

**AN EXAMINATION OF THE EXPERIENCES WHICH UNIVERSITY TEACHERS HAVE  
IN THE PROCESS OF INCORPORATING COMPUTER MEDIATED INSTRUCTION  
TECHNIQUES INTO THEIR COURSES.**

by

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**A thesis submitted in conformity with the requirements  
for the degree of Doctor of Philosophy,  
Department of Theory and Policy Studies, Higher Education Group  
Ontario Institute for Studies in Education of the  
University of Toronto**

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## **ABSTRACT**

### **AN EXAMINATION OF THE EXPERIENCES WHICH UNIVERSITY TEACHERS HAVE IN THE PROCESS OF INCORPORATING COMPUTER MEDIATED INSTRUCTION TECHNIQUES INTO THEIR COURSES.**

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This qualitative study explores the experiences of and elucidates the processes involving twelve university faculty members in the incorporation of computer mediated instruction techniques (CMITs) into their teaching. The study uses a semi-structured interview guide to gather specific demographic and course information and to prompt the participants to reflect on the pros and cons of incorporating CMITs, support mechanisms for incorporation, and the implications for their teaching.

It is evident from the literature and the comments of faculty members that the incorporation of CMITs involves a complex of processes. To help frame these processes, incorporation is viewed from three perspectives, i.e., the objectivist-constructivist continuum, instructional design, and diffusion of technology. While the participants do not talk in these terms, it is evident that they are moving to a student-focused approach in line with a constructivist viewpoint. They are also experimenting with new tools for their courses although there has not been a great deal of reflection on the impacts of these tools and techniques on course design. The experimentation and incorporation activities of these subjects can also be usefully examined in the framework of diffusion of innovation.

The faculty members, from three Ontario universities, have at least one year of

experience using CMITs and are diverse in regard to both their subject specialties and the techniques used. Their focus is on e-mail for communication and web pages for course management. All use, have used, or are familiar with presentation software, audio/video conferencing, course authoring templates, or special statistical or musical software. They are generally positively inclined to these but have reservations on further use and development. These concerns revolve around practical and policy issues, such as, that increasing e-mail access for students requires coping strategies for faculty; requiring students to have computers or high level computer skills may create barriers to learning; and, putting course materials on-line requires much clearer intellectual property rights and responsibilities. Even in the face of these concerns, as well as insufficient training support and/or poor technical infrastructures, these keen faculty members still forge ahead into uncharted territory.

## ACKNOWLEDGEMENTS

A thesis of this nature is a collaborative affair. While the final responsibility rests with one individual, such a product would not have been possible without the patience and assistance of others.

The un-ending support of my partner in life deserves recognition for her patience and insight both of which have not only kept me linked to the real issues but also enabled me to go where I had not thought possible.

The many others who have spurred me on are also deserving of note. Michael Skolnik has, with his constructive comments and his dedication to detail, been my mentor for the last four years. Without Michael's contribution this work would still be a long way from complete. Lynn Davie and Jamie-Lynn Magnusson, my other thesis committee members, providing their insights and comments spurred me on also. To all the supporters at Ryerson and in the Ryerson Library, I'm especially grateful for enabling me to succeed at this endeavour.

To the twelve who gave me of their time and knowledge, I'm also appreciative. They gave me their time and support in ways that energized me and showed me how important curiosity and exploration are in today's challenging educational environment. Altogether they kept the fires burning.

**Education is not the filling of a pail, but the lighting of a fire.**

**- William Butler Yeats**

**A new look at teaching, if there is to be one, seems to require us to move up close to the phenomena of the teacher's world. But such a move, though by our due, is just the beginning.**

**Jackson, 1968, p. 159**

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# **CHAPTER ONE**

## **INTRODUCTION**

Issues surrounding the use of computer technology in the delivery of university courses are the subject of increasing attention. Dolence and Norris (1995) set out a number of harrowing statistics of the probable world demand for higher education. In their book they draw the conclusion that the only way that higher education will be able to satisfy this demand is for it to take on a transformative vision which, in their view, is one which utilizes the full scope of the information age technologies. Skolnik (1998), in his examination of the literature on twenty-first century higher education recognizes that among the seven major characteristics of higher education in the twenty-first century, the most visible is the extensive use of information technology (p. 641). Collins (1996) also outlines many of the converging trends not only in student traits and demands but also the growing ease of use of the communications network called the information highway. Noble (1998, Fall) outlines a grim fight ahead in the protection of faculty self determination and their intellectual property rights as higher education moves onto the electronic highway. Even more general literature on the nature of higher education contains articles which often emphasize the negative but in doing so outline the impact of the information highway on education and on society. Oppenheimer's recent (1997) article is just such an article. Oblinger's (1997) article notes the incursion of business into the education area. Inter-university competition grows as well with every new connection to the information highway. The World Lecture Hall at [www.utexas.edu/world/](http://www.utexas.edu/world/) of the University of Texas and Petersons at [www.petersons.com](http://www.petersons.com) have links to hundreds of on-line courses. The virtual university is upon us with its high-tech, consumer-centric business model which bodes ill for faculty members and institutions of old (Skolnik, 1999). There are many others examples, but these few illustrate the online environment in which faculty members find themselves.

The initial interest of this researcher in this environment stemmed from his work in implementing information technology and designing customized courses. Taking a structured, project management approach to customized courses led this researcher to

conclude that a systematic approach to transmitting information was the best way to transfer knowledge to others. In addition, the use of information technology was viewed as a way to increase the efficiency of the process and to reach others who were remote in time and place. Flowing from this was an expectation that detailing stages of course design and pinpointing the impacts of technology would provide clear steps leading to successful course development and transfer of knowledge. The oversimplification of taking this approach and of equating information transfer and knowledge development became clearer to this researcher as the study developed.

After much reflection this researcher now recognizes the importance and utility of a more flexible approach in examining the ties between technology and education. This change results from the continuing analysis of the applications of technology in education. The many yearbooks (Branch & Minor, 1997) and surveys (Green, 1998; Ely, 1996a) illustrate the long and growing interest in and variety of views on this topic. Komoski (1987), in his discussion on curriculum and instruction notes the concerns with effectiveness, efficiency and productivity in education and on the use of the 'new electronic technologies' to address these issues (p. 3). His sobering comments on the evaluation of advanced learning technology and on the unclear relation between technology and the core educational processes of teaching and learning, bring a sound pragmatism to runaway expectations. The HEIRAlliance produces a series of reports called 'What presidents need to know' covering information technology development and the many facets that executives of universities must consider (HEIRAlliance, 1992). These reports and specific case studies provide valuable insights into underlying assumptions and implications, and the many problems and solutions. The complexity of the application of technology to education, and specifically to post-secondary education as these sources indicate, prompts a broad-based approach.

A consideration of the use of the terms educational technology and instructional technology, symptomatic of fluctuating viewpoints, also suggests the need for a more flexible approach. Educational technology is generally understood to be of broad scope and utility. Ely, as cited by Eraut (1996, p. 9) and a key proponent in the field from the 1960's, suggested a schema for educational technology in which the three main components of management

functions, learning resources development functions and learning resources are included. Ely (1996), suggests that the two terms are often used interchangeably but that instructional technology is usually a narrower term used to designate the process of teaching and learning through purposeful use of teaching-learning strategies and communication media (p.18). However, a tension occurs with the recent expansion of the definition developed by the Association for Educational Communications and Technology. Their definition expands instructional technology to include theory and practice of design, development, utilization, management and evaluation of processes and resources for learning (Seels & Richey, 1994, p. 9). Their insistence on broadening the definition to include those elements noted above under educational technology, only continues the confusion. To add to this wavering, Nichols and Allen-Brown (1996), bring their critical theory perspective to bear and define the term educational technology from a learning perspective. They suggest that it refers not 'only to media and hardware and the conscious, systematic application of technologies' but also 'includes the ways in which technology gets into learning and schooling' (p. 226). By focussing on what is often taken for granted, they extend the term educational technology to cover pedagogic theories and strategies as well as race and popular culture. In addition, they shift the focus away from practical and technical forms of knowledge to a much broader transformative knowledge perspective (p. 235). These extensions tend toward Ely's view of a differentiation between the two terms but emphasize the importance of understanding theories of learning and teaching.

This continued turmoil in definitions does nurture creative solutions and changing perspectives and signals the need for a holistic approach to studying technology and education. Hawkrige (1991), points to this when he outlines four challenges which are at once daunting and invigorating for members of higher education. First, there is a continuing updating and rethinking of the foundations of educational technology. This turmoil is illustrated quite well in the literature and will probably continue to be reflected in it for the foreseeable future. Second, there is a need to integrate information technology with educational technology both of which share some of the same media and reach the same audience. Third, there is also a growing political challenge from the Left that views the field

ideologically and questions technological optimism. The growing unease with technology run amok, with the publicity around global warming and the breakdown of values seen in violent crimes is reflected in a growth of technological activity within education. Fourth, there is also an increasing moral challenge from radical critics who hold that educational technologists separate means from ends and that teachers using educational technology may “lose control to professionals who base their work too much on operative precepts”(Hawkrige, 1991, p. 106). While these challenges stem from 1991, they are nevertheless relevant to the current situation. In fact, these issues promote an increased reaction within university faculty members to the whole realm of educational technology and specifically the move towards technology based learning. The incidents at York University (Young, 1997) and Acadia University (Sacouman, 1997) where faculty members have protested the seemingly headlong dash by university administrators to implement online environments without sufficient consultation and preparation are cases in point. In both cases, the faculty members went on strike and received contract language assuring that they would not be forced onto the Internet. These comments indicate that there are no clear cut definitions or singular approaches to technology in education and that there needs to be an awareness of the variety and breadth of opinions or troubling times may result.

There are other aspects at play in this field of education and technology and to which university faculty members need to stay alert. A call by students or administrators for the use of technology can place significant pressure on university faculty members to move in ways they do not want or in which they are not ready. Educational technology can have an impact on courses in several ways. Interactive multimedia can add a self-paced dimension to a course so that students can repeat sections or advance as quickly as they want. By having the material available electronically, the student is not limited to visiting the classroom but can either take the material home or complete it in a laboratory after hours (Oblinger, 1997). Allowing the shifting of place and time provides students with flexibility and added convenience, especially for those students with work responsibilities. Once the course is completed in electronic form it can also support distance education either as part of a diploma or a degree program or as a separate offering linked with businesses such as corporate

universities (Meister, 1994).

The impact can also be at the pedagogic level. Much of what is available from Internet sources is elementary text transferred to screen; a textbook converted to electronic form that the student reads. The work done by the Knowledge Connection and its Interactive Learning Connection illustrates the great deal of background work and formative and summative evaluation that is necessary to produce a course of high quality and of value to students (Gillis, 1996). Ehrmann (1995), also notes the long development cycle and the non trivial nature of course refinement (p. 25). There is also a concern not just over the method of teaching in a single course but also the integration or loss of integrity with the removal of a course from the whole program. There is still a great deal of debate going on about the benefits of the Internet and the delivery of courses over it. However, the work of the University Space Network in developing and delivering spacecraft design courses on CD-ROM and over the Internet and the work at the California State University illustrate that there are some positive results (Brimley, 1996, p. 83; McCollum, 1997).

Faculty members are continuously beset. This is often portrayed as the 'threatened faculty myth' (Millar, 1991, p. 221). If a faculty member perceives a curtailment in ability to decide how to teach courses or that the outcome of developing a particular course in electronic form is the loss of a job, there is going to be hesitation. Millar points out the need to address these attitudinal concerns whether they are real or not. The aforementioned activities at York University (Yonge, 1996) and Acadia University (Sacouman, 1997) illustrate the conflicts that develop from insufficient planning. This feeling of loss may also stem from or be exacerbated by the combination of many issues not only those related to use of educational technology. For example, the recent discussions on and the looking for new models of tenure are certain to have some faculty members very concerned about job security even without having to deal with loss of job security due to technology (Perley, 1997). In addition, as business jargon and principles seep into the university, there is a growing use and acceptance of terms like customer or market driven, demographics, global competition, just-in-time learning, competencies, job-skills and bottom-line. In this vein, educational technology is often seen as a tool to respond to customer demand or enlarge market share

whether it is local or on the other side of the globe. These are not terms which likely endear the use of technology to faculty members.

Lastly, and probably the most likely, but to some the most disconcerting aspect of the use of educational technology, is the change in the relationships of people involved in the university. The increase in the use of e-mail complements face-to-face communication but in some cases may supplant it. For those who prefer face-to-face interaction this can be a problem. For others, this may signal increased participation such as that presented by electronic lists, or an increase in reactions such as that provided by student-faculty member e-mail. For a faculty member who uses e-mail and the Internet to deliver a course and facilitate discussion, there may even be increased interaction. Becoming linked with the Internet can provide increased collaboration through easing contact with remote students or other faculty members but maintaining the electronic interaction as a complement or a replacement can add to the overall burden of teaching while changing the face of scholarly communication.

This great ferment around the use of computers in the education process is unlikely to diminish. In much of this material and discussion, the focus is on the technology itself. Some of the discussion deals with how the technology might assist in teaching our children and ourselves. Other discussion is on how the technology helps us deal with the great amounts of information flowing over the Internet. Yet other discussion covers how technology is going to revolutionize education. However, a very important component of this is the faculty member and what he or she is doing in the face of all this turmoil. It is the experiences of these university faculty members who are incorporating technology such as, e-mail, presentation software, the Internet, web pages and similar computer mediated instruction techniques (CMITs) into their courses that this researcher is interested in examining.

Specifically, this study focuses on the experiences of faculty members adopting and integrating CMITs into their courses (hereinafter referred to as the incorporation process). Prompted by the discussion above, this researcher recognizes the benefit of examining this incorporation process not as one monolithic process but as a number of processes which the

faculty members face. In addition, running through the discussion above and linked with this researcher's recent experience, are three major threads. These three threads are the broad issue of viewing the adoption of CMITs in the context of various theories of learning and teaching, the instructional design of courses, and the introduction of technology. The complexity of the incorporation process and the environment of the faculty members necessitate a broad sweep but a bounded one. Therefore, in this work the researcher uses these three main foci, beginning with the theoretical and moving to the practical, i.e., first viewing the use of CMITs in the context of theories of learning and teaching; then within the framework of instructional design; and finally from the introduction of technology. These three are useful because they subsume the elements of incorporation under philosophical, practical and support categories and provide a number of perspectives from which to view the incorporation process. Using such perspectives should also provide many insightful ways to view, document, and interpret how faculty members use CMITs in their courses.

### **Purpose**

The purpose of this study is to explore the experiences of and to elucidate the processes which occur for faculty members during their incorporation of CMITs. It is also to model these processes, insofar as that is possible, and to outline the range and significance of the factors considered and/or influencing faculty members during these processes. To accomplish this, a phenomenological approach and a semi-structured interview guide are used to gather information on and to explore the process of introducing CMITs into university courses, to describe and categorize significant issues, themes and patterns, and to attempt to develop an integrative model and/or approach. With these insights, teachers can better understand the processes, see the breadth of factors being considered, and generate suggestions for effective incorporation of CMITs into their courses.

### **Statement of the problem**

What are the experiences of the faculty who are incorporating CMITs into their courses? How can the processes within and surrounding this incorporation be modelled? What are the sets of factors, educational, pedagogical, and technical, that faculty consider during these processes?

## **Research questions**

There are several research questions that frame this study. The questions which focus the semi-structured interviews are:

1. What are the experiences that faculty members have in incorporating CMITs into their courses?
  - 1.1 What are the processes that faculty members go through in their attempts at incorporating these CMITs into their courses?
  - 1.2 What are the definable steps in these processes?
  - 1.3 What are the views of faculty on technology in general and on CMITs in particular, and how are these reflected if at all in their pedagogy?
  - 1.4 How do the assumptions, priorities and decisions of the faculty support or counteract each other or those of the institution?
  
2. What factors do faculty members take into consideration as they incorporate CMITs into their courses?
  - 2.1 What is the range of factors that might be considered?
  - 2.2 Which factors are seen as incentives and which as disincentives or barriers?
  - 2.3 What are the priorities set on these by the faculty?
  - 2.4 What are the implications of these factors?

## **Definitions**

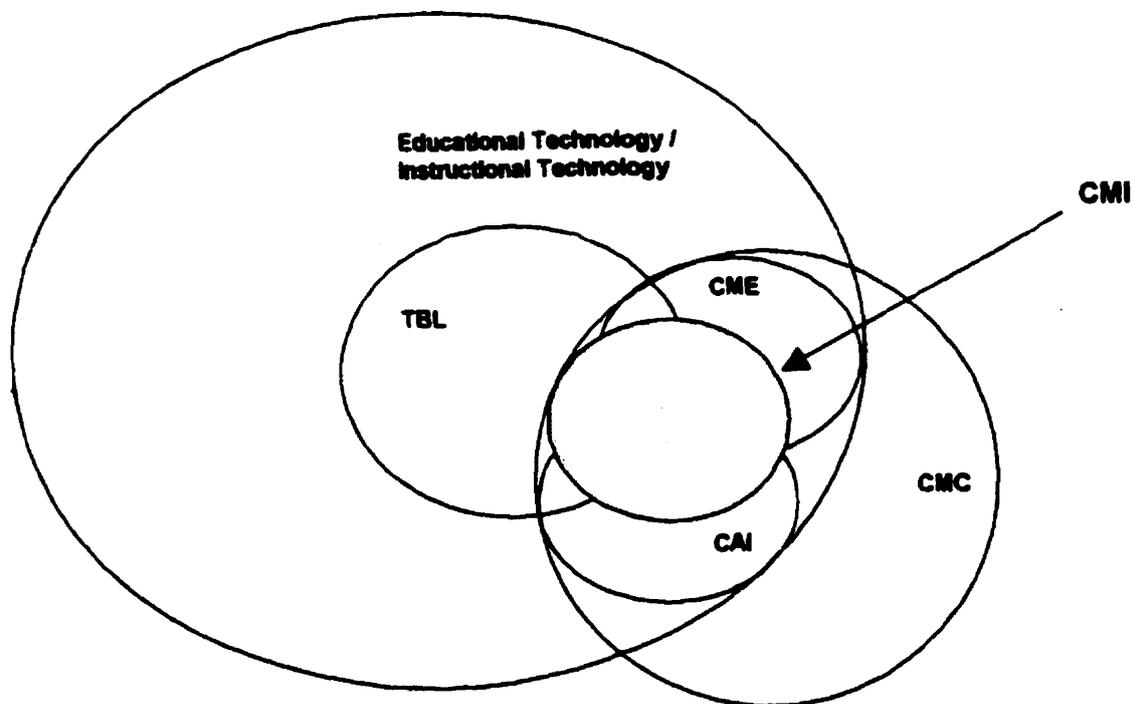
There are numerous acronyms in use which cover aspects of the use of technology in education. In the following paragraphs some of these acronyms and their definitions are introduced. Some of these appear in later sections but others which do not occur later do help to provide boundaries and context for those terms used. The terms are listed alphabetically. For a Venn diagram which interrelates these definitions, see Figure 1.1. The terms are:

**CAI/CAL/CBT** - Computer Assisted Instruction, Computer Assisted Learning, and Computer Based Training are often used synonymously and pertain to the use of the computer as the sole means of training students. In these approaches, the traditional role of the teacher is replaced by the computer.

**CMC** - Computer Mediated Communication deals with all aspects of the use of computers in the communication process whether this is within education or outside the education process.

**CME** - Computer Mediated Education is the use of computers in the education process.

**Figure 1.1 - A Venn diagram interrelating the definitions.**



- CMI -** Computer Mediated Instruction covers the use of computers in the classroom or course instruction process. The intent of this use of the term CMI is to convey the meaning that the faculty member is still a key component of the teaching-learning process and is not replaced holus-bolus by the computer. The use of CMI is not equivalent to CAI, CAL or CBT and so deviates slightly from Bates (1995), who equates these and associates them with the replacement of the teacher (p. 189).
- CMITs -** Set within the circle of CMI are the Computer Mediated Instruction Techniques which include the use of such items as e-mail, presentation software, chat software, listserv, CD-ROM, web pages, and course template software in delivering classroom instruction or in delivery of on-line courses.
- Educational Technology -** This term and the next are often used interchangeably. Educational technology is an area of study and practice (within education) concerned with all aspects of the organization of educational systems and procedures whereby resources are allocated to achieve specified and potentially replicable educational outcomes (Mitchell, 1978, p. 325).

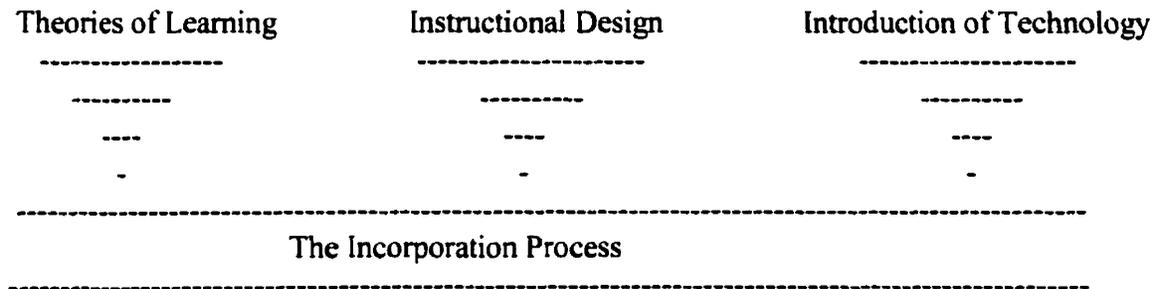
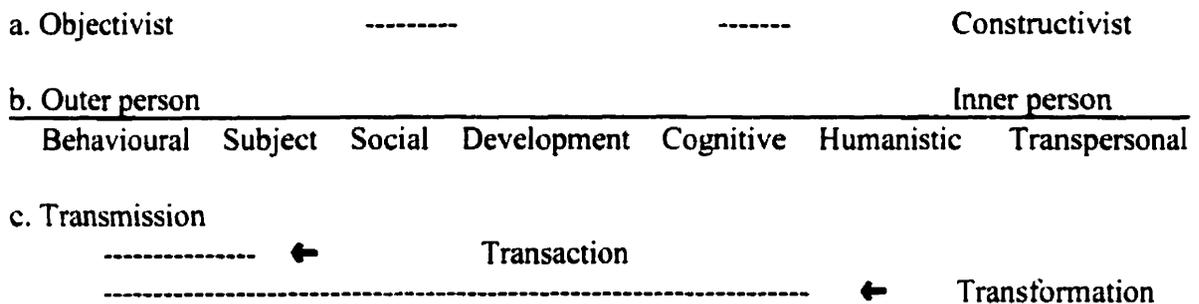
**Instructional Technology** - This is a narrower term than the one directly above and refers to those aspects of educational technology that are primarily concerned with instruction (Mitchell, 1978, p. 327).

**TBL - Technology Based Learning** covers any educational technology that falls into the area of electronic delivery systems for education and training. Those of primary concern are: a) world wide web, b) presentation technologies, c) dedicated educational software, d) interactive educational TV or video conferencing, e) computer assisted learning (EVNET, 1997, p. 1).

### **Theoretical framework**

In order to give some initial bounds to this study, several perspectives within an inductive, phenomenological approach are taken. Without curtailing or prejudging specific processes or factors, there are three groupings which are of most relevance to this researcher and which are the initial focus of study. These three groupings are theories of learning, instructional design, and the introduction of technology. Figure 1.2 illustrates the use of these three perspectives to view the incorporation process. It is through these three filters that broad exploratory questions flow to examine the incorporation process, to gather data on the process, and to focus attention on the research questions noted above.

First, theories of learning in this study encompass three overlapping models or continua (See Figure 1.3) which guide an examination of the philosophies and teaching approaches of those interviewed. The first filter is the objectivist-constructivist continuum of learning theories (Jonassen, 1991a). The second is Miller's (1983) orientations that categorize teachers and how they work with students. This spectrum of orientations extends from a focus on student behaviour (the outer person) to a focus on student thoughts and feelings (the inner person). The third is Miller's (1996) work on holistic education that groups educational orientations under three categories, i.e., transmission, transaction, and transformation. In studying faculty educational orientations such a series of expanding and increasingly integrative orientations are helpful guidelines. Understanding the dynamics within these orientations and the particular teaching styles and uses of computer mediated instructional techniques of the faculty members helps to pinpoint seeming discordances within faculty members approaches and can suggest routes for further analysis.

**Figure 1.2 - Perspectives on the incorporation process****Figure 1.3 - Guiding models in assessing faculty in the incorporation process**

Second, instructional design, to take the Dick and Carey's (1994) viewpoint, is an umbrella term which includes all the phases of instructional systems development. These phases are analysis, design, development, implementation and evaluation/assessment. This is a systems approach which subdivides the course development process and focuses attention on the particular components. In this study the focus of the course design and development is on the use of the CMITs in the faculty members' course.

As Dolence and Norris (1995), indicate in their work, the move from an industrial age model to information age model of education suggests several transformations which are already in progress. Specifically, within the curriculum segment of higher education, there are several changes that fit on a continuum stretching from one to the other of these ages. Viewing the traits mentioned by Dolence and Norris at the course level hints at likely impacts of technology on courses. The traits outlined by Dolence and Norris are elaborated in the following list.

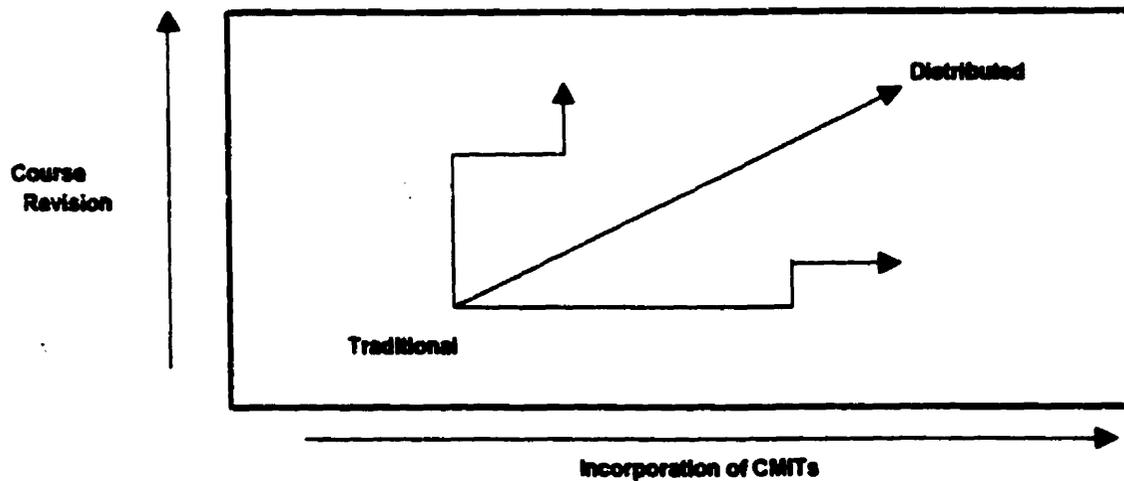
**Figure 1.4 - Course transformation** (after Dolence and Norris, 1995).

<b>Course</b>	<b>Industrial age model</b>	<b>Information age model</b>
content	standardized	customized
delivery	face-to-face, classroom talking head presentation	remote, electronic interactive multimedia discovery
learning model	continuing education	perpetual learning
outcomes	teaching & mastery combined into credentials, degrees general education	learning & certification related yet separated, unbundled learning experiences specific training
calendar	fixed time out for learning	flexible just-in-time learning

The left column describes what is common today for most of the courses in higher education while the right column is what Dolence and Norris (1995), suggest higher education courses are moving toward or should be moving toward. For example, they suggest that the whole character of education will change such that students will be able to choose specific courses (customize what they learn) to focus on specific training when they need it or want it (just-in-time) no matter where they are (remote). This move to specific competencies and remote electronic access is not new but it is growing as the Internet grows. As the infrastructure of information technology increases, there is greater access to and reliance placed on information technology all of which quickens the shift toward the right column. Figure 1.5, the relation of course and CMITs, illustrates the relation between these and offers three scenarios (one by a straight and two by jagged lines). The straight centre line illustrates the suggestion by Dolence and Norris and groups their traits along the line from traditional, local, prescriptive, and extensive features at one end to novel, distributed, segregated and selected characteristics at the other.

Figure 1.5 may be used to describe and to suggest several relationships. Moving diagonally up the axis from left to right takes one along the continua that Dolence and Norris suggest by their portrayal of industrial age and information age models. The traditional industrial age model as outlined in Figure 1.4 indicates a situation that is familiar to many

**Figure 1.5 - Relation of courses and CMITs - an initial view.**



faculty members in universities. However, what occurs today is probably a mixture of both columns noted in Figure 1.4. This researcher has designated the information age model by the term 'distributed' as noted in Figure 1.5. What this means is that as faculty members use more and more CMITs to disseminate course materials, to answer frequently asked questions, and to conduct educational activities, they are distributing activities that have been traditionally accomplished in classes or seminars. Dolence and Norris also suggest a change in content and calendar elements both of which lead toward the concept of open learning. In other words, the distributed activities which begin as a complement to class activities can either by design or accident replace them altogether. As the distributed elements expand, the educational process moves clearly into the distance education realm and toward extremely customized, flexible open learning. In this move from the traditional course environment towards the distributed, there is a reduction in the face-to-face teacher-student interaction and an increase in student self-reliance. These changes in relationships must be recognized and accepted or rejected.

The move diagonally to distributed courses forces a move to systematic instructional

design. These prescriptive processes hold greater importance because objectives, content, and evaluation must be explicit at the beginning and because there may be less flexibility within courses than in the traditional classroom, face-to-face courses. Both faculty members and students must understand their responsibilities while the latter must have sufficient information to choose to take the course or pass it by. As a consequence, the intuitive reactive possibilities as commented upon by Jackson (1968) may be less likely. In order to approach the upper reaches of this information age course map, there is also a heightened dependence on information technologies to deliver course information and conduct student-faculty interaction. The step-wise progression to the right suggests that there is an increase in technology with little course revision. At some point, along with the introduction of technologies there is a significant jump in course revision. There can also be a revision without much introduction of new technologies. That route is illustrated by the jagged line initially moving upwards. The model depicted in Figure 1.5 helps to bring out some of the hidden consequences of moving to the remote delivery of courses. These moves and impacts are explored and detailed in the following chapters.

