapter presents a synthesis of the literature on technology and teacher training. It includes a review of research studies and reports conducted in places such as the United States of America (USA), Great Britain and Australia; however, works done in the USA dominate this review. This area is still unexplored in the Jamaican setting, therefore, little have been written about what currently exists in this setting. This review addresses ten broad areas--the first section presents an overview of technology and teacher training, in the second section a theoretical framework is established and includes discussion of social learning theory and diffusion theory. The subsequent sections examine (a) barriers to technology integration in the classroom as well as in teacher training programs; (b) factors that will facilitate technology integration; (c) effective training programs; (d) models for integrating technology into pre-service teacher training; (e) approaches to integrating technology into teacher education programs; (f) common threads across model are explored; (g) conditions that facilitate implementation of educational technology innovations; and (h) recommendations for integrating technology in teacher education programs.

Overview of Technology and Teacher Training

Classrooms are becoming increasingly technological with computers in many classrooms across the United States. An examination of the Jamaican context shows that a similar situation also exists in Jamaican schools (Crawford, 2001). Teachers have access to machines that some believe will *revolutionize* the way we teach and enhance the amount of learning that takes place in schools. The proliferation of these devices has complicated the teaching-learning process and finding the best ways of integrating technology into classroom practices is one of the challenges the 21st Century teacher faces.

The advent of the 21st Century has also significantly changed the roles of classroom teachers--their new function now includes preparing students to live in a world where technology plays a significant part in everything we do; the way we communicate, access information and life in general. Since technology plays such a pervasive role in the society in which we live, it is incumbent on educators to prepare students to function in an increasingly technological world (Kimble, 1999).

A report from the National Advisory Committee on Training and Employment (NACTE, 1997) corroborates this view. It states: "The business world demands that our schools prepare educated workers who can use technology effectively in the global marketplace… technology is a central element of educational reform and student learning" (p. 3). It is incumbent upon schools, therefore, to equip students with knowledge and skills required to function effectively in the society in which they live.

Despite the proliferation of computers in schools, however, and the obvious need to prepare a technologically literate populace, computers in schools are either

underutilized or misused (Cuban, 1993; 1998). In instances where computers are used, they are being used in what Cuban (1993) describes as "unimaginative" ways: writing term papers, writing tests and for tutorials and drill and practice (Abdal-Haqq, 1995; Jost, 1995; Office of Technology Assessment (OTA), 1995). The full potential of modern technological devices are not fully explored and utilized in ways that will be beneficial to students. M. Grabe and C. Grabe (2001) propose that technology, when used in the classroom, should facilitate meaningful learning in an environment that "engages the thinking, decision making, problem solving and reasoning behaviors of students" (p. 10). These, they believe, are *cognitive behaviors* (italics added) that children need to learn in an Information Age.

If technology is to be integrated into the classroom and play a significant role in educational reform, teachers need to be prepared to use emerging technological devices, including computers, in ways that will facilitate teaching and learning. Despite the numerous plans to use technology in schools, however, teachers--the catalyst for educational reform, have received little training in this area in their teacher education programs (Vrasidas & McIsaac, 2001). Teacher preparation programs need to play a more proactive role in preparing new teachers to teach in technology-rich classrooms, or in the very least, classrooms where teachers and students have access to computers. According to Gillingham and Topper (1999) teacher education administrators and faculty face the challenge of preparing future teachers for a classroom where technology plays a ubiquitous role. If we are of the opinion that teachers are *the primary agents of change*, then teacher education programs must be reformed so that prospective teachers can be better prepared to integrate various technologies in their teaching (Vrasidas & McIsaac,

2001). Other scholars interested in integrating technology in teacher preparation programs share this sentiment (e.g., Brownell, 1997; Fisher, 1997; Parker, 1997; Schmidt, 1998). Technology should be integrated in teacher preparation programs so that students can see technology in use. This will in turn influence the way they use technology when they become in-field teachers. The task of preparing teachers to use technology in their classroom practices should not be relegated to their post-college experiences, it has to begin with the training they receive in their college experience. "Better preparing teachers is not a challenge that begins with teachers already in the classroom; it begins earlier" (The CEO Forum- School Technology and Readiness Report, 1999).

Results of research on the effectiveness of teacher preparation programs in preparing future teachers to integrate technology in their classes paint a bleak picture. The findings indicate that, in general, graduates of teacher preparation programs are not prepared to integrate technology in their classes (International Society for Technology in Education (ISTE), 1999; National Center for Educational Statistics, 2000; NCATE, 1997; OTA, 1995). The National Center for Education Statistics (2000) in a report entitled, *Teachers' Tools for the 21st Century: A Report on Teachers' use of Technology* used the Fast Response Survey System (1999) to conduct a survey with public school teachers to ascertain their use of computers and the Internet. Results from the survey indicate that only 10% of teachers surveyed felt "very-well prepared" to use technology in the classroom; another 23% reported feeling "well-prepared"; about 53% feeling "somewhat prepared" and 13% felt "not at all prepared" to use technology in their classes. This indicates that less than 50% of the teachers surveyed felt "well-prepared" to use computers in their teaching.

In 1999, The Milken Exchange on Education Technology commissioned ISTE to survey teacher preparation institutions to ascertain the status of technology education in teacher training programs across the United States. The report entitled, *Will New Teachers be Prepared to Teach in a Digital Age?* concluded, based on responses from 416 teacher preparation institutions (representative of 90,000 graduate per year), that "…in general, teacher-training programs do not provide future teachers with the kinds of experiences necessary to prepare them to use technology effectively in their classrooms" (p.2). Other studies and reports (e.g., Barron & Goldman, 1994; Campoy, 1992; Fisher, 1997; Howland & Wedman, 2004; Swaminathan & Yelland, 2003; Wetzel, 1994) corroborate the view that teachers are not being adequately prepared to use technology in the classroom.

Willis and Mehlinger (1996), synthesized the literature on technology in teacher education. From the studies reviewed, they concluded: "Most pre-service teachers know very little about effective use of technology in education … teacher education, particularly pre-service, is not preparing educators to work in a technology-enriched classroom" (p. 978). They also found that despite the fact that many pre-service teachers were exposed to instructional technology (IT) coursework, it was not linked to pedagogy or their field experiences. As a result, teachers were unable to make the connection between what they had learned in theory and its practical applications in real classroom situations.

It is no denying then that there is a relationship between educational reform and technology. It can also be further stated that teacher training is critical; teachers must feel prepared to use technology if they are to use it in their classes with their students.

Brownell and Brownell (1991) note that, "The possibility exists that new teachers, adequately prepared, can act as change agents and accelerate the process of meeting students' needs for the Information Age" (p. 147). The report from the National Center for Education Statistics (2000) posits a relationship between level of preparedness and technology use. Results of the survey indicate that teachers who felt prepared were more likely to integrate technology in the classroom than those who felt unprepared. Teachers play a significant role in determining whether technology is used and the extent to which technology will result in educational reform.

Therefore, it is imperative that teacher education programs adequately prepare new teachers with skills necessary to integrate technology in their classes. Pre-service teachers must be taught with technology as well as exposed to ways in which technology can be used in their classes if technology is to reform the education process (Abdal-Haqq, 1995; Brownell, 1997; Fisher, 1997; Howland & Wedman, 2004; Parker, 1997; Pope, Hare & Howard, 2002; Schmidt, 1998; Shenouda & Johnson, 1995).

Theoretical Framework

Before examining the issues that directly relate to adoption and diffusion of educational technology innovations, it is imperative that a theoretical framework be established. Two different theories will be discussed in this section; Bandura's Social Learning Theory (Bandura, 1977) specifically as it relates to modeling and self-efficacy and diffusion theory. Two diffusion theories will be examined: (a) Instructional Technology Diffusion theory (Surry, 1997; Surry & Farquhar, 1997) and (b) Innovation

Decision Process Theory (Rogers, 1995). These theories establish a relationship between knowledge of these theories and their impact on the adoption and diffusion of technological innovations in teacher education programs.

Social Learning Theory

The major tenet of the social learning theory is that the social context plays a significant role in a learning situation. According to this theory, much of the learning that takes place happens vicariously, that is, through observing the behaviors of others. It also emphasizes the importance of modeling and imitation in learning. Learning via this mode is not restricted to the acquisition of new behaviors, but attitudes and emotions are also learned. Bandura (1977) cited online (http://tip.psychology.org/bandura.html) states:

> *Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally though modeling: from observing others one forms an idea of how new behaviors are performed and on later occasions this coded behavior serves as guide for action* (p. 22).

The theory also postulates that behaviors are more likely to be modeled if the observer perceives it as valuable and if the model is someone held in high esteem. Modeling can therefore be an efficient way of teaching new behaviors and determines the extent to which new behaviors become incorporated into the repertoire of an individual's existing behaviors. Modeling also impacts the frequency of new behaviors learned through observation. The social learning theory has a number of implications for education. If we were to agree that students learn by observing, then it is important that the teacher models appropriate behaviors, in this case, technology use.

Another dimension of the social learning theory, the construct *self-efficacy* is closely related to the notion of self-confidence. The primary principle underlying self-efficacy is that individuals are more likely to engage in behaviors when they feel confident they can accomplish the task; this means the individual has high self-efficacy. If there is a relationship between feeling competent and the probability of successfully accomplishing a task, this speaks volumes to the issue of preparing persons to participate in tasks they will be required to accomplish. This usually means providing them with the knowledge and skills required to perform the task. Thus teachers with high self-efficacy are more likely to use technology in their classrooms (Sprague, Kopfman & de Levante Dorsey, 1998).

Diffusion Theory

Instructional Technology Diffusion Theory. The field of Instructional Technology (IT) is undoubtedly one that hinges on innovations and the extent to which they are adopted. In fact, Surry (1997) describes the field as an *innovation-based discipline* (italics added). Instructional technologists are concerned with novel ways of delivering content to enhance learning and also developing new products and packages that will positively impact learning. As a result, it is important that instructional technologists be concerned with issues that influence adoption, diffusion and implementation of educational technology innovations. This knowledge will provide a broader perspective of the reason innovations are underused or misused and why practice does not always reflect the potentials of changing technologies.

Surry (1997) and Surry and Farquhar (1997) believe that diffusion theories can be applied to instructional technology at both the macro and micro levels. When applied at the macro level, instructional technology is used to reform an entire organization-Systemic Change Theories. When applied at the micro level, on the other hand, the focus is usually on applying diffusion theories to ensure that particular products are utilized-Product Utilization Theories. These two categories are divided into the Determinist and Instrumentalist theories. Determinists believe that technology is the source of social change. Little attention is paid to the person(s) who will be using the innovation; change will occur by simply putting technological devices in schools. Unfortunately, this shortsighted approach is the one taken by educational policy makers; as a result, technology in schools is often not effectively used. Determinists also focus on the development of products that will bring about change. Change is a complex process that results from an interaction of many factors. Therefore, developing innovative products will not automatically result in educational reform.

The Instrumentalist theory takes a different approach to educational change. Its primary focus is the "human and interpersonal aspects of innovation diffusion". The persons who will be using the innovation play a significant role and are viewed as "the primary force for change" (Surry, 1997). Therefore, the extent to which an innovation becomes adopted is dependent on how individuals within the organization perceive its impact on the organization and on their lives. Adopter based theories emphasize the *social context* in which the innovation will be used. Factors unrelated to the technology itself also determine whether it becomes adopted or rejected. Surry and Farquhar (1997) cite three major reasons diffusion theories may be significant in the field of instructional

technology-- first, it may give instructional technologists some of the reasons their products have not been used in classes. If instructional technologists understand the interrelationships of the myriad factors that influence adoption, then steps can be taken to overcome these potential barriers. Secondly, the authors view instructional technology as an "innovation-based discipline" in that instructional technologists are always producing new products and ways of teaching that will require educational reform. Finally, diffusion theory could lead to the "development of a systematic, prescriptive model of adoption and diffusion" which may define the field in ways similar to Instructional Design models.

Therefore, knowledge of innovation diffusion theories can provide instructional technologists with invaluable information regarding reasons innovations do not become adopted. This knowledge can provide them with information needed to proactively plan measures to put in place to facilitate technology use.

Innovation Decision Process Theory. Rogers (1995) developed one of the most influential innovation diffusion theories. He defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." (p. 5). He further sees diffusion as "a kind of *social change*" which involves restructuring the social system of an organization. The extent to which an innovation becomes adopted relies on the type of communication that occurs in the innovation diffusion stage. According to Rogers, an innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 11).

The Innovation Decision Process Theory defines a series of stages in the innovation decision process which starts with hearing about the innovation to deciding whether it actually becomes implemented in the organization. The stages are: knowledge,

persuasion, decision, implementation and confirmation. In the first stage, knowledge, members of the organization become aware of the innovation and its potential benefits to the organization or the system in which it will be implemented. The persuasion stage involves making a judgment about the innovation, while the decision stage includes making a choice to accept or reject the innovation. In the implementation stage, the innovation is used in the organization. Finally, after the decision to adopt the innovation has been made, there needs to be confirmation in the form of reinforcement.

The innovation diffusion process is influenced by a number of factors. These include communication, time, the characteristics of the innovation and the social system and climate that exists. The rate at which an innovation becomes adopted depends on a combination and interaction of these factors. If members of the organization realize the potential of the innovation to enhance their daily activities, adoption of the innovation is more likely to occur. Diffusion does not occur instantly, the diffusion process occurs over time. Therefore, allowing enough time for individuals to learn about the innovation is important as it can determine the rate at which the innovation is adopted.

Barriers to Technology Integration

Barriers to technology integration will be discussed under two separate headings: (1) reasons classroom teachers do not use technology in their classes, and (2) barriers to integrating technology in teacher education institutions. It is important that these be examined separately because these are two distinctly separate settings and though the barriers may be similar, they have different implications for each.

A synthesis of the literature reveals some common barriers across studies namely: teacher attitude, access, lack of time, teaching experience, lack of practice using technology, teacher training, lack of technical support, and teacher beliefs about the role of technology. This section of the paper will examine each of these barriers individually.

Barriers to Integrating Technology in Classrooms

Teacher attitude. Rogers (1999) argued that barriers to technology integration can be the result of either internal or external sources. Internal sources include "teacher attitude" or "perception" about technology. Teachers' attitude toward technology is a variable that determines the extent to which computers are used in classes as this may lead to computer avoidance (Bohlin, 1999; Pettenati et al., 2001). Computer avoidance becomes manifest in two ways, "computer anxiety" and "computer attitude". A person who experiences computer anxiety has a physical reaction to the computer and may experience higher levels of blood pressure and increases heart rate. On the other hand, the person who experiences "computer attitude" has a negative attitude to the computer and may decide not to use it in the classroom (Bohlin, 1999).

Teacher attitude toward technology can become manifest in one of two ways--teachers are either anxious about using the technology, or they do not realize the potential of the technology and as a result, do not see how using it in their classes will benefit their students. Sprague et al. (1998), believe that one of the primary reasons teachers do not use technology in their classes is that they are unaware of technology's potential to enhance the teaching-learning process. If this barrier is to be overcome, it is imperative that teacher training institutions expose teachers in training to the value of technology so

they can view it as something that will positively enhance their classroom activities rather than regard it as a "threat" (RAND Report, 1995). Teachers also need to realize the impact technology is having on their life and society in general; they must be exposed to the changing role of technology in communication, research and how it affects workplace practices. When teachers see the benefit of being technologically literate and the impact it will have on student learning, they are more likely to adopt technology innovations.

If teachers are to successfully use technology in their classes, they need an attitude that encourages them to be "fearless in the use of technology" (RAND Report, 1995). This new attitude is developed when teachers are sufficiently comfortable with the technology and knowledgeable on how to use it in their classes.

Inadequate Access/ Inadequate hardware/ software. The barrier discussed in this section has been variously called lack of funds, inadequate hardware and software, and inadequate access to technology. Lack of funds to obtain the necessary hardware and software has been proposed by many scholars as one of the reasons teachers do not use technology in their classes (Mumtaz, 2000; NCATE Report, 1997; OTA, 1995; Ritchie & Rodriquez, 1996). The Office of Technology Assessment (1995) surveyed graduates of teacher education programs in the United States to determine how they were using technology as well as to ascertain whether training received had sufficiently prepared them to use technology in their classes. The findings indicate that the most significant barrier to infusing technology in school was access to resources- hardware and software. A report on teachers' use of technology by the National Center for Education Statistics (September, 2000) indicates a correlation between availability of computers and

computer use. In general, teachers who had computers in their classes were more likely to use them in instruction than teachers who did not; more than 50% of teachers who had computers in their schools used them for research and activities related to lesson preparation. A total of 78% of teachers surveyed cited limited access to computers as a barrier to effectively using computers in their classes. Of this total, 38% thought "not enough computers" was a "great barrier" to using technology in their classes. The issue of not enough computers varied by school type and geographical area--secondary school teachers and teachers in large city schools were less likely to report lack of computers as a barrier than elementary teachers in small schools and rural schools. Therefore, access to hardware and software required for technology use is an issue that needs to be addressed.

Lack of time. Studies that report lack of time as a factor that hinders technology integration in schools (e.g., Mumtaz, 2000; Rogers, 1999) propose this barrier becomes manifest in two ways: (a) release time and (b) scheduled time. Results of a study conducted by the National Center for Education Statistics (2000) with in-service teachers revealed that 82% of the participants thought that lack of release time was the most significant factor that prevented them for using computers in their classes as well as prepare materials for use with their classes. Teachers felt that, with their regularly scheduled classes, they did not have enough opportunities to practice using computers in their classes.

Lack of time scheduled on the timetable to use computers with students is also a factor mentioned by teachers as a barrier to using computers in their classes. Approximately 80% of the teachers surveyed in the aforementioned study thought there

was not enough time scheduled for students to use computers. Even though some of the teachers had a genuine need to use computers with their students, there was no time available to do it. In a review of the literature on reasons teachers do not use computers, Mumtaz, (2000) identified lack of time required to successfully integrate technology into the curriculum as a recurring issue.

Teaching experience. One of the factors that determines the extent to which teachers use computers in their classes is the number of years they have been teaching. Findings from the National Center for Education Statistics (2000) study reveal that teachers with fewer years of experience were more likely to use computers in their classes than teachers with more years of experience. More specifically, teachers with three years or less teaching experience reported using computers 48% of the time; teachers with 4-9 years, 45% of the time; those with 10-19 years, 47% of the time, while teachers with 20 years or more reportedly used computers only 33% of the time. Teachers with fewer years teaching experience were also more likely to use the Internet at home to conduct research than their counterparts. This may be due, in part, to the fact that *new* teachers have been experienced to computers during their training and therefore, have more experience using this tool. In addition, these teachers may use the Internet for other reasons such as communication with peers, personal reasons such as shopping and locating information and are therefore more proficient in using the tool for class related research.

Lack of practice using technology. Rosenthal (1999) cited inadequate preparation to use technology as one of the reasons teachers do not systematically use computers in their classes. She believes teacher education programs fail to give teachers practice using technology tools and as a result, they go into the field with limited knowledge regarding how technology can be integrated in their teaching. Teachers need to be given opportunities to practice using technology during their teacher raining programs so that they can see ways in which technology can be used to augment their classroom activities.

Teacher training. It has been proposed that lack of training is the most profound reason for the underutilization of technology in schools (Brownell, 1991; Cole, 1996). Cole (1996) suggested that despite the fact that some teachers may receive training on "how to use the hardware and software" much of the training should focus on how to use technology to enhance classroom activities. Training should provide teachers with ways of using technology in their field experiences or teaching practice. The report by the National Center for Education Statistics (2000) indicated that there was a significant relationship between years of experience and the impact of training on ability to use computers. In general, 54% of participants reported that college work prepared them for using computers in their classes. However, this was higher among teachers with less than three years teaching experience and approximately.

Pope, Hare and Howard (2002) in a study with twenty-six pre-service teachers found that exposure to methods of integrating technology into their teaching during methods classes at college, increased their confidence levels. In addition, their levels of

confidence increased when their faculty modeled technology use in their clases. Fullan (1993), suggested that training should not be one-shot workshops, but rather ongoing experiences so that learners can be kept up-to-date with ever-changing technologies. Teachers need follow-up training sessions to ensure that they keep abreast with current technologies.

Lack of technical support. The National Council for the Accreditation of Teacher Education (NCATE) Report (1997) identified lack of technical support as one of the major barriers that resulted in computers being underutilized in the classes. Teachers did not want to use computers because they were not sure where to turn for help when something went wrong while using computers. The National Center for Educational Statistics (2000) survey found that 68 % of the teachers surveyed believed lack of support regarding ways of using technology in the class hindered technology use. The results also show a descriptive relationship between the significance attached to administrative support and years of teaching experience. More specifically, teachers with 10-19 years of experience perceived lack of support to be a greater barrier to their use of technology than teachers with 20 or more years experience. The survey also found that teachers in schools with no technical coordinator were more likely to cite lack of technical support as a barrier to their use of technology than teachers in schools with a technical coordinator. Sixty-four percent of the teachers surveyed identified lack of technical support or advice as a barrier to using technology in their classes. In a review of the literature on technology use, Mumtaz (2000) also identifies lack of on-site support for teachers using

technology as one of the reasons given by teachers for not using technology in their classes.

Teacher beliefs about the role of technology. Whenever there are new innovations, technology-related or otherwise, there has to be some degree of change in one's behaviors and beliefs (Fullan, 1992). Teachers' beliefs about technology can determine the extent to which it becomes integrated in the teaching-learning process. Ritchie and Rodriquez (1996) postulated that teachers may not fully understand the potential of emerging technologies to augment their teaching activities and this may, in part, account for why they do not use technology in their classes. Some teachers believe that having technology in the classroom will lead to disciplinary problems; others perceive the presence of computers and other technologies in their classes as "threats"--that somehow these devices will replace them. As a result, they do not want technological devices to be placed in their classes.

Another factor that may hinder effective technology integration in the classroom relates to teachers' concerns that technology in the classes will expose their students to inappropriate materials. Findings from the 2000 survey by the National Center for Education Statistics reveal that, although not high on the list of barriers, teachers' "concern about students' access to inappropriate materials" was given by 59% of the participants as a barrier to using computers in their classes. It should be noted, however, that only 13% perceived it to be a "great barrier" compared with 28% who thought it was a "small barrier". Teachers' failure to see how technology can accentuate learning and administration can severely hinder technology integration. Unless teachers see how

technology will benefit them and their students, it is quite unlikely that it will be used in the teaching-learning situation.

Barriers to effectively integrating technology in the classroom are many and varied. If one is aware of these barriers, steps can be taken to minimize their effects, and thereby play a more facilitative role in the technology integration process.

Barriers to Integrating Technology in Teacher Education Programs

A review of the literature indicates that the barriers to integrating technology in teacher education institutions are similar to those in elementary and secondary school classrooms. A number of studies have looked specifically at teacher education and the following factors have been identified as barriers to integrating technology in teacher education programs: (a) lack of equipment/inadequate access, (b) lack of time, (c) inadequate staff development/training, (d) lack of knowledge of the importance of technology, and (e) sociological factors.

Lack of equipment/ Inadequate Access. Lack of equipment or inadequate access to technological devices has been reported as a factor that significantly impacts the extent to which technological innovations are adopted in teacher education programs. Parker (1997), in a study of 42 faculty members of the College of Education at the Louisiana Tech University (LTU), found that one of the reasons technology was not "systematically" integrated into teacher education programs was lack of equipment. Sudzina (1993) from a synthesis of the literature on trends in educational computing also reports similar findings. She believes that the availability of hardware and software

influences the extent to which technology is incorporated into teacher education programs. Lack of materials has always plagued teacher education programs (Bullock, 2004; Barron & Goldman, 1994; David, 1994) and as a result, colleges of education are sometimes among the last group to have access to the facilities that will expose their students to technological innovations. Kortecamp and Croninger (1996) in a study with members of a teacher education program at the University of New England (UNE) found that one of the major barriers to technology diffusion was the high cost of acquiring, maintaining and upgrading technology. This is especially significant as technologies change so often.

There must be a source that will continually upgrade the technologies available if teacher preparation programs are to be on par with other organizations. If teachers do not have access to hardware and software required, then preservice teachers will not be exposed to and given practice using technology.

Lack of time. A number of studies found lack of time as a variable that hindered effective technology integration in teacher preparation programs (Parker, 1997; Sudzina, 1993). Time is operationalized in terms of time to learn how to use the technology as well as time to prepare for technology use in the classroom. Barron and Goldman (1994), in a survey of 70 faculty members of teacher education programs, found that "lack of time to learn about the equipment and to prepare to use new materials in the class" was a significant barrier to technology integration. Faculty, especially those who are not accustomed to using technology, need time to experiment with and practice using technology as well as time to learn how to integrate technology in their classes.

Inadequate staff development/ training. Teacher educators have identified scarcity of opportunities for staff development as another barrier to technology use. Barron and Goldman (1994), in their study found that institutions that had a great number of persons using technology were more successful integrating technology in the curriculum than those that did not. Faculty of teacher education programs have not been provided opportunities for staff development and as a result, are unable to model technology use with their students. Before faculty of colleges of education programs are required to integrate technology in their classroom practices, they have to be exposed to technology. McKenzie et al. (1996) recommend that professors participate in staff development activities so they can stay current with ever changing technologies. They need hands on experiences with the technology to see what it can do and how they can use it to facilitate their practices. Therefore, there is a need to train faculty who will in turn train pre-service teachers.

Lack of knowledge of importance of technology. One of the reasons technology is not successfully integrated in the curriculum of colleges of education is that some of these colleges have failed to realize the magnitude of the changes that technology is bringing to education. As a result, their pedagogies have not changed to reflect technological advancements (Rosenthal, 1999). Administrators and faculty of teacher preparation programs need to see the significant impact technology is having on the world in general. They should also realize that preparing a technologically literate populace should be one of their primary goals. McKenzie et al. (1996) report one of the

reasons technology was successfully integrated in a model at the West George College was that teachers realized the importance of training students to survive in a technological age.

Sociological factors. Cuban (1998) postulated that teachers' underutilization of technology is not limited to the narrow view of lack of hardware and software, training, time, etc. He proposed that chief among the factors related to underutilization is "teachers' beliefs about their authority and control of the students and what the teachers' role is" (p.7). The school is a complex social system with prespecified power relationships-- some teachers believe computers will change the social relationships that exist in classes. This, Cuban believes, accounts for a great part of why teachers do not use technology in their class as even in some cases where professors had access to technology and opportunities for training, technology was not used. Data gathered from studies with Stanford professors from 1980 to 1994 indicate that the growing presence of technology in schools did not correlate positively with technology use. In a 1994 survey with 750 undergraduate professors, Cuban (1998) found "Fifty-nine percent of the professors said that they never used a computer in the classroom; 19% said that they used the machines occasionally; and 8% said that they used the computers often" (p. 6). He also found that professors who cited "lack of time to develop relevant software for their course" did not take advantage of help available from consultants. Lack of technology adoption may be more a sociological factor than other reasons proposed. In a paper entitled *Computers meet classroom: Classroom wins* (1993), Cuban echoes this view. He states that the underutilization of technology may be attributable to "…dominant cultural beliefs about

what teaching, learning, and proper knowledge are and how schools are organized for instruction" (p. 206).

Educational change is a complex process which involves the interaction of many factors. This statement alludes to the fact that simply equipping schools with technological devices is necessary for, but not sufficient to facilitate technology integration. There are many other sociological variables that should be taken into account as these have a direct influence on the rate of adoption.

Factors that will Facilitate Technology Adoption

Adoption of technological innovations is not an end in itself. However, adoption is a critical phase as prior to implementation, any innovation has to be adopted. If instructional technologists are cognizant of the factors that facilitate the adoption process, they will be one step ahead of the game. A number of factors critical to the adoption of technological innovations have been proposed. These include (a) training or staff development, (b) access to computers, (c) modelling computer use, (d) support and leadership, and (e) positive attitude and self-efficacy.

*Training/ staff development***.** One of the key factors that facilitate technology integration in the classroom is training. If technology is to be integrated in colleges of education and positively impact performance, there is a need for intensive and ongoing staff development (Kimble, 1999) The RAND report on teacher training (RAND, 1995) reiterates the need for ongoing training to ensure that teachers achieve a level of comfort

with the technology. A statement made by one of the workshop participants effectively captures the need for going staff development- “we need professional development in the school’s water supply”. Training should not be conducted in “one-size fits all” or one size workshops, but should be ongoing to facilitate changes in technology as well as to provide support for teachers using technology (Jacobsen & Lock, 2004; Sprague et al., 1998). The Apple Classrooms of Tomorrow (ACOT) project, cited in Kimble (1999) recommends “30% of available technology resources be dedicated to providing ongoing staff development for teachers who are implementing its use”. This will ensure, or in the very least encourage teachers to continue using technology in their classes. Pettenati et al. (2000) suggested that teachers, “not only need to become proficient as users and acquire new technical skills, but they also need to learn to use the technological means effectively as an educational tool” (p.2). Teacher training programs should also be futuristic in training decisions. Technology is changing at a rapid pace; in order to keep abreast with ever changing technologies and the technological demands of the society, designers of teacher training programs must have a vision of how technology will be in the future and design programs that will cater to these needs (Dasher, 1997). Technology training should also be “hands-on” and practical. Simply telling teachers in training about the technology will not prepare them to use it--they need to see technology in use as well as be provided opportunities to practice using it themselves. Training should not focus only on “computing skills” but on ways of integrating technology into classroom practices (OTA Report, 1995; Parker, 1997; Pettenati et al., 2000).

The Milken Exchange on Education Technology study conducted by ISTE (1999) surveyed 416 teacher preparation institutions in the United States. The findings revealed

that teacher training institutions have to increase the amount of exposure teachers receive if they are to be prepared to use technology in their classrooms. It seems fit then to reiterate here a statement made by Rosenthal (1999). She postulated that, teacher training programs should ensure future teachers can use technology to facilitate communication, collaboration and develop their critical thinking and creative problem solving. The primary way to do this is through training. Kortecamp and Croninger (1996) report findings from a four-year study conducted at the University of New England with teacher education faculty. The findings indicate, "…careful planning combined with education and training are essential to garnering the support needed to bring about widespread and effective use of technology". Time should be dedicated to training so that teachers can see how technology can be used in their classes (Cole, 1996; OTA Report, 1995).

Access. Access to technology is a necessary ingredient to integration of technology in teacher education programs (Bullock, 2004; David, 1994; Parker, 1997; Surry, 2001). If teachers do not have the hardware and software required, then technology use will be hindered. The report from the National Center for Education Statistics (September, 2000) shows a relationship between frequency of use and the number of computers available. Teachers who had more computers available reported using them more often that those who did not. The report further proposed that teachers who had access to computers and the Internet in classroom were more likely to use them to facilitate instruction than those who did not have adequate access to equipment and network connections. Teachers who had computers at home were also more likely to use

computers in their classes than those who did not. There was also an association between years of experience and computer use. Therefore, if teacher training programs are to effectively prepare pre-service teachers to use technology, access is critical.

*Modeling***.** Modeling can provide a form of vicarious learning that can be quite powerful; through this medium, complex behaviors, attitudes and emotions can be learned. Methods of teaching displayed by teachers are usually reflective of the ways they were taught to teach during their teacher training (Barron & Goldman, 1994). If this is so, then this statement speaks volumes to the importance of modeling of technology use in teacher education programs. According to Munday (1991), the most effective way of integrating technology into teacher training programs is to incorporate it into the college curriculum through modelling by college professors. Despite the fact that modeling seems to be so effective in teaching new behaviors, many teacher educators do not model technology use and as a result, pre-service teachers do not get an opportunity to see technology in use. A number of reasons have been proposed for the paucity of modeling in teacher preparation programs. Findings from the OTA survey (1995) indicate that there were generally low levels of technology use in colleges of education classrooms. Students are neither taught with technology or how to use technology to enhance instruction.

The 1999 survey by ISTE found that over 70% of teacher training programs include some amount of instructional technology training. Many faculty members describe their technology facilities as “adequate”, however, the majority of these faculty

believed that ways in which technology can be used to facilitate teaching were not "adequately" for the pre-service teachers that they teach. The importance of modelling computer use by college faculty is supported by the fact that the report indicated that institutions that had a high level of success integrating technology had 75-100 percent of faculty modeling technology use. Faculty do not use technology in their own research and teaching; as a result pre-service teachers have been denied role model who have actively incorporated technology in the classes. Even if other faculty members do not use technology in their practice, it is imperative that faculty of teacher education programs use technology in their classes. They should also use technology while conducting and supervising field experiences (OTA Report, 1995) so that pre-service teachers will be exposed to ways in which technology can be used to augment their practices.

Bullock (2004) in a case study with two pre-service teachers aimed at highlighting their experiences as they used computers during their field experiences found a number of factors that facilitated or hindered their technology integration. He found that pre-service teachers use of technology was facilitated when, during their training, they were taught by faculty who used technology in their classes and encouraged pre-service teachers to do the same.

Support and leadership. The OTA Report (1995) on colleges of education found that institutions where technology was successfully integrated possessed certain key characteristics; these include strong instructional leadership, funding and support. Support and leadership is critical and can significantly determine the extent to which technology becomes integrated in schools. Integration is facilitated in situations where

the leadership body places great emphasis on technology use. Teachers need both technical and administrative support when they decide to use technology in their classes.

Fullan (1992) believes that the role of the leader is crucial to the successful implementation of educational innovations. If leaders are cognizant of the benefits to be gained from using technology in the teaching learning process, then technology use in school is more likely (Munday, 1991). Mackenzie et al. (1996) found that training programs that were successful were those that provided follow-up training and support as participants continued using technology. The leader must embrace technology and realize the role that technology can play in the teaching-learning process. The leader should also provide support and encouragement as members of the organization integrate technology in their practice.

Positive attitude and self-efficacy. Faculty's attitudes towards technology can determine whether technology will be used in the classroom. Teachers with positive attitudes are more likely to use technology than those with negative attitudes. Mann and Shafer (1997) in a survey of 4041 teachers found that there was a connection between "teachers' enthusiasm, initiative and sense of improvements" and the success of technology integration. They also found that teachers who thought technology was able to contribute to school reform and their own work were more likely to integrate it in their classes. According to Sprague et al. (1998), teachers with high self-efficacy are more likely to use technology in their classes.

Parker (1997) suggested that faculty attitude toward technology can influence pre-service teachers' attitude. Faculty's attitude toward technology will become manifest in

the way they use technology in their classes. As was stated earlier, learning does not only occur through direct instruction, but according to social learning theory, via observation as well. If teachers believe technology will enhance the way their students learn, they are more likely to use it (OTA Report, 1995). It is important then that teachers are exposed to the ways in which technology is changing their lives and the lives of their students Teachers who possess a positive attitude towards information and communications technology are more likely to use technology in their classrooms that those who do not (Mumtaz, 2000). Therefore, faculty need to display a positive attitude toward technology so that pre-service teachers can imitate this behavior.

David (1994) proposes four "local conditions for effective technology use". The figure below depicts the interrelationships between each of these factors. This diagram effectively summarizes the factors that should be in place to facilitate technology adoption in teacher preparation programs. It should also be reiterated here that the school is a social organization and the fact that these may be in place will not assure technology adoption. The social climate of the system, the people involved must be given due consideration in the reform process.

Effective Training Programs

Sally Bowman Alden, Executive Director of the Computer Learning Foundation (1989) identified five features that define *effective* teacher training programs. In recognition of the importance of teacher training to successful integration of technology

in schools, in 1998, the foundation hosted a competition among teacher training programs to identify features that defined effective training programs. The following were identified as necessary conditions: incentives and support for teacher training, teacher-directed training, adequate access to technology, community partnerships and ongoing informal support and training.

Incentives and support must exist for teachers who are participating in teacher training. At the college level, incentives may be in the form of college credits at the end of a training program. Bowman Alden also found that programs that were "teacher-directed" that is, based on the needs identified by the teachers themselves, were more successful than those that were "administrator-directed". Training programs should be designed to address the needs of the participants and should expose teachers to ways in which technology can be utilized in their classes. Teacher training programs should also "emphasize hands-on experience" and provide teachers with an opportunity to experiment with technology. This can be one of the primary means through which proficiency is achieved. In tandem with access to training opportunities, teachers must have access to computers in their classes; access correlates positively with use (Bowman Alden, 1989). Programs that had the support of the community were also more effective. Community partnerships can be a source for accessing resources required, hardware, software as well as human resources needed. Finally, effective programs were those that exposed their teachers to opportunities for continuous training to reflect the constant changes in emerging technologies. Ongoing training is needed to ensure continued technology use. Support can be in the form of collaboration among teachers as they

experiment with technology. When teachers work together, they can share experiences and talk about problems and success encountered while using technology.

Models for Integrating Technology into Pre-service Teacher Training

A number of models for effectively integrating technology into pre-service teacher education programs have been proposed; some of them will be discussed here. Schmidt (1998) postulates that two approaches have been primarily used in pre-service teacher education programs -- offering an undergraduate instructional technology course or integrating technology throughout all courses. Each of these approaches has its share of pro and cons.

In the first approach, a complete instructional technology course is offered to pre-service teachers as one of the courses in their program of study. This in itself can be problematic and counter intuitive because technology classes are usually focused on teaching students about using technology at the expense of exposing them to practical ways of applying it in their classroom practices (Parker, 1997). Brownell (1997) argued that pre-service teachers need to understand what computers can do, what learners can do with computers and ways of using them in their classes.

Findings from the ISTE survey commissioned by the Milken Exchange family Foundation (1999) show that simply implementing a single instructional technology course in teacher preparation programs is not usually very effective. Based on the findings of the study, researchers concluded that exposure to an independent Instructional Technology (IT) course does not does not equip pre-service teachers with skills required

to integrate computers in their classes. In an article entitled *Information Technology Underused in Teacher Education*, (September 2002) Bielefeldt proposed that while specific technology training is important, pre-service teachers who had been exposed to technology throughout their teacher training programs had higher levels of technology shills than those that had been exposed to computer courses.