Third, the introduction of technology, in general, can be viewed from many perspectives. In this study, which focuses on the experiences of faculty members who are incorporating CMITs into courses, three perspectives are used as guides, i.e., the stages of technological development, a business marketing model of new technology, and the diffusion of technological innovation. Green and Gilbert (1995), illustrate one perspective in their discussion of the implementation cycle of technology integration by outlining four stages of technological development in higher education institutions (p. 11). With a little extrapolation, their stages may be appropriate for examining the integration of technology and the incorporation of CMITs at both the institutional and individual faculty member levels. Another perspective, and the more directly applicable to faculty members, is that outlined by Moore (1991) in his book which covers marketing high technology products to customers. The utility of this work comes from his warning that it is necessary to understand that different segments of the population react differently to technology and that one should not make the mistake of underestimating these differences. His descriptions of the traits of

various users of technology provide another approach to studying the traits and reactions of the individual faculty members incorporating CMITs. A third perspective is that of Rogers (1995) who examines the diffusion of innovation. Rogers provides insightful material which elaborates facets of and links together the previous two perspectives. In addition, Rogers' work outlines many appropriate issues in innovation such as social underpinnings, innovation-decision process, attributes of adoption, and the consequences of adoption.

### **Significance of the research**

“The Internet will not totally replace schools and universities, but these traditional institutions must transform themselves if they are to prepare tomorrow's students for lifelong learning.” (Pelton, 1996, p. 17)

Post-secondary education is facing difficult issues, such as diminishing budgets, increasing demand for access, and growing expectations from students (Dolence and Norris, 1995). The Internet and the many CMITs are seen as a viable method of addressing increasing costs, of answering the call for increased access, and of responding to the growing expectations of students for better technical infrastructures within institutions. While installing a computer and telecommunications infrastructure is expensive, it is seen by many as a cost efficient solution at the same time as providing a means of transforming higher education for the 21st century. There is also a growing concern that there is insufficient understanding of the underlying assumptions of faculty about CMITs or assessment of the learning outcomes of such instructional techniques.

The processes are viewed from the viewpoint of individual faculty member experiences. Delving into the individual faculty members' experiences of the incorporation process of CMITs has not been done to date. This study attempts to expose these experiences of faculty members, to identify the factors which provide incentives or disincentives, to examine the underlying assumptions, and to draw out the implications of these assumptions. In addition, it uses these experiences to develop an integrative framework within which to synthesize the findings. Such work should provide insights into important factors in these processes and suggest significant practices and policies.

Use of this approach ties the practical and the theoretical. The survey and study of

the actual experiences of faculty members involved currently with incorporating CMITs provides the basis for elaborating process information, for developing patterns and relationships with and among the various elements, as well as infusing the study with a practical and pragmatic outlook. A combination of theories of learning and instructional design models provide elaboration and currency for the development of models appropriate for the end of the 90's. The integration of business models of technological change and new product development with course delivery models provide new and controversial viewpoints that may have novel and positive results for examining processes and outcomes.

### **Delimitations**

This study is of faculty members who are somewhere in the process of incorporating CMITs or who are currently working with CMITs in their courses. There are many faculty members in Southern Ontario universities who are grappling with these issues and who fit within the scope of this study. The selected faculty members who were found through personal contacts and referrals, have a range of experience in incorporating CMITs. At one end of the continuum are faculty who are beginning to incorporate CMITs by using only one or two elements, e.g., presentation software or e-mail for communication. These faculty are either new to this activity or use a limited number of elements. Further along the continuum are faculty who have combined many elements, e.g., presentation software and e-mail, plus the Internet, video conference and course development software. They have done so over a number of years. Using a diversity of faculty allows framing processes and issues generally and points to policies of particular importance to these faculty and perhaps instructive to a broader range of faculty. To assist in this study theories of learning, models of instructional design, stages of information technological development, diffusion of innovation and new product development are used in an attempt to develop an integrative approach.

### **Researcher interests and biases in the subject**

Throughout the material above, issues of focus and boundaries are noted. The topic of technology and specifically information technology has been a consuming issue in my working life. With a planning, managing and consulting background, I began this study with a very structured, objectivist point-of-view. There was an initial expectation that the

best route in examining incorporation of CMITs into courses was to take a systematic instructional design tack akin to the Dick and Carey (1994), Stark (1989 and 1991), and Dinham and Blake (1991) models, and focus on outlining factors, determining significance of factors, modelling processes in light of new technologies, and suggesting avenues for improving efficiency and effectiveness. In addition, with my work in systems analysis and information technology projects I took a clearly systematic reductionist approach to analysis and synthesis. However, throughout this research there has been an attempt to keep a balance by always bringing in alternative perspectives and reflecting on the participants' insights. Working with this topic and collecting data from the faculty members at different universities, I am continually reappraising my own views on these topics of course design and the impact of technology. The journey of completing this research is causing me to range far wider in assessing my own philosophy and work than I originally expected.

## **CHAPTER TWO**

### **METHODOLOGY**

The purpose of this chapter is to cover the procedural aspects of the study. There are three main topics included here, i.e., the qualitative nature of the study, the data gathering processes, and the data analysis processes.

#### **Qualitative study**

As a means of focussing attention on the experiential nature, the processes, and the meaning of the incorporation of technology in teaching by individual faculty members, this researcher takes a qualitative approach. With this approach the personal insights of faculty members are examined and the issues and processes that are most important to them and to others working with technology in the university environment are highlighted. While teaching is fraught with technology, there is a newness in the move to CMITs using communications technology and the new media brought on by the burgeoning availability and use of the Internet and web browser technologies. It is this newness accompanied by the rapid growth, that suggests the need for, or the potential value of, a close look at the players in their experiences of and their reflections on the incorporation process.

The incorporation process involves integrating a number of processes on different personal and organizational levels. Faculty members face a number of challenges during the incorporation process. For instance, they must fit any incorporation of CMITs into their teaching with their own educational philosophies. They must deal with the many pragmatic aspects of infrastructure support (technology, pedagogic, financial) and the political and organizational challenges of their university. As a consequence, an examination of the incorporation process requires a multi-dimensional approach to include such components as those of the faculty members' theories of teaching and learning, of the technological supports available, of the organizational context in which they are situated, and of the policy issues that they raise. The focus is on determining the similarities and differences among the approaches taken by faculty members as they face the myriad challenges encompassed within the incorporation process.

This thesis is designed not as a 'power survey' but rather a survey, small in number but broad in scope. Rather than focussing on one particular type of teacher, variety is sought in regard to gender, subject specialties, levels of experience, years of experience and course levels. Maintaining a wide variance in teacher traits is seen as leading to a broader understanding of the incorporation process.

In this study, the unit of analysis is the individual faculty member. The focus is on faculty members in an attempt to elucidate the process and the challenges they face in the classroom while incorporating CMITs. The analysis is not at the institutional level, nevertheless, while the major emphasis is on individual experiences, there is a consideration of the organizational and policy context within which the individual faculty members reside. In addition, the faculty members in the study are those who are incorporating CMITs and have been doing so in one or more courses and for more than one year. Such faculty members are still in the process but have had some time to reflect on their use of and views on CMITs.

With this in mind, the study pulls together insights and perceptions regarding processes and patterns from these individuals to develop a broad context and an integrative picture of the incorporation of CMITs. The diversity of subjects helps to expose and to elucidate the relevant issues, processes, and policies, and provides data with which to attempt the creation of meaning and understanding out of this range in individual experiences.

### **Data gathering**

This research focuses on recent experiences, underlying assumptions, and changing expectations of university faculty members. While these aspects lend themselves to discussion, reflection, and open-ended questions, there is need to draw attention to the topic at hand and channel the comments toward the incorporation of CMITs. An interview approach with a semi-structured interview guide directs the general inquiry and captures these ideas and reflections.

### **Interview guide**

The interview guide, used to address the research questions and guide the interviews, is composed of both closed and open-ended questions and divided into five sections. (See

Appendix A - The Semi-structured interview guide.) Section A deals with the background information, the course, the CMITs and supports available and elicits factual information. Section B deals with teaching background and experiences. It draws out the extensiveness of the use of technology prior to and in teaching. In addition, it delves into the participants' first thoughts on the move to computer mediated instruction, some of the assumptions about the CMITs, and specific techniques used. Section C focuses on specific insights regarding the use of CMITs in the course or courses. It probes for any sequences of development, changes to teaching as a result of incorporating CMITs, specific decision points or events during the incorporation and use, and the views of colleagues in regard to CMITs. Section D addresses insights of the participants regarding technology. Here are questions on their specific views of the CMITs that they use and their definitions of technology and educational/instructional technology. The discussion also probes for changes in views about technology as a result of their use of CMITs, some of the barriers or incentives to their using CMITs, and some of their assumptions underlying their views. These sections are the main ones and are those used in all the interviews.

The last section, Section E in the interview guide in Appendix A, is a list of items which may or may not have any impact on the faculty during their incorporation process. The items in this list are meant to probe those aspects which have more or less significance to the faculty members incorporating CMITs. In addition, the list is meant to direct or prompt the participants during the discussion in the hope that something of relevance might be recollected and captured in the study. Assessments of this sort provide valuable correlations with the open-ended discussions during the interviews.

After the initial nine interviews were conducted an additional question was developed in order to have the faculty members look into the future of their use of CMITs. This question dealt with the participants' views on their incorporating CMITs and what the future challenges might be for them in continuing to use CMITs. The question asked of the last three participants in the interviews and sent electronically to the first nine was,

On reflecting back on our conversation, what three or four main challenges do you see ahead of you as you continue to incorporate computer mediated instruction into your courses? Do you see more of the same? Has

something else come on the scene in the meantime or has something come to mind since we talked?

### **Pilot interviews**

With the initial interview guide the researcher interviewed two faculty members in May and June, 1998, to assess the value of the questions for eliciting information on the incorporation process. The questions were asked as they appear in Appendix A. The factual or closed-question section created no difficulty. The broad nature of the other sections often resulted in answers to one set of questions being provided in the answers to another set of questions. With such broad topics to cover, there were often questions from the participants and a need for discussion of background and reflection between participant and researcher in order to address the full scope of the main questions or the supplementary probing points. It was necessary to use the whole interview in assessing full answers to the open-ended sections.

The last section on significant items developed into more than just a marking off of the scales. It was evident from the comments and questions about the list that items could be interpreted in different ways by this researcher and the two initial participants. After some discussion with this researcher's committee, the list of items was used not at the end to recap but in the section on teaching background and experiences. It was useful more as a prompt than as a tool to develop a priority listing.

The two faculty members involved in the pilot were of different backgrounds but each was willing to be a test case for the interview guide and to provide constructive comments on the questions and interview schedule. The first faculty member, tenured in a nursing Faculty, had eight years of computer experience in administrative work and four years using e-mail to complement class teaching. The second faculty member, tenured in an economics department, had sixteen years experience with computers but only two years of using computers in teaching. In this latter case, the computer experience in teaching encompassed e-mail, chat group, web page development, and special software all within a laptop-delivery environment.

These two initial interviews illustrated the willingness of the faculty to talk about

their experiences, the processes that they were involved with, and the trials and tribulations they faced. The factual group of questions was straightforward for the faculty members to address. The next two groups of questions, six questions altogether, brought out the greatest amount of information. The faculty members extemporised on their backgrounds, their experiences, and their courses. It was evident to this researcher that the last two groups of questions on technology insights and significant factors, garnered the least amount of reflection and the greatest difficulty in interpreting by the participants. The technology questions were insightful but did not get elaborate responses. Nevertheless, the questions were retained for the main group of interviews. As noted above, the list of significant items proved to create difficulty in interpretation and assessment but stimulated broader comments more appropriate to the second section of the interview guide. The list was used earlier in the interview to assist faculty to interpret the questions and broaden their responses.

### **Main interviews**

With the ethical review process completed and with final versions of the letters of information and of consent prepared, this researcher carried out the main series of interviews in July, 1998. (See Appendices B and C for copies of the letters.) The sequencing of the questions followed the original format except that the list was used in section B. While the sequence was the same, the focus of the questions in the main series of interviews was shifted from an equal coverage of all the questions to an emphasis on sections B and C, the two with questions dealing with backgrounds, experiences and course development. Section D, technology insights, was used but the researcher tried to be sensitive to the interests of the participants so as not to exhaust or frustrate them with these questions.

These seven participants continued, as those in the pilot, to be most forthcoming with their ideas and opinions. They roamed over many associated issues as we moved from topic to topic. Keeping them focussed on one section at a time was, as in the pilot interviews, very difficult. Nevertheless, the questions were covered, if not in sequence, certainly fully over the 45 to 70 minutes of the interviews.

### **Last interviews**

In the Fall of 1998, a third set of interviews was conducted. These three interviews

continued the diversity of the earlier interviews but played the important role of corroborating earlier findings and/or providing new examples. These last three interviews were completed in November, 1998, three and a half months after the main set and after much coding, analysis, and reflection on the earlier data. While CMITs are in rapid change, there were no specific new developments during this time period that this research could discover.

The use of the additional question on future challenges gave the participants further chance to reflect on impacts. Each of the three participants in the last set of interviews responded to the question directly and seven of the original nine participants responded to the e-mail requesting a response to this question.

### **Interview experience**

While this researcher has interviewed faculty members before, there is always a hesitancy in asking faculty what they are doing with CMITs in their courses and what impact they think those actions are having on their students. The initial trepidation of this researcher on intruding on faculty members' time was one hurdle that was always present. It was essential to be wary of intimidating the faculty members and of inadvertently setting up blocks to gathering sound data; that is, data that is reflective of their opinions and not just something that they think this researcher might want to hear.

Another issue of concern and that this researcher tried to focus on was staying at a macro level of the incorporation process. Getting mired in the evaluation of software or the idiosyncrasies of the local computer network was a concern. Banging the side of the cantankerous computer and complaining of the lack of response time on the network were two of the barriers to using CMITs that needed noting but not to the exclusion of examining the faculty members' reflections about what the CMITs meant to their work. Going off on a tangent, while one way to make the faculty member comfortable during the interview, was a concern because of the impact it would have in reducing topical information on CMITs within a reasonable time frame.

A consideration during the six month period over which the interviews were conducted was that of relevancy of the information. Would there be some significant change during the period that might require going back to do interviews over again or extend

interviewing? Would this project turn into a research program or one of those seemingly never ending longitudinal studies that go on for years? This was another reason to focus on the broader issues and not drill into a particular piece of software or hardware and its particular problems. The broader issues of course development, reflections on teaching approaches, organizational behaviour, and impacts of CMITs do not change as rapidly.

Personal biases within this researcher were a major concern. Coming to this research with a strongly structured approach, long work experience in universities, and many years of dealing with information technology, could cloud vision and skew data gathering or data analysis or both. As a result, this researcher was ever watchful of not seeking closure on an issue too quickly, mindful that others might not think the same way, and careful of not being dismissive of contrary views.

The faculty members interviewed certainly surprised this researcher with their effusiveness. They were without exception keenly interested in the topic of CMITs. In several cases, having a chance to talk to someone about their use of CMITs gave them a chance to reflect on their work and put it into the context of what others were doing. This researcher not only gathered information but after the interviews often remained to talk about what faculty members at other universities were doing. Getting a sense of where they stood in relation to others was a pleasant surprise for them. On the other hand, this two-way flow was certainly encouraging to this researcher and eased some of the earlier trepidation.

### **Selection of participants**

Maintenance of confidentiality and anonymity was necessary in order to gain access to faculty and facilitate their continued openness. While there were more than enough faculty beginning to use CMITs at any one university, in order to assure this confidentiality faculty were chosen from several local universities. This researcher, being involved in the Network for the Evaluation of Education and Training Technologies (EVNET), Theme One project, had immediate links with three Southern Ontario universities. It is from these three Southern Ontario universities that the participants were chosen.

The selection of faculty members might best be described as reflecting the snowballing approach. Faculty selection was by word-of-mouth. This researcher, active in

several working groups which deal with computer mediated communications and computer mediated instruction evaluation, had numerous contacts who suggested participants. The EVNET, Theme One team suggested several members of their respective universities that were using computer mediated instruction techniques. In addition, several of the participants suggested other faculty members involved in using CMITs. This researcher then examined the home pages of the respective universities and selected prospective participants based on seven criteria. These were;

- maintenance of as diverse a representation as possible with respect to subject background and length of experience in teaching and in use of computers,
- choice of faculty from three local universities so that confidentiality and anonymity could be maintained,
- maintenance of approximately equal numbers of female and male faculty members,
- selection of candidates who illustrated the use of a variety of CMITs,
- coverage of a broad array of subject matter,
- faculty members who taught at lower, upper or graduate levels in day and/or evening, and
- faculty members who had taught one course for at least a year so that they would have some experience and a chance for reflection.

It was evident that the faculty members involved in the incorporation of CMITs who were selected were generally friendly and open about their experiences. While several felt that they did not have much experience and were curious that I should want to interview them, once started, were effusive with their comments. In only two cases did the faculty member contacted not wish to participate. Both indicated that they were pleased to have been contacted and suggested other contacts who might have the time to participate.

### **Categories or continua?**

An initial assessment suggested a grouping of university teachers into four probable categories. These categories were: 1) faculty who had considered CMITs and decided not to incorporate them; 2) faculty who were looking at CMITs for the first time; 3) faculty who

were beginning to incorporate CMITs by using only one or two elements, e.g., presentation software or e-mail for communication; and 4) faculty who had combined many elements, e.g., as in category 3) above, plus the Internet, video conferencing and course development software.

The first two categories were outside the scope of this study. The first category consisted of those teachers who considered CMITs and decided for one reason or another to forego their use. While this group might throw light on the initial decision process and the many barriers or concerns great enough to stop incorporation, the focus of this thesis was on processes and patterns within those faculty who have already begun their journey. As a consequence, this first category, by definition, fell outside of the purpose of this thesis. The second category covered teachers who had not had any experience with using CMITs. These teachers were also outside the purview of this thesis because of their lack of experience with the techniques.

The last two categories consisted of teachers who had varying degrees of experience with CMITs. Some teachers experimented with e-mail and with presentation software. By using these technologies in a simple manner, they more or less replicated electronically what they had done in class. Other teachers used video or audio conferencing to link participants from several locations. These techniques complemented their face-to-face discussions, substituted for overhead slides, or compensated for distance. As teachers became familiar with these, they either branched off into new technologies or experimented with new uses of the technology and new methods of teaching. The focus of this thesis was on these teachers who were grappling with CMITs in delivering their courses.

Whether the data could be best described by using discrete categories or a series of points along a continuum was an important consideration. Initially, the broad range of teachers encompassed was divided into four distinct groups. Questioning teachers, categorizing into types, and developing broad characteristics of types would be useful in making generalizations and/or extrapolating to other contexts. Even with continuous data, it might be a useful for descriptive purposes if subjects could be divided into categories. However, once the range of coverage had been reduced to two categories, the question then

shifted to whether it was useful to view the basic distribution as arrayed along a continuum with teachers having more or less experience over time, having more or less contact with different techniques, or undergoing more or less change over the period of experience.

Using either categories or continua could throw a different perspective on the data. Use of categories would be in line with an attempt to define stages-of-development and to emphasize groupings and levels of characteristics. This would simplify the perspective on the data and prompt identification by readers of probable steps or stages in incorporation of CMITs. The use of continua, on the other hand, would focus on the non-discrete nature of the data and would emphasize its flowing, process nature. Maintaining an openness to the implications of these two perspectives during the analysis was an important consideration so as not to close off possibilities of interpretation.

### **Time frame**

Time frame for the study was another consideration. As noted above, the minimum criteria for inclusion in the study became one academic year of experience in the use of one type of CMIT in at least one course. This was a minimum period in which use of and reflection on CMITs was possible.

A one year period may seem extremely short but it must be seen in regard to the recent development and growth of CMITs. It is important to keep in mind the short period over which computers have been used in education and the extremely brief period in which the use of the Internet and web pages has skyrocketed. CMITs encompass a variety of techniques from standalone computers and Computer Aided Instruction (CAI), to telecommunications for audio and video conferencing, to the integration of both computers and telecommunications for e-mail and web-based Internet activities. While CAI and audio and video conferencing are decades old, web-based activities are only a few years old. It is these more recent CMITs such as e-mail, web pages, and web-based course authoring software which have grown ubiquitous since the early 1990s that are the main focus of this thesis. Because of the rapidity of growth and change, it is essential to remain current and capture the recent activities of the faculty members using CMITs.

## **Sample size**

A definite size to the sample was not determined at the beginning of the study. As Miles and Huberman (1994, p. 27) note, a researcher must deal with the often conflicting actions of setting boundaries and creating a frame for the study. On the one hand, the bounds of the sample were purposely chosen to reflect a broad spectrum of experiences of the faculty members in a wide range of subject fields. The frame or filter, on the other hand, focussed interest on the faculty members' current experience with CMITs and within the three aspects of theories of learning, instructional design and introduction of technology.

The intent was to complete the semi-structured, taped interviews, all the while examining the data for processes within educational, instructional and technical aspects of the faculty members. Reassessment of the sample size followed each interview and a determination of whether processes identified in the latest interviews were newly discovered or were beginning to repeat themselves.

A sense of the number of interviews became clearer only after detailed analysis of and reflection on the first two groups of interviews were complete. The two participants in the pilot illustrated that useful data would be more forthcoming from a reemphasis on the topics within sections B and C. They also suggested structural changes in the sequence and the value in using the list of items. The main group of interviews completed in the summer of 1998 provided a wealth of experiential data for analysis. During these two groups of interviews there was some overlap in the processes noted, but while some of the aspects became repetitive for the interviewer, each new participant brought his or her own perspective, keen interpretation and particular examples.

On reflection, however, the patterns that were forming in the data might have been expected. The faculty members were all on the forefront of the use of CMITs. While they were in different subject areas and in some cases different universities, they had, nevertheless, similar opinions and experiences even if slightly different in colour and shade. As noted above in the section titled, 'Last interviews,' after some analysis of the first nine interviews, a supplemental set of interviews was organized to provide corroboration of the initial findings or to open new doors onto the incorporation process. The conclusion was

that these additional three interviews reflected much of the broad content of the first nine but provided illustrative material within the frame set out earlier.

This is not to say that more interviews might not uncover other processes and patterns. However, taking into consideration the rapid change in CMTs, the time frame of the thesis work, and the realization that this is a preliminary assessment out of which other detailed work might flow, the sample size was capped at twelve faculty members.

### **Data analysis**

The first decision pertaining to the data analysis process was to determine a suitable method of handling the data, of assigning headings or codes, and of analysing all the material. This researcher wanted to be sure to avoid the fate that Robson suggests when he says, "Naive researchers may be injured by unforeseen problems with qualitative data" (Robson, 1993, p. 370). Some of the initial difficulties in this current study centred on choices of categories, equivalency of terms and sheer information overload.

The interviews were tape-recorded and transcribed by this researcher and by an OISE student hired to assist in the transcription. Each interview ranged from 45 to 70 minutes in length and took from six to seven hours to transcribe. The fatigue of transcribing prompted the use of assistance but created some initial concern with accuracy. Only verbatim transcription was farmed out so there was no lasting problem. This researcher checked the taped interview with the transcription and corrected where necessary. Using an OISE student minimized these corrections because she knew the terms involved. Once the transcriptions were completed they were transferred to NUD\*IST for coding and preliminary analysis.

This coding process was done completely by this researcher so that all data would be treated with some consistency. The coding structure grew out of reading and re-reading the interviews and out of reassigning and reassembling codes. This reflection on codes and their organization was assisted through use of the powerful functionality of NUD\*IST and a link with another software package called INSPIRATION. The former provided the ability to attach codes and notes to the data, create index trees and review the interview data with powerful search tools. The latter provided a graphical interface to the index tree. This

researcher found the graphical representation of the tree with an ability to attach notes to particular nodes an excellent method of organizing and understanding the nuances of the data. Using such tools might seem mechanical and removed from the data but this researcher found that they facilitated rethinking and readjusting the concepts identified. This mechanical facility ensured that this researcher did not get locked into a dysfunctional data structure.

The process of coding and re-coding was necessary because as new insights were gleaned from one interview, insights into the previous interviews occurred. The initial coding was perfunctory with an emphasis on factual data about the interviewees, naming of the CMITs used or referred to, and the pros and cons of using CMITs. (See Figures 4.1 to 4.2 for a summary of the factual information.) On subsequent readings the focus became the traits of the faculty members, their concerns about the use of CMITs, their reasons for incorporating CMITs, their views on teaching, and their views of technology. These various elements, detailed throughout Chapter Four, centred on the major themes of theories of learning, instructional design, and introduction of technology.

After the first interviews were analysed, there were approximately 70 nodes in the index tree. After all twelve interviews were analysed there were over 200 nodes in the index tree covering almost 2000 text units within the interviews. This produced a great deal of information on the incorporation process as well as on the characteristics of the participants, their attitudes towards CMITs, and their views on their institutions, students and colleagues. The NUD\*IST functionality provided an excellent means of analysing and assembling the information.

In taking quotes from the data several conventions were used. Each of the quotes were identified by the code for interviewee and for the text unit both within angle brackets. For instance, <10,119> at the end of a quote indicated that the quote was the 119th text unit in the verbatim transcription of the tenth interview. If there was need for the insertion of a word or phrase for clarity, the square brackets, [ ], were used to bound the inserted text. If a very long quote had some unnecessary or tangential comment in the middle, this unnecessary phase or sentence was removed and replaced with ... , the ellipsis marks. In order to protect

confidentiality, proper names of universities were replaced by the generic term [university] or [the other university] depending on the context. In this vein, a personal name was replaced by the term [name] and the referral to a specific office was replaced by the term [office].

## **CHAPTER THREE**

### **REVIEW OF THE LITERATURE**

There are an increasing number of issues, as noted in Chapter One, concerning university faculty members today. The increasing pressures on faculty members come from several directions not the least of which is probably from the faculty members themselves as they try to cope with current workload, to enhance their courses, and to stay up-to-date. With expanding student populations, university administrators are seeking efficiencies and new methods to deal with the increased demand. Some say that they are doing this at the expense of the faculty members and the educational process (Noble, 1998). The call of others (Hawkrige, 1991; Nicholas and Allen, 1996) to look more closely at the underlying assumptions and implications of using educational technology points to additional concerns for faculty members. In addition, the incursion of a business mentality with such concepts as a 'consumer-centric model' (Twigg and Oblinger, 1996) and the 'commoditization of learning' can bring a 'ruthless utilitarianism' (Long, 1995) which can create stress and doubt in the most confident.

This diversity of perspectives and concerns is also reflected in faculty members as they attempt to incorporate CMITs into their courses. Dealing with the incorporation process necessitates taking a multi-faceted approach. In this researcher's view, as indicated in Chapter One, the incorporation of CMITs into courses is best viewed from three perspectives. These three perspectives are the broad issue of viewing the adoption of CMITs in the context of various theories of learning and teaching, the more specific instructional design of courses, and the introduction of technology. These three provide the frame of reference for this review of the literature.

The first perspective views the adoption of CMITs in the context of theories of learning and teaching. In this case, the focus is specifically on the objectivist - constructivist dichotomy as outlined in the works of Jonassen (1991, 1994, 1995) and the transmission - transaction - transformation orientations of Miller (1983, 1996). Understanding faculty views

toward teaching and learning assists in an examination of how they use CMITs. Examining the inter-relationships among CMITs, pedagogy, and faculty views on teaching and learning reveal what role each might play within the incorporation process.

The second perspective views the incorporation of CMITs from the instructional design field and the boundary layers between education technologies. Stark's theoretical contextual filters model (Stark, Lowther, Ryan and Genthon, 1988, p. 235) is one practical guide amongst many but, in addition, provides a useful organizing schema for other models. Several other systematic course development tools are outlined to suggest alternative integrative models and to expand the horizon of likely significant issues in the incorporation process. These tools which draw attention to a myriad of issues are especially useful in light of the recent impact of the Internet, the World Wide Web, and the continued rapid expansion of a global networked computer infrastructure. The boundary or transition layers that developed between the traditional class environments and the class which incorporate CMITs also provide useful insights into the incorporation process. The transitions include those between traditional, face-to-face classroom environments and distance education delivery methods, between traditional classroom methods and interactive television, audio/video conference delivery methods, and between traditional classroom methods and those distributed delivery methods using CMITs.

The third vantage is a technological one which covers the introduction of technology, the adoption of technology by faculty members, concepts of new product development, and business cycles or stages of technology implementation. The first two approaches might be subsumed under the rubric of diffusion/adoption of technology and illustrated by the works of Moore (1991) and Rogers (1995) in the first case and by the works of Geohagen (1994), of Proulx and Campbell (1997), and of Anderson, Varnhagen, and Campbell (1998) in the second. The last two approaches are encompassed by the stages of development perspective and illustrated by the works of Spivey, Munson, Nelson and Dietrich (1997) and those of Green and Gilbert (1995) and Waterman (1982). This integration of various viewpoints broadens the net of inquiry and enhances the examination of faculty members' experiences of the CMIT incorporation process.

## **Theories of Learning.**

As noted in the Chapter One, and diagrammed in Figure 1.3, theories of learning in this study encompass three overlapping models or continua, i.e., objectivism - constructivism, outer person - inner person, and transmission - transaction - transformation. These three continua are the first edge in the triangular framework in the examination of the CMIT incorporation experiences of the faculty members interviewed. Such continua, while admittedly oversimplifications, assist this researcher in organizing an examination of alternative approaches to teaching and learning.

### **Objectivism - Constructivism**

The first continuum has as its end points the two concepts of objectivism and constructivism. The recent literature on the constructivist approaches to teaching and learning may be differentiated into three predominant themes. These themes may be entitled the paradigm shift discussion, the applications of a constructivist approach to teaching and learning, and the implications for educational technology.