Therefore, integrating technology across the entire teacher preparation programs seems a more viable option that requiring students to do a single instructional technology course. This approach seems the one more likely to result in increased technology use by new teachers. One of the recommendations of ISTE (1999) in that for technology to be effectively incorporated into teacher preparation programs, pre-service teachers should "complete a well-planned sequence of courses and/ or experiences that will help them understand and apply technology in education" (p. 23). Brownell (1997) suggested that technology should be integrated into methods courses and field experiences of all pre-service teachers.

Kortecamp and Croninger (1996) proposed a model that was successfully implemented in a teacher education program at New England University (UNE). The model, designed to improve faculty's skills so they could model technology use in their classes consisted of five components which the authors believe are interrelated.

- Familiarization with hardware and software
- Partnering with mentors
- Developing personal projects
- Becoming mentors
- Keeping current

The first phase of the model involves two steps. First faculty must become familiar with hardware and software that currently exist. When they are sufficiently familiar with current technology, this is followed by aggressive professional development to equip them with the knowledge and skills necessary to use the technology that exists.

The second phase, partnering with mentors, involves collaborating with other faculty members who are more experienced using technology. The main reason for doing this is so teachers get exposed to ways of using technology in their professional activity as well as to provide ongoing support for faculty who are less familiar with technology.

In the third stage, faculty are involved in designing projects that get their students to use technology in meaningful ways. This stage also includes two basic activities: modeling technology use in their teaching activities, facilitating and placing students in technology-rich field practices where they provide skilled supervision.

Finally, faculty members become mentors and guide their students in using technology. The final stage is especially important and technologies are constantly in flux; therefore, keeping abreast with new technologies is critical if technology is to be effectively used in teaching.

A systematic Design Model

McKenzie et al. (1996) describe a model that used Gagne's systematic design model as the basis for conceptualizing and developing a technology training program that was used at West George College to facilitate staff development. The model consists of three distinct stages:

Stage 1: Planning-- this phase involves doing a needs assessment to identify areas where training is needed. The target audience is also analyzed to ascertain their skills and knowledge so that the training program can effectively address these deficiencies in their knowledge base. The needs assessment conducted by McKenzie et al. (1996) revealed that areas such as the Internet, word processing, PowerPoint, e-mail, multimedia, desktop publishing and distance learning were identified as those needed by the participants.

Stage 2: Implementation phase--during this phase, the actual training takes place. Training is based on the needs identified in the previous stage.

Stage 3: Evaluation-- during the evaluation phase, the effectiveness of the training program is ascertained. The program was evaluated at the end of each training session where participants were required to respond to items using a five-point Likert Scale.

Using the systematic design model to design the training program resulted in positive outcomes. The authors reported that the technology training program at West George College was quite effective. The evaluation revealed that "instructors' knowledge of the technology" ranked highest after exposure to the training program. Results of the study also indicated that reported they were more confident in using technology after exposure to the training program.

RIPPLES

Surry, (2001) developed a model for enhancing the incorporation of technology into teacher training programs. This model was designed from the result of a systematic review of the existing literature as well as the results of responses to questionnaires that were sent to deans of colleges of education. The model consists of seven elements:

Resources, Infrastructure, People, Polices, Learning, Evaluation and Support, hence the acronym RIPPLES. Each of these elements will be examined in the subsequent section of the review.

Resources--refer primarily to "fiscal" resources. Although not given extensive consideration in the existing literature on adoption and diffusion of technological innovations, the deans surveyed thought that access to financial resources must be given consideration as this can determine if technology becomes incorporated in colleges of education curriculum.

Infrastructure-- refers to hardware, software, network connections and other physical resources required for technology integration.

People-- the third component of the model emphasizes the important role that people in the organization play. The beliefs, values and attitudes of people in the organization determine the extent to which an innovation becomes adopted and integrated in the activities of the organization. This stage of the model also emphasizes the importance of communication among stakeholders and involving all parties concerned in the decision making process. There is usually cooperative problem solving and decision making at this stage so that resistance will be minimized.

Policies-- there should always be a plan that outlines steps required and to be taken for adopting new technologies. The plan should also identify prospective sources for funding so that technological devices can be continuously upgraded and maintained.

Learning-- "Technology should not be seen as an end in itself" but as a means by which learning goals will be accomplished.

Evaluation-- involves an assessment of four main things: (1) the impact of technology on learning, (2) evaluating technology itself, (3) developing an integration plan to identify factors that facilitate or hinder adoption and integration process, and (4) return on investment (ROI) to determine correlation between project costs and benefits to be gained from it.

Support-- the final stage of the model reiterates the need for support as people use technology. There are four critical components of the support system:

- Training (formal and informal)
- Technical support
- Pedagogical support
- Administrative leadership

Support, both technical and administrative, is critical for technology

While this model has not been tested in actual classroom settings, the author maintains it is grounded in theory and therefore, should yield significant results. It is important to reiterate here that education change is a complex process and the result of a combination and interaction of a number of factors. Having the necessary prerequisite factors in place will not guarantee successful adoption and implementation of educational technology innovations, but will facilitate the process.

Synthesis of the Integrating Technology into Teacher Training Programs (IT_3P) Framework

The IT_3P framework is based on a synthesis of the literature on technology and teacher training. It is divided into two parts: prerequisite factors and process factors. Prerequisite factors pertain to features that should be in place in colleges of education to facilitate technology integration. These include the presence of a technology plan/policy; opportunities for staff development; access to resources required to facilitate the integration process; and support, both technical and administrative. As was stated previously, different stakeholders impact and are influenced by the model at different levels. At the prerequisite stage, the primary stakeholders include curriculum decision and policy makers, college of education administrators and faculty, and the business community.

The second section of the framework, process factors, presents factors that should occur while students and faculty interact in an effort to integrate technology in the teaching learning process. These factors are critical to ensure prospective teachers are provided with experiences required to equip them with knowledge and skills needed to integrate technology in their teaching. These include modeling technology use, modeling a positive attitude towards technology, training, and providing pre-service teachers with opportunities for practice through coursework activities as well as field experience. Each of these factors will be discussed in detail in the following section of the chapter. Prerequisite factors are required before process factors can be manifested. The presence of these factors will facilitate technology use at the college level.

The third factor, the outcome, results from the interaction between the prerequisite factors and process factors. This outcome is the integration of technology into teacher training programs.

Prerequisite factors

Technology Plan/Policy. The component of the IT_3P framework, defined as technology plan is evident on two different levels: (1) in terms of a physical document or a policy that should exist in all colleges of education and (2) a plan for a needs assessment to determine where training is required.

The technology plan--the physical document, should be the result of collaboration among all the primary stakeholders: curriculum policy makers, college administrators, faculty and members of the community. Faculty should be involved at this stage of the decision-making process so that there will be a kind of *shared vision* which will in turn, reduce the amount of resistance that may occur if dissemination of the technology policy is predominantly top-down. The technology plan should include a detailed physical document that outlines the goals of teacher training programs and how technology will be used to achieve these goals. The plan should also outline how technology will be procured, allocated and maintained (Kimble, 1999). The technology plan should also specify strategies for training faculty as well as how new staff will be employed and trained (Mehlinger & Powers, 2002).

In the second instance, plan is used here in a similar way as is used by McKenzie et al. (1996). They propose that during the planning phase, a needs assessment is done to determine pre-service teachers' technology knowledge and skills to identify the gap

between what exists currently and what is required. The needs analysis gives policy makers an indication of where training is required and what skills should be trained. Ideally, this step should be conducted prior to the development of the technology policy discussed previously.

Staff Development. Critical to the successful integration of technology in teacher training programs is the availability of opportunities for staff development. However, while providing faculty with staff development opportunities is required, this feature is insufficient in and of itself. For staff development to be effective, faculty must participate in these activities. One way of doing this is through providing faculty with incentives that will encourage them to participate in staff development activities.

Staff development should not only provide faculty with technology skills and hands-on-experiences using technology, but also expose them to ways in which technology can be used to facilitate practice (McKenzie et al., 1996; Pettenati, Giuli, & Abou Kahled, 2001). It should also be ongoing to facilitate the ever changing nature of emerging technologies (Kimble, 1999; RAND Report, 1995).

Sprague et al. (1998) propose that staff development activities should not be conducted in "one-size-fits all workshops" but should be customized to suit idiosyncrasies of different situations. Colleges of Education faculty also "need individualized instruction to explore software appropriate to their content areas and need support as they begin to implement new teaching approaches" (ISTE 2000-2002, p.15).

One of the most effective ways of ensuring faculty are equipped with skills required to integrate technology in their teaching is via one-to-one sessions where the

individual needs to each participant can be addressed (Stewart, 1999). Mentoring can be a means of professional development. The mentoring process can expose faculty to both technical skills as well as provide them with knowledge of ways in which technology can be incorporated into their teaching.

Howland and Wedman (2004) describe a professional development effort by one of the Preparing Tomorrow's Teachers to use Technology (PT3) program and found that to ensure future teachers use technology in their classes, it is essential that college faculty be equipped with required skills to pass these on to their students. To prepare tomorrow's teachers as technology users, faculty must be prepared to integrate computers in their teaching.

Therefore, faculty must be provided with staff development so they will be equipped with knowledge and skills to enable them to use technology in their teaching.

Access. If technology is to be integrated into the college of education curriculum, faculty and students must have adequate access to the latest technological devices and required infrastructure. Access to resources is included as a prerequisite factor because if there are outdated hardware and software and if faculty and students do not have access to resources, integration will be hindered.

This factor has been variously termed access, resources or infrastructure. While Surry (2001) makes a distinction between resources and infrastructure in his RIPPLES model, other scholars (e.g., Bullock, 2004; David, 1994; Parker, 1997) do not. Access, used here, will refer to the availability of hardware, software, telecommunication networks and infrastructures. It is important that available technologies at colleges of

education are on par with those available in the schools as well as the business community.

To ensure colleges have adequate access to technology, community support is critical. Colleges of education should develop partnerships with the community as they can be a potential source of funding to procure technological devices as well as to provide expertise. Access to current technologies should be provided to faculty and students both inside and outside the classroom.

Support. The final element included as a prerequisite factor is support, defined both in terms of technical and administrative support. Technical support refers to having a skilled expert available to assist faculty with technical issues while administrative support is somewhat less tangible.

Administrative support can become manifest in the form of encouragement to use technology in teaching, release time to learn about technology and how to use it to augment instruction; regularly scheduled meetings so faculty can share experiences regarding success and difficulties using technology as well as to get assistance and encouragement from each. Support can also come in the form of training sessions to facilitate continued technology skills development and technology use (Kinslow, Newcombe, & Gross, 2002).

Faculty should also be provided with technical support from an individual experienced in technology use as well as pedagogy. This person's primary role is to provide faculty with assistance when they have difficulties using technology, but should be available at all times to provide help when it is required.

Support for technology use has to be ongoing even after faculty decide to use it in their classes. It is critical to ensure continued use of technology tools in teaching.

Process Factors

Included in this section of the IT_3P framework are factors that should occur as college of education faculty integrate technology in their teaching. These factors apply more directly to faculty and, to a lesser extent, to pre-service teachers. Therefore, faculty should model technology use, model a positive attitude towards technology, provide students with knowledge and skills via training and ensure that they get practice using technology as teaching tools through coursework activities as well as during their field experience.

Modeling. According to Munday (1991) modelling computer use by faculty is one of the most significant ways of ensuring pre-service teachers are exposed to ways in which computers can be incorporated in their teaching. When college of education faculty model technology use, pre-service teachers get an opportunity to see how technology can be used in the classroom (Stewart, 1999) as well as how it can be applied in content-specific disciplines (Stuhlmann, 1998; Thomas, Larson, Clift, & Levin, 1996). Therefore, faculty should know how to integrate technology in their classes so they can, in turn, show teachers-in-training how to use it in their classes.

Positive Attitude. Attitude towards technology can become manifest in two ways: (a) technology affinity, which indicates a positive attitude towards technology, or (b)

technology aversion or a negative attitude towards technology. Faculty's attitude towards technology can determine the extent to which they use technology in their teaching. It also has an indirect impact on pre-service teachers' attitude. Teachers who display an affinity towards technology are more likely to integrate it into their classes than those with an aversive attitude (Mann & Shafer, 1999). If technology is to be successfully incorporated into teacher training programs, faculty must have and demonstrate a positive attitude towards technology.

Training. One way of ensuring pre-service teachers are provided with experiences necessary to integrate technology in their teaching is through training. The most typical way that has been adopted by colleges of education is by including an instructional technology course in the college curriculum. However, results of research indicate that requiring students to complete a single instructional technology course is not effective in equipping them with knowledge and skills necessary to use technology in their teaching (OTA, 1995; Stuhlmann, 1998; Thomas et al., 1996; Willis & Sujo de Montes, 2002). Training should not only focus on equipping preservice teachers with technology skills, but should also expose them to ways in which technology can be incorporated into specific content areas to enhance learning (Bielefeldt, 2001; Thomas, et al., 1996).

Field Experience/Practice. In tandem with exposing pre-service teachers to opportunities for training to equip them with knowledge and skills required to incorporate technology in their teaching, pre-service teachers should be provided with opportunities to see technology in use in actual classroom settings, as well as practice what they have

been taught. This practice can become manifest in the form of coursework, or by practicing with their peers, in contrived classroom settings. The most ideal way of ensuring pre-service teachers get practice using technology is through a combination of completing content-specific coursework as well as practice in actual classrooms. Faculty should ensure pre-service teachers are provided with opportunities to prepare technology-based lessons which require them to practice using technology as teaching tools in the classroom (Thomas et al., 1996).

According to an ISTE document entitled "Essential Conditions for Teacher Preparation" (2000-2002), "Prospective teachers must experience and observe effective uses of technology in their general education and major coursework…coursework must consistently model exemplary pedagogy that integrate the use of technology for learning content with methods for working with PK-12 students". During field experience, college of education candidates should be provided with opportunities to see technology in use, preferably under the supervision of technology using supervisors. Field experience can also provide a means of instilling in pre-service teachers that technology should be considered an integral part of their classroom environment (Stuhlmann, 1998).

Wetzel and Strudler, in their editorial report in the *Journal of Computing in Teacher Education* (Winter, 2002) postulate, " …field experience has a powerful effect on students' perceptions of what it means to be a teacher and clearly shapes their beliefs and practices" (p.30). Therefore, providing students with opportunities to use technology as well as see technology in use in actual classroom settings is a "critical step toward preparing technology-using teachers for the future" (Wetzel & Strudler, 2002, p.30).

The IT_3P proposes features that should be in place in colleges of education to ensure teachers are provided with experiences required to be able to integrate technology in their classes. Factors defined as prerequisite factors are necessary and should be in place to enhance technology integration. Process factors are those that occur while faculty and students interact at the college level. Since the IT_3P has included features from other models that have been successfully implemented in other settings, it can be considered a good conceptual framework for evaluating Jamaica's teacher training programs. Differences in settings will require modifications to reflect these differences.

Approaches for Integrating Technology in Teacher Education Programs

Gillingham and Topper (1999) propose four approaches for integrating technology into teacher preparation programs: (1) the single course approach; (2) technology infusion approach; (3) the student performance approach; and (4) the case-based teacher education program.

In the single course approach to teacher preparation, there is a single technology course within the program of instruction taught within the college by an instructor with experience with technology and pedagogy. However, from the discussion in a previous section of this discourse, it can be concluded that this is not the most efficient means of integrating technology in teacher preparation programs.

In the technology infusion approach, aspects of technology are interspersed into each course that students are exposed to during their program. In this approach, students

get a chance to see technology integrated in all areas of the curriculum and used by different faculty members teaching different subjects.

The student performance approach proposes that the student has the final responsibility to acquire the technology knowledge. This approach seems problematic; while some amount of independent learning is to be encouraged, students should not be given full responsibility for learning about technology. Students need to have access to models who demonstrate technology use.

Finally, in the case-based approach, teacher preparation programs include a series of cases in which teachers use technology. Each of these approaches has its share of potentials as well as problems. The particular approach chosen will depend on the availability of resources, human and otherwise, as well as the aims of the particular program. Based on the review of the literature, it seems that the technology infusion approach may be the most feasible and the one that will be most effective in not only teaching students the technical skills required, but also expose them to ways in which technology can be used to enhance teaching practices.

Common Threads Across Models

A review of the models proposed for integrating technology in teacher preparation programs indicates some commonalities among them. Firstly, simply requiring students to enroll in a single IT course in their program of studies is not sufficient for effectively preparing students to use technology in their classroom practices. Pre-service teachers need more prolonged exposure to technology; teaching them about it will not facilitate its

use. Therefore, technology use should be incorporated in all aspects of the curriculum with faculty modeling so that students will be exposed to ways in which technology can enhance their practice.

Secondly, a number of prerequisites must be in place if technology is to be successfully integrated into teacher education programs. Faculty must have access to staff development facilities that will prepare them to use technology. This is especially important as they will in turn model technology use so that pre-service teachers can learn, through observation, pedagogies for using technological devices in their classes. Resources required should also be in place. Teachers need to have access to hardware and software required for technology use. Technical support is also critical as teachers need ongoing support to ensure continued use of technology. Finally, teachers need to feel like they are a part of the innovation decision process. Therefore, there should be constant collaboration between the leader and members of the organization. The leader who perceives technology literacy as relevant for effective functioning in an information age is more likely to encourage pre-service teachers to use it as well as put the necessary facilities in place to ensure they are trained.

Technology integration takes time, time to learn about the innovation, time to be adequately prepared to use it. The factors mentioned here are minimum requirements. Their presence will not guarantee that a technological innovation will become built-into the curriculum; there are other variables at play. However, their presence will play a more facilitative role on the road to successfully incorporating technology in the teacher preparation curriculum.

Conditions that Facilitate Implementation of Educational Technology Innovation

Adoption of an educational innovation is not an end in itself. Rather, adoption and diffusion are antecedents to implementation. Therefore, after the decision to adopt an innovation, there is a final step that needs to be taken, implementation. A number of factors determine the extent to which an innovation becomes implemented in an organization. Ely (1999) identifies eight conditions that were common among programs that had successfully implemented educational technology innovations.

- Dissatisfaction with the status quo- there is the realization that something is wrong; the way things have been done is no longer effective. Members of the organization realize that there must be more effective and efficient ways of getting things done. When this occurs, the organization is ready for reform.
- Existence of knowledge and skills- for an innovation to be successfully implemented, persons responsible for implementing it must possess the knowledge and skills required to do so effectively. Therefore, prior to any attempt at implementation, training those involved should be given priority.
- Availability of resources- this includes hardware, software and funds. In other words, all the physical resources required for implementation must be available in sufficient quantities to facilitate smooth running of the process.
- Availability of time- time is required to obtain knowledge and skills required for using the innovation. There should also be time available to "plan for use", that is, time to plan for ways in which the innovation will be used.
- Rewards or incentives exist- rewards can be measured in terms of "satisfaction" with the innovation (internal) or it may be in the form of external rewards such as

monetary compensations. However, Ely (1999) found that external rewards were not reported as significantly important in the studies reviewed.

- Participation- in order for the innovation to be effectively integrated, stakeholders must "buy into" the innovation. One way of doing this is through "shared decision-making and communication". The research indicates that when stakeholders feel they are part of the decision making process and not simply implementing something that was conceptualized elsewhere and handed to them, implementation will be facilitated (Fullan, 1992). The process should therefore be more facilitative and not top-down.
- Commitment- there should be continuing support to ensure continued use of the innovation. Implementation is not an end in itself; after the decision to use the innovation, participants need continued support both in terms of encouragement and materials so that teachers will continue using the innovation.
- Leadership- this is critical to ensure successful implementation of the innovation. In the case of the school organization the role of the principal is critical. Innovations are more likely to be effectively implemented in schools where the principal has brought into the innovation. That is, where implementing the innovation will contribute to the development of the institution and will significantly impact the lives of the members of the school.

Recommendations for Integrating Technology in Teacher Education Programs

A number of recommendations for integrating technology into teacher preparation programs have been proposed. The NCATE Report (1997) identifies "changes" that teacher education programs need to successfully prepare new teachers to use technology in their classes. The report states that simply adding a course will not ensure change; change requires a "transformation of the culture of teacher education" (p. 9). This can be achieved in a number of ways.

Firstly, teacher preparation institutions need to create vision, a long-term view of how incorporating technology can enhance the program. This involves deciding what technology can do and how it will be used in the program. The vision should also include an examination of how technology can change the practices of future graduates of teacher training institutions. This should also include developing a plan; a physical document which details how the vision will become a reality. According to findings from the ISTE survey (1999), the majority of teacher training programs used in the study did not have a written technology plan that was updated on a regular basis. In addition, the data also showed that there was a connection between the presence of a technology plan and competence to teach with technology. The plan should include steps that will be taken to procure and distribute hardware and software required for the program. It must also include ways in which technology can be incorporated into the curriculum as well as ways in which teachers will receive on going support when they decide to implement the innovation in their classes. It should also include facilities that should be in place for staff development, acquisition of hardware and software as well as networking of computers and changing the existing curriculum to facilitate new pedagogies associated with using

new technologies (ISTE, 1999). The technology plans should also include a set of goals and objectives that can be achieved though integrating technology into the program (Kimble, 1999).

Brownell and Brownell (1991) propose three things that are required if pre-service teachers are to act as change agents:

- A required course on computer literacy for teachers
- Exposure in methods courses to the uses of technology to teach specific content and
- Field experiences where they can apply what they have learned.

Field experiences are critical to efficient use of technology in classes as students should be provided with instances that "allow experimentation" in using technology in practical situations (NCATE Report, 1997). Practice using technology will increase pre-service teachers' confidence as they become more comfortable using technological devices. Teachers need field experiences using technology under the supervision of qualified instructors.

Conclusion

The 21st Century classroom is one that is characterized by the presence of technological devices. Research has shown that the number of computers in classrooms will increase with time and reduced costs of procuring these devices. We are also living in a world where access to information plays a significant role in everything that we do. There are now multiple sources of getting information. For students to function in an

Information Age, they need to be technologically literate, critical thinkers and problem solvers. Emerging technologies support the development of these *cognitive behaviors*. However, despite the proliferation of computers in schools, computer use does not correlate positively with availability. The possibility also exists that technology will reform the education system. However, for this to occur teachers, the vehicle for educational change, must be given priority. Teachers must be equipped with the knowledge and skills required not only to use technology, but also be knowledgeable of the new pedagogies that will make integrating technology in every classroom a reality.

Chapter 3

Method

The present study was predominantly descriptive in nature as its primary aim was to describe *what is* regarding the current state of technology integration in Jamaica's teacher training programs. Further, the study also aimed at making recommendations regarding what should be in place in teachers' colleges to ensure prospective teachers are equipped with knowledge and skills required to incorporate computers in their teaching. This chapter presents the research design that was employed in the study. The following topics are addressed in the subsequent sections of the chapter: (a) research questions; (b) research variables; (c) research design; (d) sampling procedures; (e) instrumentation; (f) data gathering procedures; (g) methods of data analysis; and (h) how data collected were used to answer each research question.

Research Questions

The following four research questions were examined:

1. To what extent are components of the IT_3P evident in teacher training programs in Jamaica?
    a. What are administrators' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?

b. What are faculty's perceptions of the extent to which components of the IT_3P framework are evident in teacher training programs?

c. What are pre-service teachers' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?

d. Are there differences across colleges in the perceptions (a) teachers' college faculty and (b) pre-service teachers regarding evidence of components of the IT_3P framework in their teacher training programs?

2. To what extent are teachers' college faculty in Jamaica prepared to integrate computers in their teaching?

   a. What are faculty's perceptions of the extent to which they are prepared to integrate computers in their classes?

   b. What are faculty's perceptions of their levels of proficiency with computer productivity, communication and research tools?

   c. Are there differences across colleges in faculty's perceptions of their preparation to teach with computers?

3. To what extent are Jamaica's pre-service teachers prepared to teach with computers?

   a) What are pre-service teachers' perceptions of the extent to which the training they received during their college program prepared them to integrate computers in their teaching?

   b) What are pre-service teachers' perceptions of their levels of proficiency with computer productivity, communication and research tools?

c) Are there differences across colleges in pre-service teachers' perceptions of their preparation to teach with computers?

4. What do study participants propose as specific factors required to facilitate technology integration into Jamaica's teacher training programs?

Design

The primary design used in this study was a survey, supplemented with a number of field interviews and focus group discussions. A survey was the chosen method for this study for two main reasons: (a) the study required collection of data from a large number of persons located over a wide geographical area--therefore, administering survey instruments (primarily questionnaires) to these participants was the most efficient means of collecting required data, and (b) since one of the primary aims of the study was to gather various perspectives to describe and make inferences regarding the state of teacher training programs in Jamaica, data collection methods used in surveys are especially suited for the type of data required for this study. The researcher wanted to gather descriptive data regarding perceptions of various study participants, therefore, interviews and focus group discussions were integral parts of this design as these means were more suitable for capturing in depth opinions and perceptions.

Population and Sample

Target Population

The target population for this study was comprised of teachers' college administrators, faculty and pre-service teachers in six teachers' colleges in Jamaica. There were approximately 350 faculty employed in these six teachers' colleges. In addition, pre-service teachers who participated in this study were enrolled in the final year of their three-year teacher training program. According to data from the Joint Board of Teacher Education (JBTE), the body that certifies Jamaica's teachers, there are approximately 850 final year students in all six teachers' colleges across Jamaica--of this 850, approximately 475 attend the 3 colleges used in this study. Pre-service teachers were selected as a population to be studied for three main reasons: (1) they would have completed all their course work, including their instructional technology courses, (2) they would have had a combined three weeks of field experiences in schools from the first and second years of their program and (3) they are getting ready to go out on their extended teaching practice (internship) during the spring semester. Therefore, these pre-service teachers were a potent data source and equipped with knowledge required to provide data to answer the relevant research questions.

Sample

A two-stage sampling procedure was performed to select the sample for this study: (a) purposive sampling of teachers' colleges, and (b) selection of study participants--college administrators, faculty and pre-service teachers, within each college.

Teachers' colleges. There are six teachers' colleges located in different parts of the island: one in western Jamaica, three in the east, one in the south, and the other in central Jamaica. Recently, there has been a reclassification of the teacher training system in Jamaica and each college is now specialized and offers different programs to pre-service teachers. There are four program areas offered in the teachers' colleges in Jamaica--early childhood, primary (elementary), secondary, and early childhood education. Bethlehem Teachers' College offers primary and secondary programs; Church Teachers' College offers secondary education programs only; The Mico College offers secondary and special education programs; Sam Sharpe Teachers' College (SSTC) offers primary, early childhood and special education programs; Shortwood Teachers' College offers both early childhood and secondary education programs; and St. Joseph's offers both primary and early childhood education programs.

For the purposes of this study, respondents from three of these six teachers' colleges were purposely selected to participate in this study. In selecting these three colleges, two primary factors were taken into account: (a) geographic location, and (b) program offerings. Geographic location was used as an inclusion criterion to ensure pre-service teachers from different regions of the island were included in the study and program offerings was used to ensure pre-service teachers from each of the four different program areas were selected. Colleges used in this study are hereafter referred to as Colleges A, B and C to protect the identities of participants from these institutions.

Participant Sample

Three distinct samples within Jamaica's teachers' colleges were selected as sources from which data were collected: (a) teachers' college administrators, (b) college faculty, and (c) final year pre-service teachers.

College Administrators. The sample consisted of seven college administrators in the three teachers' colleges, six of whom participated in this study. Since the number of college administrators was so small, all were asked to participate in the study. However, one declined to participate citing lack of time as the reason for not doing so. However, since there were 3 administrators at this institution, the researcher believed others adequately supplied data required for the study. Each college administrator was contacted, first via telephone and informed of the researcher's intent to conduct the study as well as solicit his/her participation. Once consent was received, a follow-up correspondence was sent to each administrator where additional details of the study were given.

*Teachers' College Faculty***.** There are approximately 160 faculty members in the three teachers' colleges that constituted the sample for this study. An a priori estimate of sample size indicated that, given this population size and an established confidence interval of 95% and tolerance of ± .05, a sample size of at least 113 participants was required. Since the required sample size was relatively close to the actual population size, to ensure that the sample size was large enough, the researcher decided to send instruments to all academic staff members in all three teachers' colleges with the

expectation that at least 117 would be returned (an estimated response rate of approximately 69%).

Pre-service Teachers. Pre-service teachers from the three teachers' colleges enrolled in the final year of their three-year teacher training programs during the academic year 2003-2004 constituted this sample. Given a population of 475 pre-service teachers, a prior estimate of sample size with a confidence interval of 95% and a margin of error of ± .5 indicated that this sample should consist of a least 213 pre-service teachers. To ensure that there were at least 213 respondents, all final year students in all three colleges were asked to participate in the study.

Strategies for Increasing Response Rate

Fowler (1994) proposes a number of measures that a researcher can put in place to reduce non-response to survey instruments. These include:

- Making follow-up calls to potential respondents.
- Having flexible schedules especially when participants are to be interviewed. He also recommends that the researcher makes appointments with interviewees at a time and day that is more convenient to their schedules.
- The researcher should also send a cover letter to potential respondents that clearly states the purpose of the study and inform them that their participation is

voluntary. The letter should also inform potential participants of the significance of the study as well as enlist their participation in the study.

- To increase response rates to questionnaires, the researcher should make sure that the instrument is as easy to complete as is possible. This includes providing clear instructions about how the instrument should be completed as well as making sure that the questionnaires are attractive and easy to read. Questionnaires should also be as short as is required to collect data required for the study.
- The researcher should also conduct follow-up telephone calls and where possible, visit with study participants to remind them to complete the instruments.
- Additional instruments should also be provided to replace those that have been misplaced by study participants.

Fink (2003a) proposes some additional guidelines for promoting response rate to survey instruments. She believes the researcher should:

1. Provide cash or other types of tangible incentives to study participants. However, the researcher has to be careful not to violate any ethical principles.
2. Identify a larger number of participants who fit inclusion requirements of the study than those required in the sample.

To increase response rate in the present study, the researcher implemented the following strategies:

1. The researcher enlisted the support of teachers' college administrators and faculty who encouraged other respondents to participate in the study. College

administrators also organized meetings so instruments could be disseminated and collected easily and effectively.

2. The researcher also visited all three teachers' colleges and had face-to-face meetings with study participants. During these meetings, study participants were informed of the purpose and significance of the study and their participation enlisted. The researcher also conducted numerous follow-up visits at the different colleges to re-distribute and collect questionnaires.
3. Over-sampling -- for each set of study participants, the researcher selected and distributed the instruments to a larger group than was required for the study. This was one way of ensuring that the required number of instruments was returned.

Data Collection Methods

For the purposes of this study, four methods were used to gather data required to answer the research questions: (a) document analysis, (b) self-administered survey instruments, (c) face-to-face interviews, and (d) focus group discussions. These multiple data sources were used in this study to corroborate data gathered via individual instruments. The IT_3P framework formed the basis on which instruments used in the study were developed.

Document Analysis. Existing Instructional Technology college syllabi were examined to determine the extent to which these included components that expose pre-service teachers to ways in which computers can be incorporated into their teaching.

Questionnaires. Self-administered questionnaires were used in this study to gather data from faculty and pre-service teachers regarding perceptions of evidence of the IT_3P as well as perceptions of their preparation to teach with computers.

Interviews. For this study, the researcher used structured interviews to ascertain participants' perspectives of the extent to which aspects of the IT_3P were being implemented in teachers' colleges in Jamaica. Interviews were conducted with college administrators as well as instructional technology faculty members. These items were similar to those in the questionnaires and gathered data on the extent to which aspects of the IT_3P were being implemented in teacher training programs in Jamaica as well as faculty's levels of proficiency with computer tools.

Administrators were interviewed instead of being asked to respond to a questionnaire because the researcher wanted to ensure that they participated in the study. According to Weisberg et al. (1989), response rates are higher for face-to-face interviews than for questionnaires, therefore, while administrators did not have time to complete questionnaires, they were more inclined to make time for a face-to-face interview. A second reason for using interviews with this group was that the researcher wanted to capture certain attitudes and opinions that may otherwise be excluded if questionnaires were used.

Focus Group Discussions. Focus group discussions were used in the present study to collect data from pre-service teachers. This method was selected for use with this sample for two main reasons: (a) time and (b) to capture certain group dynamics that would not have been otherwise captured from questionnaires (Fowler, 1994). Since focus group discussions were conducted instead of individual face-to-face interviews, there was a significant reduction in the amount of time required to complete this activity and, at the same time, allowed the researcher to gather rich data from this group. The researcher also wanted to capture group dynamics associated with focus group discussions-- some were more willing, within the group setting, to discuss issues that were of concern to them. In focus groups discussions, participants were also more vocal regarding their attitudes on certain issues.

Since self-report data are not always reliable as participants may underreport or over report estimates of themselves and their skills, the researcher used focus group data as a means of validating data gathered via self-administered questionnaires. Focus group sessions were conducted with pre-service teachers from all three teachers' colleges. During focus group sessions, the researcher was able to obtain in-depth perspectives of their perceptions of their preparation to teach with computers as well as additional data regarding their levels of proficiency with computer tools.

Description of Instruments

Four instruments were developed for this study: (a) The Faculty Technology Integration Instrument (FTII) in the form of a self-administered questionnaire, (b) the

Pre-service Teachers' Technology Integration Instrument (PTTII) also a self-administered questionnaire that used rating scales; (c) Administrators and Instructional Technology Faculty Interview Schedules, and (d) the Focus Group Discussion Schedule (outline of questions that guided the discussion). Variables inherent in the IT_3P formed the basis on which instruments used in this study were developed.

Faculty Technology Integration Instrument (FTII). This self-administered questionnaire (see Appendix A) was designed to obtain information from teachers' college faculty regarding (a) the extent to which aspects of the IT_3P framework were being implemented in the teacher training programs in their college, (b) their perceptions of how well they considered themselves to be prepared to teach with computers, and (c) their computer proficiency. The questionnaire was comprised of 12 sections; the first (Section A) gathered demographic data (items 1-7). The subsequent nine sections (B-J) solicited faculty's perceptions of the following: (B) evidence of a technology plan or policy at their college (items 8-11), (C) faculty access to staff development opportunities (items 12-17), (D) administrative and technical support for faculty use of computers (items 18-20), (E) the extent to which faculty model computer use in their classes (items 21-24), (F) the amount and quality of training pre-service teachers receive in the use of computers (items 25-29), (G) the amount of practice pre-service teachers receive in the use of computers during their training and field experiences (items 30-35), (H) faculty attitude towards computers (items 36-48), (I) access to computers at their college (items 49-52), and (J) faculty's perceptions of their preparation to teach with computers (items 53-57). Participants were asked to respond to these items using a 4-point Likert-type

scale: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Agree*, to 4 = *Strongly Agree,* to indicate their level of agreement with the given statements.

Section K of the FTII solicited faculty's perceptions of their computer proficiency. Faculty were asked to use a 4-point rating scale: 1 = *Poor*, 2 = *Fair*, 3 = *Good* to 4 = *Excellent*, to rate their proficiency with each software category. Items in sections B through I were based on the IT_3P conceptual framework and provided data required to answer the first research question. Items in sections J and K provided data required to answer the second research question. The final section of the FTII (Section L) gathered data regarding the extent to which different types of software were used in classes or to complete class-related activities. Participants were asked to use the following 4-point rating scale: 1 = *Never*, 2 = *At least once per week*, 3 = *At least twice per week,* 4 = *At least three times per week*, to indicate how often they use the different types of software.

Pre-service Teachers' Technology Integration Instrument (PTTII). This instrument (see Appendix B) consisted of nine sections, seven of which included items aimed at ascertaining pre-service teachers' perspectives of the extent to which components of the IT_3P conceptual framework are evident in their teachers' college. The first section of this instrument contained six items that gathered data on demographic variables such as pre-service teachers' gender and age, as well as background information such as school attended prior to entering teachers' college, the college they currently attend, and whether or not they received any computer training prior to entering college.

Pre-service teachers were asked to respond to these items by checking the most suitable option.

Section B of the PTTII was comprised of items that gathered pre-service teachers' perceptions of their preparation to teach with computers (items 5-9). The subsequent five sections of the PTTII (Sections C to G) solicited pre-service teachers' perceptions of the extent to which components of the IT_3P were evident in their teacher training program and gathered data regarding (C) the extent to which they received training to use computers during the college experience (items 10-13), (D) the amount of practice pre-service teachers receive in the use of computers during their training and field experiences (items 14-19), (E) the extent to which faculty model computer use during their college experience (items 20-23), (F) access to computers at college, and (G) pre-service teachers' attitude towards computers (items 28-36). Pre-service teachers were asked to respond to these items using a 4-point Likert-type scale: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Agree*, to 4 = *Strongly Agree,* to indicate their level of agreement with each statement.

Section H of the instrument (items 37-47) was comprised of items designed to gather data regarding pre-service teachers' perceived proficiency with various computer tools. They were asked to use the following 4-point rating scale: 1 = *Poor*, 2 = *Fair*, 3 = *Good*, 4 = *Excellent*, to rate their proficiency with each software category. The final section of the instrument (Section I) gathered data regarding computer skills acquired at college. Participants were asked to use a 4-point rating scale: 1 = *Not at all*, 2 = *To a small extent*, 3 = *To a moderate extent* to 4 = *To a great extent,* to indicate the extent to which they were taught how to use the different types of software indicated.

Interview Schedules. Interviews were conducted with both teachers' college administrators and IT faculty--both were comprised of similar items. Interviews were divided into two parts: Part 1 was comprised of eight sections that solicited administrators' and IT faculty's perceptions of: (A) evidence of a technology plan, (B) access to opportunities for staff development for faculty, (C) administrative and technical support at college, (D) the extent to which faculty model computer use in their classes, (E) the amount and quality of training using computers re-service teachers receive during their college experience, (F) the amount of practice pre-service teachers receive during their training and field experience, (G) administrators' and IT faculty's attitude towards computers, and (H) faculty and pre-service teachers' access to computers at college. Items in the first part of the interview schedule gathered data regarding evidence of components of the IT_3P framework.

Part two of the interview schedule included open-ended questions used primarily to obtain participants' views of what should be in place in teacher training programs to ensure graduates are equipped with knowledge and skills required to integrate computers in their teaching. Interview data along with data gathered from other sources were used as a means of proposing recommendations regarding how Jamaica's pre-service teachers should be prepared to teach with computers.

Focus Group Discussion Schedule. The focus group discussion schedule was comprised of two parts. Part 1 was comprised of six sections that solicited pre-service teachers' perceptions of: (a) the amount and quality of computer training they received at

their college, (b) their perceptions of extent to which their teachers' college experience prepares them to teach with computers, (c) the amount of practice and experience pre-service teachers received during their training and field experience, (d) the extent to which they have access to computers during their college experiences, (e) the extent to which faculty model computer use in their classes, and (d) their attitude towards computers. Part 2 of the focus group discussion schedule was comprised of two questions that solicited pre-service teachers' perceptions of what they think should be in place at their college to ensure future teachers are prepared to integrate computers in their teaching.

Instrument Validity and Reliability

To assess the content validity of the questionnaires, three procedures were used: (1) a panel of experts was asked to review the questionnaires and provide feedback on content relevance and clarity, (2) a pilot test of each instrument was administered to a small group of participants similar to those who participated in the study, and (3) cognitive pretests were conducted with participants similar to those used in the study. While these three methods were used to assess the content validity of questionnaires, interview schedules and focus group discussion schedules were pilot tested and subjected to cognitive pretests. Cognitive pretests and pilot tests are two means of ensuring that items on the instruments that are potentially problematic are identified and rewritten before instruments are implemented in final study thereby reducing the probability of

non-response to survey items. A brief description of each of the procedures used is given below.

Content Validity

Panel Review. Firstly, to establish content validity, the questionnaires were reviewed by a panel of experts familiar with integrating technology in teacher training programs. Since the IT_3P framework and research questions formed the basis on which instruments were developed, the researcher sought to ensure all variables in the IT_3P as well as items that provided data required to answer the research questions were included in the survey instruments.

The review panel consisted of four persons: two members of faculty at the University of the West Indies, Jamaica -- one Instructional Technology faculty member, the other a faculty member of the Institute of Education who currently has an interest in technology and teacher training; a member of the Joint Board of Teacher Education (the body that certifies teachers in Jamaica), and a member of the Ministry of Education. The representative from the Ministry is currently working on a pilot project on technology integration in primary schools. Panel members were given a statement indicating the purpose of the study, research questions, constructs/variables the instruments were intended to measure, as well as a diagram of the IT_3P conceptual framework. They were asked to examine each of these along with the instrument and indicate whether the instruments would (a) adequately collect data required to answer each research question, (b) if all the variables in the IT_3P were represented by items on the instrument and, in addition (c) if items on the instruments and directions were clear. Since constructs were

reflected in the research questions, panels were given research questions as part of the document they were required to review.

Panelists were further asked to read items for clarity and other semantic, language- related issues. Finally, they were also asked to examine how items have been grouped together (subscales) to assess whether each group of items was measuring the construct it was purporting to measure. In general, there was consensus among panelists that all variables on IT_3P as well as items required to answer research questions were covered in the instruments. However, panelists expressed concern about how items that addressed "attitude towards computers" were developed. The researcher gave them a copy of the Hogarty and Kromrey (2000) survey that has been previously validated and which contains items similar to those on the instruments that were used in the present study. Panelists were satisfied with the detailed nature of the instrument and expressed a belief that the instruments would gather "rich and useful" data that may be valuable beyond the scope of this study.

Pilot Test. Questionnaires and focus group discussion schedules used in the study were pilot tested with 10-15 participants similar to those used in the study, however, a smaller number of participants were used to pilot test interview schedules. The pilot test was conducted with faculty and students from two teachers' colleges. Two factors informed the selection of participants for the pilot test, (a) geographic location of the college, and (b) program offering. Given the language situation in Jamaica, it was important that participants from two different sections of the island were included in the pilot test to ensure that problems associated with semantics and other language issues

were resolved prior to formal administration of the instrument. In addition, it was essential that participants from the various programs offered in teachers' colleges be included in pilot test so that this group was representative of the target sample. During the pilot test, participants were asked to do the following: (a) time themselves to determine how long it took them to complete the instrument and record the time taken, and (b) identify items that posed difficulty for them to respond to, for instance, items that were not clearly worded or were ambiguous.

Results of the pilot test were used to make revisions to the instruments before they were implemented in the final study. For instance, in the pilot test, approximately 90% of the pre-service teachers *strongly agreed* that they used computers to communicate with faculty and peers; however, in the cognitive pre-tests when asked if they used e-mails and discussion boards to communicate, they said "No". As a result, this item was changed to qualify what *communication* means in this context. Therefore, the item was revised to include e-mails and discussion boards as examples of using computers to communicate with peers and faculty.

Cognitive Pretests: A third measure used to ensure validity of instruments was cognitive pretests. Cognitive pretests are interviews with potential respondents in which the researcher asks respondents to interpret each question and response choice on the instruments (Fink, 2003b). The researcher asked a small group of participants from two of the colleges used in the pilot test to meet with her for the cognitive pretest. She then read aloud each item on the instrument and its options and asked participants to interpret

them. This was done to determine whether or not items were clearly communicating what they were intended to communicate to study participants.

Internal Consistency Reliability of Self-administered Questionnaires

Internal consistency is a reliability estimate to ensure all items grouped together on an instrument are measuring the same construct consistently. If an instrument has high internal consistency, then if participants strongly agree on one item, it is expected that they will also strongly agree on other items measuring the same construct. There are a number of procedures that can be used to assess internal consistency of an instrument. For the purposes of this study, the researcher used *Cronbach's Coefficient Alpha* to establish reliability of subscales, inter-item correlation, and item-to-item total scale correlation. Cronbach Coefficient Alpha was computed for items on both the Faculty Technology Integration Instrument and the Pre-service Teachers Technology Integration Instrument. Results of these procedures are reported in Chapter 4 of the study.

Procedures for Administering Instruments

This section of the chapter discusses the procedures for administering instruments that were used in this study.

Faculty Technology Integration Instrument. The principal of each teachers' college was asked to allow the researcher to visit one of the college's scheduled staff meetings to meet with and inform faculty of the purpose of as well as solicit their participation in the study. While this was successfully organized at College A and the

researcher was able to meet the majority of faculty members at one sitting, similar meetings could not be organized at the other colleges. At College B, one faculty volunteered as contact in that institution and disseminated and collected instruments on the researcher's behalf. At College C, however, the researcher had to visit, on numerous occasions, to speak with individual faculty members as well as distribute, re-distribute and collect instruments. In some instances, participants at this institution had to be given the same instrument on at least three or more occasions as participants reported they had not completed the instrument, but were not sure where they placed the ones previously given them. Participants were told that by volunteering to complete the survey instrument, they were indicating their consent to participate in the study.

Pre-service Teacher Technology Integration Instrument. Questionnaires were administered to pre-service teachers either during the first week of their scheduled orientation or later during that same semester when they were required to report to the colleges for one-day workshops. At Colleges A and C, data were gathered at scheduled meetings prior to their departure for their extended teaching practice assignment. At College B, however, the meeting was scheduled for a date later that semester. As a result of these scheduled meetings, the researcher was able to meet with large groups of the participants at one sitting to administer questionnaires--these were completed and returned on spot. During these meetings, respondents were informed of the purpose and significance of the study and their participation solicited. Despite the fact that these were scheduled, large group meetings, pre-service teachers were told their participation was voluntary and those who did not want to participate in the study could simply decline to

complete the instruments. They were further informed that by volunteering to complete the instruments, they were giving the researcher their consent to take part in the study. As a result of these meetings, the researcher was able to distribute and collect instruments quickly and efficiently, and, in turn, account for the high completion rate of approximately 89%.

Administrators' Interviews. To conduct interviews with college administrators, the researcher followed the four steps suggested by Weisberg et al. (1989). These are: initiating contact; selecting respondents; establishing interview conditions; and informed consent.

Initiating contact. Initial contact with college administrators was done via telephone--the researcher called each college and talked with the principal. Once contact was established, the researcher gave each administrator a brief overview of the study and solicited their participation. Participants were also faxed a copy of the informed consent form as well as copies of the interview schedules so these could be examined prior to the time for the actual interview. Face-to-face interviews were scheduled with each administrator.

Selecting respondents. Since the number of administrators in the 3 colleges was so small, all administrators were asked to participate in the study.

Interview Conditions. The researcher made an appointment for a day and time convenient to each college's administrator(s). Interviews were conducted in the

administrator's office in order to minimize distractions that may be present at other locations on the campus.

Informed consent. Despite the fact that participants were previously given a document that informed them of the purpose of the study, at the time of the interview, the researcher also gave each participant a detailed description of the purpose of the study and how data gathered would be utilized. Participants were also informed that their identities would remain anonymous and information gathered in the study will be reported as group data, therefore, data will be reported anonymously. Further, in reporting results of the study, the researcher will not report what individual participants said during the interview process. The researcher also requested permission to record the interviews on audiotape so that perceptions and opinions could be accurately captured and reported.

At the beginning of the each interview, participants were informed of the topics to be covered as well as the approximate time of the interview process. This estimate was derived from a pilot test done prior to the actual administration of the interview. Participants were also informed, at the beginning of the interview, that their participation in the study was an indication of their consent to be interviewed.

Faculty Interviews. Like the administrators' interviews, the steps proposed by Weisberg et al. (1989) were followed when conducting IT faculty interviews.

Initiating contact. Participants were informed about the interview at the beginning of the study. Individual IT faculty were contacted and their participation in face-to-face

interviews requested. Time and place for the interviews were also scheduled with each IT faculty.

Selecting respondents. Since the number of IT faculty at the three colleges included in this study was small, all instructional technology faculty were asked to participate in follow-up face-to-face interviews. Each of the three colleges used in this study had a minimum of two IT faculty--therefore, a total of seven interviews were conducted with this group of participants.

Interview conditions. Appointments were scheduled with each interviewee at a time and place that was most convenient for him/her. Each person was interviewed individually.

Informed consent. Since participants were previously informed of the purpose of the study, the researcher informed them of the topics to be addressed in the interview as well as the approximate length of the interview process. This estimate is based on a pilot test done previously. In all cases, faculty were given a sheet with actual questions that were to be asked so they could be somewhat prepared with their responses. During interviews, permission to audiotape interviews was requested and granted in all instances. While the first section of the instrument was comprised mainly of close-ended, structured items, participants were free, at all time in the interview process, to make additional comments on issues of interest to them. Interviews were conducted in the offices of IT faculty or at other locations within the staff room.

Focus Group Discussions. For this study, focus group discussions were conducted with pre-service teachers from each of the three teachers' colleges. At all three colleges,

during the week planned for their seminar, the researcher asked 15 students from each college to volunteer to participate in a 20-30 minute focus group discussion. Focus group discussions were conducted after pre-service teachers had completed their questionnaires. Students were eager to participate and focus group discussions were generally lively and interesting. The researcher and students who volunteered were given a room where the activity could be conducted. During the discussions, certain key questions that addressed the extent to which various components of the IT_3P are in place were asked. Students were also allowed to give their perspectives on the extent to which their training prepared them to teach with computers as well as what should be in place in colleges to ensure they are provided with knowledge and skills required to integrate computers in their classes.

In the focus group sessions, the researcher played the role of moderator. However, the researcher was the only person present with the students as she wanted to ensure that students felt free to express their opinions on the issues being addressed. Since the researcher wanted to ensure that opinions and perceptions were correctly captured, permission was requested and received and all focus group discussions were audio taped. As a back-up, the researcher also made hand-written notes.

Treatment of Data

This section of the chapter describes how data collected in the study were screened and analyzed. In order to perform the data analysis, the first step the researcher conducted was to develop an analysis plan. Fink (2003b) proposes that an analysis plan is

useful as it helps the researcher identify the type of analysis that will be done to answer each research question. The subsequent sections of the chapter describe how data gathered were used to answer each research question.

Coding

Coding involves assigning numbers to verbal answers to survey questions. It is important in large surveys where the researcher has large amounts of data to analyze. Coding is also a useful practice when computers will be used to analyze large amounts of data (Fink, 1985; Fink, 2003b; Fowler, 1984; Weisberg et al., 1989). For the purpose of this study, items in the questionnaires contained inherent codes for each response. Data were entered into the SAS software Version 8.0. In keeping with requirements of the SAS software, a period was used to indicate missing data or non-response to a particular item. To ensure data were correctly entered into the SAS software, instruments were selected at random by three independent observers (from a college not used in the study), and responses on instruments checked with data entered in SAS to make sure these were corresponding. Each observer was asked to choose at least five instruments for cross verification. Reviewers found no errors in data input in SAS software.

Qualitative data gathered via interviews and focus group discussions were coded to identify themes that emerged from these data. These themes informed content analysis of qualitative data. These data were also subjected to reliability tests where a faculty member, not assigned to one of the colleges used that participated in the study checked data for reliability of themes identified.

Missing Data

Survey researchers sometimes face the formidable task of dealing with missing data in survey instruments. Even in instances where survey response rate is high, there may be some items on the instruments that some respondents did not complete. Since survey respondents usually return instruments anonymously, researchers are not be able to follow-up with respondents to ask them to complete missing items. Besides, this is not practical in large scale surveys. There are a number of measures that can be put in place to deal with missing data. These include using "*statistical imputations*" where researchers "impute or estimate how respondents who did not answer particular questions would have answered them if they had chosen to" (Fink 2003b, p.21). However, this practice is often problematic as the research cannot accurately predict what the respondents will say; as a result, measurement error may occur. Another way to deal with missing data is not to report it at all. This too can be problematic as not reporting missing data can also result in measurement error.

In the present study, missing data were treated in the following ways: (a) for demographic data, the numbers of respondents who did not complete relevant items were reported, and (b) in cases where descriptive statistics were computed and reported, missing data were not reported and overall means and percentages were computed for only data provided.

Data Analysis Procedures

There are a number of procedures for analyzing survey data. The procedure selected is dependent upon a number of factors: (a) the type of data collected (b) the

variables being measured and the levels at which they are measured (c) the nature of the research questions (d) whether the researcher is looking for relationships, comparing groups, describing what exists in the setting being investigated; and finally, (e) if the data are recorded in numbers.

For this study, the researcher was primarily interested in describing the current state of technology integration in teacher training programs in Jamaica and to evaluate them in relation to what the literature proposes should exist. Quantitative data analysis techniques included descriptive statistics, specifically, percentages, means and standard deviations and inferential statistics (analysis of variance), to ascertain differences in perceptions among participants within and across colleges. For the ANOVA, composite means were calculated for individual IT_3P component subscales and one-way ANOVAs conducted to test differences between these means. Since there were also some qualitative data gathered from face-to-face interviews and focus group sessions, these data were subjected to content analysis.

Research Question 1

To what extent are components of the IT_3P evident in teacher training programs in Jamaica?

a. *What are administrators' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?*

Data required to answer this research question were gathered through structured interviews with teachers' college administrators in all three colleges. In analyzing these data, the researcher conducted a deductive content analysis where prerequisite and

process factors inherent in the IT_3P were used as pre-selected themes that guided the analysis. The data were then carefully examined to ascertain administrators' perspectives of the extent to which individual components of the IT_3P were evident in respective teachers' colleges.

In order to perform the content analysis, a number of steps were performed by the researcher.

Transcribe data. Since all data gathered via this medium were audio taped, the researcher undertook a comprehensive transcription of these data. This means that tapes were transcribed word-for-word in the first instance, after which data that could be regarded as *noise*, including asides such as jokes, were removed.

Become familiar with data. After data had been transcribed, the researcher examined them to identify emerging themes or recurring issues. The data were also examined to (a) highlight the perspectives of each interviewee to identify commonalities among and differences between responses given regarding evidence of components of the IT_3P, (b) describe how they could be used to support or refute data gathered via other means (c) answer relevant research questions, and (d) identify themes that emerged and how these could contribute to the analysis, inform revision of the IT_3P framework, or provide new information that was relevant and interesting. In reporting the data, direct quotations that emphasized interviewees' attitudes about and opinions of certain issues were included.

b. What are faculty's perceptions of the extent to which components of the IT_3P framework are evident in teacher training programs?

To answer this research question, the number and percent of faculty who concurred (strongly agreed or agreed) or were in disagreement (strongly disagreed or disagreed) that prerequisite and process factors delineated in the IT_3P are evident in their college were computed for each college and for the total sample of all three colleges combined. The data utilized were faculty responses on the FTII on items pertinent to prerequisite factors: (A) Technology Plan (items 8-11), (B) Staff Development (items 12-17), (C) Resources/Access/Infrastructure (items 49-52), (D) Support, technical and administrative, at the college level (items 18-20) and items pertinent to process factors: (E) Faculty modelling computer use (items 21-24), (F) Faculty attitude towards computers (items 36-48), (G) Pre-service teachers' training (items 25-29), and (H) Pre-service teachers' Field Experience/practice in Using Computers (items 30-35). In addition, data gathered from structured interviews with IT faculty were analyzed and used to corroborate or refute data gathered from another source.

c. *What are pre-service teachers' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?*

To answer this research question, the number and percent of faculty who concurred (strongly agreed or agreed) or were in disagreement (strongly disagreed or disagreed) that prerequisite and process factors demarcated in the IT_3P are evident in their college were computed for each college and for the total sample of all three colleges combined. The data utilized were pre-service teachers' responses to items in five sections (C-G) on the PTTII on items pertinent to prerequisite factors: (A) Resources/Access/Infrastructure (items 24-27), and process factors: (B) Faculty

Modelling Computer use (items 20-23), (C) Pre-service Teachers' Attitude Towards Computers (items 28-36), (D) Pre-service Teachers' Training to use Computers (items 10-13), and Pre-service Teachers' Field Experience/Practice using Computers (items 14-19). In addition, data gathered via focus group discussions were used to corroborate data gathered via PTTII.

d. *Are there differences, across colleges, in the perceptions of (a) teachers' college faculty and (b) pre-service teachers regarding evidence of components of the IT_3P framework in their teacher training programs?*

To answer this research question, subscale scores were computed for each of the four prerequisite factors and the four process factors based on faculty ratings of items on these subscales on the FTII and pre-service teachers responses on the PTTII. Means and standard deviations of these subscale scores were computed. Data were then subjected to one-way ANOVA procedures to determine if there are significant differences in perceptions between faculty and pre-service teachers on individual subscales across colleges.

Research Question 2

To what extent are teachers' college faculty in Jamaica prepared to integrate computers in their teaching?

a. *What are faculty's perceptions of the extent to which they are prepared to integrate computers in their classes?*

To answer this research question, the number and percent of faculty respondents indicating that they (1) strongly agreed or agreed or (2) disagreed or strongly disagreed with each of the five statements in Section J, "Preparation to Teach with Computers" of the FTII (items 53-57) were calculated. Data were examined and percentage of faculty who perceived themselves as prepared or not prepared to teach with computers reported. Data were reported descriptively.

b. What are faculty's perceptions of their levels of proficiency with computer productivity, communication and research tools?

To answer this research question, data regarding perceptions of proficiency with various computer tools were gathered in section K of the FTII and faculty were asked to use a four-point rating scale ranging from 1 = *Poor* to 4 = *Excellent* to indicate their proficiency with different computer software. Composite means were calculated for the total sample for each software type and proficiency levels reported by software type. The data were examined and software type that faculty perceived themselves to be most proficient and least proficient with reported. Composite means were also computed for faculty within individual colleges and cross-college comparisons done to ascertain differences in perceived proficiency levels across colleges.

c. *Are there differences across colleges in faculty's preparation to teach with computers?*

To answer this sub-research question, composite means were calculated for items in this subscale--these data were then subjected to a one-way analysis of variance procedure to ascertain if there were differences in perceptions of preparation to teach with computers among faculty from the three colleges used in this study. In addition, post-hoc analysis using Scheffé test was conducted to ascertain where differences lie.

Research Question 3

To what extent are Jamaica's pre-service teachers prepared to teach with computers?

a. *What are pre-service teachers' perceptions of the extent to which training they receive at college prepares them to integrate computers in their teaching?*

To answer this research question, the number and percent of pre-service teachers indicating that they (1) strongly agreed or agreed or (2) disagreed or strongly disagreed with each of the five statements in Section B, "Preparation to Teach with Computers" of the PTTII (items 5-9) were calculated. Data were examined and percentage of pre-service teachers who perceived themselves as prepared or not prepared to teach with computers reported. Composite means and standard deviations were also calculated for items in this subscale--these data were then subjected to Analysis of Variance procedure to ascertain if

there were differences in perceptions of preparation to teach with computers among pre-service teachers from all three colleges used in this study. In addition, focus group data were examined to ascertain whether these data corroborated data gathered from other sources.

b. What are pre-service teachers' perceptions of their levels of proficiency with computer productivity, communication and research tools?

To answer this research question, data regarding perceptions of proficiency with various computer software were gathered in section H of the PTTII and pre-service teachers were asked to use a four-point rating scale ranging from 1= *Poor* to 4= *Excellent* to indicate their proficiency with various types of computer software. Composite means were calculated for the total sample and for participants within individual colleges for each software type and a table of proficiency generated. The data were examined and software type that pre-service teachers perceived themselves to be most proficient and least proficient with reported. Composite means and standard deviations were also computed for pre-service teachers within individual colleges and cross-college comparisons done to ascertain differences in perceived proficiency levels across colleges. In addition, focus group data were also examined to substantiate or refute data gathered through the PTTII.

c. *Are there differences across colleges in pre-service teachers' perceptions of their preparation to teach with computers?*

To answer this research question, composite means were calculated for items in this subscale--these data were then subjected to a one-way analysis of variance procedure to ascertain if there were differences in perceptions of preparation to teach with computers among faculty from the three colleges used in this study. In addition, post-hoc analysis using Scheffé test was conducted to ascertain where differences lie.

Research Question 4

What do study participants propose are specific factors required to facilitate technology integration into Jamaica's teacher training programs?

To answer this research question, the researcher performed a content analysis on data gathered through interviews with teachers' college administrators and IT faculty and focus group discussions with pre-service teachers. Content analyses were performed on data gathered from each set of study participants. To conduct the content analysis, the researcher performed the following three steps:

Step 1: Transcribe data. Since all data gathered in interviews and focus group discussions were audio taped, a comprehensive transcription of these data was done. This means that tapes were transcribed word-for-word in the first instance, after which data that could be regarded as *noise*, including asides such as jokes, were removed.

Step 2. Become familiar with data. After data were transcribed, the researcher examined them to identify emerging themes or recurring issues that emerged. Direct

quotations that emphasized participants' perceptions of factors required to facilitate technology integrating into Jamaica's teacher training programs were also reported.

Step 3: Analysis. To analyze these data, a deductive approach was taken and data were examined to identify themes that emerged from the data. These themes were proposed as factors required to ensure future teachers are equipped with knowledge and skills required to incorporate computers in their teaching. In order for emerging themes to be proposed as factors required for technology integration, they have to be proposed by at least one participant from each of the three colleges used in this study. Data from each set of participants were analyzed separately to identify factors specific to different groups of participants.

Chapter 4

Results

This chapter presents results of the data that were gathered for this study and highlights how these data were used to answer each of the four research questions. The literature proposes eight factors that are characteristic of teacher training programs that have successfully integrated technology into their curriculum. These include having a technology plan, access to staff development activities, access to resources and infrastructure, technical and administrative support, modelling computer use by faculty, positive attitude towards computers, pre-service teachers' training in the use of computers and field experience/practice using computers. The present study examined and described the extent to which these factors are present in the Jamaican teacher training system. Further, the study also examined the extent to which teachers' college faculty and pre-service teachers perceived themselves as prepared to teach with computers. Finally, based on data gathered, a for integrating technology into Jamaica's teacher training programs was proposed. The chapter is organized into three broad categories: section one provides a description of each sample--teachers' college administrators, faculty and pre-service teachers, section two reported the internal consistency reliability results of the Faculty Technology Integration Instrument and the Pre-service Teachers Technology Integration

Instrument, and the final section (Section 3) report the results of the data analysis conducted to answer each research question.

Description of Sample

College Administrators. Six of the seven teachers' college administrators participated in this study yielding a response rate of 86%. There were four females and two males in this sample. Of the six administrators that participated in this study, there were two principals and four vice-principals. Administrators had qualifications ranging from masters' to doctorates--two of these respondents held doctorates and the remaining masters' degrees. However, one administrator at one of the colleges used in the study was currently pursuing a doctorate in Instructional Technology through a collaboration that college had established with an off-shore university.

Teachers' College Faculty: A total of 121 faculty members responded to the Faculty Technology Integration Instrument (FTII) yielding a response rate of 76% for this questionnaire. A descriptive profile of this sample is provided in Table 1 which shows a breakdown of the respondent sample by selected demographic variables--gender, age range, teaching experience and academic degree level.

As in shown in Table 1, the majority of the faculty sample was female (65.3%). This percentage breakdown was consistent for Colleges A and C; in the case of College B, however, the breakdown of males and females was about equal (45% & 47%). With regards to age, approximately 83% of the respondents were between ages 20 to 39. This was consistent across all three colleges; however, College A had the highest percentage

of faculty over 40 years age range (28.6%). Relative to years of teaching experience, the majority of the faculty respondents reported that they had been teaching 20 years or less (81.7%). This pattern was consistent across all three colleges. College B had the smallest percentage (5.7%) of faculty teaching 21 years or more.

Table 1

Demographic Breakdown of Faculty Respondent Sample by College and Total Sample

Demographic Factors	College A (N=35)	College B (N=53)	College C (N=33)	Total (N=121)
	N (%)	N (%)	N (%)	N (%)
Gender				
Male	9 (25.7)	24 (45.3)	5 (15.2)	38 (31.4)
Female	26 (74.3)	25 (47.2)	28 (84.8)	79 (65.3)
Missing		4 (7.5)		4 (3.3)
Age				
20 – 29	11 (31.4)	24 (45.3)	7 (21.3)	42 (34.7)
30 – 39	14 (40)	25 (47.2)	19 (67.8)	58 (48)
40 and over	10 (28.6)	4 (7.5)	7 (21.2)	21 (17.4)
Total Teaching Experience				
1 – 10 years	11 (32.3)	28 (52.8)	9 (27.3)	48 (40)
11 – 20 years	13 (38.2)	22 (41.5)	15 (45.4)	50 (41.7)
21 years and over	10 (29.4)	3 (5.7)	9 (27.3)	22 (18.3)
Qualifications				
Teachers' Diploma	1 (2.9)	0	0	1 (1.1)
Bachelor's	16 (45.7)	17 (32.1)	7 (21.2)	40 (33.1)
Master's	16 (45.7)	28 (52.7)	24 (72.7)	68 (56.2)
Doctorate	0	8 (15.1)	1 (3)	9 (7.4)
Missing	2 (5.7)		1 (3)	3 (2.2)

N = 121 Note. Numbers in parenthesis represent percentage

Approximately 56% of faculty respondents reported having a master's degree. This pattern was observed at all three colleges; however, a much larger percentage of faculty respondents from College C (73%) reported holding a master's degree. There were no faculty members at College A with doctoral degrees, one from College C, and the largest percentage (15%, N = 8) from College B**.** The only person with a Teachers' Diploma--that is, with no university training, but with teacher certification from a teachers' college, was at College A.

Pre-Service Teachers. A total of 268 pre-service teachers responded to the Pre-service Teachers' Technology Integration Instrument (PTTII) yielding a response rate of 56% for this questionnaire. A descriptive profile of this sample is provided in Table 2 which shows a breakdown of the respondent sample by selected demographic variables--gender, age range, type of high school attended, and prior training in computer software.

As is evident from the data represented in Table 2, the pre-service teacher respondent sample was comprised primarily of females (82%)--this percentage breakdown is consistent across all three colleges and represents the general trend in teacher training population in Jamaica. Almost all the sample (90.6%) were between the ages 19-39, but across all three colleges, more than 55% of these respondents were between the 19-29 age range.

With respect to the type of high school attended prior to attending college, over 48% of pre-service teachers surveyed reported they had attended Traditional High schools, that is, high schools that offer traditional subject areas and do not focus on the

development of technical skills. Students who attend these schools are most likely, after graduation, to enter professional fields such as nursing, teaching, medicine, and law.

Table 2

Demographic Breakdown of Pre-Service Teacher Respondent Sample by College and Total Sample

Demographic Factors	College A (N=89)	College B (N=99)	College C (N=80)	Total (N=268)
	N (%)	N (%)	N (%)	N (%)
Gender				
Male	12 (13.5)	14 (14.1)	10 (12.5)	36 (13.4)
Female	74 (83.1)	79 (79.8)	66 (82.5)	219 (81.7)
Missing	3 (3.4)	6 (6.1)	4 (5)	13 (4.9)
Age				
19 – 29	56 (62.9)	53 (53.5)	41 (51.3)	150 (55.9)
30 - 39	28 (31.4)	35 (35.4)	30 (37.5)	93 (34.7)
40 and over	3 (3.5)	8 (8.1)	7 (8.7)	18 (6.7)
Missing	2 (2.2)	3 (3)	2 (2.5)	7 (2.7)
High School Type				
Secondary	11 (12.4)	25 (25.2)	11 (13.7)	47 (17.5)
Traditional	46 (51.6)	44 (44.5)	39 (48.7)	129 (48.1)
Technical	12 (13.5)	11 (11.1)	8 (10)	31(11.6)
Comprehensive	20 (22.5)	17 (17.2)	21 (26.3)	58 (21.6)
Missing		2 (2)	1 (1.3)	3 (1.2)
Prior computer training?				
Yes	56 (63.6)	40 (40.4)	40 (50)	136 (50.7)
No	32 (36.4)	59 (59.6)	40 (50)	131 (48.8)
Missing	1 (1.1)			1 (.5)

N = 268 Note. Numbers in parenthesis represent percentage

The data also show that approximately 51% of these respondents reported they had received computer training prior to their teacher training experience. However, the highest percentage of respondents reporting prior computer training was from College A

(64%) and the lowest percentage from College B (40%). These respondents have received training primarily in the use of word processing software.

Internal Consistency Reliability of Survey Instruments

Faculty Technology Integration Instrument (FTII). Table 3 presents the internal consistency reliability (Cronbach Alpha) for subscales of the FTII. In addition, the item with total scale correlation within each subscale is reported.

Table 3

Internal Consistency Reliability of Subscales of the Faculty Technology Integration Instrument

Subscale	Number of Items	Cronbach Alpha	Item with Total Scale Correlation
Technology Plan	4	.85	.59 - .77
Staff Development	6	.83	.48 - .73
Support	3	.82	.66 - .69
Modelling	4	.83	.50 - .72
Training	3	.87	.52 - .82
Experience	6	.83	.41 - .75
Attitude	6[a]	.74	.39 - .64
Concerns about using computers	7	.77	.47 - .76
Preparation	5	.89	.66 - .79
Access	4	.85	. 59 - .78

[a] Number of items in this subscale reduced from 13 to 6 items. Remaining 7 items reported as concerns about using computers.

An examination of the data presented in Table 3 shows that for all the subscales but two on the FTII, Cronbach alpha ranged from .82 to .89 with the exception of the attitude subscale and concerns about using computers which had internal consistency reliability coefficient of .74 and .77, respectively. In general, the subscales showed strong internal consistency (interrelatedness) of the items within each subscale. With respect to

the Attitude Subscale, it should be noted that there were 13 items included in the original subscale. However, an initial analysis of the 13-item subscale yielded a rather low Cronbach Alpha (.37) suggesting that all the items were not measuring the same construct. A closer examination of these items indicated that some did not belong to the composite, therefore, the attitude subscale was divided into two sections--items that measured positive attitude towards computers (items 36-41) and items that gathered data regarding concerns about using computers (items 42-48). Items that gathered data regarding concerns about using computers were reported descriptively.

Pre-service Teachers Technology Integration Instrument (PRTII). In Table 4 is reported the internal consistency reliability (Cronbach Alpha) for subscales of the PTTII. In addition, item with total scale correlation within each subscale is reported.

Table 4

Internal Consistency Reliability of Subscales of the Pre-service Teachers Technology Integration Instrument

Subscale	Number of Items	Cronbach Alpha	Item with Total Scale Correlation
Preparation	5	.89	.45 - .71
Training	4	.86	.51 - .72
Experience	6	.85	.56 - .71
Attitude	5[a]	.72	.51 - .63
Concerns about using computers	4	.76	.54 - . 66
Access	4	.86	.58-.78
Modelling	4	.81	.39 - .75

[a] Number of items in this subscale reduced from 9 to 5. Remaining 4 items reported as concerns about using computers.

As is indicated from the data reported in Table 4, in all cases but two (the Attitude Subscale and Concerns about using computers), Cronbach Alphas ranged from .81 to .89 indicating strong internal consistency of items within a subscale. In addition, there is strong, positive item-to-item correlation for all variables used in the instruments. These data provide strong evidence that items that have been grouped on each of those subscales are measuring the same constructs. With respect to the Attitude subscale, Cronbach alpha of .72 was obtained for a reduced subscale of 5 items rather than the original 9-item subscale. With respect to the 5-item subscale that measured concerns about using computers, Cronbach alpha of .76 was obtained for this 4-item subscale. Like the FTII, only items on the PTTII that measured positive attitudes towards computers (items 28-32) were included in this analysis. Items 33-36 gathered data regarding concern about using computers--these items were dropped from the Attitude subscale and treated descriptively in the study.

Evidence of Components of the IT_3P in Jamaica's Teacher Training Programs.

Research Question 1

1. To what extent are components of the IT_3P evident in teacher training programs in Jamaica?
    a) What are administrators' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?

Data required to answer this research question were gathered through interviews with teachers' college administrators. These data were analyzed descriptively to identify

administrators', principals and vice-principals, perceptions of the extent to which prerequisite and process factors delineated in the IT_3P are evident in the three colleges used in this study.

Technology Plan. In general, administrators surveyed from all three colleges believed there was no evidence of a written technology plan at their colleges. What existed in all three teachers' colleges were plans for using technology to facilitate distance learning and for upgrading instructional methods using technology, but not a general, written technology plan. At College C, for instance, the administrator interviewed indicated that the college did not have a technology plan that existed *in black and white*. This respondent postulated that since the JBTE are currently revising the IT syllabus for Jamaica's teacher training programs, devising a technology plan within an individual college was not feasible at this time.

Staff Development. In response to the question of the availability of opportunities for staff development at individual colleges, administrators from all three colleges concurred that there were opportunities for staff development available to their faculty. However, there was a lack of consistency in perceptions of whether or not faculty had actually taken advantage of these opportunities. For example, administrators from College B postulated there are opportunities for staff development at that institution. They reported that staff development has been offered through partnerships with off-shore universities. One administrator stated, "A number of our lecturers are currently doing a master's or doctorate in Instructional Technology". In addition, administrators at

this institution reported that some faculty had "embarked on training in using computers during the summer and at other intervals within the school year". One administrator at College B stated:

> *In the training of the staff, the whole training of the staff, we have reached the stage now where we are quite comfortable. Members of staff are using cutting edge technology. (This college) is well on its way with regards to staff development. That does not seem to be an issue at (this college).*

An administrator at College C stated:

> *I think there are. I think some of them (faculty) are either not managing their time, but there is availability. There are in-house persons who are willing to help them, there are opportunities for them. There are opportunities, I don't know if they are making use of it.*

Resources/Access/Infrastructure. During their interviews, college administrators were asked to indicate their perceptions of the extent to which both faculty and pre-service teachers at their colleges have access to computers. Administrators from all three colleges were of the opinion that both pre-service teachers and faculty at their individual colleges have access to computers. However, in response to the question of whether faculty and pre-service teachers had adequate access to computers, administrators at all three colleges posited that they would not describe access to computers as *adequate*. A statement made by an administrator at College A, succinctly captures the perceptions of this group of participants regarding the adequacy of resources at their colleges. This respondent stated, "More resources would be welcomed and would facilitate computer use in the college". Similarly, at College B, one administrator said: "I do not think they

are adequate, adequate would mean each student having a computer". Another administrator at College B posited, "What we need are portable labs" so that computers can be taken to classrooms by individual lecturers. At College C, one administrator stated:

> *We want more. I don't think they (computers) are adequate. We want more resources like for instance the camcorder and digital camcorders. I think these are some of the things that would really help. The students are actually excited about the idea.*

Support (Technical and Administrative). The general perception among teachers' college administrators from all three colleges that participated in this study was that they are supportive of computer use within their colleges. In response to the question, *Do you encourage your faculty to use computers in their classes?*, one administrator at College C responded: "Yes, but they don't have many classrooms with computers--but then they can always change classes and have them downstairs" in reference to the computer lab. At College B, one administrator stated "Well, yes. We would say that we encourage it (computer use). It does not occur often right now, but we encourage it." They also proposed that technical support was available for faculty who want to use computers in their classes. In each of the three colleges there were trained faculty members available to provide assistance to faculty who want to use computers in their classes. At College C, there was at least one Peace Corps volunteer available to provide faculty with technical assistance.

Modelling Computer use by Faculty. The paucity of faculty who model computer use in their classes was common among the three colleges that participated in this study. In response to the question of whether or not they have observed faculty modelling computer use in their classes, administrators from all three colleges could indicate, by name, those faculty members who used computers in their classes. The general perception among this group of participants was that faculty used computers primarily to complete word processing tasks such as creating course outlines and quizzes. In addition, a few have been observed using the Internet for research as well as for personal tasks such as receiving and responding to e-mails. At College C one administrator stated: "… I think most of them have done their course outlines using the computer in the staff room, but, they do not use them in their classes".