The first continuum representing the objectivist - constructivist approaches may be used to position and interrelate several other approaches, such as, programmed instruction, systematic course design, instructional design and discovery learning. These examples are not new approaches, but Candy (1991) provides an assessment that summarizes the extremes and indicates the strong movement near the beginning of this decade from the objectivist approaches toward the more constructivist approaches to learning. He suggests that until the late eighties research on learning was dominated by four factors which were clearly objectivist in tenor, i.e., an atomistic view of knowledge, a behaviouristic view of people, a preference for the perspective of the researcher over that of the learner, and a tendency to conduct research in laboratories or artificial settings. However, recently the major focus has shifted along the continuum toward viewing "learning as a qualitative transformation of understanding rather than a quantitative accretion" (Candy, 1991, p. 249). This movement is depicted well by Jonassen (1991a) who highlights the extremes on the objectivist - constructivist continuum. These end points, illustrated in Figure 3.1 Assumptions inherent in objectivist and constructivist approaches, reflect the factors which Candy mentions and

**Figure 3.1 - Assumptions inherent in objectivist and constructivist approaches.**  
(After Jonassen, 1991a, p. 9)

	<b>Objectivism</b>	<b>Constructivism</b>
<b>Reality</b>	<p>External to the knower</p> <p>Structure determined by entities, properties, relations</p> <p>Structure can be modeled</p>	<p>Determined by the knower</p> <p>Dependent upon human mental activity</p> <p>Product of mind</p> <p>Symbolic procedures construct reality</p> <p>Structure relies on experiences/interpretations</p>
<b>Mind</b>	<p>Processor of symbols</p> <p>Mirror of nature</p> <p>Abstract machine for manipulating symbols</p>	<p>Builder of symbols</p> <p>Perceiver/interpreter of nature</p> <p>Conceptual system for constructing reality</p>
<b>Thought</b>	<p>Disembodied: independent of human experience</p> <p>Governed by external reality</p> <p>Reflects external reality experience</p> <p>Manipulates abstract symbol</p> <p>Represents (mirrors) realities</p> <p>Atomistic: decomposable into building blocks</p> <p>Algorithmic</p> <p>Classification</p> <p>What machines do</p>	<p>Embodied: grows out of experience</p> <p>Grounded in perception/construction</p> <p>Grows out of physical and social</p> <p>Imaginative: enables abstract thought</p> <p>More than representation of reality</p> <p>Gestalt properties</p> <p>Relies on ecological structure of conceptual system</p> <p>Building cognitive models</p> <p>More than machines are capable of</p>
<b>Meaning</b>	<p>Corresponds to entities and categories in the world</p> <p>Independent of the understanding of any organism</p> <p>External to the understander</p>	<p>Does not rely on correspondence to the world</p> <p>Dependent upon understanding</p> <p>Determined by the understander</p>
<b>Symbols</b>	<p>Represent reality</p> <p>Internal representations of external reality</p>	<p>Tools for constructing reality</p> <p>Representations of internal reality</p>
<b>Learning</b>	<p>Process of mapping entities &amp; concepts denoted by words (languages) onto the learner</p>	<p>Process of interpreting information in the context of the learner's own experiences.</p>

which many other authors describe in the growing number of articles in the nineties on constructivism.

### **Paradigm shift**

The paradigm shift discussion in the constructivist approach to teaching and learning is encompassed in the works at the turn of the decade of such authors as Candy (1989), Jonassen (1991a, 1991b), Duffy and Jonassen (1991, 1992), and Yarusso (1992, April). They focus attention on the objectivist - constructivist dichotomy, proffer their views on the constructivist approach to learning, and begin the application of constructivist tenets to teaching and learning.

Candy, in his work on self-direction and the adult learner, suggests that the slow down in research which is dominated by a positivist/empiricist paradigm has resulted from a dissonance between the research approach and the topic being researched (Candy, 1989, p. 95). He suggests that a more effective approach would be to view knowledge formation, the learner, and teaching/learning from a constructivist approach. Such an approach, in moving away from the objectivistic views on the left side of Figure 3.1 towards the constructivistic views on the right, provides a synchronisation of approach and topic that opens up new and more relevant avenues of research and provides a better foundation for the development of effective learning environments. He also makes it clear that this repositioning or use of a constructivistic approach is not easy because it is not one simple concept but a cluster as outlined in Figure 3.1 that demands substantial revision of ideas and perspectives (Candy, 1989, p. 97). This difficulty is highlighted in the following pages on the application to teaching/learning and the implications for educational technology.

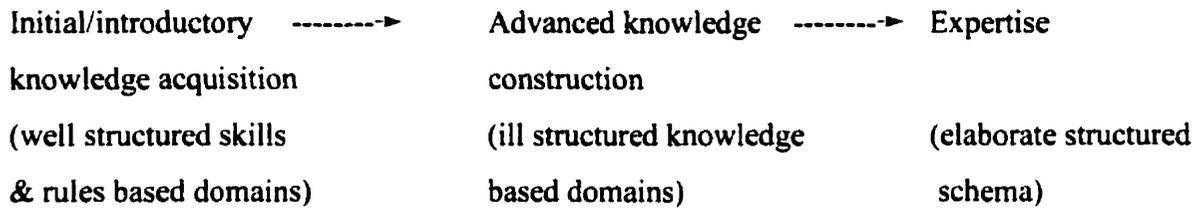
Jonassen (1991b) positions several approaches to learning along his objectivism - constructivism continuum. His examples consist of objectivism, programmed instruction, instructional design, discovery learning, and constructivism. Moving from left to right along this continuum, he suggests, poses several questions about individualistic interpretations of experiences that play havoc with an objectivist attempt to map reality onto learners. Rather than doing this mapping, teachers need to help learners interpret experiences and construct meaningful representations. In addition, teachers must consider moving away from criterion-

referenced instruction and evaluation towards goal-free evaluation methodologies of constructivist environments. This points clearly toward what he calls 'authentic tasks' or tasks 'that have real-world relevance and utility, that integrate those tasks across the curriculum, that provide appropriate levels of complexity, and that allow students to select appropriate levels of difficulty or involvement' (Jonassen, 1991b, p. 29). Jonassen in his works of the early nineties, initially deals with the definition of constructivism and the comparison of it with objectivism. Later he moves to applications of this approach to teaching and shows the various implications of it for instructional design and educational technology (Jonassen, 1994, 1995a, 1995b).

A key component of Jonassen's discussion (1991b) is his three stages of knowledge acquisition. Figure 3.2 illustrates the process of knowledge acquisition through what Jonassen labels introductory, advanced and expert levels. It is here that he introduces an objectivist approach as a necessary initial component for knowledge acquisition. He notes that beginning learners have very little context or prior knowledge with which to organize, interpret, and construct knowledge. As a result, it may be more appropriate to have structured criterion referenced instruction and evaluation at an acquisition stage and then move into constructivist approaches for knowledge construction as domains become less well structured and elaborate. Such a multi-faceted approach does not diminish the value of a constructivist approach. On the contrary, it suggests a pragmatic view towards understanding the proclivities of the learner, the scope and nature of the content, and the most suitable approaches for teachers and learners. It highlights the flurry of activity at the beginning of the decade in applying constructivism to education and offers new insights on the teaching-learning process.

Underlying the assumptions outlined in Figure 3.1 are particular approaches to the adoption and use of CMTs. To use CMTs in an objectivist manner tends to relegate them to storage and one-way transmission tasks. This would include the use of e-mail or listserves as a method of disseminating course information in a one-to-many fashion but not using them as discussion forums. Perkins' information banks would fall into this one-way transmission

**Figure 3.2 - Stages of knowledge acquisition - construction** (after Jonassen, 1991b, p. 32).



category (Perkins, 1992, p. 46). Interactivity in the extreme objectivist approach is of the odious 'drill and kill' type whereby the student repeats the drill until he or she has it correct and then goes onto the next level of competency. This rudimentary form of computer assisted instruction may be useful at the introductory knowledge acquisition stage (see Figure 3.2) which focuses on learning well-structured skills in a rules based situation (Jonassen, 1991b, p. 31). The objectivist assumption is that the codified knowledge is in the machine and all that is required is for the student to use the machine to gain that knowledge (Lapp, Bender, Ellenwood and John, 1975, p. 11). Contrary to this is the use of CMITs in a constructivist setting where context and process are main foci. E-mail and listservs are used to their fullest extent as two-way communication from one-to-one or many-to-many. Construction kits, phenomenaria and task managers (Perkins, 1992) are key categories for building context and interactive learning environments. Simulations where the students have the ability to interact with and change their environments also fall into this category (Brimley, W., White, W.E., Zywno, M.S., Kennedy, D., 1998, p. 3). A useful approach to CMITs is to recognize their characteristics, to use them to complement each other, and thereby to enhance the learning environment. Laurillard (1993), does this as she combines theory and practice in her outline of how students might participate and how particular media and CMITs can support specific learning processes (p. 177). Her chart links specific interactive and reflective actions of teacher and student with what she calls 'media,' such as, simulations, microworlds, tutorial systems, and computer supported collaborative work. By doing this she illustrates how both computer and non-computer mediated instruction techniques may be of use in the learning process.

This use of both objectivist and constructivist approaches illustrates once again that the extreme points on this continuum are seldom populated. Most of us are somewhere between the two trying to understand and apply a wide array of approaches and techniques where most suitable. Duffy and Jonassen (1992) provide an energetic debate by bringing together authors who are situated at several sites along the objectivist - constructivist continuum and who hold divergent views. On the one hand, several authors writing from a constructivist perspective attempt to illustrate the boundaries of constructivism through definitions and applications. Cunningham (1992) with a humorous but revealing Copernican Dialogue focuses attention on the individual nature of experience and knowledge construction and the attendant need for alternate learning environments which emphasize processes of knowledge formation and contextual assessment. Perkins (1992) briefly covers facets of learning environments, i.e., information banks, symbol pads, construction kits, phenomenaria, and task managers. However, he stresses the key central goals of understanding and active use, and shows the impact that these have on the relevance of the five facets in a constructivist approach to teaching. For instance, construction kits and phenomenaria are key to centring the learner in sense making situations whereas information banks are less central (Perkins, 1992, p. 53). Spiro, Feltovich, Jacobson and Coulson (1992) expand on the complex nature of ill-structured advanced knowledge domains and the value of a constructivist approach for promoting integration of knowledge in ways to facilitate adaptive use or transfer across cases or situations.

On the other hand, several authors with systematic or instructional design approaches illustrate that there is much more clarity needed before universal application of constructivist tenets are possible. Merrill (1992), Dick (1992), and Reigeluth (1992), provide critical and sobering assessments which indicate several valuable avenues for further constructivist elaboration, e.g. providing a great latitude for learners to choose from means costly course development; the learning seems technology dependent; and individual goals-based evaluation is onerous as well as very difficult. Merrill (1992) suggests that there have been too many straw men set up and knocked over, i.e, extreme views of objectivism or constructivism taken as standard. A less emotional analysis suggests that there is much

similarity between the tenets of the constructivism defined by Duffy(1992), Jonassen (1992), Perkins, and Cunningham (1992), and the tenets of the instructional design theorists as noted by Merrill (1992, p. 99). Dick (1992), reflects Merrill's views but outlines concerns that the constructivists must make the theoretical boundaries of constructivism clearer; that they need to illustrate the effectiveness of applying these tenets to learning; that they must deal more satisfactorily with the beginning learner and their entry behaviours; and that while assessment is recognized by both groups it is not clear how it is accomplished in the constructivist approach especially in certification situations (p. 96). In a nutshell, Dick states that the constructivist approach is costly, requires technology to implement and is very difficult to evaluate. These are all issues that the constructivists must address in their contribution to advancing theories of learning and appropriate strategies. Reigeluth (1992) mirrors the points of Merrill and Dick and continues by calling for clarity with regard to what is being discussed. He suggests that the constructivists focus on what should be taught while the instructional designers focus more on how something should be taught. Perhaps Yarusso's pragmatic approach might act as a guide, i.e., "If I have a bias, it is to use constructivism when faced with a need to be creative and to use objectivism when faced with a need to be productive" (Yarusso, 1992 April, p. 9). Clement's (1995) aphorism that "constructivism is a philosophy of learning, not a methodology of teaching" might prove as useful (p. 200).

The debate continues to swirl around what constructivism is, what its underlying, often hidden, assumptions are, and how its application might assist the education process. In the swirl, subdivisions of constructivism are also growing. Phillips (1995) considers three possible dimensions of constructivism with their distinguishing characteristics and continues by talking about the socio-political facets of each. Osborne (1996), from his science education perspective, argues for pluralism. Nevertheless, he contends that while there is individual construction of knowledge, the constructivist approach is trivial in comparison to the importance of a structuralist, objectivist approach in science and science education. He does not dismiss constructivism but takes his own advice and accepts it for what it can do. Zevenbergen (1996), in dealing with mathematics education, views constructivism as liberal discourse which valorizes the individual construction of meaning, but in doing so, may ignore

the social and political contexts of mathematical knowledge. These and others force reflection on how one might define constructivism and use it as a guide. Geelan (1997), reflecting on a pluralistic methodology, suggests that such “dialectical interaction throws each theory into sharper focus, making it more useful and powerful” (p. 26).

### **Applications**

Over the last seven years many authors have taken on the task of clarifying the boundaries of constructivism and of illustrating how such an approach might be put into operation. Articles often start with a brief definition, context and history and then move onto case studies or examples of applications. Cole (1995) provides a concise history with comments on the contributions to constructivism of such figures as Dewey and Piaget and concludes with comments on science education in the museum field. Glatthorn (1994) considers a constructivist unit development process which includes the degree of integration with the curriculum, the establishment of unit parameters, the drafting of unit scenarios, and the determination of relevant learning strategies. Anderson (1996) approaches the topic with questions and answers and suggests how to assess student understanding and what it means for students to work in a constructivist classroom.

Many authors deal with the constructivist approach in specific subject areas. Authors such as Leder (1993), Davis, McCarty, Shaw, and Sidani-Tabbaa (1993), Chang, Romiszowski, and Grabowski (1994), Caprio (1994), Glanville (1995), and Geelan (1997) deal with these issues within mathematics and science education. Leder and Geelan treat constructivism and science education broadly by dealing with definition, categories, and usefulness of elements of constructivism. Davis, et al. note that there is a crisis in science education and that constructivism provides a vantage from which to make new and valuable decisions. The value of this article is that it deals with six issues that are essential to change, i.e., perturbation (disequilibrium), awareness of a need to change, making a commitment to change, creating a vision, projection of self into the vision, and reflecting on change. Chang, et al. outlines her detailed study of students in chemistry and the application of four teaching methods. Her conclusion suggests that constructivist approaches enable students to predict and explain with more facility than students being taught using traditional teacher-centred

strategies. The latter students did however, perform better on multiple choice tests. Caprio provides insights by describing his experiences with using a constructivist approach in his college science class. Glanville briefly defines three approaches, positivism, constructivism and critical constructivism, and then provides practical examples so that teachers can see the constructivist approach through comparison. The value of these and especially Davis, et al. and Caprio is that they illustrate the importance of a change in perspective, e.g., the use of a constructivist approach, and describe the many positive experiences that teachers have in incorporating supportive techniques into their courses.

Yet others such as Lord (1994), Hand and Peterson (1995), Scheurman (1995), and Nicaise and Barnes (1996) call for the integration of constructivist approaches in teacher training as a means of diffusing the approach throughout the schools. Scheurman's work is especially useful for his outlining of a teaching model and significant elements within this model to help teachers understand and develop a constructivist approach. Many of these articles do not deal with post secondary situations specifically but much of the work is illustrative and transferrable.

Another topic of interest within constructivism and which is dealt with by many of the authors noted in the last paragraph is that of evaluation. Holmes and Leitzel (1993) compare traditional and constructivist evaluation of learning and go on to suggest constructivist evaluation strategies, such as, one-sentence summaries, concept maps, annotated portfolios, invented dialogues, and prospectuses.

### **Implications**

Dick (1992), from his instructional design perspective, points out that it is only with the recent implementation of a significant amount of technology that constructivism is possible (p. 96). However, Wilson (1993), also from an instructional design background, suggests, as does Clements (1997), that a constructivist theory of instructional design is possible if constructivism is seen as a philosophy and not as a strategy. He goes on to state that instructional design theories require better grounding in a broad understanding of learning and instructional processes and designers need more relevant generic principles and specific heuristics for dealing with recurring problems (p. 2). Laurillard (1993), illustrates

this, as noted above, in her 'media comparison chart' and thereby, provides faculty members with insights into how they might use the different media (p. 177).

Others look to technology as a useful tool for developing constructivist approaches to teaching. Ritchie and Baylor (1997) outline another pragmatic approach by combining learning strategies based on a combination of behaviourism, cognitivism, and constructivism. They suggest that a multi-faceted approach with the approach matching the circumstance is the only real solution in education. White (1996) also outlines a multi-faceted program that uses technology to integrate constructivist principles into teacher education but focuses on the need for appropriate use of technology, for incorporating techniques such as modelling and reflection, for active student involvement, and for developing a strong community of learners. Jonassen (1994, 1995b) continues in this vein by outlining the traits of learning environments and by emphasizing the development of processes around constructing knowledge, setting authentic contexts, and facilitating collaboration among learners. Jonassen (1995a), from his constructivist perspective, illustrates how technology-supported environments can assist in knowledge construction and learning in a distance education context (p. 15). What these examples point to is the need to use a broad spectrum of approaches and techniques in an effort to develop meaningful learning environments and successful knowledge construction.

### **Towards an holistic approach**

The two other continua reflect Miller's (1983, 1996) holistic approach (see Figure 1.3). Miller's (1983) orientations categorize teachers and how they work with students. This spectrum of orientations extends from a focus on student behaviour (the outer person) to a focus on student thoughts and feelings (the inner person). This approach parallels the objectivist - constructivist continuum, in part, but it stresses intuitive thought, connectedness, and a balance between intuitive and analytic thought (p. 7). Miller's descriptions of the various orientations provide teachers with insights into concepts such as that of the learner, the learning process, the teacher's role, and how learning might be evaluated.

Miller's (1996) recent work on holistic education, groups educational orientations under three revised meta-orientations or categories, i.e., transmission, transaction and

transformation. These do not flow from bad to good nor are they mutually exclusive within the teaching - learning process. Miller focuses on the interrelatedness of these within what he calls his holistic stance (p.9). Each of these has specific psychological, locational, and focal aspects which point to related teaching - learning strategies. See Figure 3.3 for a graphical presentation of the traits of the meta-orientations. The transmission position outlines the decidedly objectivist view of reality with the teacher conveying the necessary information down to the student who imitates and repeats; the student is the vessel into which the teacher pours knowledge. The transactional position moves to the interactive with dialogue between student and teacher and with a focus on cognitive interactions and problem solving. The arrow pointing to the left in Figure 1.3c suggests that the teachers can still utilize the transmissive approach. The transformational position focuses on the student as a whole person with the teacher using such strategies as creative problem-solving, cooperative learning and authentic tasks. Once again the left pointing arrow suggest that teachers can avail themselves of functionality of all orientations as appropriate. The arrows also imply the broadening of scope of the teachers to an ecological or interdependent perspective. In so doing, there is reinforcement of the movement from a strictly objectivist position towards a constructivist one. These illustrate what might be called the changing roles of the teacher from a sage-on-the-stage to a guide-on-the-side.

**Figure 3.3 - Traits of the meta-orientations** (Miller, p. 35).

<b>Position</b>	<b>Psychology</b>	<b>Location</b>	<b>Focus</b>
<b>Transmission</b>	Behavioural	Body	Behaviour
<b>Transaction</b>	Cognitive	Mind	Intelligence
<b>Transformation</b>	Transpersonal	Self	Wisdom

In studying faculty educational orientations and approaches to teaching, such a series of orientations are helpful guidelines. Understanding these orientations and their particular approaches to teaching can assist in explaining seeming discordances within faculty members and suggesting routes for further possible analysis and suggestions.

## **Instructional design**

### **Contextual filters model.**

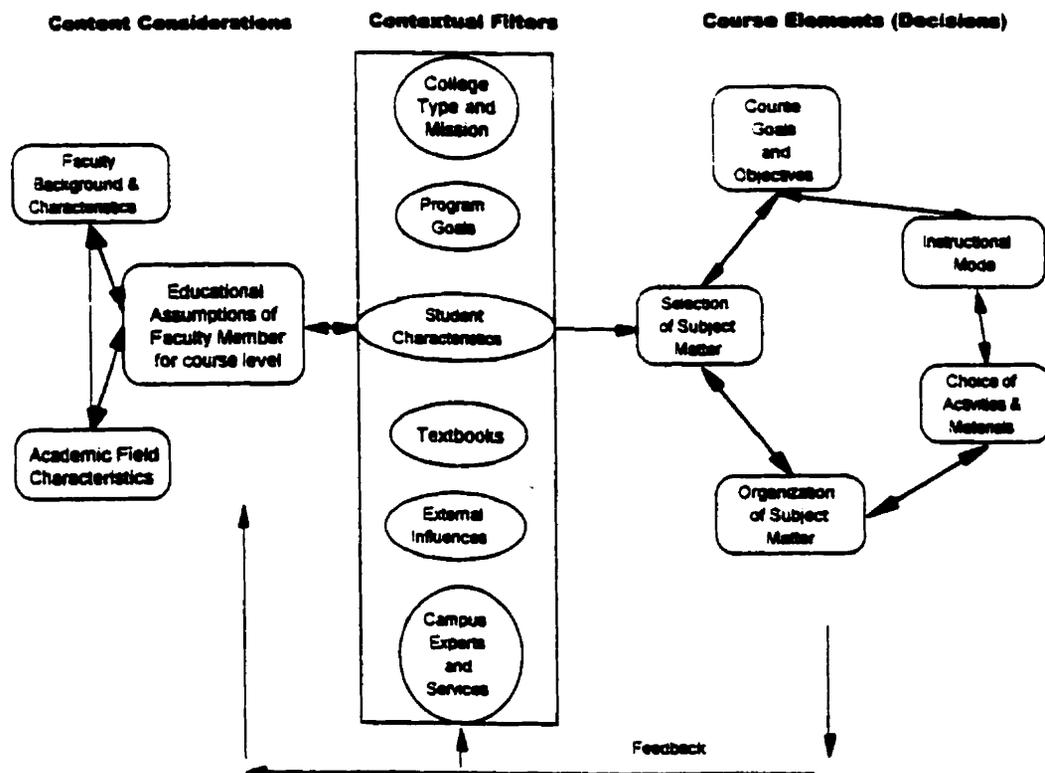
Stark et al. (1988) describes a model of course design (Figure 3.4) in which there are three main segments (p. 235). The Content Considerations segment focuses on faculty who work from a discipline grounded perspective. Nevertheless, faculty take into consideration a number of Contextual Filters which modify this perspective. The last segment in the model is the Course Elements. Even though the model places the contextual filters between the content considerations and the course elements, Stark notes that the process of course design is not linear. This means that course design can start at any point but probably has certain elements such as subject matter which come before others. The feedback loops in the model also suggest that whenever changes are made there should be a reassessment of the other elements of the model. For example, if there is a change in instructional mode there needs to be a reappraisal of the other elements within the content considerations, the contextual filters or the other course elements. The model is useful in guiding an assessment of the implications of changes to and delivery of courses.

Within each of Stark's segments there are groups of elements. Under content considerations fall elements of faculty background, educational assumptions and discipline. Contextual filters in Stark's model are any specific characteristics of the instructional setting which modify, to varying degrees, the views of faculty members. The major contextual filters according to Stark and as noted in her model are student characteristics, textbooks, external influences, campus experts and services, college type and mission, and program goals. Under course elements there are course goals and objectives, selection of subject matter, organization of subject matter, choice of activities and materials, and instructional mode. Stark's work represents a general model of course design that points to many issues which faculty face in developing their courses and when incorporating new techniques.

### **Supplemental models.**

Many authors deal with the issues faculty confront in developing their courses and in moving to CMITs. As might be expected their categorizations (See Figure 3.5) and emphases differ somewhat from that of Stark. Three authors who take a generalist approach

**Figure 3.4 - Contextual filters model of course design** (Stark et al., 1988, p. 235).



provide an excellent summary of the literature. First, Geis and Hiscock (1991) outline eleven primary influences on course design in their discussion about faculty and how they plan courses. Their influences such as knowledge and skill, discipline, course level, delivery mode, and environment/resources fit within the Stark conceptual filters model of course design. The difference of the Geis and Hiscock discussion is that it describes the influences in a non-prioritized and non-structured manner. Second, Yinger (1980) describes three influences on the teacher's dilemma of course design, i.e., environment and organization, curriculum and resources, and pupil characteristics (p. 116). In addition, he outlines other components such as teacher knowledge and experience, teaching goal conceptions and materials. Again, these fit within the Stark model. Third, Dinham and Blake (1991) whose work rests on that of Stark, study a few teachers throughout the planning and life cycle of their courses. The categorization of influences covers disciplinary, educational and organizational contexts but details many of the items that the other two examples above cover in more general terms.

### Figure 3.5 - Issues teachers face in designing courses or incorporating CMTs.

- Allen & Carl - (as cited in Price & Repman (1995) - Establish high standards  
 Train and retrain staff  
 Carefully evaluate teaching sessions prior to distribution  
 Provide easy communication between all participants  
 Develop rigorous and valid testing that provide feedback  
 Package the course content  
 Provide ready accessibility to resources
- Dinham & Blake - Discipline  
 Organizational context  
 Logistical realities  
 Necessity of change
- Geis & Hiscock - Knowledge & skill - subject matter & teaching skill  
 Discipline - intrinsic structures  
 Level - introductory or graduate  
 Years teaching  
 Delivery mode  
 Student traits  
 Guidelines/locus of control  
 Environment/resources  
 Organization of course planning  
 Incentive systems  
 Perceived roles
- Stark - Content - Academic field characteristics  
 Faculty background  
 Educational assumptions of faculty  
 Contextual filters - College type/mission  
 Program goals  
 Student characteristics  
 Textbooks  
 External influences  
 Campus experts and services  
 Course elements -Course goals and objectives  
 Selection of subject matter  
 Organization of subject matter  
 Choice of activities/materials  
 Instructional mode
- Wagner - Existing course design standards  
 Graphic redesign  
 Instructional variety  
 Time estimates and specifications  
 Site configuration
- Wilson - Self-pacing  
 Rapid feedback  
 User-friendly interaction with the institution  
 Well structured, relevant curriculum  
 Highly motivated students
- Yinger -Environment & organization  
 Curriculum & resources  
 Pupil characteristics

Dinham and Blake comment in their study that:

In addition to being positioned in a disciplinary context, the course exists also in an institutional context fraught with educational realities such as student characteristics, and organizational realities as conceptual as departmental policies and goals or as concrete as resource availability (p. 14).

Such comment reinforces the need to look beyond the faculty member to gauge the challenges that he or she might face in any move to change a course or incorporate CMITs. From these authors it is clear that they see course planning as an interconnected whole, not as islands;

change one aspect and the others require reassessment. The value of these studies is that they point to the whole gamut of influences and make researchers aware of the complexity of course design, of the implications in making course changes, and of the importance of individual elements such as instructional mode.

**Boundary issues.**

The articles dealing with changing the delivery mode or combining two or more modes within a course tend to focus on particular critical boundary issues. Their strength is not their overall model of course design, but their focus on issues and practices specific to the alternate mode of delivery. For example, Maxwell (1995), discusses both general and particular aspects of the incorporation of technology to open learning and distance education. She also deals with shifting educational paradigms from teacher-centred to learner-centred, constructivism, restructuring the social context, and the use of media. Of significance are her suggestions for integrating open learning and distance education, and her series of troubling questions that the suggestions prompt. Three of her questions that directly impinge on the boundary issues of the class-to-online transition are:

How practical is it to assume that all students naturally and quickly can adapt to this restructured situation and not let their learning potential be negatively affected?

How practical is it to allow students to start, progress and stop the course at will?

How practical is it to provide a variety of effective, quality and affordable media?

(Maxwell, 1995, p. 47)

Her article also points to many other fast approaching issues, e.g., how can educational institutions afford the technology, how much should the students pay for the new technology, and what alternative access capabilities will come available as new telecommunication players such as cable television companies expand their products.

Price and Repman (1995) survey instructional design models, present a nine-step instructional design model, and outline important characteristics of delivery via interactive television. Of the seven characteristics necessary for successful distance learning most deal with general expectations such as establishing high standards for teachers and mediators and conducting evaluation of teachers and programs. Specifically relevant to the successful use of the technology are the consistent and continual training of staff, the provision of easy communications and timely and accurate feedback, and the establishment of ready access to human, print and media resources (p. 255). Price and Repman draw these comments from the work by Allen and Carl (1988). They also draw the following specific provisions on distance education from Wilson (1991): self-pacing, rapid feedback, user-friendly interaction with the institution, well structured, relevant curriculum and highly motivated students. Price and Repman go on to stress the importance of reflective analysis and formative evaluation neither of which is unique to distance education or interactive television (p. 262). The important feature of this article is the reiteration of the need to maintain an open perspective so as to extract the best from other delivery modalities.

Wagner (1993) in her article on distance education deals with three phases in the development of distance education projects, i.e., technological reliability, institutional support and organizational design and development (p. 28). These cover many of the issues that appear in the articles above but take a very practical, technical view of needs. In the first phase she deals with the reliability of the access by students to course materials. In the second phase she focuses on the provision of services and the adapting of traditional support structures for addressing student, teacher and staff needs. The third phase deals with adapting the administrative aspects such as departmental structures, funding formulas and job design to accommodate technological integration. As she discusses the variables affecting program success she covers specifics. One relevant section is on course re-configuration

which touches on many variables, e.g., existing course design standards, graphic redesign, instructional variety, time estimates and site coordination (p. 30). While she deals with these from a video perspective, these five have direct relevance for the move to CMTs. The value of these articles on the boundary issues of moving from one technology to another is that they point to the myriad and often unexpected challenges that faculty members face in moving into new technologies. They can act as guides for the adventuresome.