Attitude Towards Computers. Administrators' attitude towards computers were ascertained through interviews. The data show that administrators from all three colleges displayed a positive attitude towards computers and their role in the teaching-learning process. The consensus among this group of participants is that computers should be available in all classrooms and used by both teachers and students to facilitate the teaching-learning process. In response to the issue of the use of computers in the classroom, an administrator from College A stated: "Computers should be used by teachers the same way they would use any other instructional tools like charts and TVs, they are important in the classroom". At College B, one administrator proposed "Teachers should use computers. If they have the hardware and software, they have to use computers, as this is a reflection of the times we are living in." At College C, one

administrator stated: “If it is used properly, computers can go a long way. The students are ready; the teacher can no longer be the repository of knowledge. Computers should be used to get them to think and make decisions and be creative.”

Training. During interviews, college administrators were asked to indicate the extent to which the training pre-service teachers receive during the college experience prepared them to teach with computers. Perceptions differed slightly among college administrators. An administrator from College A stated: “I would not describe it (computer training) as adequate, but we do our best with what resources we have”. At College B, one administrator made the following statement:

> *… we try as much as possible to expose much of the population to computers. We are talking about a population of over 1500 students. That’s a lot. And to bring them to the levels of competence that we would like to provide the types of hardware and software required to do that is a big challenge. But we do try as much as is possible to expose them to computers*.

The following statement was made by an administrator at College C regarding the extent to which pre-service teachers at that college receive adequate training to use computers in their classes: “*Yes, if they have that supported classroom. What I have found is that the students who are doing the Advanced IT are well on their way.”*

Field Experience/Practice Using Computers. In general, administrators were not certain whether or not students actually used computers at college or during their field

experience activities. However, at College C, one administrator noted: “There are some students who have a lap top; I have seen them using them outside under the trees”.

b) What are faculty’s perceptions of the extent to which components of the IT_3P framework are evident in teacher training programs?

Data required to answer this research question were gathered through the Faculty Technology Integration Instrument (FTII) as well as from interviews with Instructional Technology faculty. The data are reported separately for prerequisite factors and process factors depicted in the IT_3P. Data from the FTII are presented first followed by data gathered though interviews with IT faculty. For the purposes of description, the four response categories from the FTII (Strongly Disagreed and Disagreed and Strongly Agreed and Agreed) have been collapsed into two categories (Strongly Disagreed and Disagreed = SD/D and Strongly Agreed and Agreed = SA/A) and reported accordingly in Tables 5 to 13.

Prerequisite Factors

Technology Plan. As is evident in Table 5, the general perception among faculty from all three colleges is there was little or no evidence of a technology plan at their college. For all four items on this subscale, between 67% to 87% disagreed with each of the statements that measured the perceptions of the presence of a technology plan at their individual colleges. The majority of faculty from all three colleges (77% to 91%) disagreed that there was a technology plan in place at their individual colleges that stated

how teachers should be prepared to teach with computers as well as how computers will be acquired and allocated.

Table 5

Percent of Faculty Responding to Evidence of IT_3P Prerequisite Factor (Technology Plan) by College

	College A (N= 35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
Technology Plan								
Policy/plan states how teachers should be prepared to teach with computers.	83	17	82	18	91	9	85	15
Policy/plan outlines how computers will be acquired and allocated in my college.	77	23	88	12	97	3	87	13
Document from JBTE that outlines computers skills required to teach in the 21st Century classroom.	49	51	82	18	70	30	68	32
Plan outlines goals of teacher training and how computers can be used to achieve these goals.	49	51	80	20	69	31	67	33

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

However, while more faculty from both Colleges B and C disagreed that the JBTE outlines skills that teachers need in the 21st Century classroom, as well as the goals of teacher training and how computers can be used to achieve these goals, the converse was reported from faculty from College A.

Data gathered from IT faculty interviews corroborate the general perspective among faculty that colleges did not have a written, frequently revised technology plan. One IT faculty member at College A reported that he had written a technology plan under the previous college administration, but that the plan had been "put on hold" with the advent of new administration. However, other IT faculty at this same institution were not aware that a technology plan existed in their institution. At College B, IT faculty indicated there was a technology plan that was written by the principal. The primary objective of this plan is "To get all students computer literate and able to teach using the computer as a tool". A situation similar to that of College A also existed at this institution--other IT faculty were not aware of the presence of a technology plan. At College C, IT faculty proposed that while there was not a written technology plan, computers were acquired through partnerships with various organizations.

Staff Development. Six items on the FTII solicited respondents' feedback regarding the availability of opportunities for staff development at each college. Items were divided into two subgroups: (a) availability of opportunities for staff development in use of computers (items 12-14) and (b) faculty participation in staff development activities (items 15-17). These data are presented in Table 6.

From an initial review of the data presented in Table 6, it is evident that a slightly higher percentage (51%) of faculty members surveyed concurred there were opportunities for staff development for lecturers interested in using computers in their classes. For College C, 79% reported that workshops are offered at the college for lecturers to

improve their computer skills as compared with 20% and 19% reporting the offering of such workshops at Colleges A and B respectively.

Further review of these data show a majority of faculty surveyed indicated they had received training on how to use computers in their classes (59% to 72% concurrence from individual colleges). In addition, a majority an overall of 59% from all three colleges indicated they have received training to improve their computer skills.

Table 6

Percent of Faculty Responding to Evidence of IT_3P Prerequisite Factor (Staff Development) by College

	College A (N= 35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
Staff Development								
There are opportunities for staff development for lecturers interested in using computers in their classes.	52	48	73	27	15	85	51	49
Organizations such as the JBTE offer workshops for lecturers to improve their computer skills.	62	38	77	23	63	37	68	32
Workshops are offered at my college for lecturers to improve their computer skills.	80	20	81	19	21	79	64	36
I have received training on how to use computers in my classes.	31	69	41	59	28	72	36	65
I have received training to improve my computer skills.	37	63	36	54	36	64	41	59
I have participated in workshops and other staff development activities offered to improve my computer skills.	46	54	65	35	30	70	50	50

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

With respect to faculty's participation in staff development training, the general perception among faculty from all three colleges is that they have participated in workshops to improve their computer skills as well as workshops that exposed them to ways in which computers can be integrated in their classes. However, it should be noted that the majority (70%) of faculty from College B indicated that they have participated in workshops and other staff development activities offered to improve their computer skills as compared with 54% and 35% from Colleges A and B, respectively.

The data suggest that perceptions of availability of staff development opportunities were uneven across colleges surveyed. Faculty from College C reported more positively on availability of staff development opportunities, workshops offered at their college and their participation in these activities than faculty at Colleges A and B. Only with respect to training offered by the JBTE were all three faculties in concurrence where a majority reported a lack of offerings of these workshops.

Data gathered from interviews with IT faculty indicate that, at all three colleges included in this study, IT faculty have struggled with the issue of staff development. At College A, one IT faculty member indicated that while there are attempts at "in-house" training, these efforts were generally not successful because of lack of time and resistance from faculty. At College B, an IT faculty member noted that "we had staff development activities is previous times, but at present, these are generally unavailable". In addition, faculty "do not always take advantage of these activities". At College C, one IT faculty member suggested that while there are attempts at in-house staff development activities, these are not always successful. This respondent stated:

> *There are attempts at in-house staff development, but while faculty see the immediate need to get these skills, lack of time has been a factor that hinders them from taking full advantage of these opportunities. There have been no recent staff development efforts from organizations outside of the college community. Whatever training happens, occurs locally, within the college by members of technology faculty. These are not very frequently organized. However, some faculty members have received training on their own.*

IT faculty from all three colleges recalled that the last staff development activity that has been organized by external sources was conducted "over five years ago". At all three colleges, attempts at in-house staff development have been unsuccessful because of (a) lack of time or (b) resistance from faculty. While IT faculty from College C reported a paucity in the number of workshops offered at that institution, approximately 85% of college faculty surveyed from this institution concurred there are opportunities for staff development for lecturers interested in using computers in their classes. One of the possible reasons for this is that, as administrators at this institution indicated, courses are offered by off-shore universities for faculty who want to improve their computer skills.

Access/ Resources/ Infrastructure. This subscale on the Faculty Technology Integration Instrument gathered faculty's perceptions on their access to computers as well as pre-service teachers' access to computers at college. These data presented in Table 7.

An examination of the data presented in Table 7 show that overall a majority of faculty participants (93%) indicated that they have access to computers at college. However, a further examination of the data on access to computers shows a disparity in faculty's perceptions of pre-service teachers' access to computers across colleges. The majority of faculty from Colleges A and C (83% and 94% respectively) concurred that

their students have access to computers at their college as compared with 47% from College B. While 96% of faculty respondents from College B agreed that they have access to computers at college, on 57% indicated that if they want to teach a computer-based lessons, computers are available for use.

Table 7

Percent of Faculty Responding to Evidence of IT_3P Prerequisite Factor (Access/Resources/Infrastructure) by College

	College A (N= 35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
Access/Resources/Infrastructure								
I have access to computers at college.	20	80	4	96	0	100	7	93
During teacher training, my students have access to computers.	17	83	53	47	6	94	30	70
If I have to teach a computer-based lesson, there are computers available for use.	26	74	43	57	0	100	26	74
I can take my class to the computer lab to complete computer-based lessons.	34	66	62	38	6	94	39	61

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

With regard to whether or not faculty can take their classes to the computer labs, only 38% of faculty from College B concurred that they can take their classes to the lab as compared with 66% and 94% from Colleges A and C, respectively. In addition, only

57% of the faculty in College B concurred that computers are available for them to use if they wanted to teach a computer-based lesson as compared to 74% and 100% in College A and College C respectively.

Like faculty, data gathered from IT faculty interviews corroborate the perception of access to computers for both faculty and pre-service teachers at college. IT faculty at College A stated that they have access to at least three computer labs with about 80-90 computers that are fully functional. However, one IT faculty at this institution stated that "I would not describe access to resources as adequate, we need more to facilitate the number of students we have here". This respondent further stated that "students and faculty can use the labs when we are not using them for teaching". At College B, IT faculty believed faculty and pre-service teachers have access to computers and that faculty can take their classes to the computer labs to teach computer-based lessons. This perception was not consistent with what faculty at this institution reported. The reason for this difference in perception is not clear, however, one faculty member at this institution noted that if faculty want to use the computer lab for teaching their lessons, "they have to book the lab in advance--long in advance" if they want to use it. Similar opinions were reported at College C. One IT faculty member at this institution reported that "Students have access to the lab during the day and between 4:15 p.m. and 9 p.m. when classes are over", but we need more computers so there will be increased access".

Support at the College Level. For the purposes of this study, support was examined on two levels: (a) administrative support and (b) technical support. Three items on the faculty technology integration instrument gathered data regarding support at the

college level. Of these three items, 2 measured administrative support and the other, technical support. These data are presented in Table 8.

As shown in Table 8, the general perception among a majority (57% to 79%) of the faculty from all three colleges concurred that both administrative and technical support was evident in their individual colleges.

Table 8

Percent of Faculty Responding to Evidence of IT_3P Prerequisite Factor (Support at the College Level) by College

	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
				Support				
College administrators encourage and support computer use.	14	86	36	64	3	97	21	79
There is someone at the college to provide technical assistance.	12	88	22	78	0	100	13	77
There is support from administrators for lecturers who want to use computers.	33	67	59	41	30	70	43	57

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

However, in all instances, more faculty from College C concurred that support was evident at their college compared to faculty from the other two colleges. All faculty members from this institution who participated in the study agreed there is someone available at the college to provide technical support in the use of computers.

At all three colleges, IT faculty members interviewed indicated that college administrators are supportive of faculty's and pre-service teachers' computer use at their college. In addition, at all three colleges, there is a trained faculty available to assist faculty while they attempt to incorporate computers in their classes. However, these faculty are primarily trained in technology and do not necessarily possess pedagogical skills of integrating computers in the teaching-learning process.

Process Factors

Faculty perceptions of evidence of process in their colleges are reported in Tables 9 to 13.

Modelling. In this instrument, modelling computer use was explored to ascertain faculty's perceptions of the extent to which they model computer use in their classes, model a positive attitude towards computers and, the extent to which they feel competent to model computer use. The data reported in Table 9 show that the general perception among faculty from all three colleges included in the study is that they did not model ways in which computers can be used as teaching tools. Overall, 67% of faculty surveyed reported that, in their teaching, they did not model ways in which computers can be used as teaching tools. Similarly, a majority (73%) of these respondents disagreed that they show their students how to use computers in their classes. A total of 83% of faculty surveyed concurred that they modeled positive attitudes towards computers. However, only 38% of these respondents agreed that they feel competent to model computer use for their students. A closer examination of the data reported in Table 9 indicate that more

faculty at College C (64%) disagreed that they felt competent to model computer use for their students as compared with 56% and 35% from Colleges A and B, respectively.

Table 9

Percent of Faculty Responding to Evidence of IT_3P Process Factor (Modelling) by College

Item	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
				Modelling				
In my teaching, I model ways in which computers can be used as teaching tools.	65	35	57	43	85	15	67	33
I show my students how to use computers in their classes.	83	17	56	44	88	12	73	27
I model positive attitude towards computers.	9	91	8	92	39	61	17	83
I feel competent to model computer use to my students.	56	44	35	65	64	36	62	38

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

The data presented in Table 9 show that relative to faculty modelling positive attitudes towards computers, 91% and 92% of faculty from Colleges A and B, respectively, concurred that they modeled these attitudes towards computers--only 61% of respondents from College C reported modelling positive attitudes towards computers. Only at College B did a majority of faculty (65%) concur that they felt competent to model computer use for pre-service teachers.

To corroborate data gathered from self-administered questionnaires, during interviews, IT faculty members were asked if they had observed any faculty member modelling computer use in their classes. Responses to this question ranged from "Never" to "No" to "Sometimes" to the identification, by name, of one or two faculty members who have used computers in their classes. At College B, one IT faculty member noted "one person uses a lap top and a multimedia projector constantly, others do not". At College C, one IT faculty member stated:

> *Yes, not a lot. I would want it to be more frequent, because we have a number of multimedia projectors, some of them will take the multimedia projectors to classes. For instance, Mr. C. in Reading, the people in Guidance will try it. Not a lot of the other lecturers use it for actual teaching, they probably use the lab for getting resources, personal uses, the Internet, that sort of thing*.

Attitude Towards Computers. Thirteen items on the Faculty Technology Integration Instrument gathered data regarding faculty's attitudes towards and concerns about using computers. The first six items measured positive attitude towards computers. The remaining items represented those that identify faculty's concerns about using computers. These data are presented in Tables 10 and 11.

The data represented in Table 10 show that the majority (93% to 100%) of faculty respondents from all three colleges agreed with items that measured positive attitudes towards computers. A closer examination of the data reported in Table 10 show that all faculty members from College B and 97% from both Colleges A and C concurred that computers can improve quality of learning in schools.

Similarly, all faculty from Colleges A and C agreed computers should be placed in all schools. In addition, 90% to 96% of these respondents agreed computers should be placed in all classrooms.

Table 10

Percent of Faculty Responding to Evidence of IT_3P Process Factor (Positive Attitude Towards Computers) by College

	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
				Positive Attitude				
I believe computers can improve the quality of learning that takes place in schools.	3	97	0	100	3	97	2	98
Students who have access to computers are more likely to do better.	18	82	22	78	19	81	20	80
Computers are important learning tools.	0	100	2	98	0	100	1	99
Computers should be placed in all schools.	3	97	0	100	6	94	3	97
Computers should be placed in all classrooms.	4	96	10	90	7	93	8	92
Having computers would enhance my teaching.	14	86	10	90	6	94	10	90

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

Table 11

Percent of Faculty Responding to Evidence of IT_3P Process Factor (Concerns about using Computers) by College

	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
Concerns About Using Computers								
Access to computers should be limited to the school library.	94	6	91	9	94	4	92	8
Students should be monitored when using computers.	26	74	58	42	21	79	38	62
Having computers in my class is a waste of resources.	94	6	100	0	100	0	98	2
If I use computers, I would not have enough time to complete the syllabus.	85	15	95	5	94	6	92	8
I feel nervous when I have to use computers.	74	26	75	25	85	15	78	22
If I have computers in my class, I would use them with my students.	9	91	13	87	3	97	9	91
Computers are potential sources of distraction in the classroom.	76	24	86	14	90	10	84	16

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

With regard to concerns about using computers, overall, only 8% of faculty surveyed agreed that access to computers should be limited to the school library. In

contrast, 62% concurred that students should be monitored when using computers. Only 2% of faculty agreed that having computers in classes is a waste of resources. Similarly, only 8% of faculty members concurred that if they used computers in their classes, they would not have enough time to complete their syllabus. Only 22% of the respondents agreed that they are nervous when they have to use computers. In addition, 91% of faculty surveyed concurred that if they had computers in their class they would use them with their students. Only 22% agreed that they felt nervous when they have to use computers. Similarly, only 16% of these respondents agreed that computers are potential sources of distraction in the classroom.

Data gathered through interviews with IT faculty members indicated that all IT faculty members from all three colleges displayed a positive attitude towards computers. They were also of the opinion that administrators, faculty and pre-service teachers were positive about using computers in their teaching.

Training. Items in this subscale gathered faculty's perceptions of the extent to which the training pre-service teachers receive during their college experience prepares them to use computers in their classes. These data are presented in Table 12.

The data reported in Table 12 indicate that, in general, only 40% of faculty surveyed concurred that training pre-service teachers receive prepares them to teach with computers. While a small majority of faculty from College A (51%) and College C (65%) concurred that training pre-service teachers receive at their colleges prepares them to teach with computers, only 17% of faculty from College B shared this perspective.

Table 12

Percent of Faculty Responding to Evidence of IT_3P Process Factor (Training) by College

Items	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
				Training				
Training students receive prepares them to teach with computers.	49	51	83	17	35	65	60	40
Students in my college are taught how to teach with computers.	31	69	71	29	19	81	46	54
Methodology classes expose students to ways in which computers can be used as teaching tools.	24	76	27	73	38	62	29	71
At my college, there are courses specifically designed to teach students how to integrate computers in their classes.	15	85	62	38	22	78	34	66
At my college, there are courses that teach students specific computer skills.	15	85	63	37	3	97	32	68

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

Similarly, while faculty from College A and College C agreed that pre-service teachers at their colleges are taught how to teach with computers, only 29% of faculty from College B shared this view. However, more faculty (62% to 76%) from all three colleges concurred that methodology classes expose pre-service teachers to ways in which computers can be used in their classes. In addition, while more faculty from both

College A (85% in both instances) and College C (78% to 97%) concurred that there are courses at their colleges that expose pre-service teachers to how computers can be integrated in their classes as well as teach them specific computer skills, the opposite was reported from faculty from College B (38% and 37%).

During interviews, one IT faculty member at College A indicated that pre-service teachers are exposed to two Technology in Education courses at this institution. This respondent explained that the first of these two courses focuses on basic computer literacy and exposes pre-service teachers primarily to Microsoft Office software. This is an in-college course and is examined within that particular college. The second course is the one that is common among all teachers' colleges in Jamaica and is mandated by the Joint Board of Teacher Education (JBTE) and exposes pre-service teachers to ways in which computers can be incorporated in their classes. At Colleges B and C, pre-service teachers are required to complete one course, "Introduction to Educational Technology" which is a requirement of the JBTE. One IT faculty member from College C noted, however, that they have started a program that exposes pre-service teachers to two courses similar to those at College A, however, current final year students would not have benefited from this program.

Field Experience/ Practice. Items in this subscale of the Faculty Technology Integration Instrument gathered faculty's perceptions of the extent to which pre-service teachers receive practice using computers during their training as well as during their field experience activity. These data are presented in Table 13.

Table 13

Percent of Faculty Responding to Evidence of IT_3P Process Factor (Field Experience/Practice Using Computers) by College

Items	College A (N=35)		College B (N=53)		College C (N=33)		Total Sample (N=121)	
	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA	SD/D	A/SA
Field Experience/Practice Using Computers								
I require my students to use computers to complete course assignments.	46	54	48	52	78	22	55	44
My students are required to use computers for class presentations.	67	33	70	30	94	6	75	25
I assign activities that require my students to use the Internet for research.	31	69	21	79	28	72	26	74
I encourage my students to use computers to communicate.	86	14	24	76	91	9	60	40
During TP, I require students use computers to prepare lessons.	75	25	83	17	87	13	82	18
During teaching practice, I ask my students to use computers to complete classroom activities.	75	25	90	10	94	6	87	13

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

As is evident from the data in Table 13, a majority of faculty surveyed disagreed that they required their students to use computers to complete course assignments (55%) or for class presentations (75%). In contrast, 74% of these respondents concurred that

they assigned activities that require their students to use the Internet for research. In addition, a majority (82% and 87%) of these faculty members disagreed that students are required to use computers to prepare their lessons or to complete classroom related activities during their teaching practice activities.

While the majority of faculty from College A (86%) and College C (91%) disagreed that they required their students to use computers for communication, 76% of faculty from College B agreed that they did. The data in Table 13 also indicate that the majority of faculty reported that their requirement for computer use by pre-service teachers was limited to using computers to complete course assignments and to use the Internet for research.

IT faculty from all three colleges required students to use computers for class presentations, research and to complete course assignments. At both Colleges A and B, however, they did not require pre-service teachers to use computers during their practicum activities. According to an IT faculty from College A, “Ideally we would want them to, but they do not have access to lap tops that they can take with them, or to computers in their teaching practice schools”. At College C, however, IT faculty proposed that pre-service teachers who have IT as their “Advanced” area are required to use computers during their practicum.

d) What are pre-service teachers' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?

Data required to answer this research question were gathered through the Pre-service Teachers Technology Integration Instrument as well as focus group discussions with pre-service teachers. The data were examined by responses to prerequisite and process factors depicted in the IT_3P model and are reported separately. Data from the PTTII are presented first followed by data gathered though interviews. Prerequisite factors data are presented in Table 14; process factors are reported in Tables 15 to 19.

Prerequisite Factors. Only one prerequisite factor, *Access to Resources*, was included on the Pre-service Teachers Technology Integration Instrument as this was the only prerequisite factor that was relevant to this population. Items in this subscale gathered data regarding pre-service teachers' perceptions of the extent to which they had access to computers at college during their teacher training experience. These data are presented in Table 14.

The data reported in Table 14 indicated a consensus among pre-service teachers that they have access to computers at college (100% agreed) and that they can use computer labs to complete their course assignments (90% of the total sample agreed). In addition, the majority (60%) of these respondents concurred that they can use the computers in the lab to complete class-related activities during their practicum. A majority of pre-service teachers from both Colleges B and C (78% and 99%, respectively) agreed that they have access to the Internet at their college, however, at

College A, approximately 94% of the respondents reported that they did not have access to the Internet.

Table 14

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Prerequisite Factor (Access/Resources/Infrastructure) by College

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
I have access to a computer lab at college	0	100	0	100	0	100	0	100
If I want to use computers to complete class assignments, I can use the computer lab.	1	99	23	77	0	100	10	90
I have access to the Internet at college.	94	6	22	78	1	99	40	60
If I want to use computers to prepare lesson plans or complete activities needed for teaching practice, I can use the computers in the lab.	30	70	27	73	38	62	35	65

Note: SD/D represents responses indicating Strongly Disagree and Disagree; A/SA represents responses Agree and Strongly Agree

During focus group discussions responses to the question of access to computers at college included: “To some extent, not enough, sometimes, only some persons have access to the computers”. In addition, a pre-service teacher from College C stated: “There are rules about when we can use the lab and there are not always enough computers for all the students to use”. Pre-service teachers from all three colleges suggested that they did not have *adequate* access to computers at their college. At College A for instance,

one pre-service teacher stated that “sometimes some of the computers are not working and there are no computers for us to use”.

During focus group discussions it was ascertained that pre-service teachers at College A did not have access to the Internet at their college. These data are consistent with those gathered in the PTTII where 94% of the respondents disagreed that they have access to the Internet at college. Respondents from College B reported that they have access to the Internet, but one pre-service teacher stated, “If you want to use the Internet, you have to pay”. Respondents from all three colleges agreed that they can use computer labs, however, they have access to the labs only “at special times” when the labs are not being used for classes or other scheduled activities.

Process Factors

The following four process factors were examined in data gathered in the PTTII: modelling, positive attitude towards computers, training to teach with computers, and field experience/practice using computers at college and during field experience. Pre-service teachers’ responses are reported in Tables 15 to 19.

Modelling. Items in this subscale gathered pre-service teachers’ perceptions of the extent to which faculty model computer use in their classes as well as display a positive attitude towards computers. The data in Table 15 show that a majority of pre-service teachers surveyed reported that their faculty did not model computer use in their classes (73%) or show them how to teach with computers (70%). In addition, 68% of pre-service

teachers from all three colleges disagreed that during their college experience, their lecturers used computers as teaching tools.

Table 15

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Process Factor (Modelling) by College

Items	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
				Modelling				
My lecturers model computer use in their classes.	61	39	80	20	77	23	73	27
My lecturers use computers as teaching tools.	63	37	68	32	73	27	68	32
At college, lecturers show us how to teach with computers.	53	47	86	14	70	30	70	30
My lecturers display a positive attitude towards computers.	27	73	41	59	20	80	30	70

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

In contrast, the majority (70%) of these respondents concurred that their faculty modeled a positive attitude towards computers. Generally, pre-service teachers from College B rated the extent to which faculty modeled computer use at their college more negatively than their counterparts from both Colleges A and C. In contrast, pre-service teachers from College A generally rated items in this subscale more positively than their counterparts in Colleges B and C.

During focus group discussions, the question of whether or not faculty model computer use in their classes resulted in resounding laughter from pre-service teachers. A respondent from College C proposed, “At one point one teacher took us to the lab to use the Internet. Teachers do not even use PowerPoint slides in their classes”. Similar views were shared by pre-service teachers from Colleges A and B. Data gathered through this medium support data gathered through questionnaires and indicate that pre-service teachers, for the most part, did not perceive that their faculty modeled computer use in their classes.

Positive Attitude Towards Computers. Items in this subscale of the PTTII gathered data regarding pre-service teachers’ (a) attitude towards computers, and (b) concerns about using computers in classes. The first five items on this subscale gathered data regarding pre-service teachers’ attitude and the last four items focused on concerns about using computers in their classes. Table 16 presents data on positive attitude towards computers.

The data reported in Table 16 show that, in general, a large majority of pre-service teachers (66% to 97%) with items that measured positive attitude towards computers. For instance, 98% of these respondents concurred that computers are important learning tools. This response pattern was consistent at the individual college level with 95% to 100% of these respondents concurring with these items. However, with regard to the extent to which students with access to computers are more likely to do better than those who do not, only approximately 59% to 74% agreed with this statement. This pattern was consistent among respondents from all three colleges.

Table 16

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Process Factor (Positive Attitude Towards Computers) by College

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
				Positive Attitude				
I believe computers can improve the quality of learning that takes place in schools.	1	99	3	97	3	97	3	97
Students who have access to computers are more likely to do better than those who do not.	32	68	41	59	26	74	34	66
Computers are important learning tools.	1	99	5	95	0	100	2	98
Computers should be placed in all schools.	5	95	9	91	1	99	5	95
Computers should be placed in all classrooms.	19	81	12	88	2	98	12	88

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

Concerns about using Computers. Table 17 presents data regarding pre-service teachers' concerns about using computers in their classes.

With regards to concerns about using computers in their classes, the data presented in Table 17 show that 99% of the respondents disagreed that computers are potential sources of distraction in the classroom. Similarly, 95% disagreed that access to computers should be limited to the school library. In contrast, 36% disagreed that students should be monitored when using computers. Only a limited number (14%) of

pre-service teachers surveyed concurred they are nervous about using computers in their classes.

Table 17

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Process Factor (Concerns about using computers) by College

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
Concerns About Using Computers								
Computers are potential sources of distraction in the classroom.	100	0	98	2	100	0	99	1
Access to computers should be limited to the school library.	96	4	91	9	100	0	95	5
Students should be monitored when using computers.	45	55	18	82	47	53	36	64
I feel nervous when I have to use computers.	95	5	86	14	77	23	86	14

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

Focus group data regarding pre-service teachers' attitudes towards computers corroborate data gathered via the PTTII. The data indicate that in general, pre-service teachers from all three colleges displayed a positive attitude towards the computer and the role it can play in the teaching learning process. They were of the opinion that computers are important learning tools and can improve the quality of learning that takes place in schools. They also believe that students who have access to computers are likely

to do better in schools that those do not. At College A, one respondent proposed that "access to computers can expose learners to another world that they have only imagined. The computer combines images and sounds to make things real. Therefore, learners need to be exposed to this new world". These respondents indicated that they were not nervous about using computers and are looking forward to using computers in their classes.

Training. Items on this subscale gathered data regarding pre-service teachers' perceptions of the extent to which training they received at their college prepared them to integrate computers in their classes. These data are presented in Table 18.

As is reported in Table 18, only 37% of pre-service teachers surveyed concurred that their teacher training programs exposed them to ways in which computers can be used to manage their classroom activities. While a majority of pre-service teachers from College B agreed that their teacher training programs exposed them to ways in which computers can be used to manage their classroom activities, the contrast was observed in responses from pre-service teachers from both Colleges B and C. At these institutions, only a small percentage (21% and 19%) from Colleges B and C, respectively, agreed with this statement. In addition, 45% of pre-service teachers reported training received during their college experience equipped them with knowledge and skills required to teach with computers.

Table 18

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Process Factor (Training) by College

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
Training								
My teacher training program exposed me to ways in which computers can be used to manage my classroom activities.	24	76	79	21	81	19	63	37
My teacher training equipped me with knowledge and skills required to plan lessons that involve students using computers.	46	54	71	29	74	26	55	45
My teacher training equipped me with knowledge and skills required to teach with computers.	43	57	78	22	66	34	63	37
My teacher training program exposed me to different software that can be used in my classes.	41	59	86	14	63	37	64	36

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

Similarly, 37% reported teacher training equipped them with knowledge and skills required to teach with computers and 36% concurred that their teacher training program exposed them to different types of software that can be used in their classes. On all four items in this subscale, the pattern of responses from pre-service teachers at College A differed somewhat from that from Colleges B and C. More specifically, a

higher percentage of pre-service teachers from College A concurred with each of these statements than their peers at Colleges B and C.

During focus group discussions, pre-service teachers described training they received on how to integrate computers in their classes as *minimal*. At College C, for instance, one respondent stated, "assumptions were made about our computer skills, therefore, courses were not carefully designed to cater to the needs of students who had little previous experience using computers." In addition, respondents from all three colleges proposed that while the primary source of their technology training was through their Introduction to Educational Technology class, the course did "not directly" expose them to ways in which computers can be used as teaching tools, but more on how to use particular software, primarily word processing software--exposure to other types of software was minimal. At College A, for instance, pre-service teachers indicated that they had been exposed, *to a small extent*, to using presentation software such as PowerPoint. Pre-service teachers from all three colleges indicated that their teacher-training program did not provide them with adequate exposure to computers and how these tools can be integrated in their classes.

Field Experience/Practice Using Computers: Items in this subscale gathered data regarding pre-service teachers perceptions of the extent to which they used computers during their teacher training or during their field experience. These data are presented in Table 19.

Table 19

Percent of Pre-Service Teachers Responding to Evidence of IT_3P Process Factor (Field Experience/Practice Using Computers) by College

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
Field Experience/Practice Using Computers								
At college, I use computers to conduct research.	15	85	26	74	30	70	24	76
At college, I use computers to complete course assignments.	2	98	16	84	29	71	16	84
At college, I use computers to communicate with peers and faculty.	82	18	78	22	73	27	78	22
During my teacher training, I used computers for class presentations.	63	37	72	28	64	36	66	34
During teaching practice, I used computers to prepare my lessons.	59	41	57	43	80	20	65	35

Note: SD/D represents responses indicating Strongly Disagree and Disagree; A/SA represents responses Agree and Strongly Agree

The data represented in Table 19 show that 76% of all pre-service teachers surveyed concurred that, during their college experience, they used computers to conduct research. In addition, 84% reported that they used computers to complete course assignments. In contrast, only 22% of the respondents concurred that they used computers to communicate with peers and faculty while at college. Approximately 34% to 35% concurred that they used computers for class presentations and to prepare their lessons during their practicum activities.

Data gathered from focus group discussions support findings from the PTTII. Pre-service teachers indicated that faculty do not require that they use computers to conduct research or for communication. However, they noted one exception, Technology in Education faculty usually assigned them activities that involved using the Internet, but this was not generally done by other faculty members. Pre-service teachers also reported that they used the Internet as a source of information when they do research even though faculty did not require that they do this. In addition, data from focus group discussions indicated that faculty do not systematically require pre-service teachers to use computers to complete course assignments, but they sometimes do. Despite the fact that on the PTTII these respondents reported that they have access to computers at college, during focus group discussions, additional information was provided regarding the *amount* of access to and the availability of computers at college. They explained that despite the fact that there were computers at their colleges in the labs and the library, they were not always available and while pre-service teachers wanted to use computers to complete their course assignments, they sometimes did not have access to the computer laboratories. In addition, there are rules regarding when and who can use the labs at given points in the day.

d) Are there differences, across colleges, in the perceptions of (a) teachers' college faculty and (b) pre-service teachers regarding evidence of components of the IT_3P framework in their teacher training programs?

To answer this research question, composite means for each college were calculated for individual prerequisite and process factors delineated in the IT_3P framework. Table 20 presents means and standard deviations for faculty ratings on the FTII by teachers' college.

A cursory review of data presented in Table 20 reveals that for the prerequisite factor technology plan, a slightly higher mean (M= 2.24; SD= .72) was observed from faculty at College A than for faculty at College B and C (M = 1.95 and 1.83, respectively). For the factors staff development and access to computers, the highest means were recorded from respondents from College C. For all prerequisite factors, lowest means were recorded for faculty respondents from College B, indicating the majority of these respondents did not concur these factors were evident in their college. Of all the four prerequisite factors, the lowest mean was recorded for technology plan showing the least agreement among faculty that there was on evidence of a technology plan in their respective colleges.

With regard to process factors, the data suggest that faculty from all three teachers' colleges reported generally positive attitudes towards computers with means of 3.60, 3.62 and 3.49 from respondents from Colleges A, B and C, respectively. The majority of faculty from College C did not concur that they modeled computer use for their pre-service teachers or that the pre-service teachers at their college had practice using computers in their classes or during their field experience activities. Faculty from both

Colleges A and B were more likely to concur with that these two factors were evident in their colleges.

Table 20

Means and Standard Deviations of Faculty Ratings on Subscales of the FTII by College

Subscales	College A (N = 35)		College B (N = 53)		College C (N = 33)	
	Prerequisite Factors					
	Mean	SD	Mean	SD	Mean	SD
Technology Plan	2.24	.72	1.95	.52	1.83	.62
Staff Development	2.39	.67	2.26	.49	2.72	.48
Access to Computers	2.86	.87	2.56	.50	3.13	.34
Support at the College Level	3.10	.84	2.55	.62	3.08	.42
	Process Factors					
Modelling Computer Use	2.26	.49	2.39	.83	1.99	.56
Attitude Towards Computers	3.60	.34	3.62	.42	3.49	.39
Pre-service Teachers' Training	2.93	.60	2.32	.59	2.94	.48
Field Experience/Practice	2.09	.80	2.42	.53	1.86	.52

N = 121
Response Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4= Strongly Agree

To determine if these differences in faculty mean ratings were statistically significant across colleges, each of the eight subscale scores was analyzed separately

through a one-way ANOVA procedure. To minimize the probability of a Type 1 error, (i.e., finding a significant difference when there was none), a significance level of .01 was employed for these analyses. In addition, the Scheffé method was used to perform all possible pair-wise comparisons to identify specific sources of differences among colleges. Table 21 presents ANOVA results for each of the IT_3P factors.

An examination of the analysis of variance summary data reported in Table 21 shows that there were significant differences ($p < .01$) in mean faculty ratings on three prerequisite and three process factors. Post-hoc analysis using Scheffé's test identified the colleges between which mean ratings were statistically significant.

Faculty

Prerequisite Factors. Differences in mean ratings for the prerequisite factor technology plan were not statistically significant. With regards to the prerequisite factor staff development, the significant difference was between mean ratings for faculty in College C and College B ($p < .01$). Faculty at College C had more positive ratings for availability of opportunities for staff development as well as faculty participation in staff development than faculty at College B. Difference in mean ratings for faculty from College A and C was not statistically significant at $p < .01$.

Relative to access to computers, post-hoc analysis reveal the mean ratings for faculty at College C ($M= 3.13$) was significantly higher than that of College B ($M = 2.56$) but not College A ($M= 2.86$) indicating that faculty at College C rated their access to computers more positively than their counterparts at College B. However, their ratings were similar to that of faculty from College A.

Table 21

Summary Results of ANOVA of Faculty Ratings on the FTII Subscales Across Teachers' Colleges

Subscales	df	MS	F	P
Prerequisite Factors				
Technology Plan	2	1.519	3.97	.021
Staff Development	2	2.135	7.19	.001*
Access to Computers	2	3.231	8.98	.000*
Support at the College Level	2	4.112	9.87	.000*
Process Factors				
Modelling Computer Use	2	5.665	13.16	.000*
Attitude Towards Computers	2	0.138	0.835	.437
Pre-service Teachers' Training	2	5.139	15.98	.000*
Field Experience/Practice	2	3.381	8.95	.000*

$p < .01$

With regards the prerequisite factor Support at the College Level, post-hoc analysis show that mean ratings for faculty at Colleges A (M = 3.10) and C (M= 3.08) were significantly higher than that of faculty from College B (M = 2.25). Faculty at

Colleges A and C were relatively similar in their ratings and perceived college level support to be more evident at their college than faculty from College B.

Process Factors. The data presented in Table 21 indicate that differences in mean ratings of faculty across colleges were significant for three of the four process factors--modelling computer use, training pre-service teachers received in the use of computers and field experience/practice pre-service teachers received in using computers. Relative to faculty modelling, post-hoc analysis show the mean ratings for faculty at College B (M = 2.39) was significantly higher than that of faculty ratings at College C (M = 1.99), but not from College A (M = 2.26). The means for College A and College C were not significantly different at $p < .01$. With regards to pre-service teachers' training, mean ratings of faculty respondents from both Colleges A and C were very similar (M = 2.93 and 2.94, 43spectively) and rated the training pre-service teachers received at their college in the use computers more positively than faculty at College B (M = 2.32). Significant differences in mean ratings were observed for faculty from Colleges A and B and C and B, differences in mean ratings between faculty from Colleges A and C were not significant. Regarding field experience/practice pre-service teachers receive using computers, post-hoc analysis revealed that the mean faculty ratings for College B (M = 2.42) were significantly higher than mean ratings for faculty from College C (M = 1.82). However, no significant differences in mean ratings were observed for faculty from College A (M = 2.09) and College B (M = 2.42) or between mean ratings for faculty from College A and College C $p < .01$.

Pre-service Teachers

To ascertain if there were differences in perceptions of pre-service teachers across colleges regarding components of prerequisite and process factors delineated in the IT_3P, composite means were calculated for items in each subscale. Means and standard deviations for IT_3P prerequisite and process factors on the PTTII by college are presented in Table 22.

Table 22

Means and Standard Deviations of Pre-service Teachers Ratings on Subscales of the PTTII by College

Subscales	College A (N=89)		College B (N=99)		College C (N=80)	
	Mean	SD	Mean	SD	Mean	SD
			Prerequisite Factors			
Access to Computers	3.75	.29	3.34	.12	3.69	.45
			Process Factors			
Faculty Modelling Computer Use	2.45	.62	1.89	.66	2.20	.63
Attitude Towards Computers	3.14	.34	3.00	.49	3.03	.30
Pre-service Teachers' Training	2.61	.52	1.75	.43	2.01	.41
Field Experience/Practice	2.64	.59	2.37	.67	2.23	.73

Response Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4= Strongly Agree

An initial review of the data presented in Table 22 suggest that pre-service teachers at College A were more likely to agree that they had access to computers at their college than their peers at Colleges B and C. With regard to process factors, the data suggest that the highest means were recorded from pre-service teacher respondents from College A on all four process factors. In addition, on the factor, attitude towards computers, relatively high mean ratings were observed from respondents from all three colleges suggesting that pre-service teachers from all three colleges had generally positive attitudes towards computers. On the process factors modelling and training, the lowest means were recorded from pre-service teachers from College B suggesting these respondents were less likely to concur that these factors were evident in their college than pre-service teachers in Colleges A and C. To ascertain whether differences among these means were significantly different, data for each of the five subscales was analyzed separately using one-way ANOVA procedures. To determine if differences in mean ratings were indeed significant and guard against Type 1 error, a more rigorous significance level of .01 was set. To identify specific sources of differences between colleges, pair-wise contrasts were performed using the Scheffé's post-hoc test. The ANOVA summary results for the PTTII are presented in Table 23.

As is evident from the data presented in Table 23, on the prerequisite factor access to computers, there were no significant differences ($p > .01$) in mean ratings among pre-service teachers from all three colleges. With regards to process factors, significant differences were observed for three of the four process factors--modelling computer use, training pre-service teachers received in using computers, and field experience or practice pre-service teachers receive in the use of computers.

Table 23

Summary Results of One-way ANOVA of Pre-service Teachers Ratings on the PTTII Subscales Across Teachers' Colleges

Subscales	df	MS	F	p
		Prerequisite Factor		
Access to Computers	2	3.312	7.78	.026
		Process Factors		
Modelling Computer Use	2	6.009	14.24	.000*
Attitude Towards Computers	2	0.480	3.02	.50
Pre-service Teachers' Training	2	12.456	37.12	.000*
Field Experience/Practice	2	3.211	7.41	.001*

In terms of the extent to which faculty model computer use in their classes, there was a significant difference ($p < .01$) between the mean rating of pre-service teachers from College A ($M = 2.45$) and that of their peer at College B ($M = 1.89$). Thus, pre-service teachers from College A rated the faculty significantly higher on faculty modelling computer use in their classes than did their peers at College B. No differences were observed between mean ratings of pre-service teachers from College A ($M = 2.45$) and College C ($M = 2.20$) or College B and College C.

Relative to pre-service teachers' attitude towards computers, post-hoc analysis revealed there were no significant differences ($p > .01$) in mean ratings among pre-service teachers from all three colleges. These participants were generally positive in their ratings

of attitudes towards computers. With regard to pre-service teachers' training in the use of computers, ($p < .01$) differences in mean ratings were observed from College A ($M = 2.61$) and College B ($M = 1.75$) and between College A ($M = 2.61$) and College C ($M= 2.01$). However, there were no significant differences in mean ratings between respondents from Colleges B and C. Finally, the Scheffé' test revealed that for the process factor, field experience/practice using computers in their classes and during field experience, there was a significant difference ($p< .01$) in mean ratings for Colleges A and C. However, there are no significant differences observed in the mean ratings of pre-service teachers from Colleges B and C or from Colleges A and B.

Faculty Perceptions of Preparation to Integrate Computers in their Teaching

Research Question 2

To what extent are teachers' college faculty in Jamaica prepared to integrate computers in their teaching?

a. What are faculty's perceptions of the extent to which they are prepared to integrate computers in their classes?

To answer this research question, faculty were asked to respond to five items on *Preparation to Teach with Computers* on the FTII. Items in this subscale gathered faculty's perceptions of the extent to which they felt prepared to use computers as teaching tools and to teach their students how to teach with computers. Items in this subscale also gathered faculty's perceptions of their preparation to use computers for

communication and research. The percentages of teachers' college faculty who concurred or disagreed with individual items are presented in Table 24.

As is indicated from the data presented in Table 24, overall 48% of teachers' college faculty surveyed perceived themselves to be prepared to teach with computers. In addition, 40% of the respondents concurred that they felt prepared to teach their students how to teach with computers. However, the response patterns on these two items differed between faculty at College B and those at Colleges A and C. A majority of faculty at College B (62%) reported that they felt prepared to teach their students how to teach with computers compared with 25% from College A and 18% from College C.

Approximately 30% of faculty reported that they knew enough about different types of software to use them in their classes. However, as was observed previously, responses from faculty from College B differed somewhat from the pattern of responses from faculty at Colleges A and C. More specifically, 50% of the faculty at College B considered themselves to know enough about different types of software to use them in their classes as compared to only 23% and 6% of faculty from College A and College B, respectively, reporting such knowledge. Approximately, 72% concurred that they felt prepared to use computers to communicate and collaborate and 71% reported that they feel prepared to use computers to conduct research. Patterns of responses were consistent across all three colleges on these items.

Table 24

Percent of Teachers' College Faculty Responding to Preparation to Teach with Computers Subscale by College

Items	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
I feel prepared to teach with computers.	66	37	38	62	64	36	52	48
I feel prepared to teach my students how to teach with computers.	75	25	38	62	82	18	60	40
I know enough about different types of software to use them in my class.	77	23	50	50	94	6	70	30
I feel prepared to use computers to communicate and collaborate.	29	71	32	68	21	79	28	72
I feel prepared to use computers to conduct research.	37	63	26	74	24	76	29	71

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

b. What are faculty's perceptions of their levels of proficiency with computer productivity, communication and research tools?

To gather data regarding faculty's perceptions of their computer proficiency, faculty were asked to use a four-point rating scale ranging from 1 = *Poor* to 4 = *Excellent* to rate their proficiency with various software types. Means and standard deviations of faculty ratings of their proficiency for each software type by college as well as for the total sample across all three colleges are presented in Table 25.

Examination of Table 25 revealed that for the total sample teachers' college faculty perceived themselves to be most proficient with using E-mail (M = 3.06), word

processors (M = 2.88), web browsers (M = 2.79) and web search engines (M = 2.58). They reported themselves to be least proficient in the use of programming and authoring software (M = 1.41), web publishing (M =1.55), electronic Gradebooks (M = 1.55) and desktop publishing software (M = 1.74).

Table 25

Means and Standard Deviations of Teachers' College Faculty Ratings of Computer Proficiency by College and for the Total Sample

Software Type	College A (N = 35)		College B (N = 53)		College C (N = 33)		Total Sample (N = 121)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Word Processors	2.60	.85	3.06	.79	2.91	.95	2.88	.88
Databases	1.58	.87	2.24	.97	1.56	.72	1.86	.93
Spreadsheets	1.71	.97	2.16	1.03	1.76	.79	1.92	.97
Programming/ Authoring	1.17	.45	1.74	.88	1.13	.56	1.41	.75
Web Publishing	1.37	.81	1.92	.95	1.13	.34	1.55	.85
Presentation	2.00	1.02	2.10	1.02	2.36	.86	2.14	.98
Desktop Publishing	1.63	1.11	2.00	1.04	1.45	.79	1.74	1.02
Web Browsers	2.74	1.05	2.73	1.17	2.94	1.00	2.79	1.08
E-mail	2.74	.95	3.21	.95	3.15	.97	3.06	.97
Other Internet Communication tools	1.80	1.02	2.18	1.02	2.00	.87	2.02	.99
Online Databases	1.76	1.05	1.90	1.04	2.00	1.00	1.89	1.03
Web Search Engines	2.49	1.17	2.54	1.11	2.75	1.11	2.58	1.12
Electronic Gradebooks	1.46	.74	1.88	1.06	1.12	.33	1.55	.88

Scale: 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

A cursory review of these data suggest that, generally, faculty from College B rated their levels of proficiency with word processors, databases, spreadsheets, programming/authoring, web publishing, desktop publishing, e-mail, Internet communication tools, and electronic Gradebooks higher than their counterparts from Colleges A and C. In contrast, faculty from College C perceived themselves as more proficient in using presentation software, web browsers, online databases and web search engines than their peers from Colleges A and B. Faculty from College A reported least proficiency in using all the different software types.

c. Are there differences in faculty's perceptions of their preparation to teach with computers?

To answer this research question, composite means for each college were calculated for the five items on the FTII that measured faculty's perceptions of their preparation to teach with computers. An examination of these means indicated that the highest mean was reported from faculty from College B (M = 2.69), followed by College C (M = 2.38), and College A (M = 2.29). When interpreted on the response scale of 1= Poor to 4 = Excellent, these means are relatively low indicating that faculty rated their perceptions of preparation to teach with computers as *Fair to Good*.

Data were subjected to one-way ANOVA to determine if differences in mean ratings were significant between colleges. Results from the ANOVA show that means were not significantly different among colleges ($F= 3.745$, $p > .01$) at the .01 level of significance used for this study.

Pre-service Teachers' Perceptions of Preparation to Integrate Computers in their Teaching

Research Question 3

To what extent are Jamaica's pre-service teachers prepared to teach with computers?

a. What are pre-service teachers' perceptions of the extent to which the training they received during their college program prepared them to integrate computers in their teaching?

To answer this research question, pre-service teachers responded to five items on the PTTII on *Preparation to Teach with Computers*. Items in this subscale gathered pre-service teachers' perceptions of the extent to which they are prepared to teach with computers and use computers for research and communication. These respondents were asked to use a four-point Likert-type scale ranging from 1 = *Strongly Disagree* to 4 = *Strongly Agree* to indicate their level of agreement with each of the five statements. The percentages of pre-service teachers who concurred or disagreed with individual items are presented in Table 26.

An examination of the data in Table 26 indicate that a majority (64%) of pre-service teachers who participated in this study did not perceive themselves as prepared to teach with computers. Only 36% of these respondents concurred that they felt prepared to teach with computers. Similarly, only 36% of pre-service teachers surveyed agreed that they knew enough about different types of software to use them in their classes. Only 37% perceived themselves as prepared to use computers to teach their students and 48% felt prepared to use computers to communicate and collaborate. In contrast, 62% of the

pre-service teachers surveyed reported that they felt prepared to use computers to conduct research.

Table 26

Means and Standard Deviations of Teachers' College Faculty Ratings of Computer Proficiency by College and for the Total Sample

	College A (N=89)		College B (N=99)		College C (N=80)		Total Sample (N=268)	
	SD/D	A/SA	SD/D	A/SA	SD/D	/SA	SD/D	A/SA
I feel prepared to teach with computers.	47	53	75	25	71	29	64	36
I feel prepared to use computers to conduct research.	27	73	49	51	41	59	39	61
I know enough about different types of software to use them in my classes.	40	60	86	14	63	37	64	36
I feel prepared to use computers to teach my students.	46	54	74	26	72	28	63	37
I feel prepared to use computers to communicate and collaborate.	51	49	61	39	43	57	52	48

Note: SD/D represent response categories Strongly Disagree and Disagree, SA/A represent response categories Agree and Strongly Agree

A closer examination of the data reported in Table 26shows that the pattern of responses relative to pre-service teachers' perceptions of their preparation to teach with computers varied across colleges. On all but one item on this subscale, a majority of pre-service teachers from College A reported preparedness to teach with computers, use computers to conduct research, different types of software in their classes and to use computers to teach their students. In contrast, a majority of pre-service teachers from

College B and College C reported that they did not feel prepared to teach with computers, use different types of software in their classes, and use computers to teach their students. However, a slight majority (51% to 59%) indicated that they felt prepared to use computers to conduct research. They felt prepared to use computers to communicate and collaborate.

Data from focus group discussions support the general perceptions among that pre-service teachers do not feel prepared to teach with computers. When pre-service teachers were asked if they felt prepared to teach with computers, responses such as, "To a small extent, not really, more training is needed, I'll do a computer course after college" were recorded from approximately 75% of respondents from all three college. Only a moderate number of pre-service teachers reported that they were prepared to use computers as teaching tools. These pre-service teachers did not attribute their feeling of preparedness to teach with computers to the training they received at their college rather to their own initiative. For instance, one respondent stated, "Preparation to use computers did not result from training received at college but from my own initiative and need to be computer literate. I also acquired computer skills prior to coming to college".

b. What are pre-service teachers' perceptions of their levels of proficiency with computer productivity, communication and research tools?

To answer this research question, data regarding pre-service teachers' perceived *Computer Proficiency* were gathered from responses to items on the PTII. Pre-service teachers were asked to use a four-point rating scale ranging from 1 = *Poor* to 4 =

Excellent to indicate their perceptions of their proficiency with various computer tools. Table 27 presents means and standard deviations of proficiency ratings for each software type by college and for the total sample.

When total sample means in Table 27 are examined for pre-service teachers from all three colleges, it was found that, in general, pre-service teachers perceived themselves as most proficient with word processors (M = 2.91), e-mail (M = 2.67), web search engines (M = 2.64) and web browsers (M = 2.52). They perceived themselves as least proficient with using databases (M = 1.80), other Internet communication tools (M = 1.79), online databases (M = 1.73), web publishing software (M = 1.46) and programming/authoring software (M =1.28).

When these data are examined by individual colleges, it was found that pre-service teachers at College A rated their proficiency levels higher on all software types except presentation, web browsers, e-mail, online databases, and web search engines as compared with pre-service teachers at the other two colleges. Pre-service teachers from College B reported higher levels of proficiency with web browsers (M = 2.68), and e-mails (M =2.82) than their peers at Colleges A and C. Pre-service teachers from College C reported higher levels of proficiency with presentation software (2.49), online databases (M = 2.10), and web search engines (M = 2.93) as compared with their counterparts from Colleges A and B.

Table 27

Means and Standard Deviations for Pre-service Teachers' Ratings of Computer Proficiency by College and for the Total Sample

Software Type	College A (N = 89)		College B (N = 99)		College C (N = 80)		Total Sample (N= 268)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Word Processors	3.11	.95	2.83	.93	2.79	.85	2.91	.92
Databases	2.08	.84	1.64	.85	1.68	.84	1.80	.86
Spreadsheets	2.49	1.00	1.70	.96	2.08	.98	2.08	1.03
Programming	1.50	.80	1.24	.71	1.10	.34	1.28	.67
Web Publishing	1.67	.90	1.41	.78	1.30	.63	1.46	.79
Presentation	2.45	1.12	1.88	1.04	2.49	.95	2.26	1.08
Web Browsers	2.23	1.18	2.68	1.14	2.65	.99	2.52	1.12
E-mail	2.47	1.20	2.82	1.11	2.70	1.08	2.67	1.14
Internet Communication tools	1.89	1.08	1.82	.94	1.63	.89	1.79	.98
Online Databases	1.48	.75	1.62	.94	2.10	1.07	1.73	.96
Web Search Engines	2.27	1.21	2.72	1.22	2.93	.96	2.64	1.71

Scale: 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

In general, mean ratings for all software types were relatively low when interpreted on the response scale of 1= Poor to 4 = Excellent. The highest mean was reported for proficiency with word processing from pre-service teachers from College A

(M = 3.11); all other means were below 3 indicating that the majority of pre-service teachers rated their proficiency with various software types as *Fair* to *Good.*.

In addition to gathering data on perceptions of preparation to teach with computers, pre-service teachers were asked to indicate the extent to which various computer skills were acquired during their college experience. Pre-service teachers were asked to use a four-point rating scale ranging from 1 = *Not at all* to 4 = *To a great extent* to indicate their perceptions of the degree to which their training at college exposed them to various software categories. Means and standard deviations for each college as well as the total sample are presented in Table 28.

An examination of the data in Table 28 shows that for the total sample, the highest means were reported for word processing and presentation software with means of 2.24 and 1.86, respectively. Lowest mean ratings were reported for web publishing (M = 1.18), desktop publishing (M = 1.20) and other Internet communication tools (M =1.2). This indicates that pre-service teachers were of the opinion that they were most frequently exposed to word processing and presentation software during their teacher training experience.

Table 28

Means and Standard Deviations for Pre-service Teachers Computer Skills Acquired at College by College and the Total Sample

Software Type	College A (n = 89)		College B (n = 99)		College C (n = 80)		Total Sample (n = 268)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Word Processing	2.90	.76	1.39	.80	2.50	.79	2.24	1.02
Spreadsheets	2.29	.90	1.09	.32	1.89	.72	1.73	.85
Databases	1.84	.93	1.07	.25	1.48	.66	1.45	.73
Presentation	2.35	.92	1.23	.58	2.09	.91	1.86	.94
Programming	1.46	.79	1.10	.30	1.22	.55	1.25	.59
Web Publishing	1.35	.77	1.02	.15	1.20	.46	1.18	.53
Desktop Publishing	1.38	.73	1.03	.18	1.19	.43	1.20	.51
E-mail	1.66	.91	1.14	.43	1.77	.82	1.51	.79
Internet Comm. tools	1.29	.55	1.06	.29	1.30	.59	1.21	.49
The Internet	1.73	.87	1.41	.82	2.24	.89	1.77	.92

Scale: 1 = Not at all, 2 = To a small extent, 3 = To a moderate extent, 4 = To a great extent

When data for individual colleges were examined, respondents from College A had the highest mean ratings for all software types except e-mail, Internet communication tools and the Internet. In these instances, highest mean ratings were recorded from pre-service respondents from College C. The lowest means for all categories were observed

for respondents from College B. Generally, mean ratings for all software types are relatively low and fall within the *Not at all* to *To a small extent* range.

c. Are there differences across colleges in pre-service teachers' perceptions of their preparation to teach with computers?

To answer this research question, composite means were computed for the five items on the PTTII that measured pre-service teachers' perceptions of their preparation to teach with computers. An examination of composite means, by college, on this subscale show that the highest mean was reported from pre-service teachers from College A (M = 2.73), followed by College C (M = 2.27) and College B (M= 1.96). When placed on a scale of 1-4, these mean ratings are relatively low ranging from *Fair to Good* and indicate that the general perception among pre-service teachers from all three colleges that they are not prepared to teach with computers.

To ascertain whether there were significant differences in pre-service teachers' perceptions to teach with computers across colleges, these data were subjected to one-way ANOVA procedure. Results from the ANOVA show a significant difference in mean ratings for at least two colleges ($F= 37.12$, $p < .01$). Post-hoc analysis using Scheffé test revealed that pre-service teachers at College A reported significantly higher ratings for their preparation to teach with computers (M = 2.73) than their peers at College B (M = 1.96) and College C (M = 2.27). There were no significant differences between the mean ratings of pre-service teachers from Colleges B and C.

Specific Factors Required to Facilitate Technology Integration

Research Question 4

What do study participants propose as specific factors required to facilitate technology integration into Jamaica's teacher training programs?

Data required to answer this research question were gathered via interviews with teachers' college administrators, faculty and pre-service teachers. Data were examined and the following themes emerged and are proposed as specific factors required to facilitate technology integration in Jamaica's teacher training programs. The themes that emerged from each data source will be reported separately.

College administrators proposed the following factors are required to facilitate technology integration into Jamaica's teacher training programs:

1. *Access to computers.* All administrators interviewed were of the opinion that the single most important factor that would facilitate technology integration into the college curriculum is access to computers for both students and faculty. One administrator at College B stated, "Resources would be the thing that the college needs the most". He further proposed that each college must have "An instructional technology information center as well as computers for individual students" if technology is to be incorporated into the college curriculum. Another administrator at College A believed that a model on technology integration in teachers' colleges "would include the presence of computers and a core IT unit and also the faculty to operate the lab." Similarly, an administrator from College

C posited, “colleges need to have a lab that is dedicated to computers. I also think you need to have an area in the staff room where people can get online, prepare their lessons and communicate. It does not have to be a one-to-one computer thing.” In addition, administrators from College B proposed that computers in colleges should be wired to facilitate communication and information sharing among the college population. All these participants agreed that while faculty seem willing to use computers in their classes, inadequate resources greatly hinders their drive to teach computer-based lessons, therefore, required hardware, software and network connections need to be in place.

2. *Security*. In addition to access to computers, the issue of security was identified as one that needs to be addressed in teacher training colleges in Jamaica. Both administrators from Colleges B and C were concerned about the current levels of security in their colleges. An administrator at College C opined that before computers and related technologies can be placed in individual colleges, necessary security measures have to be put in place. She proposed that this would “mean security if we are thinking of putting a computer in each classroom. In some instances, it would mean that we have to redesign the whole classroom.” One administrator at College B had a similar opinion and postulated “security is a critical factor in any effort to integrate technology into teacher training programs.”
3. *Staff Development*. According to an administrator from College B, for computers to be incorporated into the teachers’ college curriculum, there is the need for “consistent, in-house staff development”. In addition, college administrators need

to put measures in place to ensure faculty "buy into and participate in professional development." These activities, she believes, will better prepare faculty to use computers in their classes with students. According to an administrator at College C, apart from increased access to computers, "I would want to see the technology department properly staffed. A model on technology integration should account for human resources and how they can be utilized." Staff development should equip faculty with knowledge and skills regarding how their students can use technology to "find and use information in their classes". Similarly, an administrator at College B proposed that any model on technology integration must include a component that addresses the need for extensive and ongoing staff development.

4. *Training for students*. According to an administrator at College C, methodology classes have to be designed in such a way that technology becomes a significant component of their delivery. In addition, she believed that technology should be incorporated into all subject areas by all lecturers. An administrator at College A proposed that students' training should expose them to ways in which they can "use the computer to discover knowledge. It should also enable them to search and know how to go about finding what they want. To have the skills to look for information and know what to look for."
5. *Support*. Administrators believed support structures have to be established within colleges to ensure continued use of technology by faculty. One administrator at College A postulated, "it is not enough to train staff and students, they need continued support as they use technology throughout the school year." This

support, she believed, will come primarily from someone who is familiar with different software types that both pre-service teachers and faculty will use in their teaching.

The following themes emerged from data gathered through interviews with IT faculty members who participated in this study:

1. *Access to computers*. IT faculty from all three colleges agreed that if technology is to be incorporated into the college curriculum, both faculty and pre-service teachers must have access to computers. For instance, at College B, one IT faculty member stated that if technology is to be integrated into the college curriculum, there must be "a proper technology lab with equipment." Similarly, at Colleges A and C, IT faculty members stated that there must be more computers at individual colleges to facilitate the needs of all students and faculty. At college B, one IT faculty member proposed that for technology to be integrated into the college curriculum, "there must be access to the Internet for all in all classes. There should also be computers that work and persons to assist lecturers with learning how to use computers."
2. *Training for students*. Approximately 90% of IT faculty interviewed suggested that if technology is to be integrated into the college curriculum, pre-service teachers must receive training that (a) exposes pre-service teachers to specific computer skills and (b) show them how computers can be used to facilitate the teaching-learning process.

3. *Staff Development and Support*. IT faculty at College C proposed that one of the key issues that must be addressed is ongoing staff development to "show faculty how to turn their ideas for their regular classes into computer-based lessons." Faculty, she believed, must be "trained how to use the simplest software such as PowerPoint to other complex types of software." Other IT faculty shared similar perspectives. At College A, IT faculty suggested that "all staff, especially older staff, must be motivated to participate in training if computers are to be integrated into the college curriculum." IT faculty at College A proposed that staff development must be paired with support--the college should not simply train faculty and leave them on their own to implement computers in their classes, but training should be coupled with ongoing support as they use computers in their classes. One IT faculty member at College C was of the opinion that "training of faculty coupled with support for technology use" are critical to ensure pre-service teachers are exposed to ways in which computers can be used in their classes. She believed that when pre-service teachers and faculty receive training, they should not be left on their own, but be supported in their effort to use technology.

Data gathered through focus group discussions with pre-service teachers were examined and the following themes emerged. Pre-service teachers believed that, given the important role that technology plays in the society as a whole and more specifically in education, training them to use technology should not be done in a single semester course but should be ongoing throughout their college experience. Training should also be wider in scope and focus not only on various computer productivity tools, but expose them to

ways in which the computer can be used as an instructional tool. The following factors were proposed by pre-service teachers as those required for technology integration in the college curriculum:

1. *Access to computers and the Internet*. Pre-service teachers from all three colleges were of the opinion that during training, only some students are allowed full access to the computer labs. They believe their proficiency would be enhanced if they had increased access to computers. A statement from one pre-service teacher from College A captures the sentiments of the majority of pre-service teachers surveyed for this study. She postulated, "Computer labs need to be upgraded and more computers should be made available to sufficiently serve the college population." As one participant from College A reported, "Teachers in training must have access to computers and the Internet, and more importantly, we have to be taught how to use it in our teaching."
2. *Practice using computers*. In addition to access to computers, pre-service teachers proposed that they need extensive practice to boost their proficiency and confidence with computers. They believe that in some instances, they had "no form of instruction on how to use computers" and therefore had limited experience and as a result, were reluctant to use the computer labs because they did not know what to do. There was the general belief among this population that experience with and exposure to computers will make them more confident in their computer use. One participant at College B proposed that: "Technology in education and methodology courses should give us more practice using computers

in our teaching. Lecturers told us what to do, but we did not get practice." Similarly, one study participant from College C stated, "I'm excited about the idea of using computers, but we need more practice. Courses should be designed in such a way that we get a chance to practice using computers with each other in classroom setting." At College B, students further stated that, in theory, they felt prepared to teach with computers as they were "told how to teach with computers" but were deprived of actual practical experiences regarding how computers can be used to enhance the teaching learning process.

3. *Trained Staff*. Pre-service teachers at Colleges B and C were of the opinion that trained staff was critical to facilitate technology integration. Participants from College C proposed that technology integration would be facilitated if their lecturers used technology in their classes, showed them how to use computers and provided them with practice using computers in their classes. One pre-service teacher from College B posited:

> *Lecturers need to spend more time actually teaching student teachers how to use computers in their classes. Technology in education and methodology classes should teach students how to use computers as well as give them more practice using computers in order to enhance teaching and learning*.

In addition, a pre-service teacher from College B stated, "There should be trained staff to teach us how to use different software and how to use computers in our classes".

4. *More time for training*. Pre-service teachers believed that if they are required to teach with computers, then they need time to learn how computers can be integrated in their classes. According to one pre-service teacher from College C,

> *The training we receive at college is not sufficient for us to use computers in our classes. The time that was allotted was limited. I recommend that the time should be longer and that the syllabus covers more topics so that teachers can work more effectively in this technological society.*

In addition, another participant stated "…technology should be taught indepth for the three years so that we would be adequately prepared to use it." Participants from other colleges also shared this view. At College A, one participant proposed that the "Technology in Education" course should continue throughout the duration of the college experience and not be taught as a single course." At College B, one pre-service teacher reported, "There was never a lesson in using computers in the classroom" in their Technology in Education class, rather, the course focused on "realia and charts."

When these data are examined, the following emerge as factors that should be included in teacher training programs in Jamaica to ensure future teachers are prepared to teach with computers. There must be increased access to computers at the college level. In addition, there should also be ongoing staff development to ensure teachers' college faculty are prepared to incorporate computers in their classes. There should also be continuous training for students. This training should also be combined with hands-on practice and experience using computers. Support structures must also be established within colleges to ensure continued use of computers. Necessary security practices and devices must be put in place when computers and related technologies are placed in individual classrooms. An examination of these data revealed that all factors proposed

except security were included in the IT_3P framework, therefore, what these participants proposed are consistent with what was proposed in the generic IT_3P framework with an additional factor, “security”.

Chapter 5

Summary, Discussions and Recommendations

The purposes of the study were three-fold: (a) to provide a description of the current state of technology integration in teacher training programs in Jamaica and to assess the extent to which components of the IT_3P framework are evident in these programs; (b) to assess the extent to which teachers' college faculty and pre-service teachers perceive themselves as prepared to teach with computers, as well as their perceived computer proficiency; and (c) to use data gathered in the study to inform an action plan for integrating technology into teacher training programs in Jamaica.

The following four research questions were examined in the study:

1. To what extent are components of the IT_3P evident in teacher training programs in Jamaica?
    a. What are administrators' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?
    b. What are faculty's perceptions of the extent to which components of the IT_3P framework are evident in teacher training programs?
    c. What are pre-service teachers' perceptions of the extent to which components of the IT_3P framework are present in teacher training programs?

d. Are there differences, across colleges, in the perceptions of (a) teachers' college faculty and (b) pre-service teachers regarding evidence of components of the IT_3P framework in their teacher training programs?

2. To what extent are teachers' college faculty in Jamaica prepared to integrate computers in their teaching?
    a. What are faculty's perceptions of the extent to which they are prepared to integrate computers in their classes?
    b. What are faculty's perceptions of their levels of proficiency with computer productivity, communication and research tools?
    c. Are there differences across colleges in faculty's perceptions of their preparation to teach with computers?
3. To what extent are Jamaica's pre-service teachers prepared to teach with computers?
    a. What are pre-service teachers' perceptions of the extent to which the training they received during their college program prepared them to integrate computers in their teaching?
    b. What are pre-service teachers' perceptions of their levels of proficiency with computer productivity, communication and research tools?
    c. Are there differences across colleges in pre-service teachers' perceptions of their preparation to teach with computers?
4. What do study participants propose as specific factors required to facilitate technology integration into Jamaica's teacher training programs?

A two-stage sampling procedure was employed in this study and included (a) purposive selection of teachers' colleges and (b) study participants. The participant sample was comprised of six of seven teachers' college administrators including two principals and four vice-principals yielding a response rate of 86% for this sample; 121 faculty indicating a response rate of 76%, and 268 pre-service teachers indicating a completion rate of 86%. These respondents were currently employed or attending three teachers' colleges--one in western Jamaica, one in eastern Jamaica and the other in the south of the island. The high completion rate for each instrument is attributed to the fact that questionnaires were administered on-site by the researcher.

For the purposes of this study, three sets of instruments were used to gather required data. These included: (a) Faculty self -administered questionnaire, (b) Pre-service Teachers' self-administered questionnaire, and Administrators' and IT Faculty Interview Schedules. The faculty questionnaire, the FTII was comprised of 12 sections which gathered demographic data, data regarding perceptions of evidence of components of IT_3P framework, and faculty's perceptions of their preparation to teach with computers and perceptions of computer proficiency. The pre-service teachers' self-administered questionnaire was comprised of nine subscales that gathered demographic data, pre-service teachers' perceptions of evidence of components of the IT_3P framework in Jamaica's teacher training programs, their perceptions of their preparation to teach with computers and levels of computer proficiency. The administrators' interview schedules was comprised of two sections--Section I included closed-ended questions and gathered data regarding administrators' perceptions of evidence of components of the IT_3P framework and, Section II was comprised of open-ended questions that solicited

administrators' perspectives of specific factors required to facilitate technology integration in Jamaica's teacher training programs. The IT faculty interview schedule was comprised of the same items in the administrators' interviews.

In addition to the instruments previously mention, focus group discussions were conducted with pre-service teachers to corroborate data gathered via self-administered questionnaires as well as to ascertain their perspectives of specific factors that are required to facilitate technology integration in Jamaica's teacher training programs.

This chapter is divided into three broad areas: (a) summary of findings, (b) discussions of the findings, (c) revisions to the generic IT_3P framework, (d) discussion of the proposed VIBES action for integrating technology into Jamaica's teacher training programs, and (d) recommendations for future research.

Summary of Findings

Perceptions of Evidence of Components of the IT_3P Framework in Jamaica's Teacher Training Programs

To answer this research question, interviews were conducted with teachers' college administrators and IT faculty. In addition, data were gathered through teachers college faculty self-administered questionnaires, pre-service teachers' self-administered questionnaires and focus group discussions with pre-service teachers.

Prerequisite Factors

Technology Plan. From interviews with college administrators, it was evident that there were differences in their perceptions regarding the presence of a technology plan at

their individual colleges. In general, college administrators were either unaware whether a technology plan existed at their college and what the plan included. While one college administrator acknowledge that the college did not have a plan that existed in "black and white", others were more reluctant to acknowledge that there was no written technology plan at their college. What seems to exist were *plans* regarding what can be done using technology, to facilitate distance learning, for example, but there was no evidence of written technology plans that outlined (a) sources of funding for acquisition of technological devices and (b) technology skills students need to function in the 21st Century classroom, and (c) how individual colleges were going to equip their students with these skills. In addition, there were no provisions for the re-training of faculty to accommodate changes in technology as well as account for staff turn-over within colleges. One college administrator noted that the Joint Board of Teacher Education was currently revising the IT syllabus, therefore, this participant suggested that it did not make any sense to "devise a plan" until such revisions are complete.

Similar findings were evident in data gathered via interviews with IT faculty at all three colleges that participated in this study. When IT faculty members were interviewed, over 80% of them reported that they *did not know* if their college had a technology plan. In some instances, there was a disparity in perceptions among IT faculty members within the same college--some believed there was a plan in place, others did not know. At College A, for instance, one IT faculty member indicated that this participant had devised a plan under the previous administration, however, the plan has been "put on hold" with the installation of new administration--other IT faculty within this institution were not aware that a technology plan existed or what the components of the technology plan

were. Similar observations were made in other colleges and one IT faculty at College B proposed that it was difficult to establish a technology plan because of lack of funding. Plans for the acquisition of computers are based on the "kinds of marriages we can make with the different projects". Specific technology skills pre-service teachers need are mandated in the curriculum that is devised by the Joint Board of Teacher Education (JBTE).

Like IT faculty, the majority (85%) of teachers' college faculty surveyed did not agree that their college had a technology plan that indicated how teachers should be prepared to teach with computers. In addition, a composite mean rating of 2.01 (on a four-point rating scale ranging from 1= Strongly Disagree to 4 = Strongly Agree) on this subscale of the FTII represent a low score and indicate that, in general, faculty did not concur that a technology plan existed at their college. When individual means were examined across colleges, the data reveal that that the highest mean of 2.24 (SD.72) was reported from faculty from College A indicating that a larger number of faculty from this college concurred there was a technology plan at their college than faculty from both Colleges B and C. Results of one-way ANOVA conducted on these data show that differences in mean ratings were not significant across colleges indicating that faculty from all three colleges had similarly low ratings for evidence of a technology plan in their colleges.

Staff Development: Another key requirement for effective technology integration cited in the literature and proposed in the IT_3P framework is the availability of opportunities for staff development. In addition to the availability of these activities,

necessary measures must be implemented to ensure faculty participate in staff development workshops.

Administrators who participated in this study believed opportunities for staff development were available at their colleges, however, faculty were not fully taking advantage of these opportunities. An administrator at College C proposed that there are "in-house people who are willing to help" but staff were not fully taking advantages of the opportunities offered as "some of them are not effectively managing their time". She stressed however, that opportunities are available. This view was supported by remarks made by one IT faculty member at this institution who stated:

> *…there are attempts at in-house staff development, however, while faculty see the immediate need to get these (technical) skills, lack of time has been a factor that hinders them from taking full advantage of these opportunities. There have been no recent staff development efforts from organisations outside of the college community. Whatever training happens occurs locally, within the college by members of the technology faculty. These are not very frequently organized. However, some faculty members have received training on their own.*

While administrators at College B believed that "training of staff…does not seem to be an issue" at that college, a different perspective was reported from both the general faculty sample and IT faculty at that institution. Items on the FTII solicited faculty's perspectives of the extent to which there were opportunities for staff development at their college and whether or not they had participated in these activities. An examination of these data shows that only 27% of faculty from College C concurred that that were opportunities for staff development at their college. IT faculty at this institution proposed that the most recent organized staff development activity was over four years ago.

Interview data from IT faculty and administrators revealed that within the last 3-4 years there have been very few opportunities for staff development at the different colleges. At College B, for instance, IT faculty reported that opportunities for staff development at that institution were provided by off-shore universities and are mainly done for faculty pursuing their master's or doctoral degrees in Instructional Technology. At College A, one IT faculty member reported that despite efforts to offer workshops at that institution, lack of time for faculty to participate in these workshops had hindered the successful organization of these activities. This respondent proposed that there were problems scheduling blocks of time where all faculty members could attend workshops. In addition to lack of time, resistance from "older" faculty had prevented this institution from successfully conducting workshops aimed at improving faculty's computers skills and exposing them to ways in which computers can be used to enhance their practice. One IT faculty member at College A also shared a similar perspective and postulated that lack of time has contributed to faculty's reluctance to participate in staff development exercises that have been organized within that institution.