## **Technological change**

### **Views of technology**

The pervasiveness of technology in our society, in education specifically, and on faculty, requires an understanding of technology and underlying assumptions and implications. Knee (1985) notes that we define ourselves with our technology and as a result, we need to understand that which we are using as a touchstone (p. 118). Of the many overlapping approaches to technology, four generalizations serve as a guide in understanding faculty approaches. These generalizations are substantive, instrumental, critical theory and pattern.

The substantive approach is one in which technology is a force in its own right and one that shapes our society and values. It is often called the sociological approach or 'technological value determinism.' Borgmann (1984) notes that those writers who talk of the 'imperatives of technology' and who seek to explain our world by reducing its perplexing features or changes down to one force, i.e., technology, reflect this substantive position (p. 9). An example of this approach is Jacques Ellul whose idea of modern technique is that it is an autonomous and irresistible power that enslaves everything and causes our current societal dilemma (Ellul, 1964). Feenberg notes also that this view is one which "attributes an autonomous cultural force to technology that overrides all traditional or competing values" (Feenberg, 1991, p. 5). Such pessimism and determinism casts technology in a bleak light. Borgmann comments that such an obscure and pernicious power is too easily dismissed as the demonizing of technology and that this dismissal often results in any good ideas being thrown out as well (p. 10). Those who hold this view see little opportunity for change.

They relegate society either to dystopia as the technology juggernaut forces its course or to a return to a more primitive pre-technological era. Their unassailable view is that technology is more consequential to humanity and nature than are its ostensible goals (Feenberg, 1991, p. 5).

A second approach to technology is the instrumentalist view which sees human beings as tool makers and tool users. In this anthropological approach, human capacities are extended through the use of machines and tools with a continuous thread leading from our complex machines back to simpler tools and instruments. In this view, technology is seen as a value-neutral tool or instrument which has a clear role in public policy as a means to achieving desirable ends. Holders of this view treat technology as subservient to values established in social spheres of culture and politics but by taking a purely functional view of activities they often minimize or eliminate these selfsame social or biological values (Feenberg, 1991, p. 8).

Borgmann also notes that some critics of this view comment that it is naive to disregard the ends technology serves because to do so obscures social reality. This radical view or 'politicized technology' view gives rise to analysis and evaluation of technology over the whole political spectrum from left to right. Borgmann agrees and comments that it is a shortcoming of the instrumental view to isolate a specific piece of technology and put it forward as a value-neutral tool. Borgmann writes that "a means in a traditional culture is never mere but always and inextricably woven into a context of ends" (p. 11) and that to interpret technology through a veil of politics or isolate it from context is too limiting an approach.

A third approach, a critical theory of technology proposed by Feenberg, takes elements of the former two and melds them together. This approach is the politicized technology noted by Borgmann. As in the substantive view this approach accepts that the technical order is more than a sum of its parts and that this order has an autonomous nature. Contrary to the substantive approach of Ellul, however, there is no inherent fatalism and there is no single technological phenomenon which can be characterized and rejected as a whole. Contrary to the instrumental view of technology as value-neutral, this view holds that there is

no 'free' use of technology. Technology is an ambivalent process of development which is a struggle between social and technical values (Feenberg, 1991, p. 14). However, the focus in this view is not to bound or remove technology but to transform it so that technical progress is in relation to other dimensions of human existence. Feenberg suggests that an alternative can be created on the basis of workers' control, re-qualification of the labour force and public participation in technical decisions (Feenberg, 1991, p. 12). In this way, a critical approach views the future with its opportunities being possible through a strong means-ends dialectic and political activity.

The fourth view is that proposed by Borgmann, e.g., the pattern or paradigm view. This view considers the basic pattern or paradigm that has been serving as a blueprint or template for the transformation of the physical and social universe (p. 12). Borgmann suggests that the technology can be understood by analysing its machinery and commodity components. The machinery is the actual process or physical mechanism of the device while the commodity is its underlying reason or function. In this latter case, commodity answers the question, 'What is it for?' This approach focuses on the means-ends distinction and highlights the common concealment of or unfamiliarity with the means at the same time as the larger prominence and/or availability of the ends (p. 45). Examples range from the changes in radios and computers to that in municipal governments. By understanding the pattern or paradigm of the machinery and commodity, focal concerns can be highlighted, implications exposed and decisions made openly.

These four approaches toward technology are not mutually exclusive. The overlaps indicate the complexity of defining and understanding technology. The first three have readily recognized characteristics while the fourth illustrates one of the many hybrid attempts at defining and describing technology. The first is the most deterministic and negative while the second holds a positive view of technology and is the most common especially within staff and faculty members. The third approach illustrates the growing movement towards asserting the importance of social and political values. Its proponents not only reject the pessimistic and bleak future of the first approach and the naive, overly simplistic views of the second but provide optimism and goals beyond those of the fourth. Categorization in this

way can air the assumptions of faculty members holding these particular views and draw attention to their use of and reaction to technology generally and CMITs specifically.

### **Stages of technology**

The notion that implementation of technology can be divided into stages is a common idea. Green and Gilbert (1995) suggest four stages in the implementation of information technology. While they draw the basic information from business, they apply the stages to the implementation of information technology in educational institutions but mention the types of faculty involved. Their beginning stage, Stage 0, includes some planning, investigation and experimentation in the institution with individual faculty members recognizing that they can do some of their work better and faster. This stage is similar to Naisbitt's (1982) first stage of technological development (p. 27). In his stage 1, Naisbitt suggests that the new technology or innovation follows the line of least resistance and is applied in ways that do not threaten people. The technology fits the work with little if any change in what is accomplished.

The next stage brings more investment and a greater concern with planning and with broadening use. In the Green and Gilbert conception, Stage 1, there is a marked increase in planned capital investment for individual staff. Faculty find more support and so increase their activities in using information technology and in incorporating technology into more of their courses and academic duties. In Stage 2 of the Naisbitt formulation, there is a greater improvement of what we do through the use of technology. Naisbitt notes that the use of the microprocessor in more and more tools to ease our work and improve our life is an indication of this move to his Stage 2. This stage is the growth of 'automating and 'informating' work processes. Zuboff (1988) uses the verb 'to informate' to describe this process of informing us about our work (p. 10). Zuboff suggests that the increasing use of information technology generates information about and a new transparency of the underlying productive and administrative processes, and about the activities, events, and objects of our work.

Green and Gilbert suggest that the next stage, Stage 2, is one of stabilization or rejection. The institution goes through readjustments where costs and investments in technology stabilize and capacity continues to grow and new functions are developed and

implemented. In the case of a business organization, they suggest that the business can also reject the automation and/or leave the business altogether. From Naisbitt's analysis this is the beginning of his Stage 3. The users of technology recognize the potential; new ways of accomplishing tasks are attempted and deeper understanding or complex processes are possible. The informing activities expand to enable greater realization of process links or controls and new avenues for change and development.

The last stage of Green and Gilbert, Stage 3, occurs after several years when the organization achieves new levels of efficiency and effectiveness. The implication here is that technology has had such an effect on the organization and the users of technology that the organization and its staff are no longer pursuing the old objectives and certainly not using any of the old ways. This is the full blown Stage 3 of Naisbitt where new directions are taken or new uses of the technology implemented (p. 28). Zuboff suggests that with the fulfilment of the duality of information technology, i.e., to automate and to informate, new possibilities arise requiring new deliberations and that from the new vantage point we can understand the essence of our new technologic reality and consider the many choices ahead (p. 390).

A significant issue within these comments on technology and in any move from one stage to another or along a continuum of change and development is the decision criteria. The business and engineering literature on new product development and on re-engineering of organizations covers both decision criteria and process. Spivey, Munson, Nelson and Dietrich (1997) compare the new product development process in an organization and the implementation of new technology in a research laboratory to illustrate the similarity of major stages within each organization and to point to key success factors in the processes. While all the business literature may not be directly relevant to education as Green and Gilbert (1995) note some useful hints may be gleaned from the discussion.

One schema of criteria and process is the McKinsey 7-S framework for organizing a company in support of implementing a particular strategy. The seven criteria are strategy, structure, systems, style, staff, shared values, and skills (Waterman, 1982). Defining and interrelating these criteria into a coherent plan of action requires as a first step, a clear

strategy and a willingness to face revising the other components in support of that strategy (Waterman, 1982). An importance of this schema is that it not only deals with technology and strategy but also overlaps with several of the components of the Stark model, e.g., strategy with course goals, staff with students, structure and systems, campus experts and services. In addition, the criteria are also applicable to analysis of the activities of individuals, in this case of faculty members. The McKinsey framework is also useful in integrating other works on innovation, product development, re-engineering, and staff change. Many of the do's and don't's that Dortenzo (1997) covers are aspects of the seven S's. The need to consider the development cycles of information technology in a heuristic manner, as noted by Fried and Johnson (1992), is also part of the McKinsey process of definition and adjustment. These are all aspects which can inform the situational issues faculty members face when incorporating CMITs into their courses.

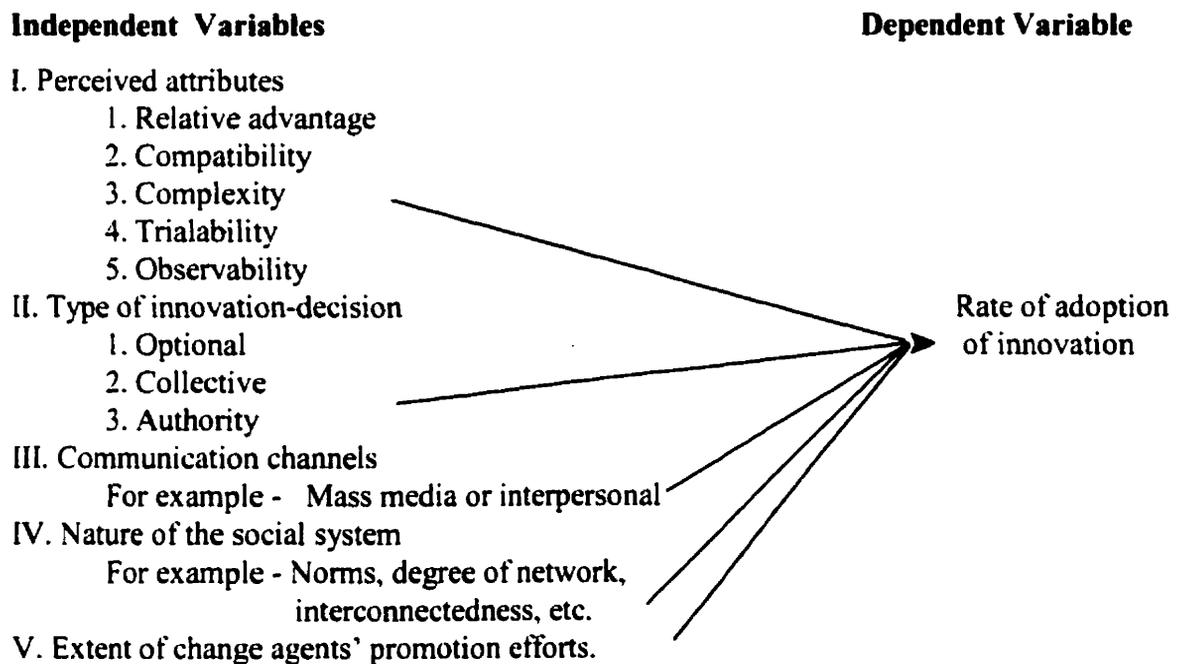
#### **Diffusion/Adoption or ?**

Viewing the incorporation process within a framework of diffusion of technology innovation and adoption of CMITs by faculty members focuses attention more clearly on individuals, on their particular traits, and on their context. Three groupings of authors illustrate the breadth of work. First, Rogers (1995) and Moore (1991) are two authors who focus on the broad aspects of diffusion and adoption of technology. Second, several authors such as Geohagen (1994), Proulx and Campbell (1997), Anderson et al. (1998), and Conrath et al. (1999) provide detailed insights, through their surveys of university faculty members, into the adoption of technology in general and CMITs in particular. Third, there are a number of authors who exemplify the concern with a headlong dash into the use of technology and the seeming corollary of a move to distance education. Authors such as Noble (1998), Feenberg (1998), and Shneiderman (1998) call for caution, sometimes restraint, and clarity of judgement in the face of a push to incorporating technology or using it to replace traditional forms of higher education.

There are two main sources used by the diffusion studies. The first source is the works by E.M. Rogers, the most recent summary being his 1995 edition. While he provides many examples from different fields of study, his discussion of the elements in and phases of

the diffusion of innovation process are useful for highlighting aspects of the incorporation of CMITs. Combining these into variables determining the rate of adoption of innovation provides a guide to assessing faculty members' adoption of technology. See Figure 3.6, Variables determining the rate of adoption, for an overview.

**Figure 3.6 - Variables determining the rate of adoption** (after Rogers, 1995, p. 207).



Rogers' (1995) schema outlines the elements or variables in the rate of diffusion of innovations as characteristics, innovation decision, communication channels, social system, and change agent (p. 207). For instance, there are five characteristics or perceived attributes (p. 15-16). A relative advantage to adopting a CMIT may crop up when a faculty member perceives the CMIT as reducing workload, facilitating current work activities, or conveying status. The compatibility of the CMIT is the degree to which it is consistent with the adopter's values, past experiences, and needs. The complexity refers to the perceived difficulty of learning and using the innovation. Another characteristic is trialability which is the degree to which an innovation may be experimented with on a limited basis. Lastly, the observability of the perceived benefit is an important characteristic to the adoption and spread of innovations. E-mail is not difficult to use, its benefits are easily recognized, and it

seems to be most compatible in complementing scholarly communication. In Rogers' terms, these may suggest why faculty members adopt e-mail so rapidly.

Rogers (1995) divides innovation-decisions into three types (p. 372). First, optional innovation-decisions are those made by individuals independent of other members of the institution. Second, collective innovation-decisions are those made by consensus among the members of the institution. Third, authority innovation-decisions are those made by relatively few members who possess power, status, or technical expertise. In some situations, one decision may be contingent on another being made first. In the case of e-mail, the faculty members could not make an optional innovation-decision until a collective or authority innovation-decision had been made to install the e-mail system. In many cases, where there are independent or standalone technologies such as presentation software, an optional innovation-decision might be made because the preparatory decisions and the timing of these decisions are essentially within the individual's control.

Another component in determining the adoption rate of an innovation is the communication channels. Rogers divides these into two types, mass media and interpersonal, and may be either local or cosmopolite (p. 194). He also suggests that these can have different impacts on different adopters, i.e., mass media channels are relatively more important than interpersonal channels for early adopters than for later adopters (Rogers, 1995, p. 197). An important corollary of this is that the early adopters who see mass media and cosmopolite channels as most important often become the interpersonal and local channels of information and persuasion for the later adopters.

A fourth variable that Rogers considers is the social system within which the adopters are situated. In the case of university faculty members, there are several aspects of this system to keep in mind, i.e., formal and informal organizational structures. As Rogers notes, it is important to have some knowledge of the social situation because the structures such as the informal communication structures or flows can affect the diffusion of innovations, however, untangling the impact of these structures from the characteristics of the individuals is difficult (p. 25). Part and parcel of these structures is the system norms or pattern of behaviour of the members.

Change agent, the fifth variable, alludes to a person who acts to have innovations adopted. Rogers defines this type of person as the link between an agency and a client system (p. 336). Such a person may or may not be situated inside the organization. It might be the computing centre employee who hawks some new technology or it might be a computer salesperson who wants to sell some new equipment. Often associated with the change agent is an opinion leader who is a person within the organization and who is usually at the centre of an interpersonal communication network. An example might be the faculty member who is a technophile and who acts as the departmental resource for resolving problems in new innovations.

Rogers draws these together in describing his innovation-decision process. His diagram includes five phases which an individual adopter might experience. See Figure 3.7 Innovation-decision process, for an overview of the phases as Rogers outlines them. These phases begin with the knowledge phase in which a person becomes aware of an innovation and gains some insight into how it might function. Next is the persuasion phase in which an individual forms a favourable or unfavourable attitude toward the innovation. The decision phase occurs when the individual makes a choice to adopt or reject the innovation. The implementation phase occurs when an individual puts the innovation into use. Lastly, the confirmation phase occurs when the individual seeks reinforcement of an earlier innovation-decision or reverses an earlier decision to adopt or reject an innovation. The use of these five phases in the innovation-decision process accompanied with the associated variables determining the rate of adoption and the role of a change agent and/or opinion leader highlight issues experienced by faculty members during the incorporation of CMITs into their courses and provide useful analytical guides.

The second useful source is one with a business marketing approach which modifies Rogers' work slightly and which describes the traits of the users of information technology. This work by Moore (1991) focuses on developing marketing strategies for technology companies but in order to do this, segments the market into five categories of technology users, i.e., innovators, early adopters, early majority, late majority and laggards. Moore draws this idea of market segments and the use of a normal distribution of the population

from Rogers (1995, p. 262). Moore adapts this segmentation of the normal curve by placing a chasm between each of the segments and by reinforcing the idea that people in the segments on either side of the chasm have different traits and different reactions to technology. (See

**Figure 3.7 Innovation-decision process** (After Rogers, 1995, p. 163)

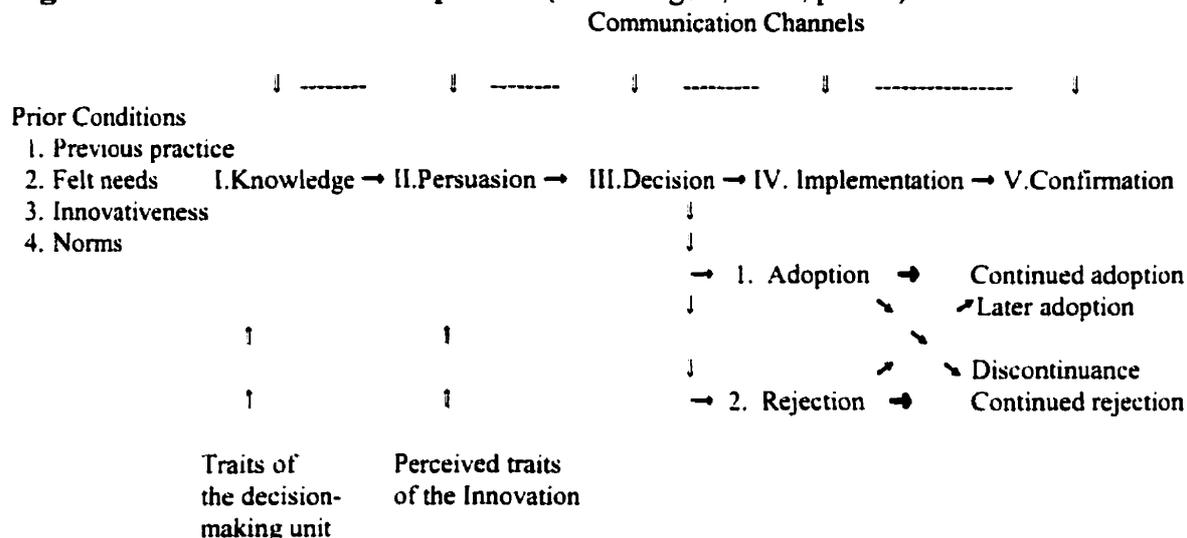
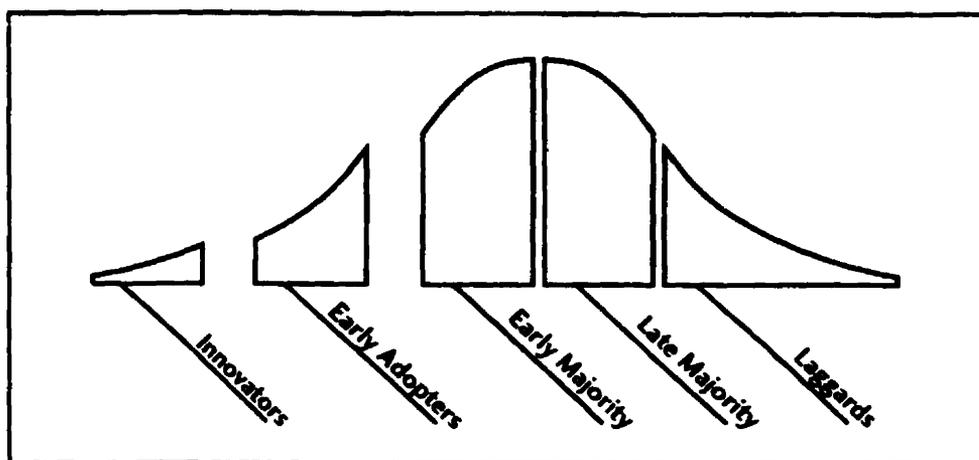


Figure 3.8 - Revised technology adoption life cycle.) His view is that it is necessary to understand the traits of these people if there is to be continued diffusion of technologies throughout the whole population. It is this key concept of a chasm between segments that the following articles surveying university faculty members use in delving into the diffusion of information technologies.

Four recent articles focus on faculty use of information technology or CMITs as defined here. The first paper is by Geohagen (1994) in which he suggests that instructional technology (CMITs) has not been widely adopted by faculty members nor integrated into the curriculum. In fact, while the data are scattered, Geohagen points out that "information technology may be integrated into no more than five percent of the courses being taught today" (Geohagen, 1994, p. 2). He goes on to suggest that even with the large investment in instructional technology there is only a small minority of faculty members who use it in their courses for anything more than "logistical support" or "preparation of lecture notes, handouts, overhead transparencies, and other types of printed and display material that substitute for the products of yesterday's blackboard and typewriter technologies" (Geohagen,

1994, p. 3). Geohagen incorporates the works by Rogers and Moore into his discussion. However, the real value of Geohagen's work is his answering, 'Why has instructional technology not "Bridged the gap?'" by examining the various factors which, he feels, explain

**Figure 3.8 - Revised technology adoption life cycle** (after Moore, 1991, p. 17).



this low integration. The factors proffered by Geohagen are the ignorance of everyone concerned to the existence of a gap, the technologic alliance among the computer savvy people within the university, the alienation of the mainstream faculty members, and the seeming lack of a compelling reason to adopt information technologies for teaching and learning.

The second article is by Proulx and Campbell (1997). They survey 71 faculty at Mount Allison University. Proulx and Campbell categorize the respondents into their level of computer use, prepare eight descriptive charts on diffusion of computing technologies, and conclude with comments on the character of this diffusion. They quantify the responses under nine categories such as computer use levels (high, medium and low use), feelings toward computers, purpose of computer use by type of user (word processing at 96.9%, e-mail at 87.7%, course materials at 84.6%, assist research at 76.9%), areas of use of computers, and reasons for beginning to use computers (professional demands at 80.0%, thought it would be interesting at 41.1%, was available 27.7%, instructional purposes at 21.5%). Proulx and Campbell echo some of the comments of Geohagen, e.g., non-teaching

use is higher than teaching use, teaching use tends to be for logistical support, technical and training infrastructure support is essential. They go on to suggest approaches which might encourage the application of computer mediated teaching, e.g., develop teaching technologies which are easy to use (complexity), and focus on those which are compatible with current practices (compatibility). While covering similar ground to Geohagen, they also point out that the implementation of technologies is not an isolatable phenomenon but one which requires a broad analysis of the social world of faculty practice (p. 12). Continuing in this line of thought, they suggest that widespread adoption of computers in education may lead to a de-emphasizing and a transformation of the classroom but that this could re-sensitize faculty members to the relationships between classroom and immediate social environment (p. 13).

The third article surveys some 557 faculty members at the University of Alberta (Anderson, Varnhagen, and Campbell, 1997). Anderson et al. combine the segmentation and normal distribution of Rogers' work, the chasm between the early adopters and the mainstream faculty members of Moore's work, and the factors contributing to the chasm as noted by Geohagen. They look at the use and distribution of eight information technologies. They also test, through faculty member self-assessment, the perception of the usefulness of these information technologies. They report more knowledge of and use of information technology outside of teaching than in teaching. They note that about 43% of the faculty believe that instructional technologies have improved contacts with students, 41% note an impact on the quality of their teaching, and 39% note improvement in their productivity as teachers (p. 81). This is above the 5% level reported by Geohagen of faculty using information technology. Among the factors, the technologic alliance amongst the computer people, early adopters and vendors is a significant issue. In fact, this issue of alliance leads to alienation because the mainstream faculty members feel excluded from the dialogue on technology issues, they fear the impact of technology on the human component of teaching, and they strongly feel the conflicting demands of this new technology on their time and resources. These issues compound the barriers brought on by the lack of institutional supports for training and classroom improvement. In addition, these aspects of alienation are

increased by a seeming lack of any clear proof of the effectiveness of the new technologies in the education process. In other words, these faculty members believe the use of information technology in research, communication and collaboration is effective but less so in teaching (p. 91). Anderson et al. confirm the four factors identified by Geohagen. Following a statement about the likely positive benefits of information technology to teaching and learning, they comment on the challenges facing this enhancement to teaching and learning and outline several practices which might support faculty members in their use of information technology (p. 95). These practices focus on making faculty members aware of the research base and compelling reasons to adopt such techniques, on providing support and training facilities as needed, on involving faculty members in the strategic planning of these supports, and on reevaluating the reward, tenure and promotion processes to recognize the worthiness of work in the area of incorporating information technology (Anderson et al., 1997, p. 96).

These findings are not dissimilar to some of those reported in a fourth paper by Conrath, Cuneo, Evers, Kalmin, Malinski, and Warrick (1999). This group interviewed 39 faculty members in five post-secondary institutions in Ontario with the purpose of eliciting current policies and practices with regard to technology based learning. After a qualitative analysis this group suggested that while there is a general lack of policies in support of technology based learning, there are several important factors of note. Having a champion is crucial to adoption, spreading awareness, and continuance of the technology. The concern with incentives such as rewards and recognition in the tenure and promotion process is an essential aspect if there is to be take up of new technologies in the teaching/learning process. Aspects of organizational climate and culture must be supportive. Reducing harmful technologic alliances and bringing faculty members into the planning process is important if there is to be effective use of technologies. This also echoes the need expressed by Proulx and Campbell that to understand the adoption of new technologies into teaching and learning, one must look at the larger social environment.

The third grouping of articles are those which bring out the malaise with what seems to be a headlong dash into the use of technology and the replacement of the traditional classroom higher education environment with a remote, technology mediated distance

education environment. The authors of these articles range from the fervently skeptical through the positive yet cautious to the wholeheartedly devoted. All of these authors hold strong and reasoned assessments of their positions. For instance, Noble illustrates significant concern about the loss of control by faculty over the classroom and their work and in general, is skeptical of the real advantages of information technology and questions the commercialization of the education function (Noble, 1998). He notes that this latter facet is increasing with the growing partnership of businesses and universities and the tendency to the 'commoditization' of education. This cynicism of information technology is present throughout his work, e.g., 'Visions of democratization and popular empowerment via the net are dangerous delusions; whatever the gains, they are overwhelmingly overshadowed and more than nullified by the losses' (Noble, 1995, p. 52). His use of confrontational language waves a red flag which often gets emotional reactions rather than recognition of his salient points. However, Noble's comment, "There is mounting resistance to what are typically unilateral [university] administration initiatives to wire the campuses without regard for the pedagogical value or the economic cost." as quoted by Clayton (1998, May 30) is not without some substance.

Feenberg (1998) on the other hand sets out his concerns but in a fashion which brings balance to the discussion. He recognizes the need for a sound understanding of information technology before it can be incorporated. His long experience with e-mail in distance education provides him with a reasoned approach to using technology that best fits the pedagogic purpose at hand. He suggests that video conferencing is not mature and too difficult to use but that "interactive text based systems actually accomplish legitimate pedagogical objectives faculty can recognize and respect" (p. 7). Kozna and Johnson (1991) echo much of this from their earlier statement, "Successful use of the computer depends on how its use corresponds to the goals of the teacher and the needs of the students" (Kozna and Johnston, 1991, p. 13). While Noble might say, "Cease and desist!" Feenberg might say, "Recognize the strengths and proceed!"

The turmoil that can occur is illustrated by the reaction of Educom (now Educase) to Noble's article. Shneiderman (1998) gives a summary of Noble's article and the first of four

critiques. He suggests that, "... fear-filled rhetoric and whipping of the boogie-monster of entrepreneurial corruption of education is misleading, shallow and even counterproductive" (Shneiderman, 1998, p. 26). While heeding Noble's warning of business incursions, he goes on to cry, "... let's get on with the important issue of figuring out how to improve education by taking advantage of network technologies while preserving the guiding role of teachers, the mentoring role of advisors, and the lively interactions among students" (Shneiderman, 1998, p. 27). In an earlier report, Massy & Zemsky (1995) call more clearly for the take up of information technology when they state, "The benefits of shifting away from handicraft methods, coupled with scale economies and increased flexibility, argue for the adoption of IT even when one cannot demonstrate immediate cost advantages" (Massy & Zemsky, 1995, p. 6). There needs to be balance and reason in an approach to the use of information technology. Feenberg stands out as one of these positive but cautious authors; an opinion leader.

### **Insights from the literature**

Approaching the incorporation process from the vantage points of the different paradigms, frameworks, and models outlined in this chapter suggests issues with broad applicability to the incorporation of CMITs and aspects of specific concern to particular technologies. The number of items and the linkages between them are extensive. Integrating aspects of the Stark model, the critical components within the continuum of theories of teaching and learning, the views on technology, the stages of technology development, the models of diffusion of innovation, and a balanced view of what information technology can and can't do sheds light on the incorporation process and the issues or specific techniques on which faculty put priority.

As the faculty members use more and more CMITs, what influences the success of the outcomes are not necessarily new factors but many old ones that take on new importance. For example, as faculty members grapple with the implications of learner-centred constructivist approaches, practical questions of relevant activities and sound evaluation strategies come to the fore. In addition, understanding theories of learning can, as outlined in the work of Laurillard, illustrate that understanding how students learn can assist faculty

members' use of specific CMITs to their fullest effect. From the literature of instructional design, the instructional mode is one of the many factors but not usually of top priority. As faculty members move toward more and more information technology for delivery, the technical infrastructure with its own idiosyncrasies takes on a life of its own and one that has a significant impact on the learning environment.