With regard to faculty, data were gathered to ascertain their perceptions of the extent to which there were opportunities for staff development at their college and whether or not that they had taken advantage of these opportunities. The data indicate that only 49% of these respondents concurred that there are opportunities for staff development at their college. In addition, only 32% of faculty respondents agreed that organizations such as the JBTE offer workshops to improve their computer skills. Similarly, only 36% of faculty respondents concurred that workshops are offered at their colleges to improve their computer skills. The composite mean rating of 2.43 (on a four-

point rating scale ranging from 1= Strongly Disagree to 4 = Strongly Agree), on this subscale further support the conclusion that faculty did not generally agree that there were opportunities for staff development at their college or that they had participated in these activities.

When the mean ratings were examined across colleges, the highest mean of 2.72 was reported for faculty at College C and means of 2.39 and 2.26 from Colleges A and B, respectively. These data reveal that more faculty from College C concurred that there were opportunities for staff development and that they had participated in these activities. Results of one-way ANOVA conducted on these data show a significant difference in perceptions of opportunities for staff development across colleges ($F = 7.19$, $p < .01$). More specifically, post-hoc test revealed that faculty from College C rated staff development opportunities and that they have taken advantage of these opportunities significantly higher than faculty at College B. No differences in ratings were found between College A and College B or College A and C.

Support at the College Level: For the purposes of this study, support at the college level was examined in terms of administrative support and technical support. Administrators from all three colleges indicated that they were supportive of computer use by both their faculty and pre-service teachers. At College B, one of the administrators posited that, while faculty do not often use computers in their classes at this point in time, administrators do encourage it. At the same institution, another administrator was more hesitant in her response. When she was asked whether or not she encouraged her faculty to use computers in their classes, there was a brief pause and then she stated, "*Yes"*. She

explained that since there are limited resources, it is hard for faculty to use computers as much as she would like to see them use it. She also believes that more needs to be done by way of staff development to ensure faculty are indeed *ready* to use computers in their classes. The administrator at College C eagerly agreed that she encourages computer use by both faculty and pre-service teachers. However, she cited paucity of resources as one of the issues that must be addressed before faculty can fully be encouraged and be expected to use computers in their classes.

The issue of financial support is one with which administrators at all three colleges grappled. In all three colleges, one of the computer labs was donated to them during in 1998-1999 school year though a project spearheaded by the Jamaica Computer Society Education Foundation (JCSEF). Since the project ended, colleges have had to purchase new computers and maintain old computers from funds generated locally within individual colleges. As a result, colleges are suffering from a severe lack of resources. However, some colleges have recently established a partnership with a private company that allows them to purchase computers at a reduced cost. However, funding for these computers has to come from college resources.

In terms of administrative and technical support, the general perception among teachers' college faculty was that administrators were supportive of technology use within teachers' colleges. The data indicate that the majority of faculty respondents (79%) concurred that administrators at their college were supportive of technology use. In addition, 77% of faculty respondents concurred that there was someone available at their college to provide them with technical support for using computers.

Cross-college comparisons of mean ratings on this subscale indicate that faculty from both Colleges C and A were similar in their ratings of administrative and technical support for computer use at their colleges. Both had stronger mean ratings ranging from 3.08 to 3.10 on this subscale than their counterparts at College B (M = 2.56). The results of a one-way analysis of variance conducted on these data reveal that differences in mean ratings on this subscale were statistically significant ($F = 9.87$, $p < .01$). Post-hoc analysis using the Scheffé test indicates that faculty from Colleges A and C reported significantly stronger support for technology use at their college than faculty at College B. However, administrators and IT faculty at College B reported that there was both technical and administrative support at that institution.

Access/ Resources/ Infrastructure. The issue of access to resources and infrastructure to facilitate technology integration needs to be addressed in all three colleges that participated in this study. Findings from the study indicate a consensus among study participants that, in general, both faculty and pre-service teachers have access to computers at their college. Data gathered from interviews with both teachers' college administrators and IT faculty members suggest that both faculty and pre-service teachers have access to computers at their college.

In addition, on the FTII, 93% of faculty respondents concurred that they had access to computers at their college. Seventy percent of these respondents agreed that pre-service teachers had access to computers at individual colleges. Similarly, on the PTTII, 100% of the pre-service teachers surveyed concurred that they had access to computers at college. In addition, 93% of these respondents agreed that they were able to

use the computers in the laboratory to complete their class assignments. While the data show that faculty and pre-service teachers mean ratings on this subscale was relatively high (ranging from 2.57 to 3.31 and 3.34 to 3.75, respectively), the extent to which access can be described as *adequate* is one that needs to be addressed in all three colleges that participated in this study.

College administrators and IT faculty agreed that there were not enough computers at their individual colleges to accommodate the number of students enrolled in each institution. One administrator at College B adduced that while the college currently has two equipped computer laboratories as well as computers in the library, there were not enough computers to meet the needs of the present student population at that institution. Similar perspectives were shared by administrators at College C. One administrator at this institution stated, "We need more. I don't think they are adequate". She believed that technology integration would be facilitated if there were increases, not only in the number of computers, but access to other resources such as camcorders, digital cameras and so on. For another administrator, adequate means that "every student would have access to something they can work with". She indicated that one way to increase access is to stipulate that students entering college should own a laptop computer. However, she pointed out that she realizes this is somewhat unrealistic given the nature of the population to which teacher training programs cater.

The dearth of resources available at all three colleges was further confirmed in interviews with IT faculty. According to an IT faculty member from College B, using the computer lab means booking the lab in advance, "*long in advance"*. IT faculty at College C believed that the issue of access is one that needed to be addressed, but was satisfied

with efforts being made at the college to ensure increased access to computers. This respondent stated that there are increased opening hours when students can use the computers in the lab to complete their assignments and activities.

During focus group discussions, pre-service teachers expressed dissatisfaction with the limited number of computers at their respective institutions. During these discussions, they explained that despite the fact that there are computers at their colleges, sometimes there were not enough computers for everyone to use. In addition, there were rules regarding when and who can access the labs. Pre-service teachers were also of the opinion that access to computers at various locations on the college campus would greatly enhance their computer use.

One of the weaknesses observed, however, was that some pre-service teachers were not aware of the facilities that were available at their colleges. From the focus group discussions with pre-service teachers at College B, it was evident that some pre-service teachers were not informed about the facilities that are available at that institution. However, college administrators stated that there was a drive to use professional development activities to inform pre-service teachers of the facilities that were available to them.

Process Factors

Attitude Towards Computers: The findings from the present study show that, in general, all sets of study participants reported positive attitudes towards computers. Data gathered via the FTII indicate that teachers' college faculty in Jamaica reported positive attitudes towards computers (M =3.56, SD = .41). Results from the one-way ANOVA

show that differences in means across colleges were not significant ($F = 0.835$, $p < .01$). In addition, pre-service teachers from all three colleges also reported a positive attitude towards computers (subscale means range from 3.00 to 3.14) on a four-point scale. Like faculty, no significant difference in attitude towards computers was observed across colleges.

These findings are supported by data gathered through focus group discussions and interviews with IT faculty and college administrators support the view that administrators, faculty and pre-service teachers reported positive attitudes towards computers. According to an administrator at College C, "If it [the computer] is used properly, computers can go a long way".

Modelling Computer Use: Findings from the study indicate a consensus among study participants that, in general, faculty in teachers' colleges in Jamaica did not model computer use in their classes. On the FTII, only 33% of faculty surveyed concurred that they model ways in which *computers can be used as teaching tools*. In addition, only approximately 27% of teachers' college faculty surveyed agreed that they *show their students how to use computers in their classes*. In contrast, 62% of these respondents indicated that they feel competent to model computer use. Despite this however, only 33% of them reported that they actually use computers in their classes. Inadequate resources is one of the factors that may account for limited computer use among teachers' college faculty in Jamaica.

Similar perceptions were reported by pre-service teachers from data gathered on the PTTII. The data show that only 27% of the pre-service teachers surveyed agreed that

their faculty *modeled computer use in their classes*. Further, only 32% concurred that their faculty *used computers as teaching tools*. In addition, only 30% of pre-service teachers surveyed believed that faculty *showed them how to teach with computers*. In contrast, over 70% were of the opinion that faculty *displayed a positive attitude towards computers*. During focus group discussions these respondents postulated that only IT faculty systematically used computers in their classes. At College C, the question of modelling computer use and whether faculty use the computer lab for teaching resulted in resounding laughter from pre-service teachers. One commented, "At one point one teacher took us to the lab to use the Internet. Teachers do not even use PowerPoint slides in their classes". At College B, however, some of the students indicated that their Social Studies and Geography lecturers use PowerPoint presentations occasionally. However, these instances were few and far between.

During interviews with college administrators, these participants were able to identify, by name and subject areas, the few faculty who used computers in their classes. Faculty who used computers used them only occasionally and primarily for word processing tasks such as completing their course outlines and syllabi as well as preparing notes and handouts for their students. IT faculty at all three colleges shared this perspective-- faculty generally used computers for word processing and very few used them in their classes. According to administrators and IT faculty, one of the primary reasons faculty do not use computers in their classes is that they do not have access to required resources.

Cross-college comparisons of means indicate that faculty from College B reported modelling computer use significantly more than their counterparts from Colleges A and C

(mean ratings of 2.74, 2.39, and 1.99, respectively). Results of one-way ANOVA indicate a significant difference across colleges in faculty ratings of their modelling computer use in their classes ($F = 13.16$, $p < .001$). Post-hoc analysis using Scheffé test indicated that mean ratings for faculty at College B was significantly higher than that for faculty at College C. However, there were no differences in mean ratings between faculty at College B and those at College A and faculty at Colleges A and C.

With regards to pre-service teachers, cross-college comparisons of mean ratings on this subscale indicated that the highest mean was recorded from pre-service teacher respondents from College B ($M= 2.43$), followed by College C and A with mean ratings of 2.20 and 1.93, respectively. Results of one-way ANOVA conducted on these data showed that there were significant differences in pre-service teachers mean ratings on this subscale across colleges ($F = 12.24$, $p < .01$). Post-hoc analysis using the Scheffé test indicate that mean ratings were significantly different between Colleges A and B with pre-service teachers from College A rating the extent to which faculty model computer use at their college significantly higher than pre-service teachers from College B. There were no other significant differences in mean ratings.

Training: Training pre-service teachers to teach with computers is critical to facilitate technology integration at the college level. The data show that in general, study participants indicated that training pre-service teachers received during the college experience did not adequately prepare them to integrate computers in their teaching. On the FTII, only 40% of faculty surveyed concurred training pre-service teachers received prepared them to teach with computers. In addition, only 54% of faculty respondents agreed that pre-service teachers are taught how to teach with computers.

Similarly, only 37% of pre-service teachers concurred that teacher training program exposed them to ways in which computers can be used to manage their classroom. Only 45% of pre-service teachers surveyed indicated that their teacher training program equipped them with knowledge and skills required to plan computer-based lessons. In addition, 37% of these respondents agreed that their teacher training programs equipped them with knowledge and skills required to teach with computers. Likewise, 36% of pre-service teachers expressed the opinion that their teacher training programs equipped them with knowledge of different types of software that can be used in their classes. Data gathered through focus group discussion corroborate data from PTTII.

During focus group discussions, pre-service teachers confirmed that their training did not adequately prepare them to teach with computers. At College B, for instance, one study participant described training to integrate computers received at college as *minimal*. Other participants proposed that the training they received was primarily though their Introduction to Educational Technology course, but that this course did *not directly* expose them to ways in which computers can be integrated in their teaching. From these discussions with these respondents, it was further ascertained that during their college experience, they were primarily exposed to Microsoft Office products and more specifically with Microsoft Word. They reported no exposure to instructional software of any type. In addition, pre-service teachers also pointed out that their exposure to computer use was primarily theoretical and that they lacked practical, hands-on experiences regarding how computers can be used in actual teaching.

Data from interviews with IT faculty corroborate pre-service teachers' perceptions that they were not exposed to various types of software that can be used in their teaching. IT faculty from all three colleges believed that their individual colleges suffered from a severe lack of instructional software. In all three colleges the computers were equipped with productivity tools, primarily Microsoft Office products. One IT faculty member at College C reported that that college had limited supplies of a *Reader Rabbit* series as well as some tutorials for Language Arts and Mathematics. These were acquired from participants of a recent workshop conducted at the college. Generally, there were no deliberate efforts on the part of college administrators or other stakeholders to acquire specific instructional software packages. It is interesting to note that some faculty who were completing the Faculty Technology Integration Instrument did not know what drill and practice, tutorials and so on were when used within the context of computer software. Such lack of knowledge seems to suggest that pre-service teachers are not the only ones who need to be exposed to different types of educational software and how these can be used in the teaching learning process, but there must be a systematic drive to educate faculty as well.

With regards to training to teach with computers, College A seems to be somewhat ahead of the game in the technology training they offer their students. IT faculty members at that institution attribute this to the fact that, even before it was a requirement by the JBTE, this college had been exposing pre-service teachers to not one, but two computer courses. The first of these two courses introduces pre-service teachers to general computer skills, the second exposes them to ways in which computers can be incorporated into their teaching.

When data gathered through the PTTII were examined, the majority (76%) of pre-service teachers from College A concurred that their teacher training program exposed them to ways in which computers can be used manage their classroom activities compared with 21% from College B and 19% from College C. In addition, 57% of pre-service teacher respondents from College A agreed that their training equipped them with knowledge and skills required to teach with computers compared to 22% from College B and 34% from College C.

One IT faculty member at College C informed the researcher that, while current final year students were not as exposed to the computer as much as they would have liked, the current Year Two and Year One students are now doing two computer courses similar to those offered at College A--one that teaches them basic computer skills and the other technology integration skills. IT faculty and administrators from all three colleges were very optimistic about the future of technology training in their colleges as new students coming into college from high schools are increasingly more computer literate with many of them doing Information Technology as a subject in their high school experience.

While one administrator at College B believed that the training students received at the college prepared them to teach with computers, this belief was not supported by responses from pre-service teachers. Other administrators and IT faculty at this institution had different views. They reported that while they "try as much as possible to expose the entire population to computers" and how they can be used to enhance classroom practices, the size of the population they are trying to reach, coupled with the fact that

resources are limited, result in problems getting students to the levels of competence they need to teach with technology.

During focus group discussions, pre-service teachers from College B proposed that technology should become a central part of their teacher training and that being exposed to a one-semester course will not equip them with skills required to integrate computers in their classes. They suggested that they should be exposed to computers continuously during the three years of their teacher training experience. They further proposed that IT classes should not focus on teaching them how to create charts and write on the chalk board, but should expose them to ways in which computers can be used to enhance their classroom practices.

When composite mean ratings on the training subscale were examined across colleges, the data show that the highest mean ratings were reported from faculty at College A (M=2.94), followed by College C (M=2.93) and College B (M=2.35). Results of one-way analysis of variance indicate that a significant difference in faculty ratings of the training pre-service teachers received in the use of computers across colleges ($F = 15.98$, $p < .01$). Post-hoc analysis using Scheffé's test show that faculty at Colleges A and C rated the training pre-service teachers received at their colleges similarly, and that the means for these two colleges were significantly higher than the mean for College B. However, while faculty at College C had more positive ratings on the training subscale, a relatively low mean of 2.01 was recorded from pre-service teachers at this institution indicating a difference in perspectives between these groups of participants. When cross-college comparisons were made on data gathered on the PTTII, composite means of 2.61, 2.01 and 1.75 were reported from pre-service teachers responses from Colleges A, C and

B, respectively. Results of one-way ANOVA conducted on these data indicate a significant difference in mean ratings ($F=37.12$, $p < .01$). Post-hoc analysis using Scheffé test indicate that there were significant differences in mean ratings of training to teach with computers between pre-service teachers from Colleges A and B and Colleges A and C, however, respondents from Colleges B and C rated their training to use computers similarly.

An examination of the *old* IT syllabus show there is not a significant technology integration component. However, this syllabus is under revision and the new IT curriculum includes two courses that focus specifically on Information and Communication Technology (ICT) and how these can be used to facilitate communication, research and productivity in classroom settings.

Field Experience/Practice Using Computers at College: Colleges of Education that have incorporated technology into their curriculum were those that provide pre-service teachers with opportunities for extensive practice using technology both during their training and their field experience. The findings from the present study suggested that a majority of the faculty did not systematically require pre-service teachers to use computers during their college experience to complete instructional-based activities or during their field experience. The data show that only 45% of faculty required their students to use computers to complete course assignments. Paucity of resources at the college level was cited as one of the primary reasons pre-service teachers were not required to use computers to complete course assignments. Similarly, only a combined 25% of faculty surveyed indicated that they required their students use computers for

class presentations. A closer examination of these data shows that IT faculty members were primarily those who required their students to use computers to complete class assignments and for class presentations. In addition, the majority of these respondents did not require students to use computers to communicate with them or with their peers. In contrast, however, approximately 74% of faculty included in the study concurred that they assigned activities that required the use of the Internet for research.

Similarly, teachers' college faculty surveyed indicated that pre-service teachers were not required to use computers during their teaching practice activities. Only a cumulative18% of faculty respondents surveyed concurred that they required their students to use computers to prepare their lessons. In addition, 13% agreed that they required their students to use computers to complete classroom related activities during field experience.

Like faculty, a large percentage (76%) of pre-service teachers surveyed reported that, during their college experience, they used computers to conduct research. In addition, while faculty did not require pre-service teachers to use computers to complete course assignments, 84% of pre-service teachers surveyed indicated that they used computers for this purpose. During focus group discussions, pre-service teachers explained that while faculty do not require that they do this, they believed using word processing software to complete their assignments would enhance their presentations--therefore, they took the initiative to use computers to complete their course assignments. Like faculty, the majority of these respondents indicated that they did not use computers to communicate with faculty and peers (a combined 78%). However while 76% of faculty from College B indicated that their pre-service teachers were required to use computers

to communicate with them, only 22% of pre-service teachers surveyed from this college agreed that they did.

During focus group discussions, pre-service teachers explained that, apart from IT faculty, faculty at their college did not require them to use computers for class-related activities. While IT faculty members try to get their students to use computers on a more regular basis than other faculty, the reality of (a) limited resources, and (b) limited skills on the part of the students, are issues that must be addressed. As one IT faculty suggested, "At given points in the semester, students will have a number of assignments that they need to submit, if all teachers require them to use computers, we would not have enough resources to facilitate this". Secondly, many of the students who attend college have limited word processing skills and find it easier and quicker to complete their assignments by hand. Therefore, while IT faculty anticipate increased computer use in the future, for now, they agreed that it may be unreasonable, given the current situation, to expect faculty to insist that pre-service teachers use computers to complete various activities.

The data support the following conclusions regarding evidence of IT_3P prerequisite and process factors in Jamaica's teacher training programs:

Technology Plan. There was no written, constantly revised and updated technology plan or policy in teachers' colleges in Jamaica. College administrators and IT faculty proposed that there was no plan that existed in *black and white*. In instances where there was evidence of aspects of a plan, these were devised and written by one person and not disseminated to the entire college population. If technology is to be

incorporated in teacher training programs, there is the need for a frequently revised and updated technology plan. The plan should include a written document that details how computers will be acquired and allocated. If teacher training programs in Jamaica are to successfully integrate technology in their curriculum, the issue of devising a written technology plan that indicates (a) how computers will be acquired and allocated, (b) skills students need to teach with technology as well as the (c) goals of teacher training and how technology will help achieve these goals must be evident. Further, the technology plan should be the result of a joint effort from all stakeholders--college faculty as they will be implementers of the innovation, administrators and members of the business community.

Staff Development. Findings from the research show that staff development activities have not been frequently organized and do not adequately satisfy the needs of the college population. Attempts at in-house workshops have not been very successful. In some instances, study participants reported that the last college-wide staff development workshops were conducted approximately 5 years ago. In instances where these have been organized, they have focused primarily on the development of computer literacy skills, rather than expose faculty to ways in which computers can be used as teaching tools. There is the need for more frequently organized staff development activities to improve teachers' college faculty's computer skills as well as equip them with skills required to integrate technology in their classes. Having the last workshop more that "five years ago" as one IT faculty noted, is not enough to provide faculty with knowledge and skills required to teach with computers. Staff development efforts must be ongoing to (a)

facilitate changing technologies and (b) ensure new lecturers are equipped to use computers as teaching tools and in turn, teach their students how to use computers in their classes.

Access/Resources/Infrastructure. Lack of resources and infrastructure to facilitate technology integration seems to be the most significant hindrance to technology integration in Jamaica's teacher training programs. All colleges that participated in the study suffered from a severe paucity of resources in terms of computers (hardware and software) as well as related infrastructure (network connections) to facilitate technology integration. Resources are very limited and cannot fully cater to the needs of the college population. In order for technology to be incorporated in the college curriculum, faculty and pre-service teachers must have access to these resources.

Support. All participants surveyed were of the opinion that college administrators were supportive of technology use. While administrative support does not seem to be a major issue, faculty need more technical support as they try to incorporate technology in their teaching. Similarly, colleges suffer from a shortage of financial resources to facilitate the acquisition of technological devices. Therefore, while administrative support does not seem to be a major issue at the college level, financial support is an issue that must be addressed. Since teachers colleges do not have the financial resources to purchase required hardware and software as well as establish network connections, technology integration at the college level is severely hindered. Institutions such as the JBTE have to be more actively involved in providing funding for the acquisition of these

resources. In addition, colleges have to identify ways in which partnerships can be established so resources can be acquired.

Modelling. All study participants expressed the view that faculty do not generally model computer use for their students. The issues of access to computers and staff development need to be addressed before faculty can be fully expected to model technology use in their teaching.

Attitude. While the literature indicates that negative attitude towards computers was generally evident among college faculty (RAND Report, 1995; Rogers, 1999), this was not the case in the Jamaican setting. Findings from the study show study participants reported perceived positive attitude towards computers and were generally of the perception that computers should be placed in all schools and classrooms. Survey participants were also of the opinion that computers are important learning tools and can facilitate increased quality of learning.

Training. While students receive some amount of training during their college experience, training they receive has focused primarily on the development of computer skills at the expense of exposing them to ways in which computers can be infused into their teaching and used as cognitive tools. The college syllabi should be revised in such a way that technology classes no longer focus primarily on teaching pre-service how to make charts and realia, but should introduce them to ways in which computers and emerging technologies can be used to (a) manage their classes (b) motivate their students

to learn (c) enhance their presentation (d) for research and (e) access information and enhance communication and collaboration with not just their peers within their colleges, but with those at other colleges as well. In general, training should expose pre-service teachers to how to use computers to develop students' cognitive skills.

Field Experience/Practice. Findings from the study show pre-service teachers do not receive adequate practice using computers during the college experience or as part of their practicum experience. Factors such as lack of resources and the fact that college faculty do not require that they use computers to complete given activities contribute to limited computer use among pre-service teachers. Apart from research activities, faculty did not require their students to use computers for other course related activities. In addition, pre-service teachers were not required to use computers as teaching tools during their practicum exercise. Whatever practice they receive is primarily as a result of their own initiative and not a requirement from college faculty. Despite the fact that resources are scarce, it is imperative that both faculty and pre-service teachers receive practice using computers both within real as well as contrived classroom settings. It is only through extensive practice that participants can concretize their computer knowledge and skills.

The literature proposed that prerequisite and process factors represented in the IT_3P framework identify teacher training programs that have effectively incorporated technology in their curriculum. Data from the study suggested that there was little evidence that these factors were systematically present in the Jamaican teacher training

system. Based on these findings, it can be concluded that technology has not been systematically incorporated into Jamaica's teacher training programs.

Faculty Perceptions of Preparation to Teach with Computers

The general perception among teachers' college faculty in Jamaica is that, to large extent, they were not prepared to teach with computers. Data gathered through the FTII indicate that a combined 48% of faculty respondents concurred that they are prepared to teach with computers. In addition, 40% agreed that they are prepared to teach their students how to teach with computers. Similarly, 30% of faculty respondents concurred that they know enough about different types of software to use them in their classes. In contrast, however, 72% reported that they feel prepared to use computers to communicate and collaborate with peers and 71% concurred they feel prepared to use computers to conduct research.

When aggregated mean ratings for this subscale were examined across colleges, the data revealed that relatively low mean ratings were evident from faculty respondents from all three colleges ranging from 2.29 to 2.70. Results of one-way analysis of variance conducted on these data revealed that differences in mean ratings were not significant across colleges ($F = 3.75$, $p < .01$). There were general low perceptions of preparation to teach with computers from faculty from all three colleges, however, the highest mean rating (2.70) for this subscale was recorded from faculty respondents from College B.

In addition to perceptions of preparation to teach with computers, data regarding faculty's proficiency with various computer tools were also gathered. The data showed generally low levels of computer proficiency for different software types were indicated

by teachers' college faculty. Mean ratings for the various software types ranged from 1.41 to 3.06 indicating perceptions of proficiency levels of *Fair* to *Good* among college faculty. A closer examination of the data revealed that faculty perceived themselves as most proficient with E-mail (M = 3.06), word processors (M = 2.88), web browsers (M=2.79) and web search engines (M = 2.58). In addition, they were least proficient with programming and authoring software (M=1.41), web publishing software (1.55), electronic Gradebooks (M=1.55) and desktop publishing software (M=1.74). Mean ratings for faculty from College B were higher than those from faculty from Colleges A and C in most instances indicating these faculty members perceived themselves as more proficient with certain tools than their counterparts. However, apart from relatively high mean ratings for proficiency with E-mail, word processors and web browsers, means for proficiency with other software types were relatively low.

The data support the following conclusions regarding teachers' college faculty's perceptions of preparation to teach with computers as well as their proficiency with various computer tools.

a) Jamaica's teachers' college faculty:

   I. For the most part, did not perceive themselves as prepared to teach with computers

   II. In general, did not concur they were prepared to teach their students to teach with computers

   III. Generally, did not perceive themselves as knowledge about different types of software to use them with their students.

IV. Felt prepared to use computers to communicate and collaborate with peers as well as to conduct research. While they are of the opinion that they are prepared to use computers to conduct research, they report low levels of proficiency with online research tools such as online databases. However, they report high levels of proficiency with web search engines.

V. Faculty did not perceive themselves to be proficient with various types of software. Further, they had very little experience using both application and instructional software to enhance their instructional activities.

If technology is to be integrated into the college curricula, college faculty must be equipped with knowledge and skills required to teach their students with as well as how to teach with computers. Members of teachers' college faculty need exposure to experiences that will not only develop their computer literacy skills but their technology integration skills as well. While they possess knowledge of how to use some productivity and communication tools, knowledge of instructional/educational software is lacking. Staff development should focus on how instructional software can be used.

Pre-service Teachers' Perceptions of Preparation to Teach with Computers and Computer Proficiency

Findings from the study indicate that, in general, Jamaica's pre-service teachers do not perceive themselves as prepared to teach with computers. In addition, pre-service teachers in Jamaica reported low levels of proficiency with various computer tools. The

data showed that 36% of the pre-service teachers surveyed concurred that they felt prepared to teach with computers. In addition, approximately 36% concurred that they *knew enough about different types of software to use them with their prospective students*, and 37% agreed that they *are prepared to use computers as instructional tools* with their students. Similarly, approximately 48% of pre-service teachers surveyed were of the opinion that they are *prepared to use computers for communication and collaboration* and 61% believed they are *prepared to use computers for research*.

A cursory look at the data further showed that pre-service teachers from College A were generally more positive about their training to teach with computers (M=2.73) than their counterparts from Colleges C and B with composite mean ratings of 2.27 and 1.96, respectively on this subscale. Results of one-way analysis of variance conducted on these data indicated that mean ratings were significantly different ($F = 37.12$, $p < .01$) across colleges. More specifically, post-hoc analysis using Scheffé test indicated that mean ratings were significantly different between Colleges A and B, and Colleges A and C, but not between Colleges B and C. This means that pre-service teachers at College A rated their training to use computers significantly higher than their counterparts from both Colleges B and C, however, pre-service teachers from Colleges B and C rated their training to teach with computers similarly.

Pre-service teachers' general lack of preparation to teach with computers was also reflected in their self-reported levels of proficiency with various computer software types. The data indicated that among pre-service teachers, there were generally perceived low levels of proficiency with various software types with mean ratings ranging from 1.46 to 2.91. This means that perceived proficiency ranged from *Fair* to *Good* on a four-point

scale. A more detailed examination of these data revealed that pre-service teachers perceived themselves as most proficient with word processing software (M = 2.91), e-mail (M = 2.67), web search engines (M = 2.64) and web browsers (M = 2.52). They perceived themselves to be least proficient with web publishing and (M= 1.46) and programming/authoring software (M= 1.28).

When cross-college tabulations were examined, the data showed that higher mean ratings were reported from pre-service teachers from College A for perceived proficiency with word processors (M= 3.11), Databases (M= 2.08), Spreadsheets (M= 2.49), programming/authoring (1.50), web publishing software (M= 1.67) and other Internet communication tools (M= 1.89). One possible explanation for perceived higher levels of proficiency with these types of software is that pre-service teachers at College A have always had to, as a requirement of the college and not the Joint Board of Teacher Educators (JBTE), complete what would be equivalent to an introductory computer course. According to an IT faculty member at this institution, the college has always tried to make computers accessible to all the students as well as ensure pre-service teachers complete this mandatory course as a preface to the educational technology course they are required, by the JBTE to complete as partial requirement for their teachers' diploma.

It is worthwhile to note that even with perceived low levels of proficiency with various software types reported by pre-service teachers, data from focus group sessions indicated that pre-service teachers did not attribute their levels of proficiency or exposure to these different software types to training they received at college. During focus group discussions, approximately 75% of the participants explained that they came to college already possessing some computer skills (mainly word processing), others proposed they

"picked them up on the way" primarily through experimenting and learning, through trial and error, to use various software tools. In addition, others explicated that they had taken the personal initiative to acquire computer literacy skills on their own through training with institutions external to the teachers' college. These perceptions were corroborated by data gathered through the PTTII and 51% of pre-service teacher respondents acknowledged that they had received computer training prior to their teachers' college experience.

To further corroborate data on their preparation to teach with computers, pre-service teachers were asked to respond to a set of items aimed at gathering data regarding the extent to which they acquired certain computer skills during their teacher training experience. Mean ratings on all variables were found to be relatively low with the highest mean rating of 2.24 recorded for word processing software and the lowest (1.18) for web publishing software. The composite mean rating of 1.54 shows that these respondents believed that their training exposed them, only *to a small extent*, to different types of software.

When composite mean ratings were compared across colleges, the data showed that the highest mean ratings for all software types except e-mail, Internet communication tools and the Internet in general were reported from pre-service teacher respondents from College A. In the instances previously cited, the highest mean ratings were reported from pre-service teachers from College C. In all instances, the lowest mean ratings for all software types were reported from respondents from College B. The fact that these pre-service teachers from College A were exposed to an introductory computer course could be one of the factors that account for their perceived higher levels of proficiency with

various software types. Other factors include the fact that, from indirect observation by the researcher and confirmation from interviews with IT faculty, pre-service teachers from College A had access to more computers than their counterparts in other colleges (there were more computer labs at this college than at the other two colleges and there were more computers that are operational).

The data support the following conclusions regarding pre-service teachers' perceptions of preparation to teach with computers and their perceived proficiency with different software types. Like college faculty, the majority of pre-service teachers surveyed reported that they were not prepared to teach with computers. Pre-service teachers in Jamaica:

a. Did not perceive themselves as prepared to teach with computers.
b. Did not believe they were knowledgeable of different types of software to use them with their students.
c. Did not perceive themselves as prepared to use computers as instructional tools to enhance their practice.
d. Are generally not proficient with various computer productivity, communication and research tool. Relatively low mean ratings were reported for proficiency with different software types. In most cases, mean ratings on proficiency with different software were below 2.00 on a four-point scales indicating that proficiency with different software types was, at best, *Fair*.

The fact that a majority of pre-service did not perceive that they were (a) prepared to teach with computers and (b) proficient with various computer tools, corroborate

the conclusion that Jamaica's teacher training programs have not effectively incorporated technology into their curriculum.

Specific Factors Proposed to Facilitate Technology Integration into Jamaica's Teacher Training Programs

A number of factors were proposed by college administrators, IT faculty and pre-service teachers as necessary to ensure future teachers in Jamaica are equipped with knowledge and skills required to teach with computers. These data were examined and a number of themes emerged from the data. These themes are proposed as specific factors required to facilitate technology integration into Jamaica's teacher training programs.

1. *Access to Resources and Infrastructure*. Access to resources and infrastructure was proposed as the single most important factor required to facilitate technology integration in Jamaica's teacher training programs. All teachers' college administrators, IT faculty and groups of pres-service teachers proposed this as a specific factor required to facilitate technology integration. In addition to hardware and software, faculty and pre-service teachers need to have access network connections to facilitate communication sharing of resources as well as other types of technologies that can be used to facilitate teaching and learning. In addition, IT faculty and pre-service teachers also suggested that faculty and pre-service teachers must have access to computers and the Internet. In addition to the availability of productivity tools, teachers' colleges should also be furnished with different types of instructional software.

2. *Staff development for faculty*. If technology is be systematically incorporated into teacher training programs, there must be on-going staff development to equip faculty with knowledge and skills required to teach with computers. This factor was proposed by both college administrators and IT faculty from all three colleges that participated in the study.
3. *Training for pre-service teachers*. All three groups of participants suggested that training for pre-service teachers is an essential prerequisite to facilitate technology integration into Jamaica's teacher training programs. In addition, pre-service teachers suggested that they required more time for training to teach with computers. They proposed that training to use computers should not be conducted in a single-semester course, but should be continued throughout the three years of their teacher-training experience. Like pre-service teachers, college administrators expressed concerns about the quality of training to use computers pre-service teachers received during their college experience. According to an administrator at College C, if technology is to be effectively incorporated into the teachers' college curriculum and influence how future teachers teach, methodology classes have to be redesigned so that technology integration becomes the most significant component. In addition, technology has to be interwoven into all courses so that pre-service teachers can be exposed to ways in which technology can be used in specific content areas.
4. *Support*. College administrators and IT faculty proposed that, in tandem with staff development, faculty should be provided with on-going support as they attempt to use computers in their classes. An IT faculty member at College C suggested that

faculty should not only be trained and left on their own to integrate computers in their classes but should be provided with continuous support as they attempt to use computers in their classes. Administrators proposed that support structures should be established within colleges so that faculty can receive support from each other as they use computers in their teaching.

5. *Experience and practice using computers*. Faculty and pre-service teachers reported that if technology is to be incorporated into the college curriculum, pre-service teachers need practice using computers in real as well as contrived classroom settings. Pre-service teachers suggested that practice using computers will increase their computer proficiency as well as their confidence in using computers. In addition, pre-service teachers indicated that college lecturers should not only "tell" them how computers can be integrated into their teaching, but should provide them with opportunities for hands-on practice using computers as teaching tools.
6. *Security*. This factor was proposed by administrators from both Colleges B and C as one that needs to be addressed prior to any attempt to equip teachers' colleges with computers and related technologies. Security, they believed, is critical to ensuring that incidences of larceny are reduced. If security is not addressed in teachers' colleges, one administrator at College B proposed that equipping teachers' colleges with computers will be futile as equipment will have to be constantly replaced.

Discussion

From a review of the existing literature on technology and teacher training, a number of factors emerged as those essential to facilitate technology integration into the college curriculum. These include:

a) Evidence of a written, continuously revised and updated technology plan (ISTE Report, 1999; Kimble, 1999).

b) Access to opportunities for staff development for faculty. Staff development activities should be on-going to facilitate technology use (Kimble, 1999; RAND Report, 1995) as well as to accommodate changes in emerging technologies (Jacobsen & Lock, 2004; Sprague et al., 1998). In addition, staff development activities should not focus only on the development of computer skills, but should also expose participants to ways in which computers can be integrated into their classes (OTA Report, 1995; Parker, 1997; Pettenati et al., 2000).

c) Access to required resources and infrastructure to facilitate technology integration is fundamental in teacher training programs (Bullock, 2004; David, 1994; Parker, 1997; Surry, 2001).

d) Technical and administrative support at the college (OTA Report, 1995; Fullan, 1992; Munday, 1999; Mackenzie et al., 1996).

e) Faculty modelling of computer use in their classes plays a critical role in determining the extent to which technology becomes integrated into teacher training programs (Barron & Goldman, 1994). Modelling computer use by faculty has been proposed as one of the most effective ways of incorporating technology

into the college curriculum (Munday, 1991; Wetzel, 1998, Wetzel & Strudler, 2002).

f) Positive attitude towards computers and their roles in the teaching-learning process. Research suggests that faculty who portray a positive rather than negative attitude towards computers and their roles in the teaching learning process were more likely to use them in their classes (Parker, 1997; Shafer, 1997; Sprague et al., 1998).

g) Training for pre-service teachers regarding how computers can be incorporated into their teaching. In addition, training pre-service teachers to use technology should be continuous throughout their training (Bielefeldt, 2001; ISTE, 1999).

h) In tandem with training to use technology in their classes, pre-service teachers should also receive extensive practice and field experience using computers in their classes as well as during their field experience activities (Brownell, 1997; Wetzel, 1998).

These factors were incorporated into a generic conceptual framework for integrating technology into teacher training programs. The findings from the current study indicate that while the majority of the components of this generic framework were evident in Jamaica's teacher training programs, some were more evident than others.