While there is always need for clarity in course administration and expectations of students, the move to remote CMITs requires a great deal of preparatory work in understanding the instructional strategies and the technical infrastructure, e.g., participation frequency, system sign on, and computer support. The separation of faculty members and students electronically may not be a problem in mass education and skill learning but some feel that elite education, business professionalism and scholarly socialization may not be served best by this intermediated process (Trow, 1997 Fall, p. 297). The one-on-one communication does increase between student and faculty member but the multi-level group dynamic may be more difficult to foster and maintain. As a result of this, there is pressure on all participants in the educational cycle to understand their roles and responsibilities. For CMITs to succeed, it is important for the faculty to reflect more on the education or training process, to understand the skills, competencies and expectations of their students, to conduct formative assessments, and to provide continuous feedback. The students must play a more active role in questioning and verifying processes and content at a level not often evident in class. Being isolated by space and sometimes also in time removes secondary information sources of the spontaneous or ad hoc 'water-cooler' variety. Much information is gathered informally in the sub-text of the class; question and answer sessions, non-verbal communication triggers, specific comments or brainstorming activities. With separation, a concerted effort is necessary to promote, to prompt, and to participate in activities that in the class are often spontaneous.

The instructional delivery system or more specifically, computer mediation, plays a crucial role not only in making the information accessible but in providing direct communication between faculty and students and among students themselves. The faculty need to understand the impact of the CMITs and use them to advantage. On another level,

the reliability of the network is essential. The support structure, both skilled technicians and robust equipment, grows in importance as more and more students and faculty rely on the production system for sophisticated multimedia software and informational content. The skill levels of the students using the network gains in significance especially as the sophistication of the technology increases. A network that is difficult to use and unreliable creates one more barrier to a successful learning experience. These technical hurdles should not be a barrier for the students to climb but for the institution to smooth out.

As more and more faculty use CMTs in a logistical fashion they find themselves on the track of distributed learning. As course administration information and handouts become accessible via the Internet, there is a growing expectation among faculty that students use this to answer their questions on course administration. Because of this expectation, there is also a growing facility by students and faculty with the media. E-mail becomes a complement to face-to-face communication but in doing so raises expectations that faculty members will respond. As Feenberg notes, the limitations of text-based conferencing led him and his students "to explore a Socratic pedagogy based on virtual classroom discussion that proved quite successful" (Feenberg, 1998). What technology is used, how it is used and what role faculty members and students play are all questions that need to be addressed as some of the education process migrates from the classroom environment to the electronic environment, from traditional face-to-face to remote delivery of informational components, and from local to remote situation of students and faculty. Noble, Feenberg, and Shneiderman would all agree that faculty members need to understand the limits of technology and the pedagogic benefits before rushing off to incorporate CMTs.

The use of these various perspectives of approaches to learning, course design and technology lays the incorporation process bare. Viewing the experiences of the faculty members from these vantage points uncovers the challenges they face and the patterns they form. The use of the objectivist-constructivist dichotomy reveals the breadth of change required in some faculty members and the challenges that they face. Overlaying new ideas on old or unlearning and learning anew can create real stress amongst faculty members who are already sorely challenged by day-to-day activities. The Stark model with its technical

issues, general and boundary specific, touches on a number of these day-to-day elements all the while linking to the more philosophic underpinnings. For instance, faced with the added hurdles of the technology, the faculty may face changing some of their initial educational assumptions; either they recognize that what they had assumed is no longer possible or that new opportunities have opened up. The linkages between contextual filters come into play. A concerted move to online delivery might have an unexpected impact on what the faculty members consider are the learning goals of their courses or the relevance of these goals to their students. A move to CMITs and concomitant expectation of student ownership of computers might have a significant effect on student characteristics. A reduction in diversity may result with a smaller range of students being attracted as computer costs are unloaded onto students. As recently seen at Acadia University, the faculty resistance may change the process of incorporating technology (Lewington, 1997 January 16, p. A7). More and more information is available online, but much is still controlled by publishers who are becoming usurious in their fees; costly textbooks may go the way of the dinosaur only to be replaced by prohibitively costly and restricted online information. The change in instructional mode as the Stark model suggests has a direct link to course goals and objectives as well as to materials used. Even though instructional mode (delivery technology) is one means to an end, the implications of choosing one mode or CMIT over another needs to be recognized and addressed.

Each of the perspectives reveals nuances of the incorporation process but together. approaches to teaching and learning, instructional design, technology, and diffusion coalesce into a series of intertwined scenarios. Faculty members incorporate CMITs. They gain a new understanding of their work and organization or they are 'informed' as Zuboff (1988) would suggest. If one assumes a connectedness, such incorporation and use brings about not a simple change but a deeper examination and reevaluation of their courses, their students, their particular views on teaching and learning, and their roles. Moving to an examination of the actual experiences of faculty members incorporating CMITs is one method of examining these assertions.

## **CHAPTER FOUR**

### **INTERVIEW FINDINGS**

This chapter, detailing the findings drawn from the three sets of interviews, is divided into six major sections. First, there is a brief overview of the interview sequence to set the context. Second, there is an analysis of the participants' comments outlining their characteristics and talking about their experiences as faculty members incorporating computer mediated instruction techniques (CMITs) into their teaching. Specifically, this covers their positive yet skeptical views, their excitement yet pragmatic approach to the use of CMITs, and their leadership position in the innovation of technology. Third, there is coverage of the courses and the technical supports that are available. Fourth, there is an examination of the insights into the incorporation process looking at reasons, concerns and the roles CMITs play. This large section covers the many positive and negative aspects of incorporating CMITs and illustrates the type of use faculty members make of CMITs in their courses. Fifth, there is an examination of the many processes encompassed within the incorporation process. Here are aspects of organizational setting and of the interactivity achieved in the educational process. The final and sixth part deals with the policy issues indicated by the comments and initial analysis. In this manner, Chapter Four provides an analysis of participants, courses, and insights into incorporating CMITs; exposes processes and patterns; and outlines policy areas. A synthesis, located in Chapter Five, follows from the earlier examination of the literature and a further analysis and reflection on these findings.

#### **Interview Sequence**

The three sets of interviews were conducted over six months in 1998. The first set of two interviews, the pilot set done late in Spring, provided a test of the questions but did not result in substantive change to the semi-structured interview arrangement. What the test did do was to provide this interviewer some practice. The second set, the main set of seven interviews done in the Summer, purposely covered a diverse group of university teachers. Not unexpectedly, even though there was this diversity in age, background, teaching experience and subject matter, there was a similarity in their overall positive view of the use

of technology in teaching and their pragmatism towards CMITs. The face-to-face component of teaching and the development of supportive interrelationships with students were two essential elements running through the comments of these teachers. The third set, the last set of three interviews done in the Fall, provided more of the same views but broadened the experiences and perspectives of the whole group.

### **Participants**

While all the participants are similar in that they are incorporating CMITs into their courses, they are diverse in the spread of their ages, subject matter taught and the length of time they have been using computers. They are selected from three universities in south central Ontario. Figures 4.1, 4.2, and 4.3 chart the characteristics of the participants and the data of the courses from the three sets of interviews. The participants are equally divided between male and female, range in age from their early thirties to their late fifties, and all but two are tenured faculty. One difference that might be pointed out is that participants 3, 4, and 5, all of whom have engineering backgrounds, are the only ones who have more years using computers than they have teaching. Nevertheless, their use of CMITs is very recent. There are no clear groupings of variables by age groups or years of computer use. What is clear is the preponderance of recent activity with only two participants having more than six years use of CMITs. This points to the recent development of and great interest in world wide web browsers since mid 1992.

Across the participants there are several key characteristics that stand out. The group as a whole has a positive disposition towards the use of the technology in teaching. This is not unexpected with a group of people who spend a great deal of their own time playing and hacking with the technology or who are innovators within their respective departments. The general enthusiasm and excitement coupled with a high sense of self confidence and playfulness in each of the participants are striking similarities. Such vibrant energy is illustrated in their own learning of the new technologies in the face of many challenges and frustrations. One participant, while commenting on the undue concern over copyright and intellectual property ownership, sums up the general approach when he says, "The university probably has regulations. I just get on and do it ... Life is too short"<7,239>.

**Figure 4.1 - A Compilation of participant data from the first set of interviews.**

<b>Participant →</b>	<b>1</b>	<b>2</b>
<b>Gender</b>	F	M
<b>Age</b>	late 50s	late 50s
<b>Rank</b>	Professor	Professor
<b>Tenured</b>	Yes	Yes
<b>Degree</b>	EdD	MA,Econ
<b>Yrs Teaching</b>	18	22
<b>Yrs Using Computers</b>	8	16
<b>Yrs Using CMITs</b>	4	2
<b>Course</b>		
<b>Subject</b>	Nursing Research	Economics
<b>Level</b>	Upper	Lower
<b>Type</b>	Day time+ Evening	Day
<b>Students</b>	25	37

**Figure 4.2 - A Compilation of participant data from the second set of interviews.**

<b>Participant →</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>Gender</b>	F	M	F	F	M	M	M
<b>Age</b>	early30s	late40s	mid30s	mid30s	mid40s	early50s	late50s
<b>Rank</b>	AssitProf	Contract	Prof	AssocProf	AssocProf	AssocProf	Prof
<b>Tenured</b>	No	No Yes	Yes	Yes	Yes	Yes	
<b>Degree</b>	PhD,Eng	PhD,Eng	PhD,Eng	PhD,Zoo	PhD,Mus	PhD,Soc	PhD,Ed
<b>Yrs Teaching</b>	3	13	3	10	13	25	30
<b>Yrs Using Computers</b>	9	18	10	6	8	22	12
<b>Yrs Using CMITs</b>	3	3	2	6	8	20	2
<b>Course</b>							
<b>Subject</b>	InfoMangt. Network	Space Craft Design	Elec.Engin Process Control	Biology/ Ecology	Music Theory	Sociology Research	Family Sexual Behav.
<b>Level</b>	Lower	Upper	Upper	Lower	Graduate	Upper	Upper
<b>Type</b>	Day	Distance	Day + On demand	Day	Day	Day	Dist.
<b>Students</b>	80	40	20	270	8	120	100

**Figure 4.3 - A Compilation of participant data of the third set of interviews.**

<b>Participant →</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>Gender</b>	F	F	M
<b>Age</b>	mid40s	early50s	mid50s
<b>Rank</b>	AssocProf	Prof	Prof
<b>Tenured</b>	Yes	Yes	Yes
<b>Degree</b>	PhD,Eng	MA,Ed	MA,Soc
<b>Yrs Teaching</b>	20	26	30
<b>Yrs Using Computers</b>	15	18	13
<b>Yrs Using CMTs</b>	3	18	5
<b>Course</b>			
<b>Subject</b>	English	LAN technology	Film/media
<b>Level</b>	Upper	Lower	Upper
<b>Type</b>	Day	Day	Day
<b>Students</b>	8	37	26

### **Positive disposition towards use of CMTs**

The positive disposition towards learning and using CMTs is illustrated by several of the participants. While music and technology have always been linked, the music teacher recognizes that

With the advent of computer technology and its availability my view has always been that it has been a very useful thing, for Humanities students especially, to become conversant with the medium so that they can use it and apply it wherever they end up after they finish university. I consider it a part of a well rounded education to be exposed and have some ability in using it. While the use of computers might not be necessary in any given course, I see it overall as strengthening the skills of the students' need.<7,101>

One of the engineers also finds a positive change in his teaching. This is illustrated by the following comment.

Now with the new technology, I find that it's totally changed now. I don't get bored. I don't get bored with thinking about updating the material. I know that there's still material that needs to be updated, and it's always a challenge to try and update it. But what I find instead is that the time I have in the classroom, the way I've structured the course is such, that the time I spend with my students is more discussion; team discussion, one on one discussions in the classroom, discussions over the Internet.<4,207>

Another participant shows his sense of relief and the positive nature of the change when new technology in the form of new software enables his students to use technology with considerably less stress and enables him to focus on the important issue in class.

I've taught statistics where everybody uses FORTRAN to run it. Then we got into SPSS and that eased things and I think that has been a quantum jump as we've gone into being able to do this in a way that's so friendly, in an environment like Windows. And what it's meant each time is it's made it more realistic which is a major concern. The other aspect of it is it's made it easier so that I can concentrate on people learning what a Pearson Correlation is rather than doing all the little things to run it. <8,143>

This same participant also illustrates that there is also a healthy skepticism present as well. The context is very important and if something does not live up to expectations it is often dropped. He illustrates this in the following.

I had used CoSy in a couple of classes, I think it depended on the course and the students more than anything. The last time I used it I got very little use of it by students so my initial enthusiasm for it had decreased because they just were not finding it ..I don't know why, I think it had to do with the fact that the last time I tried it was in a large Methods course, I don't know that the people taking the course were interested in anything outside of class, whereas when I did it in a smaller upper level course people would be more likely to be majors in sociology, more likely to ask me questions about things, so it clearly had to do with the type of course, the level of the course and so forth. <8,157>

I didn't do any sort of extensive analysis of it. I had used it. It wasn't used very much, students were not asking for it so I stopped using it and that was about the time e-mail started to get popular so in a sense e-mail just sort of superseded it. <8,157>

### **Expediency learning**

Throughout the group there is a leaning towards exploration and discovery; let's try this and see what improvement it makes. While they have varying degrees of technical knowledge, as suggested by their years of use of computers, all are active hands-on learners. On getting started on the use of technology one participant notes that

Oh, I just sort of stumbled into it. Ever since I was teaching I strove to bring the material to life to the students in ways other than just using overheads. <6,51>

Others comment that

I basically didn't have a lot of help, I learned it on my own. I didn't go to any classes or things. <1,165-166>

In terms of computers? The [computing centre]<sup>1</sup> puts on courses in web design or whatever. I don't know how well they are attended because I'm the sort of person who just hacks away until it happens. <7,93>

I write HTML code straight. I don't use a book. I don't use a coding program . <12.87>

### **Excitement**

There is a high degree of excitement amongst the group for learning, using and teaching with CMITs. The nursing professor comments on her fascination and energy not only in the words below but also in her voice during the interviews. Her comments are;

It was quite fascinating. There is all kinds of things and I love that stuff. I find it fascinating personally. <1,72>

Over the last year my excitement has gone up because I've learned more about the possibilities and the resources that are now more readily available to faculty. <1,604>

One of the engineers infuses her verbal comments with purpose and dynamism that carry into the following words;

The best situation would be to have them do it real, in the lab and pull wires, install operating systems and install network interface cards because that is what you really do. The next best thing is to have a planning program and have them use it. That is a stage that they would go through if they were planning a network before they got to actually pulling the wire. I see the students getting the most out of me doing that kind of thing. Mediating by computers would be amazing. <3,198>

As one teacher moves further and further into web pages and CD-ROMs for her students, she is still thinking about all the other functions that might be incorporated to simplify the students' lives or at least reduce some of the stress that she assesses is there.

I would like to also have testing over the web, all my tests, that would really

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<sup>1</sup> The term in bracket denotes the removal of an identifying name and so was replaced by a generic term, as explained in Chapter Two, to protect the confidentiality of the participants.

tickle me if for instance we could do away with the whole exam pressure chamber and have students take their exams over the web because now they can type in essays even, if they wanted to. <6,123>

Another engineer also conveys the strength of his commitment to using and continuing with technology in his teaching.

I remain very interested in the course. And I remain, I think much more interested in the students on an individual basis. I've had some really thrilling experience. <4, 199>

This is exactly what I'm trying to say. It's because of the technology. This gave me more time. This made me more accessible to the students. And as a result of that, we're building more human relationships between students to students, students to professor; team to professor; students to students at other sites. All these human relationships that we've taken to degrees that I would have never anticipated before. <4, 215>

### **Innovation/leadership**

Many of the participants also noted that they are the only one or one of two in the department using CMITs extensively in their courses. By being the first or one of the first, they are often the hackers or innovators to whom new users turn for help.

It's interesting, in the school of nursing I would say that I'm the one that's the most adventuresome in using computers and I don't consider myself that adventuresome. People are always coming to me and saying, can you tell me how to do this or how do I do that. I think it is because I just try to figure it out for myself. <1,438-441>

The energy and enthusiasm is necessary because as innovators they often have to push for support as one engineer notes or be forceful if you think that it is the right action as the educational administrator notes.

I think you always need support systems in place. And because this is just very different, and because [name] and I are, are leading it, nothing's there so it seems that every step that we go we're jumping hurdles. <5,808-809>

Let me start by saying I'm not a 'techie,' and that might seem a little bit incongruous. Even when e-mail started to come on deck partly because of my administrative responsibilities and my sense that this was a real thing rather than some of the gimmicks that we've had, I've tried to push those sorts of things early on. Although I haven't the time to become a techie I know what to do

when I know what I have to do. <9,79>

This leadership is also illustrated by the proclivity for experimentation. Many of the participants are trying new ways to use CMITs in their teaching.

I don't remember when this was, but sometime probably four or five years ago, it occurred to me one day, 'I might try writing an e-mail to one of my students, just to see what would happen.' The result was deeply shocking. Because the letter that came back revealed something about the student that I had never seen before. That I had never realized was there before. It was like another person was talking. Because they were using a completely other medium. They were using text now. They weren't using the voice. I began to see strengths and I began to see weaknesses, academically, that I had never seen in the classroom and discussions. <12,122>

I was a bit involved in mastery learning techniques, Benjamin Bloom and so on. A doctoral colleague of mine, he put one of his courses exclusively into that sort of format. None of these things really gave the benefit that people were hoping to see and so while I've always been keen to see the new things explored and evaluated and never felt like resisting them just because they were new nor jumped on the bandwagon just because they were new, they needed to be tried and explored. I know now that appropriate forms of the current technology with computers creates a better learning environment than I normally have in my classes. <9,233>

For instance, the impetus to put all general information together in one spot for the convenience of the student if not also for the teacher, is often a determining factor. One illustration comes from the teacher who notes that;

There's so much visual that I present in the class, I have slides, I have videos I have audiotapes. How do I put all of that together so that they can't think they're missing any of that? The only solution was to put them on a CD because that was the one medium that I could use where all of those other media could be put in and packaged and arranged so the students could take away, go home and do it at their own time. So when they come to class it is to ask questions. I'm not going to give them a lecture. They are to come and discuss things, maybe take up some assignment, clarify things that they don't understand, maybe even debate, hopefully debate, but then your meetings become those students who want to be there and who have a purpose to being there. <6,51>

## **Frustrations**

Nevertheless, there are the many common frustrations felt by the group. The time consuming problem of learning the new technology is one major issue. One engineer notes that,

The reason that I am driven that way is that every single time I want to use the technology to do something, it's time consuming. Like, for me to actually set it up and put it together requires a lot of time. And so I'm not so enamoured with the technology at this stage that I want to spend hours and hours and hours creating stuff that to me is not giving any kind of advantage over if I'd just done it in a conventional manner in the first place. <5, 692>

The chance for the teacher to play with the technology is an important element in learning it. If it is not readily available, frustration results as noted by one participant.

If you have a little time available in your office you can't play with it because it isn't there. <1,76>

The concerns for the students and their troubles getting access is also an important consideration as one teacher notes;

So the library computers tend to have long queues not just e-mail and personal things but assignments and of course word processing. I think students who depend on the publicly available machines get fairly frustrated when we get into the busy time around midterms. It gets hard to get a machine and so they want to get their own machines at that point. <8,117>

The connection to the campus is also a common problem. Linked with this is that teachers also have concerns about increasing expectations that students should have access. For instance one participant sees that,

One of the major difficulties is that the [university] infrastructure is not set up for very large use of modem because the bandwidth is not sufficient to accommodate a lot of use by that. So in fact for instance one of the difficulties in mounting any courses when you're using HTML is that they have to be on campus to use it and they can't get access off campus until after 6 o'clock. <6,41>

The hurdles in presenting in the classroom reduce the ease with which teachers can transfer their work from their own computers to the display units in class.

Where we have a bit of a barrier right now is how do we bring the stuff into the classroom? Our classrooms are not equipped such that [name] and I can go in

with a laptop and present a lecture and have embedded examples and things like that. We can't have a true multimedia set-up, i.e., our students can't bring in laptops themselves. They can't, it's not a two-way communication. I mean we don't have the set-up within the classroom to do that. <5,652>

The sense of isolation comes out again and again as the participants talk about their work and that of their colleagues.

There are people in this department that do very innovative things, but there's no support group, no community, no feeling that we are advancing, it's very much that we are advancing on our own. If you succeed then that's great, but if you fail, and let's face it there are more failures than successes, you're on your own. <6,135>

The group shows excitement for teaching and for using CMITs in support of their teaching not just as an end in itself. The participants are confident in nature and willing to put in a great deal of time on perfecting their use of e-mail and web pages and able to overlook imperfections of the technology. Ease of use and significance of impact on their teaching is important to them. They are, however, leery of the next steps into more sophisticated CMITs with steep learning curves and requiring a great deal of concentrated time.

### **Courses and supports**

The course data illustrate a wide variation. The courses range from the Humanities with Music, to Social Sciences with Economics and Sociology, and to Health Sciences and Engineering with Nursing and Electrical Engineering. The breadth of the sample continues with the courses spread over lower, upper and graduate levels and ranging from 8 to 270 students in each.

The compilation of data on the use of CMITs and the support facilities available illustrate several features of the incorporation process. Figure 4.4, A Compilation of CMITs used and support facilities available, charts the findings on those techniques used and/or still being used and the technical support personnel and classroom facilities available to the participants. It appears that e-mail, web pages and HTML are used by almost all of the participants. Below these, there are no CMITs that are used by more than 50 percent of the

**Figure 4.4 - A Compilation of CMITs used and support facilities available.**

Participant →	1	2	3	4	5	6	7	8	9	10	11	12
<b>CMITs</b>												
<b>E-mail for class</b> ◆	●	●	◆	●	◆	◆	◆	●	◆	◆		
<b>Web page</b>	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
<b>Web course software</b>				VLT					VirtualU	WebCT		
<b>HTML</b>	◆	◆	◆	◆			◆		◆	◆	◆	◆
<b>Other Language</b>						SGML/JAVA						
<b>Powerpoint</b>	●			◆				◆	◆	◆	◆	
<b>Multimedia</b>				◆	◆	◆	◆				◆	●
<b>CD-ROM</b>					●		●	●				●
<b>Lotus Notes</b>	●											
<b>SPSS</b>									◆			
<b>Video conference</b>					●		●		◆			
<b>Tele conference</b> ◆												
<b>Support facilities</b>												
<b>University assistance -</b>												
<b>Multimedia</b> ◆	●	◆	●	●							◆	◆
<b>Instructional Design</b>							◆	◆	◆	◆	◆	◆
<b>Departmental technicians</b>	●							◆			◆	
<b>Faculty/divisional assistants</b>							◆					
<b>Multimedia classrooms</b>					◆			◆				◆
<b>Linked classrooms</b>			◆	◆				◆				
<b>Laptop classrooms</b>	●											

participants with the multimedia (audio-video computer materials) and presentation software, Powerpoint, having been used or still being used by six participants. These CMITs take more time to learn and to incorporate into teaching and time is the element of which teachers have little to spare. The added time commitment to learn these is a major hurdle.

The participants who teach day classes use e-mail as a valuable, if not time-consuming, complement to face-to-face discussions. While e-mail is easy to learn to use, it can open up teachers to the added burden of having to respond to an increasing number of messages. However, the use of it by students is mixed. The nursing teacher mentions the lack of use by her students and suggests that it may be due to a lack of computers at home or that they are not used to using e-mail. Nursing requires, as one participant noted, face-to-face relationships. <1,136>

So I've suggested that [e-mail] is a way of communicating, I check my e-mail often and I'd get back to them quickly. But again, I've not had a lot of students using it and I don't know if it is because they are nursing students and they don't tend to use that kind of technology, although more students coming in and the younger students are now more familiar with computers and so on. It doesn't seem to be something that they gravitate to readily. <1,100-102>

Another participant notes that it fits very well with her subject, English. It may also be a result of the limited access to the teacher who is on campus for only three days a week.

So to have e-mail access to me makes it a lot easier for them. It just cuts down on the amount of time we have to spend physically moving around and asking for library help and so on. They also get in touch with each other by e-mail.<10,314>

It is very important to develop a strategy to deal with the amount of e-mail as the following participant notes.

I find students are highly sophisticated in e-mail. I find that you don't have to do any instruction on e-mail. They are there! They re using it a lot, A LOT! Sometimes too much. <8, 125>

I don't have a strategy as yet, I'm just doing it. I did last September. I sort of separated it out so if they had general questions about assignment things I had that going to the TAs, like in the statistics class of about 120 students I would typically have 2 TAs and I'd divide the class by their last names into 2 halves, the first half of the alphabet you talk to TA1 and the second half you talk to TA2. So those kinds of questions I organized a bit of a filtering so that those things were going to the TAs. Things of a personal nature or anything about complaints of grading would go to me. Anything that was appropriate to go to me, I continued with it. <8,129>

For those participants who have distance courses, e-mail is the key element for delivering the course and stimulating discussion. However, its effectiveness is limited in some cases.

Well, there's a few, a couple of surprises. Number one, they don't seem to, students don't seem to like to use e-mail to discuss in front of other students concerns or problems. To try and get chat groups going, or a general thread of discussion groups going has been rather disappointing. They would rather deal one on one with the professor or one on one with themselves. There seems to be a fear that they are too public by expressing themselves within open forums. And maybe they'll be more open to criticism. <4, 236>

I think what happens is there is a, there's a degree of competitiveness that you, that each university sort of feels they're representing their university, so they don't want to let the other universities know what their problems or issues are. Which is what was disappointing to me, because I think there's a lot of common issues. <4, 244>

In the Sexuality course there is a very high degree of e-mail communication, 500 to 600 per course to the teacher, and more to the group. The comment below suggests one of the reasons why there might be more e-mail communication than in class discussion.

... other people say, "I can't believe what's happening in this course. I normally sit in the background. I never open my mouth and look at what I'm saying on Sexuality which is a tricky area to deal with." I'm sure it does not work the same way with all fields but in this particular field, maybe partly because of the sensitivity of it, people can withdraw what they are about to say when they are typing it for the class but in front of a seminar once said there's no taking it back. Here they can choose to draft it before sending it off. Also they feel far more anonymous. I think it's a psychological effect. They know there are people out there but they're not seeing every little twitch of the eye and every little non-verbal communication that they're trying to process to get on the road. My comfortable assessment is that by far the majority of the students are far more involved in interaction with other students than they are in a regular classroom. <9,123>

Within the support facilities section, it is evident that universities are striving to help teachers by providing multimedia or instructional design assistance at the institutional level. There are few participants who noted departmental or Faculty wide support and the beginning of the development of multimedia or linked classrooms.

The naming of the university multimedia and instructional design facilities does seem to indicate a separation of the two functions, for example, Digital Media Projects Office and Instructional Design Centre. However, over the course of this research there is already some integration of multimedia and instructional design staff within these centres. The convergence of functions or integration of services across the campus is slowly gaining speed. Perhaps one facet that is contributing to this amalgamation is the introduction of web course authoring tools such as Virtual University and WebCT. The other item VLT (Virtual Learning Technology) is no longer a viable product having being superseded by HTML and

the other web course tools. These tools require an understanding of HTML or web publishing as well as a rigorous up-front plan. These are key activities that suggest a combination of the multimedia and instructional design facilities.

The location of departmental or divisional assistants is related to specialties and course focus. Participants 3, 8 and 11 have access to department technical assistants because they run special statistical/mathematical software or have a whole program dealing with information management. In these cases, it is important to have a resident technician available to maintain the system and respond immediately to problems in the classrooms and laboratories. Participant 7 has a divisional technical assistant to call on if there is a major problem in his music/multimedia laboratory. Nevertheless, in all cases, the participants do a lot of technical work themselves.

There are few multimedia, linked or laptop classrooms in use. Each of these facilities have special computer projection equipment and/or telecommunications links to other classrooms on different campuses. These rooms are costly both in money and time to build and to maintain and as a result there is not a great number and many are of very recent vintage. Even though the facilities are available, many of the participants have not used them because of the time needed to prepare materials for them and also because of the time it takes to learn how to use the equipment.

The need for other infrastructure supports is noted by some of the participants and partially reflected in some of their frustrations listed above. The limited access to on campus laboratories is one quandary, noted above by participants 6 and 8, which needs addressing. The streamlining in administrative handling of online students is also an issue.

So it wasn't a student problem that I had of any significance, it was a support problem on the technical side of simply getting students registered into the course in a way that was compatible with the delivery systems we're using. <9,107>

If there is any move to requiring students to have computers, the socio-economic situation of the students must be taken into consideration to enable all to gain use of computers.

Typing skills are one thing but I think ... there can still be a discrepancy, if you will, between socio-economic level, people that can afford the technology and those who can't. There are some issues of equity. <1,258>

## **INSIGHTS**

### **Reasons for incorporation**

There are many reasons why the participants are incorporating CMITs into their courses. These reasons can be grouped into several categories, i.e., cross-over use, course administration, course enhancement, student benefits and competition.

#### **Cross-over use**

One of the aspects of computer use is that in many cases the teachers begin to use their computers for their professional and administration duties before they use them for teaching. As they become comfortable with computers, they see similar functions in their teaching for which they can use computers. In some cases as noted below there can often be a revealing moment wherein the faculty members sees something in a student's written communication that had not been evident during face-to-face discussions.

I began to use email, more for consulting people and listserves and doing research. But as I did that, I began to realize there was something about email that was incredible as a method of communication. ... And, um, I don't remember when this was, but sometime about probably four, five years ago, it occurred to me one day, 'I might try writing an email to one of my students, just to see what would happen.' And the result was deeply shocking. <12,121-122>

For my company I had one of the first IBM computers in 1982. I've always had PCs. I've used them at home and as I'm doing a PhD myself in Britain, I've a notebook that I take over with me. ... I've been using the web for courses for about 2 years. <2,9-11>

I have been using e-mail for several years and tell my students that they can access me by e-mail at anytime. <2,30>

At the time I got a computer I was associate director... It must have been the early 90s. ... It saved me time. ... I find that I can think and write better but that was a developmental thing. <1,388-391>

With a few, it was part of their teaching from the start. Music is an example as is the teaching of statistics.

In the music area there has always been an interest in using technology, particularly in the area of ear training which is repetitive, rudimentary work. It's not something that is gratifying to a teacher. It is most efficiently done on a one-to-one basis. Before computers it was done with tapes, for example. That's

fine but tapes don't give you feedback on whether you've done it right or wrong. I don't know whether you remember the program PLATO. There was a music component. I think it was called GUIDO after the famous music theorist Guido d'Arezzo. ... When I was at the University of Alberta, GUIDO was functioning there and was used by students for rudimentary work. So it was already going there but that's where in the history of use of computers in music teaching that's where it started, I would say. <7,113>

Yes, well I've taught the course using just a calculator. I've taught the course with a mainframe where you had to do all the programming language. I've taught statistics where everybody uses FORTRAN to run it. Then we got into SPSS and that eased things and I think that has been a quantum jump as we've gone into being able to do this in a way that's so friendly, in an environment like Windows. <8,143>

### **Course administration**

The use of computers in course administration or logistics is a primary motivation for the teachers to get into CMITs. They want to reduce the handling of paper and at the same time provide more access to course information and course content. While e-mail distribution was and still is used to accomplish this distribution and access, web pages are now the main avenue.

Totally, totally remote, about four pieces of paper that they get before this course starts. <9, 67>

Yes, I put everything on the web. I didn't put the assignments up this time. I just didn't have time. But I would normally put the assignment up. <3,44>

The web page I use as essentially as a one-way broadcast from me to the students. It is not limited to [university] so that anybody from Tombouctou who wants to see it can do so. Consequently, there is nothing that is super confidential on there. ... So the students can find out, at any time in their courses where they are. They can check and keep track of their information. <2,31>

### **Course enhancement**

The participants note over and over that the use of CMITs provides complementary communication routes and increases student access to course administration information as noted above. The access to electronic information also enables the teacher to reduce the boring lecture components, to focus attention during class on discussion of the subject matter,

to address some of the students' expectations, and to increase their computer competencies while creating a collaborative, convenient, and reassuring learning environment.

I love discussions with students and that's one of the primary reasons, it may seem ironic, but my entire course is on the CD and they don't even have to come to class and you might think I must hate students and I must hate teaching, in fact it's just the opposite. What I hate is students coming into class and becoming little note-taking machines. I think that students need to come in and they need to talk to the professors, they need to converse and interact, they should do this free of the worry that they are going to miss some important notes or that even though you promised them that the notes are in the library reserve or in their text book they're just so scared that every time you talk to them they're going to miss something. ... There's so much visual that I present in the class, I have slides, I have videos I have audiotapes how do I put all of that together so that they can't think they're missing any of that. The only solution was to put them on a CD because that was the one medium that I could use where all of those other media could be put in and packaged and arranged so the students could take away, go home and do it at their own time. <6,51>

By supplying the notes via a course web page, the students can adjust their class attendance and maintain attention during the discussions or ask questions about the content.

My notes are now up on the web page for the students to consult. The assignments are already sitting there so they know that they have to look at the end of each chapter. I used to simply write that on the board. <3,80>

Even the experience of going on a field trip or laboratory exercise can be replicated and made available whenever required by the student.

Now eventually you can see that the lab experience is also something that has already been put on the CD, e.g. they get a virtual field trip, they get the CD where they interact and find out things about organisms so instead of dissecting using the microscopes they actually go into the visuals and using the simulations and that sort of thing. <6,79>

This is especially useful when the experiment in mechanical process control might result in explosions or flying debris.

You know, whereas you can't sort of drag these physical processes quite often into class. Particularly if you're showing some unsafe behaviour or some undesirable behaviour. It's not necessarily a thing that you want to have in the classroom. <5,150>

Visualization of concepts can also be enhanced especially when there is motion and when the instructor wants the student to work with the equations to gain understanding.

There's a lot of underlying mathematical theory that's at times kind of difficult for the students to grasp. What you have to do is when you're explaining the mathematics, what you'd really like to be able to do, is present a picture, paint a picture for them. What I have found and [name] found as well is that when you're trying to do this with a blackboard, it's stationary and process control requires motion. Systems are moving, they're in motion. and you really want to see a three dimensional moving kind of effect. <5,134>

Providing access to the Internet, the students can become a member of a community which reinforces learning and provides a sense of accomplishment.

Coming out of that, a number of students in writing their term papers, got as far as contacting the world experts in whatever it is they were dealing with. If it were George Crumb, they'd write to people who were dealing with George Crumb's music and say, what do you think about my ideas. So they, through that, they were able to actually have some dialogue at the highest level on their topic. Very important! One of our students who is doing her thesis on some aspect of music, obviously, was able to contact several experts in the field, people that have written the books that she's read and talk about them and get their most recent papers. I think that is ideal.<7,199>

The sheer excitement of using the web to open up vistas not possible in other ways comes out strongly. One participant likens it to opening up new worlds.

Well, it's kind of like, you know, the web for me is like a pointer. You know how they used to use those pointers. The teacher would point at a map, or they have those new laser pointers with the red light where you point at something. It's like a pointer. But it's a much more sophisticated pointer. 'Cause instead of terminating in a dot it terminates in a world. <12,143>

The extension of an interactive community also is important. When the course is one delivered via the Internet, it can incorporate multimedia and consist of modules written and supported by participating faculty at universities around the province. This is the case with one of the engineers.

Multimedia opens up a whole range of other media, such as audio, video, graphics. Interaction is through the Internet and with the students that you couldn't otherwise do with the traditional skills or tools that we have. So this opens a lot more avenues, I think both for professor and the student to see things

differently, experience things differently, and to interact in new ways. <4,183>

### **Student benefits**

Exposure of students to new technologies can assist in their learning and prepare them for their future work life.

Actually it was a good experience for me because it showed me again how important it is for students to do it hands-on. There's a lot of learning in doing it yourself, getting the printouts, trying to figure out what you've got there, and going through the procedures. I was upset that I couldn't use it [the mainframe program]. That probably pushed the people here in computing to get the PC version faster than maybe they would have otherwise. It probably initiated the process of them getting a site licence so that students could get a free copy.<8,158>

I consider it a part of a well rounded education to be exposed and have some ability in using it. While the use of computers might not be necessary in any given course, I see it overall as strengthening the skills of the students need. A typical example is a person who comes in playing the saxophone and wants to become a high school band teacher and, well, the thing is what are they going to do with that bunch of midi equipment that is sitting in the corner of their band rehearsal room when they get into their job. Where is the on button and how do they make it work? It's getting over that hurdle. Things have really changed in the last few years. <7,101>

Drawing students into CD-ROM or web page production not only gives them training and practice but affords them a chance to participate in the research process.

... undergraduates and a lot of them have programming experience but you don't have to be a great programmer, I think, you just have to have the mind set that would allow you to apply the technology. I've been very lucky that way to recruit students.<6,47>

Acceptance of CMITs can also reduce the drudgery of extensive typing and retyping of scores.

If you've got a 50 page orchestration assignment you can play in a lot of it if you have a midi instrument which saves a lot of writing. You can listen to it to see if the notes are right. Your ear will tell you if there are mistakes. When the professor attacks it and says that this music should be for French horns instead of flutes you don't have to write the whole thing out. You make your changes and print it. It ought to become a scale of efficiency in the long run. Certainly the students of mine that did large projects were very thankful to be able to use a

program to produce the notes. <7,110>

Visualizing concepts not only enhances course delivery as noted above but also provides for a varied learning environment for the students in subjects ranging from mathematics to biology to space craft design and economics.

I mean, in my case, I have some very difficult theoretical concepts that if I could help students visualize what was going on, it would help them learn it and understand it. But that's the nature of the course. <5,270>

Giving their students the edge or an ability to deal with problems that they might meet is a common goal. Using CMITs in class provides added insights and capabilities as the following participants note.

Well, I hoped that the students would ultimately profit by having web technology as part of their skill package wherever they might be. If they end up teaching like me, well it's everywhere. If they end up back in the commercial world, you know, they are all doing it. I want to give them that edge. There are many research tools available out there as well that can help them in their research if they can navigate the web. <7,158>

I give them URLs to connect with in order to find out material, e.g., the Economist offers a free download and students are encouraged to look at that. They get access to Stats Can material. The Stats Can material is particularly relevant to the macroeconomics course because much of what we do in macro is a model, abstract model. If I can draw in some of the real data, they get a feel for what it is and how the model is leaving out some of the factors. <2,42>

They will learn how to attack the problem and how other people have attacked the problems and which have been successful and which have not. When they get out of this place, they will work for an employer and see problems that they'll never have seen before and probably problems that nobody has seen before. Their function is to be analytic in their approach. ... That is what I'm trying to get across to my students. <2,92>

## **Competition**

One theme that crops up is that of the competition from other universities and from distance education. Many of the participants see face-to-face dialogue as extremely important so much so that universities are not going to go 'totally, totally remote.' The work of participants 4 and 9 with their distance education initiatives and with participant 6 and her

CD-ROM might give the others pause. There is nevertheless a concern with what others are doing as noted by one participant.

It's very difficult to know how much of this to get into, because so many other schools are getting involved in distance education so do you want to get into a competition with University of Athabasca which has been at this for a long time and has devoted millions of dollars. Do you want to get into that competition or not, that becomes an issue.<8,11>

The social setting of the university is certainly a facet that is not going to be easily shunted aside as the following participants note.

There will always be the need for this face-to-face. For the foreseeable future, unless they can offer something really, really different, I can't see technology taking over education totally. There are some courses that it has a lot, you could use it very well, but I still think you need that one-to-one; either individual-nurse, family-nurse, or group kind of thing. Once you've developed the kinds of skills with individuals, back and forth, then you can look to see what other ways we can communicate with people and so on and possibly use technology to do that. You have to have a sense of good interaction skills and abilities before you start thinking how you can translate those through technology. <1,352-358>

The computer makes a good screen but it's not a good stage. I'm a stage performer who's interested in the screen. But I am myself a stage performer. So they're getting a stage show. So stand-up teaching for me is a stage show, not a screen show. I mean, of course one of the issues in web-based teaching is rendering actual humans unnecessary. And I'm very careful about that, 'cause I think I'm very necessary. So for me, and for my teaching, the whole web thing is a support for what's going on in the class. Not in any way a form of classroom itself. <12,295-296>

A little more concern comes from the engineer who deals with coordinating multimedia education at one of the universities.

I have learned through my association in industry and now in universities, we must embrace technology. We must embrace new things. We must embrace change. If we sit back and are unprepared to change, unprepared to move forward with new things and try to influence the direction in which technology takes or the implementation of technology. If we don't move forward and try and effect that change, we will just become drawn along by it or tossed aside by it. <4,202>

I've been to enough conferences, and my staff have been to enough meetings and

I'm sure a lot of the people we deal with have been to conferences and know that this is the kind, these are the kinds of web development tools that are being made available at other universities. So, if [the university] does not move forward and provide these same sorts of resources for our faculty we'll just fall further and further behind.<4,277>

## **Concerns with incorporation**

The concerns expressed by the participants fall into three categories. These are the added burden placed on the students, the increase in workload issues of managing time to learn and keep up-to-date with CMITs, and general frustrations with the local setup. Within each of these there is a continuation of many of the concerns and issues as outlined above.

### **Added burden on students**

The participants commented that even though more students are coming to university with computer skills there are issues to be considered when incorporating CMITs. Placing emphasis on using e-mail, using web pages for course outlines, and searching the web for information add extra strain. Any requirement to purchase or lease laptops adds a considerable financial burden to students.

The main concern is that there is not enough equipment for the students to use on campus or that there is insufficient access from home.

One of the major difficulties is that the [university] infrastructure is not set up for very large use of modem because the bandwidth is not sufficient to accommodate a lot of use by that. So in fact for instance one of the difficulties in mounting any courses when you're using HTML is that they have to be on campus to use it and they can't get access off campus until after 6 o'clock, the students don't, it's just one of the limitations... . <6,41>

Another participant in referring to e-mail access is concerned about setting up undue hurdles to learning by increasing her expectations of access to and use of technology.

Part of it might be that if they don't have a computer at home with Internet access and e-mail capacity then they'd have to come to a lab at [the university] to use it. It might be that it is not convenient for them. This is part of my dilemma that in trying to build in more of an expectation that students use it, is that I'm not sure if I'm making it more onerous for students that don't have easy access, or putting in an expectation that would make it harder for them to do something. <1,103-109>

Participants must look below the surface of the CMIT. Does their use of it require a new or different skill set or financial outlay by their students. The nursing teacher who talks about herself also alludes to student abilities when she notes that

One issue is typing in quite this way. A lot of the electronic technology depends on being able to type. If you are using e-mail or using Powerpoint that kind of thing you have to have a certain level of typing ability. <1,252-253>

Moving too fast into CMITs may cause problems. The teachers may realize that the application is not turning out as they initially planned and turn to another technology. This in turn may add another burden on the students to have or find the requisite equipment. The CMIT may become a hindrance instead of a help.

The web wasn't really ready for us when we started in 1994 and the web still isn't really ready for us yet in terms of its bandwidth. That's why we still use CD-ROM and provide that to the students. Bandwidth may be a problem, I don't know, for years yet to come.<4,373>

This may mean as the following participant noted, that if students face overcrowded laboratories they may be pushed to other costly routes to access information or participate in the course.

The down side of it is that in order to get the meeting of minds with the students they have to have access to the same technology. The web is one were you can have that. The students have e-mail, the students have web access. Probably not as much as they would like to have. I know that the labs are overcrowded, so I'm told. I think that enough of the students run their own through independent services; globalserve and others that they recognize that they want web access and if [the university] is not going to provide it, then they'll do whatever they need to do to get it. <2,166>

On one campus having laptops for the students is prevalent in business and engineering but not in many other programs. This divergence of opinion is noted below. The concern is not only with burdening the less fortunate student but also the strain on the faculty in redesigning their courses to suit on-line or laptop courses.

There are a group of faculty in this university who think that every student in the university should have a laptop. I am not sure that we are ready for that and I think there are problems. ... I think in some programs it may be very appropriate. But I would still have trouble justifying to students in Nursing why I think every

student would need a laptop computer. The thing is that you'd have to design every course so that you'd have a reason for students to have laptops and be all plugged in and so on. That's a lot of work. <1,283-286>

Nevertheless, some participants are beginning to think of the requirement for laptops as one of the engineers comments,

Laptops are becoming cheaper and cheaper and cheaper and there will come a time in the very near future when I don't think it would be unreasonable to require that your students, I mean that time's probably now, where it's not unreasonable to require that your students have a laptop. <5,680>

### **Workload**

Several participants mention the added time needed to work with CMITs. The additional work results from learning and keeping up-to-date with the software, from maintaining currency in their presentations, from responding to the mounting e-mail and listserv activities, and from grappling with more and more sophisticated hardware.

In talking about the rigours of multi-campus linked classrooms one participant outlined the added and at first unrealized pressures put on those who champion the use of CMITs.

I think that it pretty much exhausted him. It's now being done more institutionally by a staff person in physics who's paid for partially by the university. And there's a comparable person on each campus. The trouble with that course was always trying to schedule it. First of all you have three universities with all different time schedules so there's been a lot of effort done by the three to standardize the time schedules and also when classes are started and stopped and things like the February break. When I taught that course in organizations, the break weeks were different so the week the students were not here at [the university], they were all set for a class at [the other university]. I ended up doing the same class once for the [university] people and once for the [other university] people. <8,59>

Continued frustrations of changing or sharing equipment leads to more time preparing and rechecking prior to class. As more complicated CMITs are used, the time to make sure that everything works increases.

The problem that I've had actually with maintaining my teaching in the computer lab has been that it has been a shared facility; you go in for an hour, then another teacher would come in and teach a completely different course, so on, all week

long. There would be one or two hours available when faculty could go in and update their materials but because it is a shared system there is always a threat that your material might not be there when you come in. We tried to mitigate by having two identical teaching labs so if one's not functioning you can use your materials in the other. Nevertheless, you see, typically, the equipment would be upgraded and not necessarily with full communications with everyone concerned. <7,127>

Even the most mundane item as a bulb burning out or a projector breaking may scuttle the class. The weakest link can ruin the most careful planning. As one participant notes, she is using CD-ROMs for course materials so that she does not have to spend time

... struggling with the laptop, getting it hooked up properly so that it will show, getting the video or at the last minute slide projector not working, and I've had that happen to me a couple of times where I had to do a complete lecture just by words because my slide projector broke down during the class. <6,80>

### **Participation and performance**

There are additional ambivalent views besides those of whether or not to go to laptops. One participant does not want to give grades based on the amount of participation but suggests that it might be the way to get the students to participate.

Having the students accessing the web regularly was one of the goals that I had for the students. I'd like to add much more interactivity but the thing I find difficult is that currency that the students work in is grades. They are not going to do anything unless it gets them grades. I don't believe in participation grades [grades for the quantity of submissions].<3,89>

Others are concerned by the lack of use of the e-mail and web pages by their students. They wonder, with the ease of use or the value of the content, why the students are not using these elements more. This is especially curious because the students must realize how keen the teachers are to respond to e-mail or how much time goes into preparing the web pages.

So I've suggested that [e-mail] is a way of communicating, I check my e-mail often and I'd get back to them quickly. But again, I've not had a lot of students using it. <1,100>

I'll tell you, most of the action is going on with my media class. And in the media class I tend to ask questions by e-mail and they give me e-mail responses. You know, 'How was class today?' Very few of them are actually saying, 'I noticed something on the web page.' In fact, the web page is not getting

mentioned a lot and I'm kind of wondering whether they're bothering to look at it. But because I'm having such a kick at doing it, I don't feel any sense of either despair or disappointment. I'm quite happy to be working on the web page anyway. But I feel they may be missing a lot. <12,154>

The participants are also aware of the possibility of getting too involved in the technology for its own sake. CMITs must be seen as tools and not driving forces.

But undergraduate students really need a nice map, you know. Step by step. A nice flow, logical flow through something. And if you, I mean the web, if you take a look at what's available on the World Wide Web, the signal to noise ratio is very low. There's a lot of noise. And you can easily fall into that trap of just throwing too much noise ... Because you get, I think, you get caught up in the technology itself, instead of thinking. <5,560>

It is not always the technical infrastructure that breaks down. It may be the administrative infrastructure which is needed to change their approach in the face of new delivery. In this case, the distance course on Sexuality.

We gave quite careful instructions how to log on and quite frankly if you can then log on and see a page then the information starts to be there. I had far more problems with the crew who were managing the putting in and out of the students than I ever had with a single student and that level of confusion about how to operate this was and remains extraordinarily hard to bear.<9,103>

Often the software does not work the way the participants expect it to or want it to work. Having the teachers change their working styles to fit the CMITs may be a major stumbling block. Powerpoint software is a case in point. It either does not fit the teacher or the student in these two cases below.

I'll tell you what I'm having trouble with. I like to have a more interactive class where I ask students questions and I have them answer and I like to write the answers down. I also like to leave blanks in my notes for my students to fill in. It's a way for me to find out whether the students have read the notes and thought about them and tried to answer the questions that I have within the notes. It's good for me to review and take up the answers. I can't do that easily with Powerpoint. It takes me a lot longer to fill in. I have to type it in and that's a real pain. I don't know that I like it as much and I may go back to overheads for that reason.<3,27>

Powerpoint being a case in point. The whole idea of Powerpoint is that you can

provide a lecture through a series of slides and the students have the slides on their machines. They weren't happy with it being on the machine. They wanted to print it. The print capabilities are black and white. Powerpoint being colour doesn't give you a very clear picture on some of the lower class printers which are the ones that the students have access to. Therefore it didn't work.<2,98>

The exasperation with software that was obligatory to use within a program or that is not as conducive to easy manipulation is illustrated by the participant below.

The NetMeeting was one which didn't work. When there were a few people on board, it worked fine but when the whole class got on board, I didn't find that it worked very well at all. I found some difficulty in loading some of the material I prepared into that space. ... I like to present a graph on the board, explain to students where it's coming from and ask the students what happens when you change something. The packages don't seem to allow you to very easily make your changes to the graph and to explain what's happening and why you would go into recession after this. I think that the weaknesses of the graphics packages is one thing that really worked against me.<2,105>

While the participants are confident in striding out alone, there is always the concern with the underlying resistance from or support of their colleagues or chair. This can be from a general lack of awareness or a specific lack of recognition for the pursuit of CMITs.

This is going to be very biased because I know my colleagues well enough that I don't usually broach the topic unless I have a fairly good idea already that they're receptive to it. So I would say that of the people that I talked to in the department, they have been fairly supportive. However that's not to say that I systematically went up to all my colleagues and asked them this. I would say that I'm getting a lot of behind the back comments. It's really an extreme. I don't find a lot of indifference here, I find people are very for it or very against it.<6,109>

It's ignorance. That's not a mean use of the word. It's just that they're not aware of what one can do, a reluctance to even find out what one can do, and maybe a reluctance to not even want to participate regardless. Sort of a closed mind.<4,413>

To my mind, this type of work, I would even go one step further and say, although it's a little off the beaten track, I actually think it's valid research. Looking at techniques to improve the process of engineering education, to improve engineering education itself. I think that's valid research. And I think that's research that should be conducted within a faculty of engineering. My Department Chair begs to differ.<5,270>

## **Role of CMITs in the instructional process.**

The twelve participants use CMITs in a number of different ways for their courses. Some have tried several CMITs and rejected them as difficult to use in a fashion that they like or have found them too time consuming to learn. The ways that the CMITs are used can be grouped into three categories, i.e., simple complement, interactive mode, and distributed delivery mode. These categories can be seen as flowing along a continuum from simple complement within current classroom teaching methods to sophisticated distributed delivery methods enabling high interactivity.

### **Simple complement**

E-mail is used by all participants but it is not used in the same fashion by all. Several do not integrate it into their course work. They use e-mail as a complement to their in-class question time, to their scheduled office hours, and in a reactive mode; if students ask a question on e-mail, they get an answer. This does provide added convenience for their busy students but does not utilize e-mail as fully as it is used by other participants.

For example I would get three student enquiries a week regarding assignments though the e-mail. I suppose it in a way supplements the office hours. <7,58>

Participants 1, 5, and 12 do not use e-mail to accept assignments electronically, nevertheless it is available to stimulate discussions amongst the students.

It was really to encourage communication with students; between students and myself around class issues and a lot around assignments and questions about assignments.<1,123-125>

The use of presentation software is another example of a CMIT being used as complement or replacement. It has had an impact on time and on the appearance of the course but not significantly on his teaching as one participant notes,

Has it changed how I teach? Yes, but in mechanical ways, rather than making up overheads now I'm more likely to make up a Powerpoint file and display that in a faster, nicer form. I can also take another version of that and make that available to the students faster. It's the same information made available more graphically. <8,177>

The use of web pages is another facet of the complement and/or replacement strategy.

All but one participant have web pages for their course. Most participants use it as a replacement for their usual course materials. Participants 2, 3, 6, 8, and 10 have the basic course information on the web such as, course title, instructor name and e-mail address, course outline, course objectives, grading scheme (marks for participation, mid-term, final exam), instruction format (lecture, lab, seminar), and texts. This also provides convenience for the students in that they know where to go to answer their course administration questions. Some go further and have course notes available so that students can prepare for class discussion rather than have to spend their time in class scribbling notes.

My notes are now up on the web page for the students to consult. The assignments are already sitting there so they know that they have to look at the end of each chapter. I used to simply write that on the board.<2,80>

At this level, the time to learn the use of the CMIT and to incorporate it is not onerous to the teacher. Their use fits well with how they teach and how they use other technologies such as using e-mail to contact colleagues, overhead projectors for slides or the Internet to surf web pages. The skill level and time required to master these tasks is low and so the use of the same techniques in teaching has grown quickly.

### **Interactive mode**

A group of participants are integrating their use of CMITs into their courses to provide for interactivity between student and faculty member and amongst students themselves. Listservs and e-mail that are asynchronous in nature are used to start and maintain this interactivity. The interactivity can also be synchronous when online chat groups are established. The faculty members are also extending the use of the CMITs by having the students participate in developing the course content and expand participation through online discussions of each others' work. Participants 3, 10, and 12 are using e-mail techniques as an integral component of their courses.

I have them hand in their assignments electronically. That way you get a date stamp on it. I have them communicate with me electronically. I post the marks electronically [on a web page], not on e-mail. The less paper, the better.<3,138>

In my graduate course, I have an e-mail line that they can all reply to. I throw information at them sometimes, or ask for responses to how they think the class

is going, or see what other approaches they'd like to take. I've set up a conference. I'm setting up a conference in May that I want them to participate in. So, e-mail has made it possible for me to get guest speakers lined up and all sorts of things without needing to write to them snail mail in Colorado and places like that. <10,156>

Well, e-mail's very vital to me because, one of the problems I have always had in the classroom (I mean it's been a kind of structural thing built into the very essence of classroom teaching), is the inability to read the audience's mind and know how are they responding and taking in what I'm saying. ... But now I can actually have long discussions with people via asking question like, 'Can you tell me what you thought this meant when I said it in class today?' And they actually, some of them sit down and write long letters back and really try to explore things. So I learn a lot more about what they don't know and what they do. <12,189-190>

Participant 7 has his students develop course components on the web either for assessment or for course critique.

They got as far as putting their final assignments, essays with musical examples and so on, on the web where they are actually available for the community at large to see. <7,65>

Expanding their current techniques with the use of CMITs also can expand the collaboration between student and teacher. It broadens how they can teach particular courses such as in this case of Old English,

I have a student who's been in two of my courses, the Old English and the Linguistics course. And for each of those, he's done a web site with information and grammar exercises and so on. And that will eventually be integrated into, it will stay on the web for the time-being, and then be integrated into the CD-ROM eventually. <10,72>

The student initiative can also push them into new areas as the same teacher noted,

... students have submitted projects on the web for that. Or they've submitted them, for example, in a Zip drive with multimedia as well as just in paper form or with tape recorders in the more primitive case. Some of them are very high-tech now. So I have to get high-tech to be able to accept those and I'm happy to do that. <10,60>

Participant 11 also uses a web module in her laboratory to provide instruction on LAN technologies and to put the onus onto students to do the lab work on their own time.

This way the teacher can put more into the semester course.

... the other thing that I have introduced in 200 is a component of theory which used to be taught via the traditional method, lecture and so on. ... So instead of two hours, three hours over the course of a couple of classes, talking about fairly straightforward factual content, I say to students, 'Here's where you can go to work through a tutorial that will give you all this information.' In this tutorial are animations, diagrams, and interviews with industry experts. So it's a richer experience, I think, than I could provide in the classroom on this particular topic. And at the same time, it frees up the classroom time to do other, more interesting things, rather than just present some facts. <11,321-322>

As the faculty members deal with more CMITs and integrate them into their courses, an increasing amount of collaboration is evident. Reliance on technical assistance with the software and hardware increases. Often there is collaboration between faculty members and students in developing course elements, or as in the case of the LAN module, between two faculty members.

#### **Distributed delivery mode**

The move to CD-ROM or web-based delivery of course information requires major up-front design and development by teachers, often comes about through collaboration with colleagues or technical assistants, and illustrates a growing expectation by faculty members of increased self-direction amongst students. Participants 4, 5, 6, and 9 have already moved into a distributed delivery mode by designing and developing their courses using a wide variety of CMITs. Participants 5 and 6 have developed specific modules or fully self-contained multimedia courses. The process control software that participant 5 developed with a colleague allows the students to experiment with actual process control equations and view the changes in the graphs as the variables are adjusted. There are still classroom sessions for overviews and discussion but much is available over the web.

So we have it embedded in there. So we have some tutorials and things available that students can access. And that's also how they can access their lab manuals and examples of how to use the lab. And little mini-tutorials about that. We've put these items on the web, and they are publicly available. <5,122>

We started putting together some tutorials for the course that were on the web. And what we did is we worked out some tutorial problems and embedded in that some simulation diagrams. Some actually ran some Matlab code or SimuLink

code to show students how to run this type of thing. <5,202>

But then you can take the code. You can actually run it. You can actually see it work. You can modify it. You can, you know, do what you want. <5,210>

The second participant has designed her course to fit on three CD-ROMs; an interactive text. Students do not have to come to class but when they do they come to ask questions and participate in the discussion. As she noted,

The only solution was to put them on a CD because that was the one medium that I could use where all of those other media could be put in and packaged and arranged so the students could take away, go home and do it at their own time. So when they come to class it is to ask questions... <6,51>

In both of these cases, there is a union of local (in class) and remote (in home) components with an expectation that the students use the material outside of class.