The literature attached significant importance to evidence of a written technology plan as one of the primary factors that identified teacher training programs that have systematically integrated technology into their curriculum (ISTE Report, 1999; Kimble, 1999; NCATE Report, 1997). Findings from the present study suggested that there was no written technology plan in Jamaica's teacher training programs. What was evident

were *plans* regarding how computers can be used to facilitate distance learning or how the library will be wired, but no indication of the roles of computers and related technologies in the college curriculum. There were also no plans regarding how computers will be acquired and allocated in teacher training programs or skills pre-service teachers need to teach in the 21st Century classroom and how computers will be used to facilitate the acquisition of the skills.

The findings of the present study are consistent with what was found in studies conducted in the USA. Findings of the ISTE study (1999) conducted with 416 teacher training programs in the USA revealed that teacher training programs used in the study did not have a written technology plan that was updated on a consistent basis. The NCATE report (1997) proposed that teacher training programs need to develop a vision--a long-term view of the role of technology and how it can be incorporated into the college curriculum. The vision should include the development of a plan that outlines steps that will be taken to acquire required hardware and software and how these will be allocated in teacher training programs. In addition, the vision should include provisions for re-training of faculty as new technologies emerge as well as to accommodate new faculty who are employed after initial training had been conducted.

While the literature proposed that there should be evidence of a technology plan in teacher training programs, none of the study participants identified this as a specific factor required for technology integration in the Jamaican setting. However, based on what the literature proposed and data gathered in the present study, the researcher is proposing that, in the current study context a technology plan is required to facilitate technology integration. However, in the Jamaican setting, the researcher is proposing that

the term vision be used instead of technology plan. Data gathered in this study showed that one IT faculty member at College A proposed that there was a technology plan at that college and that this respondent was instrumental in developing this plan. However, other study participants, including administrators and other IT faculty members within this institution, were not aware of the presence of such a plan. In essence, the technology plan had not been the result of contributions from different participants and had not been effectively disseminated to the key players in the technology integration process. Therefore, while the researcher recognizes the need for a technology plan in all teacher training settings, the researcher is proposing that, in the Jamaican context, the term *vision* be used instead of technology plan. Vision is more appropriate in this setting to emphasize the need for a shared vision--one that was created from the input of all major stakeholders and disseminated to all relevant parties. The term vision also implies a more long-term, broad-range view than is captured in technology plan. Mehlinger and Powers (2002) proposed that teacher training programs should possess a vision, that is, a statement indicating what is possible with technology. The development of the vision should precede the acquisition of technological devices. Therefore, while the generic IT_3P uses technology plan, the action that was proposed specifically for the study context will use the term vision.

With regard to staff development, findings from the study suggested that staff development activities have not been systematically organized within individual colleges or by external organizations such as the JBTE. These findings are consistent with findings from a study conducted by Kimble (1999) where faculty highlighted the need for ongoing staff development to equip them with knowledge and skills required to teach

with computers. Barron and Goldman (1994) proposed that faculty members who have received staff development were more likely to use computers in their classes than those who did not. However, in one of the colleges that participated in this study, participants indicated that they had participated in staff development activities. Despite this, however, low levels of technology use were reported by these faculty respondents. One possible explanation for the underutilization of technology in this college is the sever paucity of resources in this college.

Like studies conducted in the USA (David, 1994; Parker, 1997; Surry, 2001), inadequate access to computers hindered technology use in the Jamaican setting. Despite the fact that 96% of college faculty and 100% of pre-service teachers surveyed indicated that they had access to computers at college, data gathered via qualitative means provided additional explanations that support the view that access to computers was not perceived as *adequate*. In some instances, faculty did not teach computer-based lessons as they did not have access to computers and had to schedule use of the computer labs "long in advance". Therefore, access to resources is an issue that must be addressed in the Jamaican setting.

Findings of studies conducted in the USA, (NCATE Report, 1997; National Center for Educational Statistics, 2000; Mumtaz, 2000) identified lack of support as one of the main barriers to technology integration. Findings from the OTA (1995) survey indicated that institutional leadership and support are critical to facilitate technology integration (OTA, 1995) in teacher training programs.In terms of administrative and technical support, study participants indicated that college administrators were generally supportive of computer use in individual colleges. Support was evident in terms of

encouragement and technical assistance for faculty who want to use computers in their classes. However, what was lacking were support structures required for technology integration. Study participants proposed that support structures should be established within teacher training programs as faculty attempt to integrate computers in their classes. In addition, an IT faculty member suggested that support for technology use should be ongoing and coupled with staff development activities. In the Jamaican setting, support includes establishing support structures as faculty integrate computers in their classes.

In terms of modelling computer use, the literature proposed that when faculty model computer use in their classes, pre-service teachers experience, vicariously, ways in which computers can be used in content specific areas. Findings from the current study indicate that only 33% of faculty surveyed indicated that they modeled computer use for their students. In addition, administrators and IT faculty concurred that faculty did not systematically use computers in their classes. These findings are consistent with what was observed from studies conducted in the USA that found there were generally low levels of technology use in classrooms in colleges of education (OTA, 1995). Similarly, findings from the ISTE (1999) survey of 416 teacher training programs indicated that faculty did not model computer use in their classes. The researcher is proposing two possible reasons for lack of computer use in teachers' colleges in Jamaica: (a) inadequate knowledge of how computers can be used in their classes and (b) inadequate access to computers at the college level. If Jamaican Teachers' college faculty are to model computer use, they must have access to computers and possess knowledge of how computers can be integrated in their classes.

In the context of this study, the findings showed that all study participants reported positive attitudes towards computers. In a survey of 4041 teachers, Shafer (1997) found that teachers who displayed positive attitudes towards computers were more likely to use them in their classes than those who did not. Faculty who thought technology was able to contribute to school reform and their own work were more likely to integrate it in their classes than those who did not. Despite overwhelmingly positive attitudes towards computers from study participants, there was little corresponding computer use in classroom settings. One of the major factors that can account for this limited computer use among college faculty is limited access to resources and infrastructure to facilitate technology integration. Participants' positive attitudes towards computers can be attributed to the fact that study participants recognized the important role of technology and therefore displayed a positive attitude towards its use in the classroom setting.

With regard to pre-service teachers' training to use computers in their classes, findings from the current study showed that, in general, pre-service teachers did not believe that the training they received at college adequately prepared them to integrate computers in their teaching. These findings are consistent with those of studies reported in the literature (Brownell, 1991; Cole, 1996; National Center for Education Statistics, 2000) that found that pre-service teachers did not generally believe their training prepared them to teach with computers. Within the Jamaican setting, despite the fact that computers have been placed in schools and colleges, little corresponding training has been done to ensure future teachers are prepared to teach with computers. Revisions to existing syllabi have included a technology component, however, these revision have not

been implemented with the current study population. Therefore, it is not surprising that perceptions of training to teach with computers are low among this population.

In addition, findings from this study are consistent with what was observed in the literature--college faculty were generally not prepared to incorporate computers in their teaching (ISTE, 1999; National Center for Educational Statistics, 2000; NCATE, 1997; OTA, 1995). Only 48% of faculty surveyed indicated they felt prepared to teach with computers and 40% reported that they felt prepared to teach with computers. Therefore, the issue of preparing faculty to teach with computers is one that needs to be addressed in the Jamaican teacher training setting.

With regard to practice and experience using computers, findings from the present study showed that pre-service teachers had minimal experience using computers both during their college experience and their practicum activities. Apart from using computers to conduct research, use in other areas was, at best, minimal. Bowman-Alden (1989) proposed that teacher training programs should include a component that emphasizes practice and hand-on experience using computers. Field experience using computers can provide pre-service teachers with concrete experience regarding ways in which computers can be used in their classes (Stuhlmann, 1998; Wetzel & Strudler, 2002).

When data from the present study were examined, it was evident that all specific factors, with the exception of security, proposed by study participants as required to facilitate technology integration in Jamaica's teacher training programs were included in the generic IT_3P framework. This indicates that the IT_3P framework adequately addressed factors required to facilitate technology integration in teacher training programs, not only

in developed counties, but in developing countries such as Jamaica as well. While security was not addressed in the IT_3P, in a developing country such as Jamaica, the issue of security becomes significant and needs to be addressed. As one study participant suggested, this would mean redesigning all the classrooms if computers are to be placed in individual classrooms. Classrooms have to be designed in such a way to ensure equipment will not be removed.

Revisions to IT_3P Framework

Data gathered from the present study suggested the following changes to the generic IT_3P conceptual framework.

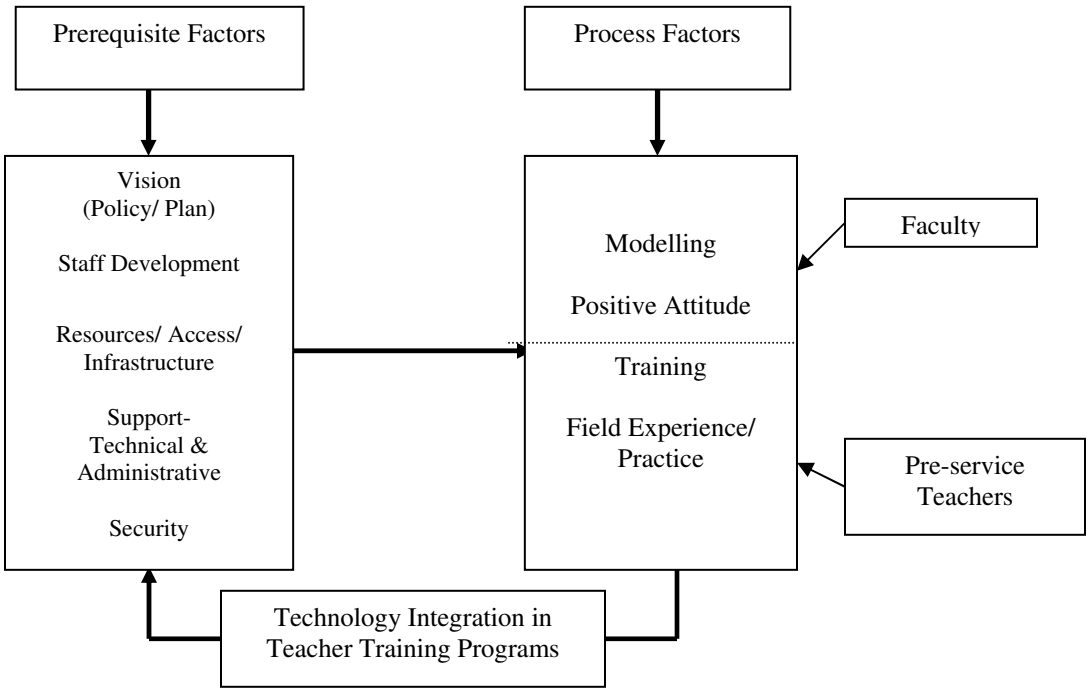

Figure 3: Revised IT_3P Framework

The revised IT_3P includes two components not represented in the original conceptual framework--vision and security. The researcher believes that, while these two

additional components of the IT_3P were suggested by study participants in the Jamaican setting, their addition to the revised IT_3P make it more generalizable to other settings. The following section of the chapter discusses components of a new action plan specifically designed to facilitate technology integration in the Jamaican setting.

VIBES- Recommended Plan of Action for Integrating Technology into Jamaica's Teacher Training Programs

Given the urgent need to prepare the Jamaican teacher population to integrate technology into their teaching, the VIBES is proposed as an action plan to facilitate technology integration into Jamaica's teacher training programs. VIBES is a conceptual framework for an action plan for integrating technology into Jamaica's teacher training programs. A number of specific factors were proposed by college administrators, IT faculty and pre-service teachers as necessary to ensure future teachers are equipped with knowledge and skills required to teach with computers. These factors were synthesized into a model for integrating technology into Jamaica's teacher training programs. In addition, one factor was retained from the generic IT_3P and expanded to assure its relevance to the Jamaican setting. Having used this generic IT_3P to frame the state of technology integration in Jamaica's teacher training programs, it provided the springboard for an *action plan*, that is, specific recommendations for facilitating technology integration into the Jamaican setting. As a result of the data, the researcher is proposing a new model, the VIBES framework, specifically designed as an *action plan* to facilitate technology integration in Jamaica's teacher training systems. VIBES is comprised of five components that are essential for effective technology integration in

Jamaica's teacher training programs. These are Vision, Infrastructure, Behaviour, Experience and Support, hence the acronym VIBES. The components are represented in a systematic order and each preceding variable is a requirement for the succeeding one. However, all the variables are invariably intertwined. VIBES was developed from data gathered primarily through interviews with teachers' college administrators, IT faculty and focus group discussions with pre-service teachers in Jamaica. In addition, data gathered via all other means used in this study were incorporated into this conceptual framework. The primary purpose of VIBES is to provide curriculum policy makers and college administrators with recommendations for infusing technology into Jamaica's teacher training programs. See a diagram of VIBES below.

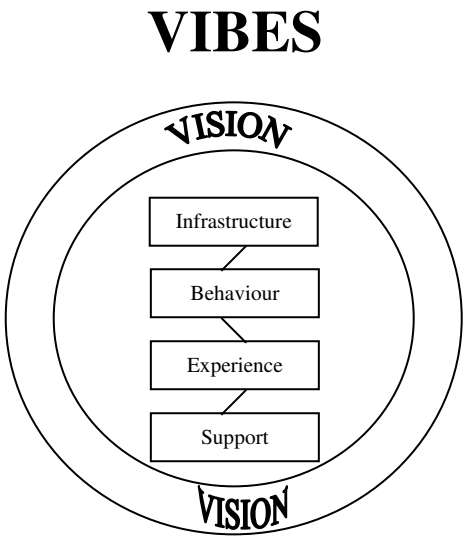

Figure 4. Diagrammatic representation of the VIBES Framework

Vision. The first component of VIBES, vision, and more specifically, a shared vision, defines the overall conceptualization of the role of technology in teacher training programs. In VIBES, the vision is the overarching factor that influences/determines all

other components of the framework. It encapsulates all the other features and is singularly the most essential component of VIBES. As a result of its significance, it encircles all other variables in VIBES and impacts each of them. The vision involves devising a technology plan which includes long-term plans for the acquisition and allocation of computers (hardware and software), as well as other technological devices that will facilitate integration. While college administrators play a leading role in the decision making process, defining the vision must include input from all major stakeholders. Faculty must be included at this critical stage so their input can be ascertained and their roles in the whole reform process defined and validated. Further, the vision should also include:

a) Conducting a comprehensive needs assessment to identify teachers' college faculty's and pre-service teachers' competence levels. Administrators interviewed proposed that students entering college possess certain computer skills. If a needs assessment is conducted, curriculum policy makers and college administrators will be provided with information where training is required. A needs assessment should also be conducted with faculty so that areas to be addressed in staff development activities can be ascertained.

b) An in-depth examination of the future of teacher training and how technology can enhance the teacher preparation process. This involves establishing long-term goals for teacher training and highlighting ways in which technology can be used to facilitate these goals. In addition, the vision should include provisions for sustainable development of the use of technology in teacher training programs.

c) A clear definition of knowledge and skills that prospective teachers need to be able to teach in the 21st Century classroom and skills their students need to function in the 21st Century society. A comprehensive needs assessment must be conducted to determine (a) necessary technology literacy skills and (b) more significantly, key integration skills that will enhance the teaching learning process.

d) The vision should also include steps for establishing partnerships with funding agencies as well as other stakeholders within the community. This will not only provide colleges with sources of funding, but these partners can be instrumental in defining future needs of prospective employers. At College C, for instance, IT faculty members at that institution suggested that they had acquired a number of computers and related software through partnerships that they had established with a number of projects. This seems to be one way in which teachers' colleges can increase the number of computers available to them.

e) Finally, steps for the re-training or faculty as emerging technologies change and make provisions for the training of staff employed after initial training had been conducted.

The vision should be constantly revised to (a) reflect changes in the needs of the populace and in emerging technologies as well as to (b) envision future needs and developments of teacher training.

Infrastructure. The second factor included in VIBES is infrastructure and is used in a similar way as access proposed in the literature or resources used in Surry's

RIPPLES model (Surry, 2001). However, infrastructure is used in VIBES instead of resources to account for, not only required computers (hardware and software), but to include all physical resources and network connections, (Local Area Network & Wide Area Network) to facilitate communication and collaboration as well as the exchange of ideas and information within and among colleges. Findings from the study indicate a consensus among participants that the major factor that hindered technology integration in Jamaica's teacher training programs was lack of resources. As a matter of fact, over 90% of participants surveyed proposed this as the factor that most often deterred faculty and students from gaining knowledge and experience using computers in their classes. While the issue of access to infrastructure still plagues teachers' colleges in Jamaica, there seems to be some hope as administrators from colleges that were sampled in this study have been able to establish partnerships with some companies that will allow them to acquire computers at a reduced cost. However, when a college has a population of approximately 1500 students, 90 computers is not nearly sufficient to facilitate technology integration. Access to required resources is critical to facilitate technology integration into the curriculum of teacher training programs.

College administrators proposed that students need to have access, not only to computers, but also to other technologies such as digital cameras and camcorders, multimedia projectors, and so on, as these are becoming more widely available in schools where they will become in-service teachers. One administrator proposed that one way to increase access is to have "portable labs" which will allow faculty to take the lab to their classrooms instead of taking their students to the computer lab. Another is of the opinion that college administrators should make having access to a lap top computer one of the

requirements for entering college as a way of increasing the amount of access to computers in colleges. This in itself is quite unrealistic given the nature of the teacher training population. It seems therefore that it is incumbent on (a) organisations such as the JBTE or (b) the colleges themselves to ensure faculty and pre-service teachers have increased access to computers. Organizations such as the Joint Board of Teacher Educators needs to become more actively involved in ensuring colleges are equipped with resources and infrastructure required to facilitate technology integration. In addition, colleges have to establish partnerships with the business community as well as national and international funding agencies and projects so that required hardware and software can be acquired to facilitate technology integration in individual colleges.

Infrastructure also includes ensuring that necessary security devices are in place in teachers' colleges to guarantee that whatever technologies are installed remain in place. One administrator believes this would essentially mean redesigning the entire classroom structure to ensure there is security if each classroom should be equipped with at least one computer. The issue of security must be addressed within individual colleges as there are idiosyncrasies related to individual colleges that will determine the levels of security measures needed.

Behaviour. Adopting a new innovation requires a change in behaviour, sometimes over time. In order for technology to be systematically incorporated into teacher training programs, college faculty must posses knowledge and skills required to integrate computers in their classes. In VIBES, behaviour requires mobilizing human resources to effect changes in technology skills and knowledge and subsequently, computer use. In

this case, a change in behaviour requires staff development for faculty and intensive, on-going training for pre-service teachers. Any model on technology integration must include a component that addresses ongoing staff development. As one IT faculty observed, while some faculty members *believe* they are capable of teaching with technology, perception is one thing, but efficacy and utilization are not evident.

Data from this study revealed that there are not many organized staff development exercises in the form of workshops to teach specific skills or expose faculty to ways in which computers can be incorporated in their teaching. As a matter of fact, it seems that some colleges have struggled to provide these activities for their faculty. College administrators suggested that some faculty are not too eager to admit they need help and therefore, do not take advantage of these activities.

In designing staff development activities, organizers should be careful to ensure these activities focus not only on computer skills, but must be conducted by persons knowledgeable in technology and pedagogy so essential technology integration skills can also be taught. Staff development activities should be frequently scheduled to account for (a) changes in emerging technologies (b) changes in required knowledge and skills by pre-service teachers and their prospective students and (c) staff turn-over in the colleges. The researcher was informed that the last major, organized staff development activity that involved all faculty took place approximately 3-5 years ago. Since then a number of new staff members have joined the faculty and therefore have not benefited from these activities. The data also show that faculty employed at the college level for less than 3 years were less likely to indicate that they have participated in staff development than their counterparts who have been there for longer periods. Most of these faculty have

reported that they have received training on their own and while some may possess computer skills, knowledge of how to integrate technology into their teaching is severely lacking. Changing faculty's behaviour through staff development involves not only the provision of these activities, but also ensuring measures are put in place to guarantee faculty take advantage of these activities. In all three colleges sampled in this study, there was evidence that, even in instances where staff development activities were organized, some were not effective as faculty did not take advantage of them. College administrators must devise innovative ways of mandating and encouraging faculty to participate in planned staff development activities. These can be through incentives, providing faculty with release time, course certification and so on. It is imperative that staff development activities be planned at least twice per year--at the beginning of the school year and at other intervals later in the school year.

Training pre-service teachers to teach with computers must also be an essential component of the teacher training curriculum. However, while exposing pre-service teachers to a single computer course is necessary, this will not sufficiently address their technology integration needs. This does not mean that pre-service teachers should not be taught essential computer skills, however, this should be done only as a preface to exposing them to essential integration skills.

During focus group sessions, students proposed that in order for technology to be successfully integrated in teacher training programs, apart from to access computers and different types of software, there should be trained faculty to teach them (a) how to use different types of software and (b) how to use technology as teaching tools. Since the majority of subject specialists also teach related methodology courses, all faculty should

be trained so using technology and exposing pre-service teachers to ways in which technology can be used can become an integral part of their methodology classes.

In order to effect a change in behaviour in pre-service teachers, they must be exposed to some level of training to improve their computer skills as well as knowledge of how to use computers as teaching and cognitive tools. The data from the present study revealed that, while perceptions of preparation to teach with computers were relatively low, respondents from College A were more likely to indicate that they are prepared to integrate computers in their classes than their counterparts in Colleges B and C. While these pre-service teachers are similar to their counterparts in other colleges in many ways, one of the distinguishing features is the presence of an introductory computer course in their college curriculum. This means that while the literature proposed that having a stand-alone computer program does not often work, the researcher is proposing that one be in place in teacher training programs in Jamaica to ensure students are technologically literate before they are exposed to ways in which computers can be infused in their teaching. In addition, it is important that training not be done over the course of one semester or two semesters, but ongoing throughout pre-service teachers' college experience. Further, integrating technology should become an integral part of methodology. As one college administrator noted, "I think the technology in education component could be the most visible integrative tool in teacher training". She further suggested that while technology in education should be taught as a single subject, it should also be used to "combine the different subject areas". Technology has to become the center of methodology. Prospective teachers should be taught how to use the computer as a teaching tool and, more significantly, how to get their students to select,

evaluate and use materials and information they access via the computer. Pre-service teachers should be exposed to how they can use computers as cognitive tools that will develop critical thinking and problems solving skills in their students. While training in colleges in Jamaica should include a course aimed at developing specific computer skills in teachers, students should be exposed to, both directly and indirectly, through methodology classes and modelling of computer use by faculty, content specific integrative skills.

Experience. In tandem with staff development and training, faculty and pre-service teachers need extensive and continuous practice using computers as it is through practice that knowledge and skills become concretized. Once behavior is changed through training, faculty and pre-service teachers need hands-on practice using computers in real as well as contrived classroom settings. One way of doing this is to require that during methodology classes, computers be used as teaching tools as any other teaching aid previously used by faculty and pre-service teachers. From focus group discussions, it was clear pre-service teachers did not believe their technology in education classes were adequately providing them with "hands-on" practice using computers and related technologies. In order to increase the amount of practice pre-service teachers receive, faculty must (a) assign activities that require using computers for research as well as to complete the activities (word processing) (b) require that students use computers for class presentations as they would with any other media and (c) as best as is possible, use

computers for intra class and college and inter college communication and collaboration with peers and learners in other parts of the world.

Faculty, too, need experience and practice using computers as teaching tools as this will not only make them more proficient, comfortable and confident in using the technology, but help them provide pre-service teachers with ideas regarding how computers can be used in their classes. Through this vicarious medium, pre-service teachers will be provided with examples of how computers can be used in specific subject areas as well as models of best practices using computers as teaching tools.

During focus group discussions, students proposed that technology should not be taught as a single course as it is currently being done, but should be ongoing throughout the 3 years of their teacher training programs. This way, they will receive adequate practice and will become more competent using computers as teaching tools.

Support. The final variable in VIBES, support speaks to the issue of institutional support at the college level. This is not so much in the form of administrative support as findings from the study indicate that administrators recognize the importance of and the need to incorporate technology in the college curriculum and are supportive of efforts to integrate computers. Support is used in VIBES to represent more technical and pedagogical support.

While faculty possess, in theory, knowledge of how computers can be infused in their teaching, technical knowledge of how it can actually be accomplished is lacking. College administrators need to ensure there is someone at the college who has the primary responsibility of showing faculty how to do tasks that range from creating and

formatting documents using a word processor to creating PowerPoint slides to setting up and using the multimedia projectors and digital cameras and camcorders and so on. According to one IT faculty member, integration of technology into the college curriculum would be enhanced if faculty had more support. She further proposes that they do not systematically use computers because they do not have required support. “The big thing would be training for faculty with support, so we do not just provide them with the skills and leave them on their own, we provide them with ongoing support as they try to design and teach computer-based lessons”. IT faculty believe that many times faculty have interesting ideas regarding how to teach a lesson that incorporates teaching with the computer, but they need technical support to provide them with assistance to put their lessons in a format they want.

Apart from technical support in the form of technical assistance, faculty, as they work together to integrate computers in their classes, need to develop support structures among themselves where they can share stories of success and challenges using technology in their classes. When faculty see others succeeding using technology or realize that they are not the only ones who are struggling to integrate computers in their classes, they will be encouraged by stories. In addition, faculty members need pedagogical support to enhance their integration efforts. This suggests that all colleges should have at least one faculty member who is knowledgeable in both technology and pedagogy so faculty can receive assistance from this person when this is required.

Summary

The current study examined and described the current state of technology in Jamaica's teacher training programs. It also assessed teachers' college faculty's and pre-service teachers' perceptions of their preparation to teach with computers as well as their perceived levels of proficiency with various computer tools. In addition, the study proposed a conceptual framework in the form of an action plan for integrating technology into Jamaica's teacher training programs. Administrators, faculty and final year pre-service teachers in three teachers' colleges in Jamaica provided data required for the study. Data were gathered via interviews, self-administered questionnaires and focus group discussions.

It was evident from data gathered in this study that technology has not been effectively incorporated into Jamaica's teacher training curricula. The IT_3P proposed eight factors required for and identified teacher training programs that have systematically integrated technology into their curriculum. Of the eight factors proposed in the IT_3P, only two--administrative support and positive attitude towards computers are evident in colleges used in this study. Others existed only minimally in some instances--however, even in these cases, they did not exist sufficiently to facilitate integration efforts. Access to computer hardware and software and related infrastructure as well as lack of knowledge and skills regarding how computers can be used as teaching tools were the major factors that hindered technology integration in Jamaica's teachers' colleges. In addition, both faculty and pre-service teachers did not perceive themselves as prepared to teach with computers. Both sets of participants also reported low levels of proficiency with various computer tools.

The IT_3P framework provided a good scaffold for conducting the research, it also provided a springboard for a plan of action for improving technology integration in Jamaica's teacher training programs. This new plan of action became manifest in VIBES. The VIBES framework proposes five factors relevant to ensure technology becomes incorporated into teacher training programs in Jamaica. These five components are Vision, Infrastructure, Behaviour, Experience and Support. While VIBES is not prescriptive, it identifies factors that are relevant for technology integration in this setting.

Recommendations for Future Research

The descriptive nature of the present study provided an understanding of the state of technology integration in Jamaica's teacher training program. These descriptive data provided an indication of what currently exists and provide a number of directions for future research. This section of the chapter provides recommendations and directions for future research.

1. Follow-up studies should also be conducted with in-service teachers to determine if they are using technology in their classes and how technology is being used by these teachers. In-service teachers should also be provided with on-going support as they use computers with their students.
2. The study should also be replicated with a larger group of participants and should include students from other institutions that are considered "multidisciplinary" institutions, but include a teacher training component.

3. Future research could also *test* VIBES to determine if alterations are required. Follow-up research could also be done to determine if its implementation results in any changes in behaviour for college faculty as well as pre-service teachers. This will include conducting a longitudinal study were data are collected over a 3-5 year period to ascertain if changes in behaviour can be attributed to the implementation of VIBES in Jamaica's teacher training programs.
4. Future research should also be conducted with recent graduates (within the last three years) of teacher training institutions to identify the extent to which they are currently using computers and other technologies in their teaching.

References

Abdal-Haqq, I. (1995). Infusing technology into preservice teacher education. *ERIC Digest. ED 389969*.

Bandura, A. (1977). Social Learning theory. Retrieved September 2002 from http://tip.psychology.org/bandura.html.

Barron, L. C., & Goldman, E. S. (1994). Integrating technology with teacher preparation. In B. Means Ed. *Technology and Education Reform* (81-110). Jossey-Bass Publishers, San Francisco.

Beck, J., & Wynn, H. C. (1998). Technology in teacher education: Progress along the continuum. *ERIC Digest. ED 424212*.

Bielefeldt, T., (2001). Technology in teacher education: A closer look. *Journal of Computing in Teacher Education,* 17(4), 4-15.

Bohlin, R. M. (1999). Avoiding computer avoidance. *IT Forum Paper #35*. Retrieved October 2002 from http://itech1.coe.uga.edu/itforum/paper35/paper35.html

Bowman Alden, S. (1989). Effective programs for training teachers on the use of technology. Retrieved September 24, 2002 from http://www.computerlearniing.org/articles/Training.htm.

Brownell, G. & Brownell, N. (1991). Designing tomorrow: Preparing teachers as change agents for the classroom of the future. *Computers in the Schools*, 8 (1/2/3), 147-149.

Brownell, K. (1997). Technology in teacher education: Where are we and where do we go from here? *Journal of Technology and Teacher Education*, 5 (2/3), 117-138.

Bullock, D. (2004). Moving from theory to practice: An examination of the factors that preservice teachers encounter as they attempt to gain experience with technology during field placement activities. *Journal of Technology and Teacher Education*, 12 (2), 211-237.

Campoy, R. (1992). The role of technology in the school reform movement. *Educational Technology*, 32(8), 17-22.

CEO Forum School Technology and Readiness Report, (1999). Professional development. A link to better learning. Retrieved September 24, 2002 from http://www.ceoforum.org/reports.cfm

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data. Complementary research design*. Sage Publications. USA.

Cole, S. 2000. Technology Has Found its Way into Our Schools…Now What? *TechTrends*, 44 (6), 23-27.

Crawford, A. (1999, November). Management of technology in education projects. Jamaica 2000. Jamaica Computer Education Foundation. Retrieved May 21, 2003 from http:// www.col.org/tel99/acrobat/crawford1.pdf

Crawford, A. (2001). Building sustainable ICT capabilities in Jamaica. Retrieved May 21, 2003 from www.capacity.org/10/editorial3.html

Cuban, L. (1993). Computers meet classroom: Classroom wins. *Teachers College Record*. 95 (2), 85-210.

Cuban, L. (1998). High-Tech schools and low-tech teaching. A commentary. *Journal of Computing in Teacher Education,* 14 (2), 6-8.

Dasher, J. M. (1997). Teaching the teacher- technology training in the classroom. *Journal of Instructional Delivery Systems*, 11 (3), 3-7.

David, J. L. (1994). Realizing the promise of technology: A policy perspective. In B. Means Ed. *Technology and Education Reform* (169-189). Jossey-Bass Publishers, San Francisco.

Ely, D. P. (1999). Conditions that Facilitate the Implementation of Educational Technology Innovations. *Educational Technology*, 39 (6), 23-27.

Fink, A. (2003a). *How to manage, analyze and interpret survey data (2nd edition).* Sage publications Inc, USA.

Fink, A. (2003b). *The survey handbook (2nd edition).* Sage publications Inc, USA.

Fink, A. & Kosecoff, J. B. (1985). *How to conduct surveys. A step-by-step guide*. Sage publications Inc, USA.

Fisher, M. (1997). The voice of experience: Inservice teacher technology competency recommendations for preservice teacher preparation programs. *Journal of Technology and Teacher Education*, 5 (2/3), 139-147.

Fowler, F. J. (Jr.) (1984). *Survey research methods. Applied social science research methods series volume 1*. Sage Publications Inc. USA.

Fullan, M. (1992).*Successful school improvement: The implementation perspective and beyond.* Open University Press, Philadelphia, USA.

Fullan, M. G. 1993. Why Teachers Must Become Change Agents. *Educational Leadership,* 50 (6), 12-17.

Gillingham, M., G. & Topper, Andrew. (1999). Technology in teacher preparation: Preparing teachers for the future. *Journal of Technology and Teacher Preparation*, 7 (4), 303-321.

Grabe, M., & Grabe, C., (2001). *Integrating technology for meaningful learning*. Houghton Muffin Company. USA.

Hogarty, K. & Kromrey, J. (2000). The nature of technology use in classrooms: The development and validation of an instrument to measure teachers' perceptions . Paper presented at the annual Meeting of the Florida Educational Research Association (FERA), Tallahassee, Florida

Howland, J. & Wedman, J. (2004). A process model for faculty development: Individualizing technology learning. *Journal of Technology and Teacher Education*.12 (2), 239-263.

International Society for Technology in Education (2000). National Educational Technology Standards (NETS) for Teachers. Retrieved June 21, 2002 from http://cnets.iste.org

ISTE Nets Project, (2000-2002). Essential conditions for teacher preparation. Retrieved June 21, 2003 from http://cnets.org/teachers/t_esscond.html

Joint Board of Teacher Education (JBTE) (2003, February). *Curriculum Guide for three year diploma in teacher-education-primary. Technology in education courses*. Kingston, Jamaica.

Jacobsen, M. & Lock, J. (2004). Technology and teacher education for a knowledge era. Mentoring for student futures, not our past. Journal of Technology and Teacher Education. 12(1), 75-100.

Jost, K. (1995). Creating a learning environment for teachers. *EDRS Document. ED 383 313.*

Kimble, C. (1999). The impact of technology on learning. Making Sense of the Research. *Policy Brief. Mid-Continental Regional Educational Laboratory*.

Kinslow, J., et al., (2002). Forming a cadre of learners. Effective educational technology integration in a teacher preparation programs. *Journal of Computing in Teacher Education*, 18(3), 81-86.

Kortecamp, K. & Croninger, W. R. (1996). Addressing barriers to technology diffusion. *Journal of Information Technology for Teacher Education*, 5 (1/2), 71-82.

Krathwohl, D. R. (1993). Methods of educational and social science research: An integrated approach. Longman, NY. USA.

Mann, D. & Shafer, E. A. (no date) Technology and achievement. An investment in technology pays off in student performance, these researchers say. Retrieved March 31, 2001 from http://www.asbj.com/achievement/ci/ci10.html

Mayring, Philipp (2000, June). Qualitative content analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research [On-line Journal], 1*(2). Retrieved September 26, 2003 from http://www.qualitative-research.net/fqs-texte/2-00/2-00mayring-e.htm

McKenzie, B. et al., (1996). Preparing for the future with technology: Extending past the classroom. *Journal of Information Technology for Teacher Education*, 5 (1/2), 83-92.

Mehlinger, H. & Powers, S. (2002). Technology and teacher Education: A guide for educators and policymakers. Houghton Muffin Company. USA

Milken Exchange on Education Technology. (1999). Will new teachers be prepared to teach in a digital age? A national survey of information technology in teacher education. Retrieved on April 9, 2002 from http://www.mff.org/publications/publications.taf?page=154

Milken Family Foundation (2002). Information technology underused in teacher education. Retrieved April 9, 2002 from http://www.mff.org/edtech/article.taf?_function=detail&Content_uid1=131.

Munday, J. (1991). Technology for learning: Are teachers being prepared? *Educational Technology*, 31 (3), 29-32.

Mumtaz, S. 2000. Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, 9 (3), 319-342.

NCATE (1997). Technology and the new professional teacher: Preparing for the 21st Century classroom. Retrieved on April 9, 2002 from http://www.ncate.org/accred/ptojects/tech/tech-21.htm.

Office of Technology Assessment, (1995). Teachers and technology: Making the connection. Retrieved November 2003 from http://www.wws.princeton.edu/~ota/ns20/alpha_f.html.

Parker, R. D. (1997). Increasing faculty use of technology in teaching and teacher education. *Journal of Technology and Teacher Education*, 5 (2/3), 105-115.

Peart, M. (1998). Essential skills for teachers in the age of information technology and interactivity. In R. King (ed.) *Institute of Education Annual*. Kingston: University of the West Indies. 1, 194-204.

Pettenati, M.C., (2001). Information technology and staff development: Issues and problems related to new skills and competence acquisition. *Journal of Technology and Teacher Education*, 9(2), 153-169.

Pope, M. et al. (2002). Technology integration: Closing the gap between what pre-service teachers are taught to do and what they can do. *Journal of Technology and Teacher Education*. 10 (2), 191-203.

Qualitative Methods 101 Handout. (no date). Retrieved April 2003 from http://www.ucsf.edu/fhop/docs/training/data-m/qualitative-handout.pdf

RAND Report: Teacher training, (1995). Technology and teacher professional development. Retrieved April 2003 from http://www.ed.gov/Technology/Plan/RAND/Tecaher.html.

Ritchie, D. & Rodriquez, S. (1996). School administrators and educational technologies: Narrowing the divide. *Journal of Information Technology for Teacher Education*, 5 (1/2), 107-114.

Rogers, E. M., (1995). *Diffusion of innovations*. (4th Edition).The Free Press.

Rogers, P. (1999). Barriers to adopting emerging technologies in education. *EDRS Document. ED 439 556.*

Rosenthal, I. G. (1999). New teachers and technology: Are they prepared? *Technology and Learning,* 19 (8), 22-24, 29-28.

Schmidt, D. (1998). Technology and teacher education: Preservice teachers can help make a difference. *Journal of Computing in Teacher Education*, 14(2), 2-3.

Shenouda, W. & Johnson, G., (1995). Cooperative effort to integrate computer technology into teacher education curricula. *EDRS Document, ED 378 109*.

Spiegel, H. (2002). Pre-service teacher training and implementation in the classroom: Considerations. *EDRS Document, ED 475-952*.