Participants 4 and 9 deliver their courses over the web. In the case of participant 4 the course is a collaborative venture amongst twelve faculty members at seven different universities. The subject matter is available on CD-ROM and over the web with students at each university having no regular classes but a work space where they can have their own group sessions and meet with their specific site coordinator. Participant 4 is the project coordinator and he visits the other universities once at the beginning of the term. This is how it works,

Yes, it uses CD-ROM, Internet, and e-mail. We have used NetMeeting. We have used video conferencing. We use real time discussion, I mean, class. The course is conducted with a number of universities in parallel. The [university] students here have an advantage or a disadvantage because they have me locally, who's the site coordinator. And I've been largely responsible for running the project and putting it together. But at the other sites we also have other site coordinators who have provided the module. They provide one or more modules. <4,82>

Participant 9 runs a totally remote course over the web using the Virtual University course software. The students do not come to campus or meet face-to-face with the instructor. As he notes, the course is

Totally, totally remote, about four pieces of paper that they get before this course

starts <9, 67>

He does note that technical and administrative assistance is critical to delivering his course. While he is enthusiastic about the course and the participation of his students, he has frustrations as he notes in the following,

The biggest problem frankly was with loading students into the course particularly into the course and, I've got a pile of sub-conferences in it, the main class forum which is like the whole class being layered, the chat group, if they want to use it because they are chatting into little seminar groups of five students, the feedback forum and so the students have to be loaded into all of that and the VU system for getting them in is unbelievably labourious ... So it wasn't a student problem that I had of any significance, it was a support problem on the technical side of simply getting students registered into the course in a way that was compatible with the delivery systems we're using.<9,107>

But a key element in the development of his course was also the instructional design assistance. His work with a graduate student on the course content and with the instructional designer to integrate the content into a well designed Virtual University site was crucial for him. While he hit a few hurdles with the first designer, he noted a positive collaboration,

They also have a person who is involved in the design of pages as distinct from the design of the content, and he'd done his Masters at [an American university], and whether it was his background or his personality, I just think he was fantastic. He used our course to develop a kind of template for all the subsequent courses, because ours was a fully web-based course. He was probably helpful because he knew that investing in this was going to have a pay-off down the line but I didn't have to worry about any of that sort of junk. He would consult with me about the design of the pages so that people could move through them well.<9,91>

There does need to be an infrastructure present to support the most modest incorporation of CMITs. As faculty members, such as participant 9, increase their expertise and vision, the technical and administrative infrastructures play a greater and greater role in the success of the courses and the learning experiences.

## **Processes**

The incorporation process is not one monolithic process but an amalgam of many sub-processes all of which the faculty members must face. Within the organizational setting,

faculty members are grappling with pragmatic issues of starting up but continuing to use CMITs in the face of financial concerns over new hardware and software, of the shifts in the expectations of the students, and of changing support infrastructures. Intertwined with these challenges but on another level, is a change in the nature of their teaching. This change in perspective and activity is encapsulated by the move from teaching-centred to learning-centred. A major challenge in these processes arises from the need to clarify policy issues such as the synchronization of organizational mission, strategy and operations, the appropriate supports for teachers, the clarification of roles and responsibilities, and the delineation of rights and obligations. The faculty members who lead incorporation of CMITs must often contend with many of these at the same time.

### **Organizational Setting**

The experience of the participants in the university setting spans three to thirty years. Their initial use of computers dates back about eighteen years. The height of activity began about eight years ago with e-mail and jumped again about five years ago with the introduction of web pages. For the most part, however, their use of these two elements, e-mail and web pages, in their courses began even later. The two exceptions were the special areas of statistics and music in which computers have been used in courses for many years. Throughout these periods the participants note the significant break points or changes in their academic work and in their teaching.

### **Start-up**

Their buying or using a computer for the first time was a noteworthy event. The early recognition of the value of the computer prior to its use in teaching comes out in several of the participants' comments.

For my company I had one of the first IBM computers in 1982. I've always had PCs. I've used them at home and as I'm doing a PhD myself in Britain, I've a notebook that I take over with me. <2,9>

I got myself going on the computer virtually the moment IBM came out with whatever it was back in 1982 or '81 not because I lust after the newest toy, but life seemed to be going that way. <9,111>

I can be very precise about it, as a matter of fact. Within a week of June the 1st,

1984, one way or the other ... My wife came home and said she had heard about something called a Macintosh which was a new computer. We heard that there was a demo at the University of Toronto book room ... So we went down there. And they had two computers set up. ... We walked up, we put in MacPaint and we played with it. Two minutes later we bought a Macintosh. Literally.  
<12,112>

Although, the specific date may not be remembered, the impact of its use was important and signalled a change in activity. The do-it-yourself characteristic is evident. The fast self-service is a real benefit as one participant notes.

It must have been the early 90s. I can't remember. I had a computer when I was the associate director and I was able to check student records. It saved me time. I could go in and I could check, once we got hooked into [the network], I was able to check students' academic records, I was able to look to see how many students were enrolled in various courses. It just meant I didn't have to call somebody else and ask them to do it and when they had time to do they could get back to me. It meant that things were faster. I got my questions answered faster. I got used to that. <1,390-395>

### **Transfer**

The recognition of the value of the technology in personal usage transfers to a use in instruction. This may be done on a whim as suggested by one participant.

I don't remember when this was, but sometime about probably four, five years ago, it occurred to me one day, 'I might try writing an e-mail to one of my students, just to see what would happen.' <12,122>

The impact of technology in getting the 'busy work' in class done faster and in saving time to focus on the important issues is especially pertinent in the following two cases of the users of special statistics and music software.

What I want are things that are useful to me either in my research on social issues or as I try to help students learn about social issues. And SPSS is a very good tool in that respect and it's grown to be a better tool as it's grown to be easier to use it, not because I want people to use SPSS in and of itself but I want people to use SPSS because now they can analyse variables that might help them to understand the social issues and through SPSS they're going to do it faster and more accurately than if they did it some other way. <8,169>

Yes, because it is more efficient in the long run. If you've got a 50 page

orchestration assignment you can play in a lot of it if you have a midi instrument which saves a lot of writing. You can listen to it to see if the notes are right. Your ear will tell you if there are mistakes. When the professor attacks it and says that this music should be for French horns instead of flutes you don't have to write the whole thing out. You make your changes and print it. It ought to become a scale of efficiency in the long run.<7,110>

### **Continuance**

However, it is also important to understand the time factors contained in learning and using various CMITs. Getting started may be easier than continuing with the use of CMITs. One participant notes after some frustration that everything does not turn out as expected; the best laid plans ...

Everyone committed in May to teach either in the Fall or in the Winter. Even at that, you really don't know how these packages are going to play out in the classroom. There is a gap between the theory and actuality; what you think is going to work, you're told is going to work and you suddenly get in the classroom and it's not going to work at all. <2,96>

Or as another participant noted, there is definitely a need for time to play with some of this new technology to learn it and to be comfortable with it.

I find it fascinating personally but to find a way to build it into my course, I've been limited, in a sense that I've not had the time to learn about it until just recently. We don't have things like Powerpoint readily available to the faculty in the School so it's hard; if you have a little time available in your office you can't play with it because it isn't there. <1,73-76>

### **Growing financial burdens**

An important aspect of the use of CMITs concerns the monetary implications for students, faculty, and the institutions. The faculty members who want to use the technology recognize the changing cost structures for establishing technical infrastructures upon which to mount CMITs, for upgrading hardware and software in unison, and for purchasing computers by students. The issues of costs and of spiralling expectations are described by the following quotations:

Powerpoint. Where are the resources to do that? We don't have the resources in the school to constantly be updating that sort of thing. So I think there is an issue for being up-to-date and having the equipment to use the latest technology.

It is an ongoing thing particularly in an institution like a university where you are trying to move and keep up with a lot of things that require you to be cutting edge. It is hard.<1,265-269>

Some of the reliance on finding funding is sometimes on the shoulders of the faculty members who want to move in this direction.

I had always had very good support through grants, not from the department. The department is encouraging but they don't ever supply you with the money. There are creative ways you can get money from them through your course budget and that sort of thing, but it's not aboveboard. ... I do research in this area and I have a very active community outreach programme so I have a lot of resources like that at my disposal.<6,43>

However, there can be a bright side when the long term is considered; the costs of the computers are coming down. With the costs coming down, some of the students are advancing more quickly than institutions, have increasing expectations, and are pushing their institutions to purchase better equipment.

I think that the thing is that as the costs come down and products improve it is easier to keep ahead. I know that 15 years ago it was really prohibitive to get seriously into computer labs but now I mean we are trying to keep up with our more advanced students who will have full programs in their home.<7,66>

### **Pulling and pushing**

The turmoil caused by a teacher moving from one technology to another can produce consternation within the department especially when such a move has cost implications for the department computers and laboratories. Perhaps the problem will go away for this department when the students, as noted below, buy their own equipment for home.

I actually made a tutorial where they had a series of videos and then I pressed them into a CD but that was still a CD available for the students to use as long as they had a computer here. Now this is going back 3 or 4 years when I don't think it was common for students to have a computer with a CD-ROM at home, this was '93-'94, and also the department was also a little bit skittish to say, 'Yes, you had to have a computer to do this course.' I think that attitude has since changed because on their own student's have their own computers and I think any student that has a computer would have a CD-ROM and therefore it's not as stringent a requirement, its not an unrealistic expectation for them to use it. So what was the problem? It was that I had these CDs. I could make copies of these CDs, but it was up to the university to provide the computers. The department was cash

strapped, we have 16 computers for a class of 250, you can't really, I mean we do, we had but it isn't something you want to keep in a prolonged way. <6,42>

These shifts towards students having better equipment or their pushing the departments to keep current also occurs in the specialty areas.

Things have really changed in the last few years. Now more and more students are coming in with basic abilities. Teaching changes much more away from teaching computers and all and using them more. For example, this last year, the first year in which I would say that 50% of my music writing assignments have been handed in by computer, by students using computer programs as opposed to writing them on paper. So that's a shift.<7,101>

The move to laptop computers has implications not only for costs but also for the students' expectations of the courses. This puts added pressure on teachers to incorporate computers and design their courses accordingly.

I think what happened is that the people in the [university] program have a feeling that they forked out \$1400 for these machines and that every class that they should be doing should be making the ultimate use of the machine. I don't think that is necessarily right! ... There should be more preparation on behalf of those who are putting the package together. We were all learning; the faculty and the students. <2,94>

### **Responsive support units**

A key development that participants mentioned is that of instructional development centres or multimedia assistance groups. These groups play important roles in making new technology available and in helping teachers become comfortable with the new technologies.

We have a unit on campus called [office] and they'll help you with how to implement certain computer innovations in your class, it's not part of the computing centre, it's typically run by a faculty member who's bought out of their teaching on secondment and currently the person there is [name]. And she's actually in the [university] department, she's very good. They're quite supportive of anything you might want to try and they have some seed money that they make available through a grant competition.<8,87>

It is important to assist faculty with their particular issues and not simply broadcast information. One participant notes.

Because there's so much out there I need more help in terms of what I'll find useful, I know this is very difficult for units like [office name], but generally the

philosophy on campus, I think this is pretty universal, is you help people with their request and I don't think that's good enough anymore. I think [office name] have to become more proactive. They have to say in their newsletter, for example, or on a global e-mail, they've got to say, 'Hey! we've just come across this thing. It will help you to do xyz and we've compared it to some other products and it's a good thing to try if this is what you want to do.' So much of the selection or even just finding the stuff becomes just happenstance because a colleague down the hall found it and it was useful to him or her and they said, I just tried this and you might want to use it. Proactive help with getting through this maze of new stuff coming down the line constantly, I think that would very useful. <8,194>

It is also important to get participation by the faculty and not just have these groups make decision on behalf of the faculty. Participant 4 who is also the coordinator of one of these support units suggests that it is important to involve the faculty in decisions that have an impact on them but all the while to remain flexible.

... when we (the support group and a committee of faculty members) go out and we look at all these course development tools that are available out there (we at this point have selected WebCT), I think we've got a very strong base of information, decision-making information, upon which to base that decision. That it's the best decision (a group decision) for [the university] at this time. That doesn't mean it's irrevocable or we couldn't change it for something else later on.<4,277>

The need for these groups to be flexible and responsive is important. If one technology does not work, it needs to be dropped or replaced. Participant 4 takes this attitude to outdated, cumbersome technology while participant 9 illustrates the need for the support groups to have a balanced response to problems.

We had taken VLT [Virtual Learning Technology] to the point where it was more of a problem than a solution, so going to the web was the next logical step. <4,373>

So it wasn't a student problem that I had of any significance, it was a support problem on the technical side of simply getting students registered into the course in a way that was compatible with the delivery systems we're using. <9,107>

### **Changing technical infrastructure**

The technical infrastructure is another element that underlies any large use of CMITs

at the university level. Such a technical infrastructure costs the institutions a great deal to implement and maintain. However, having it in place can reduce the out-of-pocket costs for faculty members and students while fostering experimentation and discovery. Having up-to-date software available in laboratories might cost more but it can mitigate some of the access and use problems and permit a greater number of students to participate. If students do a lot of printing from the electronic sources, the costs to them could increase.

... when teaching the quantitative statistics course, undergraduate level, I didn't use a computer because we had grown so large. This was before the advent of the personal computer version of SPSS. We were still on the main frame and the course was so big that there were going to be so many classes necessary to teach them the editor and so forth... what did happen was that the class size stayed large but technology came along. In effect, that enabled us to go back to using it ... So in a sense the technology has enabled me to go back to teaching statistics the way I want to teach it. <8,157-158>

The same price it would cost them to purchase the textbook, \$85 is the cost of the new book, ... they get 3 CDs and a course pack. The course pack won't be this [binder], the course pack will be a subset of this because they'll have the schedule and the maps. Everything is on CDs. It's just that, this is like a security blanket, eventually everything will be on a CD and they'll just have to print it out. Now you can say you're downloading costs. Yes, but nowadays you impart flexibility to the students, e.g. if they lose a table they just print another one out, if they want a map, if they want a printout again they just print it out. And also I got this ready, and why administration likes it, is because it's now available soon for distance education; completely because once it's on HTML and it can be mounted on the web then there is no need for the students to actually come to the class unless they want to.<6,76-77>

The university is gradually equipping the bigger rooms with video projectors and hookups so you can go into the room with your laptop and plug in and that will give you access to the display, the typical configuration is they have a video display projector hanging from the ceiling and you can plug in. Some of the rooms also have a data link so when you plug in you can also get on to the university backbone and therefore you have access to everything on university computers so that gives you the Internet and things like SPSS.<8,71>

The increased use of the network by this growing number of users can have a detrimental impact as noted below.

NetMeeting was one which didn't work. When there were a few people on board,

it worked fine but when the whole class got on board, I didn't find that it worked very well at all. I found some difficulty in downloading some of the material I prepared into that space. <2,105>

Sharing equipment in laboratories presents its own set of problems for those faculty wanting to use CMITs in less endowed departments.

I would say that in those instances when I've used them for the first time in a whole class in a computer lab situation, the computer has not detracted from the learning experience. Given the technical challenges, it has been good. The problem that I've had actually with maintaining my teaching in the computer lab has been that it has been a shared facility; you go in for a hour, then another teacher would come in and teach a completely different course, so on, all week long. There would be one or two hours available when faculty could go in and update their materials but because it is a shared system there is always a threat that your material might not be there when you come in. We tried to mitigate by having two identical teaching labs so if one is not functioning you can use your materials in the other. Nevertheless, you see, typically, the equipment would be upgraded and not necessarily with full communications with everyone concerned. <7,127>

Dealing with the changing organizational setting before a sound infrastructure is in place can be a significant hurdle for eager faculty wanting to get involved with CMITs. With the enthusiasm shown by these participants to get involved in CMITs, the current hurdles of these myriad processes are not insurmountable.

### **Teaching**

The participants view the impact of CMITs on their teaching habits in different ways. While most are positive, the impacts range from simple mechanical, logistical aspects to complementary modes of course delivery to extensive, varied approaches for students to use.

### **Degrees of content/interactivity**

The use of CMITs in instruction can be seen in what type of information is given on the web pages and what activities are incorporated. Comparing the breadth of information provided electronically and the format of the courses described on web pages provides several insights. Figures 4.1 through 4.4 illustrate the subjects and the CMITs used by the participants. All the participants use e-mail to promote two-way communication. None of the participants use video or audio conference software on any regular basis. What is

evident is the use of web sites as an organizing tool not only for communication but also for information dissemination. A closer look at the actual web sites used suggests several groupings of web sites from simple, general information provision to complex interactivity. The varieties of use of web sites include:

- a web site of general course administration information.
- a web site with course information, course notes and/or links to other sites,
- a combination web site and/or CD-ROM with interactive components, and
- an integrated web site using course authoring software.

The advantages to both faculty members and students is evident to all participants even the one who doesn't have a web page at the moment.

I'd like to create a web page for my course and put the course material on the web in terms of course description. <1,144-145>

... a lot of background information can be put on the web where it is accessible to the students. If the students says, "what was the assignment last week"? Go and look at it. "What were my marks"? Go and look at them. So that we can remove a lot of the dull administrative stuff that gets in the way of class time. <7,163>

One of the participants who uses special software (SPSS) and who has a web page for general course information suggests that there has been a mechanical change when employing CMITs in his teaching. He notes the following when asked about change.

Has it changed how I teach? Yes, but in mechanical ways, rather than making up overheads now I'm more likely to make up a Powerpoint file and display that in a faster nicer form. I can also take another version of that and make that available to the students faster. It's the same information made available more graphical.<8,177>

Nevertheless, as he notes in the following comment, he now has the ability to focus where he wants and where the students ask.

I've actually realized the last year or so that I don't have any more statistics, I'm actually covering more of the content of the course because I'm not spending time teaching how to use the computer. So that's been quite an innovation. First off, it was an innovation to be able to use the computer at all because that gave us access to large data files. <8,139>

So some of those things that I used to do or say that I just can't take the time to rewrite that overhead now, I can do that. So I can accommodate more of the

things that students ask for because of some of the technologies. <8, 185>

This is also reflected in the LAN course, where having a computer presentation module for one part of the course allows the faculty member to have the students use it on their own time. In addition, this lets the faculty member increase the course content by providing new material in the class time usually taken to explain the LAN component.

We used to spend class time on that [LAN module]. Now they do that, they've got some lab time, but they have to do it on their own. And now I've got more time to spend on other things. It was a very, very full, it's still quite full, this course. But now we have a little bit more breathing room, and now we can do some more group exercises and things like that in the time we've freed up.<11,326>

Others also recognize a difference in what they can do with the course. In effect, the whole concept of a lecture changes as one faculty member notes.

I love it that I can wake up at three in the morning and think, 'Oh, shit, I know what I said in class today. What would be really interesting would be this.' And I can just add it in. And I don't have to feel any guilt that I forgot to point to it at the critical moment in the lecture. The lecture's no longer bounded by itself. It's opened up. So that each one of my lectures, there's a classroom event that takes place over three hours. But then in fact the lecture might get spread over the whole year. Do you know what I mean? <12,145-146>

The impact is not one sided. Others see a difference in their students and the changing needs of their students.

There is a different expectation. The students are able to digest more now ... certainly their exposure to the web and what it leads to has given them a different perspective on material that I'm trying to get across to them. I have to be sure that I'm giving them material that is going to be of use to them. <2,135>

One faculty member sees a profound impact not only in expanding what can be done in class but in allowing her to do more of what she wants to do with the students; more face-to-face discussion is the real substance of her teaching. Her expectation is also that her students do more on their own with the CD-ROMs.

There's nothing that I can do in the classroom that I can't do on the CD and I think better, other than the interaction which I hope will come. I think once the students get used to it, they'll come to the lectures for that reason.<6,72>

She can also respond to student's requests for a different mode of delivery now that the content is on a CD-ROM.

Students who want to take this course on a part time basis, I had an enquiry from a student who phoned me up and said, "I heard this was possible, is it true"? I said, "Yes." Because she's working, she lives out of town but she has one more credit to take and then she has her degree and she said I'd love to take this course this way. I said. "You still have to come one day every 2 weeks for your lab." She said, "Fine!" She can arrange for the three hours. <6,78>

The extension of the use of the web pages and e-mail interaction is most evident in participants 4 and 9. For the first participant, the technologies facilitate collaboration amongst faculty and students at several universities. While the course content is delivered over the web and via CD-ROM, there are still small-group activities at each university. For the second participant, the course authoring software provides many integrated functions from course administration to sub-conferences to chat groups and for both synchronous and asynchronous communication activities. In this case, course content and all activities are conducted via the web. In both cases, the participants have found a means of developing interactivity and of gaining an unexpected degree of contact with their students.

It's because of the technology, this gave me more time. This made me more accessible to the students. And as a result of that, we're building more human relationships between students to students, students to professor; team to professor; students to students at other sites. All these human relationships that we've taken to degrees that I would have never anticipated before. <4, 215>

So this opens a lot more avenues, I think both for professor and the student to see things differently, experience things differently, and to interact in new ways. <4,183>

My comfortable assessment is that by far the majority of the students are far more involved in interaction with other students than they are in a regular classroom. <9,123>

Among all the participants, from the one using e-mail to those providing course information and to those having interactive modules or complete web delivery, there is an excitement which carries them across the many hurdles. This enthusiasm for new

technologies does not come without a healthy dose of skepticism. Gaining access and facility with new technologies comes with underlying practical concerns and some worries as reflected in the following;

The principles of putting together a good class have not changed at all I don't think, the principles of doing research have not changed. My ability to do a literature review is faster now although I have access now to a lot more stuff that's plain garbage. There so much noise now on the Internet that actually slows me down, that slows the students down, I get worried especially with some of the undergrads who find garbage and think it's valid. They go off at a tangent because of some of the material they find on the Internet. <8,186>

This is not to imply that the participants do not try various CMITs and drop those that are either not useful or that are too difficult to use!

It (CoSy) might have helped me understand the culture when I came, but in terms of getting my own work done it wasn't all that useful. So in a sense what CoSy did really very well hasn't held up all that well as an activity that I have time for any more. I mean I can do that, I can go onto listserves and all that, but I've actually deleted my name from a number of listserves because I couldn't keep up with the information any more ... My opinion is that what CoSy was designed to do and what it did well hasn't necessarily held up with something that people want to spend a lot of time on.<8,152>

Then I started having part of these modules onto the web but I was not happy with the speed, there were still limitations in terms of what you could do over the web... <6,43>

Video conferencing is way too complex a technology. The procedures are much, much too complex for general teaching use. So we have to reduce the amount of technology, procedures that it requires by making it with a simpler interface; less procedural. <3,57>

## **Policies**

The participants are quick to mention the need for general commitment from the department and/or university followed by a series of enabling policies. Having phrases in university mission statements is only the first step. It is not uncommon for university mission statements to commit themselves to the highest standards of innovation in pedagogy. There is also a recognition of the transforming nature of technology on learning and inquiry and that those who do not take a step in the use of technology will be left behind. At the same time

there is often the perception that perhaps universities have not seized upon these opportunities yet. Policies and actions are necessary to support movement into these new activities.

What is needed is long term commitment. As one participant notes, much could be lost without continuing support to new technologies.

First of all, it's an arena for coordination of all the skills that people have with the people who need them. And it's the establishment of an awareness in our, in all the faculty that is there. And the encouragement of people to use it. Well, if it's only been there for three years, it's mostly been information finding and setting up, and network setting up. What we need is some kind of long term commitment to this as a way to go from our university. <10,416>

Another key element in the establishment of the use of CMITs is the provision of time and training help to learn the techniques.

Time. Time is the thing now. When I took my first sabbatical three years ago I was determined to get technical but it didn't work out that way. I just didn't do it. What would help would be release time. What would help would be credit, like official credit for technological skills.<10,404>

The university doesn't do a good job, and I don't think this is unique to [this university], they may have all kinds of fancy toys around but they don't make sure that the professors know how to use them well. They don't spend that extra time and money to train them and to save, to actually maybe do a bit of selling, marketing, and encourage people who do use them to lead a workshop. Let's be proud that we're at the cutting edge, let's celebrate our accomplishments. No! There's nothing like that and that community is probably what I'm missing.  
<6,134>

Some of the participants suggest that without a policy on intellectual property there is going to be little real development. As several participants indicate, the lack of a policy is problematic, but as participant 8 notes below, it is also matched by the need to recognize an obligation to keep the course going for the university.

The disincentives are things like ownership of copyright and intellectual property. Getting paid for, for use of developed materials before they go out for sale. I think that's being worked on, but we really need a policy statement.<4,381>

Right now, the intellectual property here at [university] still hasn't been straightened out. And I think it's our feeling that if we start to disseminate this

information and make it available on our web site then we're basically losing our, any right to it as intellectual property. Once you make it public, it doesn't belong to you anymore.<5,716>

Intellectual property - very important. There needs to be a policy on security. If nothing happens pretty soon, I'll pull everything off my web page and let the students start screaming.<2,164>

In terms of who owns the material over time that's an issue that's under discussion. The whole intellectual property issue is very controversial but strictly speaking, if you're going to say we want this course as part of your [department] calendar we have an obligation to keep that course going as long as it's in the calendar... <8,103>

Some participants, however, do not seem to mind the lack of intellectual property protection at the moment as the following comments indicate.

I have to admit that royalties to me at this point are very far off in the distance it's really on a cost recovery at the moment. I got these grants in the past. There are now conditions placed on these grants. They are given to me as a loan. I have to pay them back at the end of two years because I am making money or I (hope) I can make money with these CDs. <6,84>

... Intellectual property, I think, has not ever been discussed and I think that will probably be an issue at some point. At this point, I'm happy they're not obstructing my approach.<6,100>

There is a bunch of people here up in arms about security. Like who cares! Geees! Ha! Intellectual property is one thing and you haven't protected up until now, why are you worried about it now. Write a CGI script for it. It's no big deal. It's not as though these courses aren't given all over the place and there are books written about it. What's the big deal? I would not see that as a barrier to doing this kind of work. As far as I'm concerned, my course work is there for the public. Our students get direct benefit because I am here not because of my course material. They can read that stuff everywhere. <3,111>

A grating issue for some faculty members is the lack of recognition of work in incorporating CMTs into their courses.

Looking at techniques to improve the process of engineering education, to improve engineering education itself, I think that's valid research. And I think that's research that should be conducted within a faculty of engineering. My department chair begs to differ. <5,270>

For example, when our merit is assessed, or when we're looked at every year, evaluated, I don't think there's any formal way of recognizing technical skills with computers, or for faculty members who have added them on to their basic academic skills they were hired for. We're often told that our teaching counts. But I'm not sure how much it really counts in hard matters of our rating. The heaviest emphasis is always on publication. And people are having a difficult time getting electronic publications recognized. Even though they may work in a peer reviewed environment, there are still a lot of the people doing evaluations who are a bit suspicious of all this. They've never had to do it. They don't see why anybody should have to do it. They don't understand it. They have a lot of negative attitudes towards technology. <10,408>

They would get recognition [for CMITs] too. There's no question that if a person isn't pushing through the research, productivity and bringing in the research dollars then why are they are here. ... they would get recognized but it's not enough. ... On the whole a person is not going to get tenure unless they've got a strong publication activity and while this [web course] is a form of publication and there are new ways of looking at this form of scholarship it's hard to get past the juniors.<9,208-216>

Others see the lack of recognition of this work as being due to a lack of awareness among their colleagues.

It's just that they're not aware of what one can do, and a reluctance to even find out what one can do. And maybe it's a reluctance to want to participate regardless; sort of a closed mind. <2,413>

Authoring in multimedia is publishing. For example, the CD that I produced is a publication. It's equivalent to doing a book. Even the book publishers don't appreciate that. <4,409>

### **Summary remarks.**

The participant's comments throughout this chapter provide the substantive findings of the interview process and provide the basis for further analysis for the subsequent chapter. These twelve university faculty members provide factual data on their backgrounds and as a result provide ample detail of the diversity of their education and experiences. They open a view onto their characters and emotions by describing their teaching, their use of technology, and their quest for better learning environments for their students. This diverse group of participants present detailed insights into their thoughts on and concerns with the use of

CMITs. Their quandary over the possible detrimental impact on their workloads and on their students comes through clearly. Nevertheless, they remain positive towards the use of CMITs even in the face of these frustrations with technical and policy infrastructures.

The information in this chapter comes from individuals but the sum of it exposes facets of the larger organizations within which they are imbedded. While they come from several universities, they proffer similar concerns with and illustrate much the same intent and process in dealing with the use of CMITs. These Ontario university organizations are of a mould and these faculty members show that in the quotes above. Challenging the old ways and calling for new policies is a daunting role for many. These faculty members nevertheless, provide ample example that they are up to the challenge.

## **CHAPTER FIVE**

### **SUMMARY AND DISCUSSION**

This chapter provides a recapitulation of the study with a review of the purpose and methodology, an assessment of the incorporation experiences, an appraisal of the issues, processes, and patterns, and an analysis of the implications of this study. In addition, throughout this chapter there is also consideration of the many changes in outlook of this researcher during this research.

The purposes of this study, as noted in Chapter One, were threefold. The major purpose was to explore the experiences university faculty members had as they incorporated CMITs into their courses. The second purpose was to elucidate the processes which occurred for these faculty members and to draw patterns out of these processes, insofar as that was possible. The third purpose was to outline the range and significance of the items considered and/or influencing faculty members during these processes. The fit of these facets with this researcher's personal interest and work experience ensured ongoing enthusiasm for the topic and valuable work-related insights into the challenges facing university faculty members.

Addressing these aspects not only illustrated to this researcher the challenges facing faculty members as they ran their courses but also the variety of approaches they took and the energy they mustered in overcoming the challenges. The faculty members also showed that while they were often dealing with the mundane equipment breakdowns and institutional procedures, they were always thinking about their students and how best to address their concerns within the confines of the course goals. They proved that there were no right or wrong routes in education but a selection of many more or less successful ones. This researcher, at the start of this study, had definite ideas of outlining good and bad practices but after listening to the experiences of the faculty members recognized the error of such a shallow approach.

Examining the incorporation process was also an awakening for this researcher. The process was not one monolithic one but many sub-processes. Coming to the research with a

simplistic, structured approach that saw a systematic course development process as the norm, this researcher struggled with a major change in outlook. The initial approach to this study was to use an instructional design approach, to assess the significance of course development parameters, and to look at this instructional design from the perspective of stages of technological development. Coming to grips with the objectivist versus constructivist literature resulted in a critical reassessment for this researcher. Examining the introduction of technology literature also suggested a shift from clear cut stages to a diffusion of innovation perspective. In addition, during the period of developing the thesis proposal, this researcher was also involved with the EVNET project and immersed in interviewing a number of faculty members on their use of technology based learning. These interviews signalled a need for this researcher to change the relative emphasis away from a systematic instructional design focus to an exploratory survey that was experiential in nature. Considering the changes in the drafts of the thesis proposal from definite modelling to exploring experiences also illustrated this change.