Sprague, D. et al., (1998). Faculty development in the integration of technology courses in teacher education courses. *Journal of Computing in Teacher Education*, 14 (2), 24-28.

Stewart, E. (1999, Fall). Learning together: The use of mentoring for faculty development in the integration of technology. *Journal of Computing in Teacher Education*, 16 (1), 15-21.

Stuhlmann, J. M., (1998) A model for infusing technology into teacher training programs. *Journal of Technology and Teacher Education*, 6(2/3), 125-139.

Sudzina, M. R. (1993). Technology, teachers, educational Reform: Implications for teacher preparation. *EDRS Document, ED 355 207*.

Surry, D. W. (1997). Diffusion Theory and Instructional Technology. Paper presented at the Annual Conference of the Association for Educational Communications and Technology (AECT), Albuquerque, New Mexico, February 12-15, 1997.

Surry, D. W. (2001). A Model for integrating instructional technology into higher education. Proposal submitted to SIG: Instructional Technology. Retrieved October 2002 from http://tigersystem.net/aera2000/viewproposaltext.asp

Surry, D. W. & Farquhar, J. D. 1997. Diffusion Theory and Instructional Technology. *Journal of Instructional Science and Technology*. Retrieved October 2002 from http://www.usq.edu/au/electpub/e-jist/docs/old/vol2no1/article2.htm

Thomas, L. et al., (1996). Integrating technology in teacher education programs: Lessons from the teaching teleapprenticeships project. *Action in Teacher Education*, 17(4), 1-8. Retrieved from http://lrs.ed.uiuc/TTA/Papers/TLCL.html

Trochim, W. M. K. (2002). Probability sampling. Retrieved January 28, 2003 from http://trochim.human.cornell.edu/kb/sampprob.htm

University of South Florida TECH initiative survey. (2003) Retrieved February 2003 from http://www.metiri.com/usf/pt3survey/

U.S. Department of Education. National Center for Education Statistics. *Teachers' tools*

for the 21st Century: A Report on teachers' use of technology. NECS 2000-102 by Becky Smerdon, Stephanie Cronen, Lawrence Lanahan, Jennifer Anderson, Nicholas Iannotti, and January Angeles. Washington, DC: 2000.

Varsidas, C., & McIsaac, M. (2001). Integrating technology in teaching and teacher education: Implications for policy and curriculum reform. *Educational Media International*, 38 (2/3), 127-132.

Weisberg, H. F. et al. (1989) *An introduction to survey research and data analysis (2nd edition)*. Library of Congress Cataloging-in-publication. USA.

Wetzel, K. (1998). The implementation of educational change in teacher education. *Journal of Computing in Teacher Education*, 14 (2), 4-5.

Wetzel, K., Strudler, N., (2002) Experiencing technology. *Journal of Computing in Teacher Education,* 19(2), 30-32.

Willis, E. M., & Sujo de Montes, L., (2002). Does requiring a technology course in preservice teacher education affect student teacher's technology use in the classroom? *Journal of Computing in Teacher Education,* 18(3), 76-80.

Willis, J.W., & Mehlinger, H. D. (1996). Information technology and teacher education. In J. Sikula, T. Buttery, & E. Guyton (Eds.), Handbook of research on teacher education (2nd ed., 978-1029).

Appendices

Appendix A: Faculty Technology Integration Instrument

Teachers' College Faculty Technology Integration Instrument

The purpose of this questionnaire is to gather data regarding the extent to which graduates of teachers' colleges in Jamaica are prepared to teach with computers.

Your participation is strictly voluntary and any information given will remain confidential and anonymous.

Section A: General information

1. Gender

   Male Female

2. Age

   20-24 25-29 30-34
   35-39 40-45 Over 45

3. Name of college where you currently teach.

   Bethlehem Church SSTC
   Mico Shortwood St. Josephs

4. How long have you been teaching?

   1-5 years 6-10 years 11-15 years
   16-20 years 21-25 years More than 25 years

5. How long have you been teaching at this college?

   Less than 3 years 3-5 years 6-10 years
   11-15 years More than 15 years

6. What subjects do you teach? (Choose **all** that apply).

   English Language Music
   English Literature Science
   Mathematics Geography
   Physical Education Home Economics
   Social Studies Art & Craft
   Foreign Languages Instructional Technology
   Methodology (Please specify) _____
   Other(s) (Please specify) _____

7. Qualifications: Choose **highest** degree attained.

   Teachers' Diploma Bachelors
   Masters Doctorate

Instructions: For each of the items in sections <u>B-J</u>, use the following scale to indicate your level of agreement with each statement.

<u>Circle:</u> 1 = Strongly Disagree, 2 = Disagree, 3 = Agree and 4 = Strongly Agree

Section B: Technology Plan

	SD	D	A	SA
8. There is a policy or plan in place at my college that states how teachers should be prepared to teach with computers.	1	2	3	4
9. There is a plan that outlines how computers will be acquired and allocated in my college.	1	2	3	4
10. My college has a document from the Joint Board of Teacher Education (JBTE) that outlines computer skills students need to be able to teach in the 21st Century classroom.	1	2	3	4
11. There is a plan that outlines the goals of teacher training and how computers can be used to achieve these goals.	1	2	3	4

Section C: Staff Development

	SD	D	A	SA
12. There are opportunities for staff development for lecturers interested in using computers in their classes.	1	2	3	4
13. Organisations such as the JBTE and the Jamaica Computer Society Education Foundation (JCSEF) offer workshops for lecturers to improve their computer skills.	1	2	3	4
14. Workshops are offered at my college for lecturers to improve their computer skills.	1	2	3	4
15. I have had training on how to use computers in my classes.	1	2	3	4
16. I have received training to improve my computer skills.	1	2	3	4

	SD	D	A	SA
17. I have participated in workshops and other staff development activities offered to improve my computer skills.	1	2	3	4

Section D: Support at the College Level

	SD	D	A	SA
18. College administrators encourage and support computer use.	1	2	3	4
19. If I encounter problems when using the computer, there is someone at the college to provide technical assistance.	1	2	3	4
20. There is support from administration (e.g., release time) for lecturers who want to learn how to use computers.	1	2	3	4

Section E: Modelling Computer Use

	SD	D	A	SA
21. In my teaching, I model ways in which computers can be used as teaching tools.	1	2	3	4
22. I show my students how to use computers in their classes.	1	2	3	4
23. I model a positive attitude towards computers.	1	2	3	4
24. I feel competent to model computer use to my students.	1	2	3	4

Section F: Training

	SD	D	A	SA
25. The training students receive at my college adequately prepares them to teach with computers.	1	2	3	4
26. Students in my college are taught how to teach with computers	1	2	3	4
27. Methodology classes expose students to ways in which computers can be used as teaching tools.	1	2	3	4
28. At my college, there are courses specifically designed to teach students how to integrate computers in their classes.	1	2	3	4
29. At my college, there are courses that teach students specific computer skills.	1	2	3	4

Section G: Field Experience/ Practice Using Computers

	SD	D	A	SA
30. I require my students to use computers to complete course assignments.	1	2	3	4
31. My students are required to use computers for class presentations.	1	2	3	4
32. I assign activities that require my students to use the Internet for research.	1	2	3	4
33. I encourage my students to use computers (e.g., e-mail) to communicate with their lecturers and peers.	1	2	3	4
34. During teaching practice, I require my students to use computers to prepare their lessons.	1	2	3	4
35. During teaching practice, I ask my students to use computers to complete classroom related activities (e.g., keep records, presentations).	1	2	3	4

Section H: Attitude Toward Computers

	SD	D	A	SA
36. Computers can improve the quality of learning that takes place in schools.	1	2	3	4
37. Students who have access to computers are more likely to do better than those who do not.	1	2	3	4
38. Computers are important learning tools.	1	2	3	4
39. Computers should be placed in all schools.	1	2	3	4
40. Computers should be placed in all classrooms.	1	2	3	4
41. Having computers in my class would enhance my teaching	1	2	3	4
42. Access to computers should be limited to the school library for research.	1	2	3	4
43. Students should be monitored when using computers.	1	2	3	4
44. Having computers in my class is a waste resources.	1	2	3	4
45. If I use computers, I will not have enough time to cover all the topics on the syllabus.	1	2	3	4

	SD	D	A	SA
46. Computers are potential sources of distraction in classrooms.	1	2	3	4
47. I feel nervous when I have to use a computer.	1	2	3	4
48. If I have computers in my class, I would use them with my students.	1	2	3	4

Section I: Access to Computers at College

	SD	D	A	SA
49 I have access to computers at college.	1	2	3	4
50. During teacher training my students have access to computers to complete course assignments.	1	2	3	4
51. If I want to teach a computer-based lesson, there are computers and available for use.	1	2	3	4
52. I can take my class to the computer lab to complete computer-based activities.	1	2	3	4

Section J: Preparation to teach with Computers

	SD	D	A	SA
53. I feel prepared to teach with computers.	1	2	3	4
54. I feel prepared to teach my students how to teach with computers.	1	2	3	4
55. I know enough about the different types of software to use them in my classes.	1	2	3	4
56. I feel prepared to use computers to communicate and collaborate with peers in the field.	1	2	3	4
57. I feel prepared to use computers to conduct research.	1	2	3	4

Section K: Computer Proficiency

For each of the following software category, rate your proficiency using the following scale:

Circle: 1 = Poor 2 = Fair 3 = Good 4 = Excellent

	Poor	Fair	Good	Excellent
Word processing software (e.g., MS Word, Claris Works).	1	2	3	4
Databases (e.g., Access)	1	2	3	4
Spreadsheets (e.g., Lotus, Excel).	1	2	3	4
Programming/ authoring software (e.g., AuthorWare)	1	2	3	4
Web publishing software (e.g., DreamWeaver, FrontPage).	1	2	3	4
Presentation software (e.g., PowerPoint).	1	2	3	4
Desktop Publishing software (e.g., Publisher)	1	2	3	4
Web browsers (e.g., Internet Explorer, Netscape Navigator).	1	2	3	4
E-mail.	1	2	3	4
Other Internet communication tools (e.g., listservs, chat, discussion boards).	1	2	3	4
Online databases (e.g., ERIC Online).	1	2	3	4
Web search engines	1	2	3	4
Electronic Gradebooks	1	2	3	4

Section L: Software used in Class or to Complete Classroom Activities

Using the following scheme, indicate how often you use the software indicated to prepare activities for your students or as part of the learning activities in which students participate.

Circle: 1 = Never, 2 = At least once per week, 3 = At least twice per week, 4 = At least three times per week.

	Never	At least once per week	At least twice per week	At least three times per week
Word processing software (e.g., Word, Claris Works).	1	2	3	4
Databases (e.g., Access).	1	2	3	4
Spreadsheets (e.g., Lotus, Excel).	1	2	3	4
Programming/ authoring software (e.g., AuthorWare)	1	2	3	4
Presentation software (e.g., PowerPoint).	1	2	3	4
Graphics software (e.g., PhotoShop)	1	2	3	4
Web publishing software (e.g., DreamWeaver, FrontPage).	1	2	3	4
The Internet	1	2	3	4
Desktop publishing (e.g., Publisher).	1	2	3	4
Drill & Practice	1	2	3	4
Tutorials	1	2	3	4
Simulations	1	2	3	4
Educational/ Instructional Games	1	2	3	4
Problem Solving	1	2	3	4

Appendix B: Pre-service Teachers Technology Integration Instrument

Pre-service Teachers Technology Integration Instrument

The purpose of this instrument is to gather data regarding your perceptions of your preparation to teach with computers.

Your participation is strictly voluntary and any information given will remain confidential and anonymous.

Section A: General Information

1. Gender

Male Female

2. Age

19-24 25-29 30-34
35-39 40-45 Over 45

1. Which college do you currently attend?

Bethlehem Church SSTC
Mico Shortwood St. Josephs

2. What type of school did you attend before coming to college?

Secondary High Technical High
Traditional High Comprehensive High

3. Did you receive computer training prior to coming to college?

Yes No

4. If yes, what types of software did you learn to use? (Choose all that apply).

Word processing Presentation software
Spreadsheets Web publishing software
Databases Desktop publishing
Other(s) (Please specify)_____

Instructions: For each of the items in sections B-G, use the following scale to indicate your level of agreement with each statement.

Circle: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree and 4 = Strongly Agree

Section B: Preparation to Teach with Computers

	SD	D	A	SA
5. I feel prepared to teach with computers.	1	2	3	4
6. I feel prepared to use computers to conduct research.	1	2	3	4
	SD	**D**	**A**	**SA**
7. I know enough about different types of software to use them in my classes.	1	2	3	4
8. I feel prepared to use computers to teach my students.	1	2	3	4
9. I feel prepared to use computers to communicate and collaborate with peers and faculty (e.g., through e-mails, discussion boards, chat rooms, etc.,).	1	2	3	4

Section C: Training

	SD	D	A	SA
10. My teacher training program exposed me to ways in which computers can be used to manage my classroom activities.	1	2	3	4
11. My teacher training equipped me with knowledge and skills required to plan lessons that involve students using computers.	1	2	3	4
12. My teacher training program equipped me with knowledge and skills required to teach with computers.	1	2	3	4
13. My teacher training program exposed me to different types of computer software that can be used in my classes.	1	2	3	4

Section D: Field Experience / Practice Using Computers at College

	SD	D	A	SA
14. At college, I use computers to conduct research.	1	2	3	4
15. At college, I use computers to complete course assignments.	1	2	3	4
16. At college, I use computers to communicate with peers and faculty (e.g., e-mail).	1	2	3	4
17. During my training, I used computers for class presentations.	1	2	3	4
18. During practice teaching, I used computers to prepare my lessons.	1	2	3	4
19. During practice teaching, I used computers to prepare handouts, quizzes, etc. for my students.	1	2	3	4

Section E: Modelling Computer Use (by lecturers).

	SD	D	A	SA
20. My lecturers model computer use in their classes.	1	2	3	4
21. My lecturers use computers as teaching tools.	1	2	3	4
22. At college, lecturers show us how to teach with computers.	1	2	3	4
23. My lecturers display a positive attitude towards computers and its impact on learning.	1	2	3	4

Section F: Access to Computers at College

	SD	D	A	SA
24. I have access to a computer lab at my college.	1	2	3	4
25. If I want to use computers to complete class assignments, I can use the computers in the lab.	1	2	3	4
26. I have access to the Internet at your college.	1	2	3	4
27. If I want to use computers to prepare lesson plans or complete activities need for my teaching practice, I can use the lab.	1	2	3	4

Section G: Attitude Towards Computers

	SD	D	A	SA
28. I believe computers can improve the quality of learning that takes place in schools.	1	2	3	4
29. Students who have access to computers are more likely to do better than those who do not.	1	2	3	4
30. Computers are important learning tools.	1	2	3	4
31. Computers should be placed in all schools.	1	2	3	4
32. Computers should be placed in all classrooms.	1	2	3	4
33. Computers are potential sources of distraction in classrooms.	1	2	3	4
34. Access to computers should be limited to the school library.	1	2	3	4
35. Students should be monitored when using computers.	1	2	3	4
36. I feel nervous when I have to use a computer.	1	2	3	4

Section H: Computer Proficiency

Instructions: For each of the following software, rate your proficiency using the following scale:

Circle: 1 = Poor 2 = Fair 3 = Good 4 = Excellent

	Poor	Fair	Good	Excellent
37. Word processing software (e.g., MS Word, Claris Works).	1	2	3	4
38. Databases (e.g., Access)	1	2	3	4
39. Spreadsheets (e.g., Lotus, Excel).	1	2	3	4
40. Programming/ authoring software (e.g., AuthorWare)	1	2	3	4
41. Web publishing software (e.g., DreamWeaver, FrontPage).	1	2	3	4
42. Presentation software (e.g., PowerPoint).	1	2	3	4
43. Web browsers (e.g., Internet Explorer, Netscape Navigator).	1	2	3	4
44. E-mail.	1	2	3	4
45. Other Internet communication tools (e.g., listservs, chat, discussion boards).	1	2	3	4
46. Online databases (e.g., ERIC Online).	1	2	3	4
47. Web search engines (e.g., Google, Yahoo)	1	2	3	4

Section I: Computer Skills Acquired at College

The following section of the questionnaire seeks to gather data regarding whether or not you were taught to use the following types of software in your training program at college.

For each of the following software categories, indicate the degree to which you were taught how to use it at college.

Choose: 1- for not at all 2- to a small extent 3- to a moderate extent 4- to a great extent

	Not at all	To a small extent	To a moderate extent	To a great extent
Word processing	1	2	3	4
Spreadsheets	1	2	3	4
Databases	1	2	3	4
Presentation software	1	2	3	4
Multimedia authoring	1	2	3	4
Web publishing	1	2	3	4
Desktop publishing	1	2	3	4
E-mail	1	2	3	4
The Internet	1	2	3	4

Appendix C: Conceptual Plan for Interviews

Part 1

Section A: Technology Plan

- Is there a technology plan at your college?
    - What is this plan comprised of?
- Do you think the plan is adequate?
- What are some of the things you would include in a technology plan?

Section B: Staff Development

- Are there staff development opportunities for faculty interested in integrating computers in their classes?
- Will members of staff get release time to participate in workshops to
    - Improve computer skills?
    - Show them how to integrate computers in their classes?

Section C: Support

- Do you encourage your faculty to use computers in their classes?
- Is there technical assistance available for faculty who want to use computers?
- Does the college receive any financial or other tangible support from the business community?

Section D: Modelling

- Have you observed any faculty members modelling computer use in their classes?
- Generally, what is faculty's attitude towards computers?

Section E: Training

- Do you believe students at your college receive adequate training to use computers in their classes?
    - What are some of the topics addressed in their training?
- Are there courses specifically designed to teach students how to integrate computers in their classes?

Section F: Field Experience/ Practice Using Computers

- Are students required to use computers during their field experience?

- Do they use computers to complete course work and other course related activities?
- Do students use computers to communicate with faculty and peers?

Section G: Attitude

- How do you feel about computers/ presence of computers in classroom?
- What role should computers play in the teaching learning process?
- Should teaching pre-service teachers how to integrate computers in their classes be included in the college curriculum?

Section H: Access to Resources

- Are there adequate resources at your college to facilitate technology integration?
- Are faculty and students allowed to use this lab?
- Are there computers at other places on the college grounds where faculty and students have access to computers?
- Do you believe the facilities at your college are adequate to facilitate technology integration?

Part 2

- What recommendations would you make regarding how technology should be integrated in the curriculum of teacher training programs?
- What are some of the factors that should be in place in teachers' colleges to ensure teachers are provided with knowledge and skills required to integrate computers in their classes?
- What role do you think computers should play in the college curriculum?

Appendix D. Guiding Questions--Focus Group Discussion

Part 1

Training

1. While you are at college, do you get any training on how to use computers in your classes?

2. Did you get classes that teach you how to use specific types of software in your classes?

3. Did your teacher training programs equip you with knowledge and skills required to plan lessons using computers as teaching tools?

4. Do you think your teacher training program has equipped you with knowledge and skills required to use computers as teaching tools?

5. Apart from your technology in education class, are there any other classes that expose you to ways in which computers can be used as teaching tools?

Preparation to Teach with Computers

6. Do you feel prepared to use computers in your classes when you graduate?

7. Do you feel prepared to use computers to conduct research?

8. Do you know enough about different types of software to use them in your classes?

Experience/Practice Using Computers

9. At college are you required to use computers to communicate with faculty?

10. Are you required to use computers to conduct research?

11. Are you required to use the computer to write your course assignments?

12. Do you use computers for class presentations?

13. Do you have access to computers while on your practicum experience?

14. Do you use computers in your classes or to prepare activities while on Teaching Practice?

15. What kinds of activities do you do with computers?

Access

16. Do you have access to computers at college?

17. Do you have access to the Internet?

18. Do you have to pay to access the Internet at your college?

19. If you want to complete your course assignments of to prepare for class presentations, can you use the computer labs?

Modelling

20. Do your faculty model computer use.

21. Do faculty show you/expose you to ways in which computers can be used in your classes?

22. Do they take computers to class and use them.

Attitude

23. How do you feel about the presence of computers in your classes?

24. What role should computers play in the teaching/learning process?

25. If you had computers in your classes, would you use them with your students?

26. Do you feel nervous/anxious about using computers?

Part 2

27. What do you think should be in place at your college to facilitate technology integration?

28. What are some factors that should be evident/present to ensure you get the training required to use computers in your classes?

Appendix E: Mean Scale Ratings and Standard Deviations by Demographic Attributes and College Affiliation: Faculty Sample

Technology Area Subscale	College A	College B	College C
Technology Plan			
Total Sample	***2.24 (.72)***	***1.95 (.52)***	***1.83 (.62)***
Gender			
Male	2.22 (.70)	1.98 (.53)	1.90 (.55)
Female	2.24 (.74)	1.92 (.51)	1.82 (.65)
Age			
20 – 29	2.36 (.70)	2.07 (.55)	1.75 (.75)
30– 39	2.00 (.73)	1.83 (.54)	1.89 (.56)
40 and above	2.43 (.72)	1.94 (.31)	1.75 (.75)
Total Teaching Experience			
1 – 10 years	2.55 (.80)	2.12 (.60)	1.92 (.77)
11 – 20 years	2.08 .70)	1.86 (.47)	1.82 (.60)
Over 21 years	2.10 (.67)	2.00 (.25)	1.76 (.56)
Qualifications			
Teachers' Diploma	2.88 (1.24)	-	-
Bachelors	2.20 (.66)	1.67 (.54)	1.61 (.61)
Masters	2.14 (.74)	1.99 (.41)	1.92 (.62)
Doctorate	-	2.00 (.88)	1
Staff Development			
Total Sample	***2.39 (.67)***	***2.26 (.49)***	***2.72 (.48)***
Gender			
Male	2.54 (.68)	2.43 (.39)	2.45 (.25)
Female	2.34 (.67)	2.10 (.34)	2.77 (.50)
Age			
20 – 29	2.23 (.71)	2.25 (.53)	2.76 (.64)
30 – 39	2.43 (.68)	2.22 (.46)	2.63 (.47)
40 and above	2.52 (.65)	2.60 (.19)	2.90 (.32)
Total Teaching Experience			
1 – 10 years	2.59 (.75)	2.21 (.55)	2.72 (.57)
11 – 20 years	2.21 (.71)	2.29 (.41)	2.67 (.50)
Over 21 years	2.35 (.52)	2.58 (.23)	2.79 (.41)
Qualifications			
Teachers' Diploma	3.33 (.47)	-	-
Bachelors	2.29 (.67)	2.31 (.30)	2.60 (.58)
Masters	2.33 (.62)	2.25 (.48)	2.75 (.47)
Doctorate	-	2.21 (.79)	2.72 (.48)

Appendix E: (Continued)

Technology Area Subscale	College A	College B	College C
Support at College Level			
Total Sample	***3.10 (.84)***	***2.55 (.62)***	***3.08 (.42)***
Gender			
Male	3.41 (.57)	2.68 (.64)	2.87 (.65)
Female	2.99 (.90)	2.42 (.59)	2.11(.36)
Age			
20 – 29	3.36 (.43)	2.77 (.47)	3.10 (.50)
30 – 39	2.90 (1.05)	2.36 (.70)	2.98 (.38)
40 and above	3.01 (.85)	2.58 (.42)	3.33 (.38)
Total Teaching Experience			
1 – 10 years	3.48 (.50)	2.67 (.61)	3.00 (.50)
11 – 20 years	2.88 (.95)	2.45 (.62)	3.01 (.31)
Over 21 years	2.83 (.89)	2.22 (.38)	3.19 (.50)
Qualifications			
Teachers' Diploma	4	-	-
Bachelors	3.35 (.45)	2.61 (.41)	2.81 (.42)
Masters	3.09 (.84)	2.57 (.57)	2.13 (.37)
Doctorate	-	2.46 (1.05)	4
Modeling Computer Use			
Total Sample	***2.39 (.83)***	***2.26 (.49)***	***1.99 (.56)***
Gender			
Male	2.81 (.73)	2.99 (.43)	2.30 (.67)
Female	2.24 (.83)	2.47 (.63)	1.94 (.53)
Age			
20 – 29	2.80 (.68)	2.80 (.44)	2.07 (.45)
30 – 39	2.36 (.85)	2.72 (.64)	1.97 (.62)
40 and above	1.94 (.81)	2.44 (.97)	1.96 (.53)
Total Teaching Experience			
1 – 10 years	2.89 (.74)	2.75 (.53)	2.25 (.53)
11 – 20 years	2.19 (.73)	2.77 (.58)	1.83 (.55)
Over 21 years	2.03 (.90)	2.33 (1.15)	2.00 (.56)
Qualifications			
Teachers' Diploma	3.88 (.18)	-	-
Bachelors	2.33 (.68)	2.71 (.58)	1.96 (.78)
Masters	2.25 (.76)	2.77 (.53)	2.01 (.51)
Doctorate	-	2.69 (.82)	1.50 (.53)

Appendix E: (Continued)

Technology Area Subscale	College A	College B	College C
Training			
Total Sample	***2.93 (.60)***	***2.32 (.59)***	***2.94 (.48)***
Gender			
Male	2.82 (.82)	2.45 (.54)	2.60 (.32)
Female	2.97 (.52)	2.18 (.61)	3 (.48)
Age			
20 – 29	2.76 (.65)	2.38 (.63)	2.86 (.28)
30 – 39	2.99 (.59)	2.26 (.55)	2.95 (.52)
40 and above	3.03 (.59)	2.65 (.66)	3.00 (.55)
Total Teaching Experience			
1 – 10 years	2.94 (.72)	2.30 (.64)	2.78 (.32)
11 – 20 years	2.85 (.58)	2.37 (.55)	2.95 (.47)
Over 21 years	2.97 (.55)	2.60 (.53)	3.09 (.61)
Qualifications			
Teachers' Diploma	3.58 (.25)	-	-
Bachelors	2.91 (.62)	2.54 (.44)	2.77 (.37)
Masters	2.82 (.58)	2.19 (.47)	3.03 (.50)
Doctorate	-	2.50 (1.04)	2.40 (.49)
Field Experience/Practice Using Computers			
Total Sample	***2.09 (.80)***	***2.42 (.53)***	***1.86 (.52)***
Gender			
Male	2.20 (.88)	2.59 (.49)	1.63 (.38)
Female	2.04 (.79)	2.26 (.53)	1.90 (.54)
Age			
20 – 29	2.36 (.64)	2.46 (.47)	2.02 (.68)
30 – 39	2.01 (.94)	2.41 (.59)	1.83 (.46)
40 and above	1.88 (.73)	2.33 (.36)	1.76 (.55)
Total Teaching Experience			
1 – 10 years	2.41 (.81)	2.41 (.48)	1.98 (.61)
11 – 20 years	1.96 9.77)	2.46 (.59)	1.89 (.47)
Over 21 years	1.95 (.84)	2.33 (.33)	1.67 (.52)
Qualifications			
Teachers' Diploma	3.83 (.25)	-	-
Bachelors	1.91 (.77)	2.50 (.32)	1.67 (.47)
Masters	1.96 (.51)	2.33 (.55)	1.94 (.58)
Doctorate	-	2.58 (.70)	1.17 (.39)

Appendix E: (Continued)

Technology Area Subscale	College A	College B	College C
Attitude Towards Computers			
Total Sample	***3.60 (.34)***	***3.62 (.42)***	***3.49 (.39)***
Gender			
Male	3.64 (.39)	3.72 (.40)	3.37 (.54)
Female	3.58 (.32)	3.54 (.43)	3.51 (.56)
Age			
20 – 29	3.69 (.23)	3.37 (.54)	3.67 (.43)
30 – 39	3.48 9.43)	3.79 (.27)	3.47 (.33)
40 and above	3.67 (.24)	3.65 9.34)	3.56 (.49)
Total Teaching Experience			
1 – 10 years	3.67 (.28)	3.42 (.52)	3.52 (.48)
11 – 20 years	3.55 (.37)	3.78 (.27)	3.45 (.32)
Over 21 years	3.64 (.32)	3.72 (.35)	3.51 (.44)
Qualifications			
Teachers' Diploma	3.20 (.28)	-	-
Bachelors	3.61 (.33)	3.49 (.54)	3.43 (.53)
Masters	3.63 (.35)	3.68 (.40)	3.50 (.36)
Doctorate	-	3.50 (.44)	3.33 (.45)
Access to Computers at College			
Total Sample	***2.86 (.87)***	***2.56 (.50)***	***3.13 (.34)***
Gender			
Male			
Female	3.28 (.55)	2.56 (.46)	3.15 (.34)
	2.71 (.92)	2.55 (.55)	3.13 (.35)
Age			
20 – 29	3.07 (.34)	2.66 (.53)	3.11 (.28)
30 – 39	3.77 (1.21)	2.44 (.47)	3.18 (.42)
40 and above	2.75 (.75)	2.88 (.32)	3.00 (.35)
Total Teaching Experience			
1 – 10 years	3.11 (.36)	2.59 (.54)	3.19 (.39)
11 – 20 years	2.73 (1.02)	2.52 (.48)	3.13 (.31)
Over 21 years	2.63 (1.01)	2.75 (.25)	3.06 (.37)
Qualifications			
Teachers' Diploma	3.63 (.53)	-	-
Bachelors	3.09 (.50)	2.78 (.39)	3.07 (.31)
Masters	2.52 (1.09)	2.39 (.45)	3.16 (.37)
Doctorate	-	2.75 (.67)	3.00 (.45)

Appendix E: (Continued)

Technology Area Subscale	College A	College B	College C
Preparation to Teach with Computers			
Total Sample	***2.29 (.87)***	***2.69 (.77)***	***2.38 (.64)***
Gender			
Male	2.91 (.81)	3.07 (.68)	2.12 (.67)
Female	2.07 (.79)	2.33 (.68)	2.43 (.64)
Age			
20 – 29	2.69 (.80)	2.85 (.68)	2.57 (.50)
30 – 39	2.16 (.92)	2.61 (.81)	2.41 (.71)
40 and above	2.02 (.78)	2.45 9.62)	2.11 (.58)
Total Teaching Experience			
1 – 10 years	2.67 (.87)	2.81 (.59)	2.71 (.65)
11 – 20 years	2.08 (.82)	2.63 (.91)	2.48 (.50)
Over 21 years	2.10 (.90)	2.33 (.70)	1.89 (.62)
Qualifications			
Teachers' Diploma	3.50 (.42)	-	-
Bachelors	2.01 (.81)	2.85 (.70)	2.29 (.70)
Masters	2.33 (.81)	2.58 (.76)	2.46 (.59)
Doctorate	-	2.83 (.79)	1 (.54)

Appendix F: Mean Scale Ratings and Standard Deviations by Demographic Attributes and College Affiliation: Pre-service Teachers Sample

Technology Area Subscale	College A	College B	College C
Preparation to Teach with Computers			
Total Sample	***2.73 (.54)***	***1.96 (.62)***	***2.27 (.59)***
Gender			
Male	2.93 (.56)	2.35 (.65)	2.15 (.69)
Female	2.70 (.54)	1.89 (.60)	2.36 (.57)
Age			
19 – 29	2.81 (.53)	1.84 (.46)	2.16 (.54)
30 - 39	2.59 (.55)	2.07 (.73)	2.21 (.57)
Over 40	2.48 (.44)	2.28 (.78)	2.31 (.74)
High School Type			
Secondary	2.62 (.59)	1.85 (.54)	2.35 (.53)
Traditional	2.65 (.50)	1.96 (.56)	2.33 (.51)
Technical	2.71 (.52)	1.77 (.76)	2.15 (.33)
Comprehensive	2.94 (.58)	2.33 (.72)	2.15 (.59)
Prior computer training?			
Yes	2.85 (.54)	2.14 (.66)	2.55 (.49)
No	2.50 (.47)	1.88 (.57)	1.98 (.52)
Training			
Total Sample	***2.61 (.52)***	***1.75 (.43)***	***2.01 (.41)***
Gender			
Male	2.55 (.46)	2.04 (.46)	2.13 (.55)
Female	2.33 (.55)	1.78 (.56)	2.17 (.46)
Age			
19 – 29	2.65 (.47)	1.72 (.66)	2.01 (.51)
30 - 39	2.31 (.78)	1.62 (.69)	1.97 (.43)
Over 40	2.21 (.67)	1.32 (.86)	1.89 (.63)
High School Type			
Secondary	2.55 (.33)	1.53 (.52)	1.99 (.61)
Traditional	2.75 (.45)	2.10 (.67)	2.22 (.35)
Technical	2.65 (.78)	1.67 (.25)	1.78 (.72)
Comprehensive	2.78 (.52)	1.99 (.56)	1.89 (.52)
Prior computer training?			
Yes	2.66 (.56)	2.11(.34)	2.44 (.54)
No	2.21 (.66)	1.98 (.76)	1.87 (.55)

Appendix F: (Continued)

Technology Area Subscale	College A	College B	College C
Field Experience/Practice Using Computers			
Total Sample	***2.64 (.59)***	***2.37 (.67)***	***2.23 (.73)***
Gender			
Male	2.65 (.59)	2.44 (.71)	1.83 (.65)
Female	2.65 (.58)	2.36 (.66)	2.30 (.73)
Age			
19 – 29	2.63 (.60)	2.48 (.47)	2.33 (.71)
30 - 39	2.65 (.62)	2.27 (.82)	2.14 (.75)
Over 40	2.50 (.17)	2.10 (1.03)	2.26 (.75)
High School Type			
Secondary	2.58 (.35)	2.40 (.59)	2.36 (.63)
Traditional	2.50 (.53)	2.51 (.66)	2.38 (.71)
Technical	2.74 (.60)	1.83 (.88)	1.98 (.68)
Comprehensive	2.91 (.71)	2.30 (.53)	2.01 (.72)
Prior computer training?			
Yes	2.75 (.60)	2.67 (.60)	2.51 (.68)
No	2.45 (.53)	2.18 (.66)	2.00 (.66)
Modeling Computer use by Lecturers			
Total Sample	***2.45 (.62)***	***1.89 (.66)***	***2.20 (.63)***
Gender			
Male	2.64 (.59)	2.39 (.80)	1.95 (.72)
Female	2.42 (.62)	1.81 (.60)	2.24 (.61)
Age			
19 – 29	2.48 (.62)	1.79 (.61)	2.16 (.57)
30 - 39	2.35 (.66)	1.96 (.68)	2.19 (.67)
Over 40	2.17 (.14)	2.43 (.79)	2.64 (.71)
High School Type			
Secondary	2.48 (.55)	1.77 (.69)	2.34 (.66)
Traditional	2.35 (.59)	2.03 (.69)	2.29 (.66)
Technical	2.46 (.56)	1.64 (.71)	1.91 (.40)
Comprehensive	2.59 (.74)	2.05 (.62)	2.04 (.62)
Prior computer training?			
Yes			
No	2.53 (.63)	2.01 (.70)	2.33 (.63)
	2.25 (.57)	1.87 (.68)	2.07 (.62)

Appendix F: (Continued)

Technology Area Subscale	College A	College B	College C
Access to Computers at College			
Total Sample	***3.75 (.29)***	***3.34 (.12)***	***3.69 (.45)***
Gender			
Male	3.23 (.45)	3.11 (.12)	3.05 (.45)
Female	2.88 (.62)	2.11 (.32)	1.98 (.32)
Age			
19 – 29	2.88 (.44)	3.33 (.67)	2.66 (.67)
30 - 39	2.75 (.56)	2.21 (.45)	2.45 (.43)
Over 40	2.65 (.34)	1.98 (.43)	2.57 (.61)
High School Type			
Secondary	3.33 (.46)	2.12 (.23)	2.55 (.54)
Traditional	2.68 (.76)	3.22 (.23)	2.42 (.32)
Technical	3.13 (.41)	2.67 (.36)	2.99 (.45)
Comprehensive	3.33 (.76)	3.56 (.68)	3.01 (.68)
Prior computer training?			
Yes	3.76 (.31)	3.23 (.23)	3.22 (.36)
No	2.66 (.65)	1.99 (.67)	2.79 (.43)
Attitude Towards Computers			
Total Sample	***3.14 (.34)***	***3.00 (.49)***	***3.03 (.30)***
Gender			
Male	3.22 (.31)	2.73 (.48)	3.26 (.25)
Female	3.13 (.34)	3.04 (.49)	3.00 (.30)
Age			
19 – 29	3.16 (.34)	2.96 (.55)	3.09 (.31)
30 - 39	3.12 (.30)	2.99 (.44)	2.30 (.30)
Over 40	3.00 (.40)	3.25 (.30)	3.00 (.28)
High School Type			
Secondary	3.13 (.24)	3.22 (.43)	3.05 (.32)
Traditional	3.10 (.41)	2.81 (.56)	2.96 (.32)
Technical	3.08 (.26)	3.29 (.37)	3.23 (.17)
Comprehensive	3.14 (.33)	3.02 (.29)	3.11 (.28)
Prior computer training?			
Yes	3.14 (.35)	2.78 (.54)	3.05 (.32)
No	3.16 (.32)	3.16 (.41)	3.03 (.29)

About the Author

Carol Granston is currently a lecturer in the Department of Technology in Education at the Sam Sharpe Teachers' College in Jamaica. Prior to undertaking her Ph.D. work at the University of South Florida, Ms. Granston taught English at the high school level for five years and at the college level for two years. She also taught a number of a number of education courses including Technology in Education at Sam Sharpe Teachers' College. During her Ph.D. work, Ms. Granston taught an introductory Instructional Technology course to undergraduates and co-taught a master's level Instructional Design course in the College of Education.

Ms. Granston holds a Bachelor's in Education (B.Ed, honours) from the University of the West Indies in Jamaica. She also has a master's in Educational and Training Systems Design from the University of Twente in The Netherlands (Holland).

She has a keen interest in the design and development of courseware materials for Jamaican students.

End Page