It was with this change in perspective that this researcher decided to scale the approach to a small number of faculty members and shift towards a less structured interview process. Capturing experiences and personal insights required, in this researcher's view, an open-ended conversational approach to gathering of data. The two pilot interviews were also instructive in confirming the validity of this change in relative importance. The faculty members appeared to appreciate this approach in that they had little difficulty addressing specific questions, extemporising on many of the issues, or appreciating the value in their discussing CMITs.

The data gathered provided many specific examples of issues or factors which the faculty members found important in their incorporation of CMITs. To generalize from these few findings would be difficult to justify. However, this researcher concurs with Hiscocks (1997) when she notes, "it is expected that the experiential aspects, through the use of thick descriptions, will resonate with the reader, providing for naturalistic generalizability" (p.202). In discussions on the incorporation topic with many faculty members during this current study, this researcher has commented on the issues raised by other faculty members in this

study and been greeted by a nod of affirmation of similar experiences.

### **Incorporation experiences reexamined**

The following recapitulates the faculty experiences from three main perspectives: issues, processes, and patterns. The focus is on the overarching elements of these suggested by the interview data and drawn together by the thread of technology or, in this case, the use of CMITs.

#### **Issues**

The language of the three main perspectives outlined in the review of the literature are not directly reflected in the interview data but exist there nevertheless. The seesaw between objectivism and constructivism is not waged in specific terms but is illustrated by the shift to a learner-centred focus by faculty members and their attempt to change their teaching approach to fit this constructivist approach. This is expressed in terms of the educational orientation and in specific concerns with incorporating CMITs. The importance of instructional design procedures and the factors influencing this design is less of a concern to these faculty. In addition, the idea that technology is important in and of itself is present but not upper most in the views of the faculty. The pragmatic focus of the use of technology to resolve a problem or ease their workload is paramount in all faculty members. The following three topics of educational orientation, instructional design and technological perspective describe the relative emphasis coming out of the interviews.

#### **Educational orientation**

Figure 1.3 outlines the overlapping continua around which the interview data group. In studying faculty experiences, such a series of orientations are helpful guidelines. Understanding these orientations and their particular facets pinpointed seeming discordances within faculty members and suggested routes for further analysis.

An objectivist-constructivist duality is present within the faculty members. There is a recognition by the faculty members of the shift in focus towards student-centred learning, to provide contexts for learning, to facilitate the integration of new knowledge by the student, and to emphasize discussion and critical thinking. However, there is the continuing quandary over moving in this direction and dealing with the conservative university

procedures moulding course development, content, and grading. The ease with which some of the faculty members talk about the use of 'hurdle learning' and a 'mastery learning approach' plays counterpoint to other comments about the 'celebration of learning experiences,' 'stretching their minds' and 'developing in them the ability to resolve problems not dealt with in class.' When the context of subject and of course level is considered, this is not an unexpected dichotomy. It is a dilemma faced by faculty members who teach both lower level and upper level courses and who want to transpose higher order thinking to the lower level introductory courses. If viewed in light of Jonassen's (1991b) model (see Figure 3.2 - Stages of knowledge acquisition - construction), faculty members who use the web-based, 'info-dump' model as a method to reduce in-class lecturing and to increase group discussion, expect a great deal from beginning students who have neither the skill nor the ability to integrate the new information nor put it in context. There is a need for faculty members to have a clearer sense of the implications for learning, teaching, and class administration procedures of this shift to student-centred learning.

The full breadth of the outer-inner person continuum as outlined by Miller (1983) in his ideas of orientation is evident in the faculty members. The faculty members see this transmittal process being successfully accomplished through the CMITs of listservs and web pages. The use of CMITs as a method to 'reduce note taking' and to unload the 'info-dump' components of lectures is a clear benefit to student and faculty. The web page advantages of accessibility and as a source of answers for mundane, frequently-asked-questions are clear to all. The web page is an excellent complement and/or substitute for printed course information. This one-to-many function not only reduces faculty dealing with the same questions over and over again, but it gives the students a sense of easy access, control, and independence.

A major objective of the faculty members is to move away from the one-way, from teacher to student, transmission of information towards a more stimulating interaction with students. The transactional process is evident in the faculty members' focus on the analysis and comprehension of empirical knowledge and the ability to solve an array of problems appropriate to the particular discipline. The key purpose of education often mentioned by

the faculty members is to provide students with both this base of knowledge and an array of problem solving skills that would benefit them as professionals.

The faculty members often talk about transforming the students into able professionals with critical thinking and problem solving abilities. The push is to broaden the perspective of their students, to develop a creative team approach to relevant problems, and to heighten the importance of relevant connections among issues. The focus is however, on the cognitive abilities with little attention to the whole person or to the complementary growth in intuitive and emotive abilities. Only in the nursing faculty member is there an indication of a need to move into this transformational realm as a precursor to dealing face-to-face with their patients. Of the three orientations, the transformational orientation has the least resonance within the faculty members in this study. With regard to the first two orientations, there is a desire to get out of the transmission process and move to the more stimulating transactional orientation.

### **Instructional design and the use of CMITs**

The use of systematic course design methodologies, the implications of moving to a different delivery mode, or the impact of CMITs on course design are not significant issues of concern to these faculty members. This may result from the newness of the most predominant CMITs used, e.g., e-mail, web pages, the Internet. It may also be that the faculty members may not have had enough time because of this newness and/or because of their heavy workload to reflect on the implications of their use of CMITs.

There are nevertheless, many reasons noted for use of and concerns about CMITs. Some of the most often noted reasons are improved communication with students, accessible course administration information and assignments, reduction of students taking notes in class, and enhancement of the course to hook the students. Conversely, there are a number of concerns voiced with such use. Some concerns often noted are increased workload on students to learn software, lack of access, insufficient technical support, costs of equipment, and intellectual property ownership.

The overwhelming reason mentioned by the faculty members for their move to the use of CMITs in their courses centres on the need to reduce their workload. The use of e-

mail is a complement to face-to-face interaction and does not require any significant change. It does reduce paper work for those who do not need to have a print copy. The use of Powerpoint as a replacement for overhead slides is convenient for those who repeat their lectures often but a hindrance for those faculty members who like to draw on their overheads as they talk. The use of a web page is considered a substitution for print by an electronic format. None of these require, in the faculty members' views, a significant change in teaching practice or course design. Perhaps the lack of impact is, as noted above, due to the short contact period with CMITs. To extrapolate from Green and Gilbert (1995), most faculty members are still in Stage 0, experimenting with technology at the substitution level and not doing enough reflecting to suggest a rethinking of their teaching or their courses.

A significant change in course design and development does come with the move to a more sophisticated use of CMITs such as CD-ROM production or complete web delivery. In the first instance, a project management methodology or new product development process is evident. This requires a considerable up-front determination and specification of the learning outcomes, sequence of content, interactive components, relevant multimedia, communication or technical support services, and costs. Neither of the two faculty members who produce CD-ROMs use any formally published instructional design template or methodology. In the second instance, complete web delivery, the use of a computer course design template is evident. This faculty member uses Virtual University as modified by his university to develop and deliver a distance education course on sexual behaviour. In developing this course, the faculty member must stay within the predetermined template and set methodology for delivery and on-line testing. In both these instances, final testing is done off-line by examination held at a specific venue and with a proctor.

Ironically, while there is no significant impact, outside the two instances mentioned directly above, on formal instructional design processes, there is a nagging concern about workload. The crossover use of computers from professional activities to teaching activities is a very common occurrence. As the faculty members make this transfer there is an expectation, noted above, that computer use should save time and reduce their workload or enable them to cope with the increase. There is, however, an unrealized opening for the

students to converse with them through electronic means. The success of this connection increases workload! In addition, there is an increased need to spend training time learning new software and revising and reformatting content. A technological solution prompts new activities that require new technology. The treadmill continues!

### **Technological perspective**

The philosophical insights by these faculty members into technology and education are few in number and cursory in nature. The definition of technology is not of great concern to them. In the view of the faculty members, one object defines technology, i.e., the computer. They are positively disposed to the use of technology, not unexpected in a selection of faculty members who use CMITs. These technophiles do have concerns with some of the financial, ownership and implementation issues but do not get deterred by philosophic or pedagogic aspects.

Assessing the impact of technology on course development is difficult at this early stage. While there is an 18-year range in use of CMITs among the faculty members, the majority have six or fewer years experience. The two who have longer experience have essentially used only one product for most of those years. The recent and great activity is concurrent with the development of web browsers since mid 1992. Pragmatic and technical issues confront these early adopters in their attempt to transfer their general computer skills to teaching. Taking a technology transfer perspective as noted by Rogers (1995, p. 142) suggests that there is definite knowledge or awareness of information technology but that the actual use of the technology presents significant obstacles. This use of the technology requires, Rogers suggests, a significantly more complex and difficult level of knowledge than just being aware of the technology. For instance, these early adopters must learn the technology and deal with skeptical colleagues and administrators. It is not surprising to learn of the low teaching use of some CMITs. While many faculty members use e-mail, fewer graduate to more sophisticated CMITs such as presentation software, courseware templates and still fewer move onto video conferencing for use in their courses. Faculty members actively involved in incorporating CMITs into their courses represent a minority ranging from 5% to 43% as noted by Proulx and Campbell (1997, p. 2) and from 10% to 25% of the

faculty members within the local universities in this study. However, the need of this minority for large amounts of financial and technical assistance puts added pressure on chairs and deans to focus support. As a result of this, the faculty members noted their isolation within departments and the use of their own resources to foster their incorporation of CMITs. Any move to commercialization, a high level of technology transfer, would require considerably more investment of time and money and would likely heighten the internal strains and strengthen any process towards marginalization that has already begun.

### **Processes**

The second main perspective in this reexamination of the experiences deals with processes that the faculty face during their incorporation of CMITs into their course. There is not so much a grand transformation as there is a slow modifying drift within the set of current processes. There is not so much a jump to different models of teaching and learning relevant to CMITs as there is an integration of the new technologies within the current approaches held by the faculty irrespective of the compatibility of the approach or technique. There is not so much a sea change in instructional design as there is a substitution of computer technology for slides and blackboard or the use of e-mail as a complement to face-to-face communication. There is not so much a clear and rapid movement through stages of development as there is a diffusion of ideas and processes on a number of levels within each educational organization. Drawing from these, the significant evident processes are innovation diffusion, technological substitution, technical infrastructure development, and strategy and tactic formulation and implementation.

### **Innovation diffusion**

The two diffusion of technology studies noted in Chapter Three (Proulx and Campbell, 1997; Anderson et al., 1998) provide insights into faculty members at Mount Allison University and the University of Alberta. These two articles describe extensive surveys covering all faculty members at their institutions and as a result consider the whole array of faculty members from early adopters to laggards. Many comments by the twelve faculty members in this present study reflect the findings of these two earlier surveys. One reflection of the Proulx and Campbell study among the faculty members is that there is a

significant perceived need for a computer, the loss of which would be detrimental or debilitating. The high usage of computers for word processing, calendars and e-mail as noted by Proulx and Campbell and Anderson et al. is universal among these twelve faculty members. The polymorphous nature of computers comes out in both these earlier studies and this study of twelve faculty members. All faculty members use computers in their professional activities, in their administrative duties, and in some of their teaching endeavours. Considering world wide web use, it is clear from the University of Alberta study that there is certainly a high awareness and use with the browsing and searching level at 90% (Anderson et al., 1998, p. 78). However, the indication for the creation of web pages or the use of course authoring software falls down to 40% and 24% respectively. If one looks at what is available from the home pages of the three local universities in this study, similar low levels of web page use in teaching is apparent. With regard to context, all studies suggest a need to broaden the scope when examining technology in teaching and learning. For instance, the adoption of CMITs “must be understood in relation to the overall use of computers by university faculty” (Proulx and Campbell, 1997, p. 1) and “is influenced not only by the availability and reliability of useful tools, but also by the cultural and social conditions in which the technology is applied” (Anderson et al., 1998, p. 72). This current study which started with a narrow focus also quickly saw the necessity of looking at the incorporation process as an amalgam of processes.

There were several differences between the two larger studies and this smaller one. These may be due to the first two being studies of populations while the latter is a small sample chosen for diversity within a group already using CMITs. The criteria for inclusion in this smaller study were faculty having a web page for a course, faculty having had time to reflect on the use of the web page and other CMITs incorporated, and keeping a balance between male and female faculty members. After this came a concern about having a variety of subject areas. Of less concern to this study were criteria such as the age or rank of the participants (See Figures 4.1, 4.2, and 4.3). Compared to other faculty members at their institutions and those who are using CMITs, this group of twelve faculty members could be designated as early adopters. This is not unexpected because of the selection method of this

study. In the Anderson et al. study the early adopters tended to be younger than the mainstream faculty, were more likely in the Sciences and Engineering than the Arts, and were probably at a lower rank than the mainstream. However, nine of the twelve in this smaller study were in their mid 40's to later 50's, were associate or full professors, and had tenure. The two engineers, one in her early 30's and one in his late 40's, did not have tenure and were either an assistant professor or on contract. In this small study, it was the tenured faculty who felt free to experiment with CMITs. This differs from the generalization in the Anderson et al. paper (p. 79). While some of the tenured faculty commented on the lack of recognition of work in incorporating CMITs within the tenure criteria, it was the younger assistant professor who said that she could not afford the time to do more incorporating because of the call on her to do research and publish. In the Proulx and Campbell study there is a suggestion that "One of the themes associated with the possibility of the widespread development of the use of computers in education is that the classroom will be de-emphasized and transformed" (p. 13). While the twelve members of this small study recognize the impact of CMITs there is a unanimous feeling that the classroom will not be de-emphasized but rather re-emphasized through less lecture and more discussion.

While the number of faculty members included in this study is much smaller than the first two, it is instructive in showing a wide variety of distinctions. Within this group there are some faculty members who are not only aware of but have adopted more sophisticated CMITs for their courses. This divergence is highlighted in Figure 4.4. All twelve faculty members are aware of and use e-mail to communicate with their students. All but one have a web page for their course and as a result almost all use HTML to edit these pages to some degree. Those two who have web pages and don't use HTML have students or departmental help to do the editing. It is at the next level of difficulty and/or cost that the number of faculty members who actually use the software or hardware for their course diminishes. For instance, there is a cost hurdle facing institutions when moving to software such as VLT, Virtual University or WebCT. Not having the technology readily available often precludes the faculty members from adopting it for course use. This contingent decision is the first hurdle that faculty members who want to use a technology must face. There is also a time

and workload hurdle for the faculty members who must learn how to use the software, maintain the information, and keep up the discussions. While six of the twelve faculty members use Powerpoint and multimedia tools, there is concern voiced with the inflexibility of the software and the length of time to learn it. As noted in Chapter Four, Powerpoint does not allow ready modification to fit the faculty member's teaching approach. In addition, another faculty member noted that without a great deal of work Powerpoint does nothing more than provide colourful overheads. The added work is just not worth the effort. Similar feelings of frustration are expressed with regard to video conferencing; there is a great deal of time required to perfect a presentation style suited to this activity. While three faculty members use video conferencing, they use it only on an irregular basis. The faculty members in this small study are not blinded by their technophilia into adopting all CMITs without careful consideration. Geohagen (1994) describes the traits of his groups well but when describing early adopters as 'risk takers' and contrasting them to the 'pragmatists' within the early majority, he does the early adopters a disservice (p. 6).

This small study suggests that the early adopters reflect many of the same concerns of the mainstream faculty. Anderson et al. reflect Geohagen's reasons in explaining the inability of moving the adoption of new technology into the mainstream. While Geohagen tends to a categorical approach, Anderson et al. are less so. This may be as a result of Anderson et al. being closer to their study population or situated in the context within which they work. Anderson et al. talk about the "technologists' alliance" being composed of faculty outside the early adopter group and that the alliance can better be explained by exposure to technology rather than "attitudes associated with early adoption and innovations with educational technologies" (Anderson et al., 1998, p.83). This small study of twelve would suggest that all the early adopters are not within this alliance either. The isolation of some of the faculty members in this study suggest that they feel marginalized and not part of any alliance. This may stem from a slight twist of another reason that Geohagen and Anderson et al. mention. Running through the twelve faculty members' comments is a sense of what might be called an alienation from the mainstream. This is illustrated by a feeling of isolation from other members of their department, a lack of recognition of their work in CMITs, or a

lack of technical or administrative support of their activities. The reasons cited by Anderson et al. as a lack of compelling reason to adopt a new technology are barriers or disincentives facing any adoption. Examples of these formidable hurdles are a lack of time or of training and technical supports, or the already heavy workloads. These are not peculiar to the mainstream, in fact, as early adopters push to adopt or incorporate new CMITs they often face much resistance from administrators who do not readily recognize the benefits or are harried by many other more demanding issues. This small study of twelve is instructive in bringing out many of the issues contained in the literature and in indicating that over generalizations and stereotyping heighten artificial differences.

### **Technological substitution**

Technological substitution is not an uncommon process especially in early periods of technology transfer. Proulx and Campbell (1997) call this crossover. Faculty members use word processing and e-mail in their scholarly communication prior to their use of these in their teaching. The use of e-mail to complement face-to-face communication in regular day classes and to supplant it in distance education courses is the usual extension of their scholarly professional activities into their teaching. In a similar fashion, the use of the Internet and web pages complement or replace printed course administration or reading materials. While there is little or no impact on course design, there is impact in increasing workload for faculty in responding to student e-mail, in needing training with new software and hardware, and in a growing call for costly upgrading of equipment.

### **Technical infrastructure development**

Once on the road of using CMITs, one is also on the road of upgrading. The two faculty members who have made long term use of CMITs note the continual upgrading to newer versions or to newer more advanced software. Without the use of an upgraded software package one faculty member found that it was impossible to teach the course and reverted to simply telling the students what the computer process was. Without the most current computer software, teaching was a debilitating experience for him. The other long term user of CMITs noted the continual need for upgrading equipment and software. Either the push came from faculty learning about new software or from students who had much

better software and hardware at home. The bandwidth problem was also a continual frustration for administrators who were continually asked for more money and for faculty members who wanted to use the most current multimedia software.

### **Strategy and tactic formulation and implementation**

The previous examples point to the continuing tension between cost conscious administrators and enthusiastic, innovative faculty members. Having a mission and statement of objectives focussing attention in a specific direction but not having a budgetary allocation can become more of a disincentive than an incentive. For instance, middle management feel the tension over issues of distributing tight resources to all their colleagues at the same time as being pushed by administrators to focus development of web-based courses in order to increase accessibility and revenues. Often coming on the heels of such mission and high level objective is an active minority who wish to move to web-based delivery for part or for all of their courses. However, the faculty members note, there is not the follow-through from their respective deans or chairs in providing support to facilitate this movement. Middle management operational action lags far behind upper level management strategic formulation resulting in stress for early adopters and barriers for the less adventuresome followers.

It is in this arena of technological change management that university administrations might benefit from studying business approaches. Similarities may be drawn between the elements in the Stark model and the seven variables in the McKinsey approach. Included in both is an examination of elements, such as organizational mission, organizational structure, and characteristics, values, and skills of staff, faculty, and students. They illustrate the use of a general systems design approach whereby the whole is divided into parts and treated separately. However, the parts may take on a life of their own to the submersion of the overall process. Whether or not the focus is an examination of course design processes or strategy formulation, the real value results from a synthesis of these elements. It is through the combination and the consideration of the characteristics of the users of the technology with an understanding of diffusion processes that successful formulation and implementation can be facilitated.

The insights of such authors as Rogers, Moore, Naisbitt, and Gilbert and Green contribute to an understanding of the integration of processes and people. Rogers provides the framework within which to view the diffusion of ideas and processes. Figures 3.6 and 3.7 summarize his work on the variables which impact the rate of diffusion and on the decision process. Rogers stresses the importance of the social setting and the concept of different types of adopters. Moore focuses on characterizing these adopters, outlines the differing values and needs of these adopters, and suggests ways to bridge the gaps between these adopters. Naisbitt and Gilbert and Green focus on stages of development in which the users of technology might find themselves. Their generalized approach provides another, simpler frame within which to view the integration of technology into organizations and specifically higher education. Their approach is much more forceful in portraying the general characteristics of each of the stages and the change process that occurs as people move through these stages. Understanding these insights which are not buried in technological jargon would provide administrators with valuable alternatives in support of the use of technology and thereby synchronizing formulation and implementation of CMITs.

### **Patterns**

The third main perspective in this synthesis is that of overarching patterns. There are two main topics into which general patterns may be grouped, i.e., subculture traits and technology introduction. The patterns of traits among the faculty members as noted earlier might be considered a 'subculture' within their universities. The patterns within the introduction of technology include elements of what is introduced and how rapidly it is introduced as well as the costs to and benefits for community members of this introduction. The faculty members while not talking in these terms illustrate them in their comments on organizational culture, on courses, on colleagues, and on their perceptions of technology generally and CMITs particularly.

### **Subculture**

The personal traits of the twelve faculty members in this study suggest an enthusiastic and energetic group of people who are keen to look at different ways of keeping the excitement and the pleasure in their teaching while bringing valuable, alternative learning

experiences to their students. Seeking out new routes to accomplish this rejuvenation brings many challenges and dilemmas. Most of Geohagen's characteristics of early adopters are reflected in the twelve within this study. Geohagen suggests early adopters are in favour of revolutionary change and are risk takers. However, these two traits are not exhibited by the twelve in this study. All but two of the twelve are tenured and so have the ability to learn and use the CMITs with little, if any, direct impact on their livelihood. One of those without tenure notes that she does not want to waste time on trying more CMITs because research and publishing are more important at this time for her tenure aspirations.

Notwithstanding these two characteristics, the twelve do reflect Geohagen's work. The members of this small sample illustrate a vision of the potential of CMITs yet are pragmatic in their approach. They incorporate CMITs because they expect a reduction in logistics and administrative/clerical work in the long term but also want to provide students with alternative learning approaches and some control in how and when they do their learning. While they are enthusiastic about the technology, they still require some benefit to accrue from their time and effort. Their positive disposition toward technology does come through in that they do not have to have proven applications but are willing to experiment on their own. The members of this small study group do have connections beyond their own departments or institutions, the horizontal connections noted by Geohagen. In addition, they play a leadership role in their departments. They are the first in the department to try new CMITs or old ones in new ways but as a result may conflict with rules or practices, and may often question policies and procedures. These aspects may be the precursors to a feeling of isolation or marginalization but their intrepid nature heightens their profile amongst colleagues who in turn often turn to these early adopters for answers and assistance. Several of the twelve participants in this study commented on this dichotomy of feeling unwanted by some and wanted by others. It is a tribute to these early adopters that they stay positive and enthusiastic and respond to the requests of their colleagues.

### **Technology introduction**

As new technology is introduced the critical issues, reflected in the material above, centre on technical support and training, on workload issues, and on the growing concern

around rights and use of intellectual property. With any use of new technologies there is an obvious need for technical training and support directly related to their use of the CMITs. The faculty members in this study recognize this issue but go further in suggesting that there needs to be training to enable them to cope with the added workload such as that dealing with increased e-mail. The issues centring on rights and uses of the intellectual property were voiced by several of the faculty members. This issue is of growing concern as more literature talks of commoditization of education and the vast rewards that are just around the corner for those involved in delivering courses on-line. The twelve faculty members in this study are concerned about the need to clarify these rights and obligations to protect their reputation but none are mesmerized by the possibility of reaping vast rewards from the sale of their online products.

On another plane, an unexpected result was the perceived impact or lack of impact of CMITs. In the case of the two distance courses and the biology course which used CD-ROM, the technology was integral and complementary. For instance, in the case of the Space Craft Design course, the objectives were clearly defined, the design was modular and focused on the mathematics and physics of the subject and the content itself was clearly bounded information. The flexibility came in the collaborative work on top of the basic foundation. There was no sense that the technology limited the learning experience. In fact, there was an increased potential for learning and collaboration through the combination of online interactivity and the use of mentors at each university in the partnership. The case of the Sexuality course was similar in delivery except that there was no face-to-face component. The faculty member estimated that he had more discussion and interactivity on-line than he would have had in the face-to-face classroom setting. In the case of the biology course, the CD-ROM was designed to provide the content with the class component focused on discussion and questions. The other faculty members stressed their maintenance of the face-to-face aspect of their teaching and as a result did not see any need to reassess objectives or student outcomes as a result of incorporating CMITs; CMITs were complements of no real impact on course design. The students were able to get information more readily but there was no significant impact on teaching. Perhaps this lack of concern of objectives is as a

result of these courses being in the early stage of the use of information technologies.

In most cases, the faculty members illustrated a straightforward transfer of text and notes from paper to electronic form and so used the new technologies to perform exactly the same function as the older technology. Others tried more interactive e-mail sessions to stimulate discussion which led to continuation within the classroom. In other words, the faculty members' comments suggested that there was a change in delivery mode without significant revision of the courses involved. They were moving out along the CMIT axis without moving very far if at all up the course revision axis as described in Figure 1.5. What they were doing was changing the transmission mode of the information not changing their thinking in the face of new technologies. This seems to fly in the face of McLuhan's aphorism that the medium is the message or that the choice of technology has a limiting or directional component. Perhaps there has been insufficient use of the new technologies for the faculty members to notice or reflect on any such influence?

### **Policy implications**

Examining the experiences of faculty members and the related issues, processes and patterns within the incorporation of CMITs was valuable in highlighting relevant policy implications. This additional exploration into the incorporation process points to four areas flowing through the comments of the twelve faculty members. These four policy areas were:

1. Training and development of faculty members in both CMITs and in instructional design.

This is a recurrent theme through the literature and in the interviews with the twelve faculty members. The need for release time to play with and learn the technology is essential.

2. Development of a supportive technical infrastructure. The contingent decisions on network and systems design must be made before there is any attempt to assist faculty members move towards incorporating CMITs into their courses. Having faculty members involved in this planning is essential so that they realize the implications and limitations of the system. The implications of this are the need for the requisite funding for materials and equipment, for support technicians to help carry out design and production, and for instructional designers to assist in course development,

assessment, and updating. A corollary to this is the necessity for providing students with ready access to computers so that they may read the online materials.

3. Clarification of the ownership of intellectual property in electronic format. The establishment of an intellectual property policy is a key consideration so that ownership rights and uses are clear from the very start. This tactic is necessary to allay fears of exploitation of faculty and clarify the commitment by both faculty and universities.
4. Synchronization of strategy formulation and implementation at all levels. As with any strategy formulation there needs to be a link with budget and a promulgation throughout the ranks to balance institutional and individual priorities. Without all levels of the institution recognizing their roles, frustrations will continue as noted above.

### **Impact on the participants**

One of the positive aspects of carrying out such a study was the impact that it had on the participants themselves. There was a growth in the awareness of these faculty members in what CMITs were and where their work fit with regard to their colleagues in other departments and at other universities. Responding to questions and reflecting on the topic of CMITs over the hour of the interview gave the participants a new frame of reference in which to assess their work. Several of the participants acknowledged their leadership role or at least recognized that their colleagues referred questions and concerns to them expecting resolution, confirmation and/or championing.

Having an hour to reflect on their work and some of the implications led to outlining several dilemmas. The faculty members were moving to CMITs to help them reduce paperwork, improve communication, cope with workload and provide students with alternative approaches to learning. They were hoping for a more transactional classroom experience rather than continuation of the one-way lecture. In doing so, they opened themselves up to greater contact from students and thereby increased their workload. They also increased the proficiency of students in the use of the new media with the resulting increase in expectation by these students that more would be available. The biology

professor noted that she gave the students everything on CD-ROM and only expected to hear from the students when they had questions or needed to discuss sections of the course. While the faculty members wanted to emphasize the face-to-face component, a greater reliance on online materials seemed to be moving in the opposite direction. Will the students expect more online and less in the traditional face-to-face setting? Another dilemma was the use of online materials required the students to have access to the materials. Students with ready access from home and/or work were less limited than those students who did not have their own or ready access to computers. Some of the faculty members voiced concerns about the financial hardships that they might be forcing on students as more and more materials were available only online. This was of special concern when the use of computers was not across the curriculum. If this was not the case, the students might not get the full use and benefit from the computer. Putting more of their materials online also opened the faculty members to more scrutiny and a concern about maintaining current information. While this scrutiny and currency was part of scholarly communication, it put greater stress on faculty members to maintain their materials and to be technically proficient or hire others to do their clerical work. Connected with this move of course content to the web was the concern about loss of ownership and control over their intellectual property. This in turn required the faculty members to be more aware of the implications of using certain software or hardware. The faculty members had to become typists to input data and technicians to understand the vagaries of the software and hardware. The move to CMITs required faculty members to address a growing number of unexpected implications.

### **Impact on the researcher**

Through the course of this study on CMITs there have been several realizations and clarifications that, on the surface, may seem like major shifts in this researcher's outlook. These awakenings can be illustrated using the language from this current research. In working with information technology generally and CMITs specifically, this researcher had tended to take a direct product approach; implementing the product was the goal with more being better and newer being even better. The Contextual Filters Model (Figure 3.4) is a useful analogy for this researcher's approach; a bucketed analytical approach which tends to

dissipate the gestalt. A consideration of the larger social setting was not of paramount importance. The examination of the objectivist - constructivist approaches in education and diffusion of innovation in organizations offered a much firmer understanding of differences in faculty members' outlooks, of the vagaries of acceptance of new techniques, and the complexity of the incorporation process. In other words, the researcher experienced a movement from a fixation on product and outcome to an emphasis on process and a broadened social context.

The figures in Chapter Three are useful in examining this change. This researcher moved further away from the objectivist end of the objectivist - constructivist continuum (Figure 3.1) to accept a less scripted and a more learner-centred approach to teaching and learning. In Miller's terms this was a movement away from the typically transmissive to the transactional and toward the transformational orientations (Figure 3.3). Much of this move can be attributed to the works of Jonassen on constructivism and his pragmatic outlook as illustrated in this description of 'knowledge acquisition - construction' as outlined in Figure 3.2. This shift is also consistent with a realization of the complexities within the incorporation process and Rogers' work in diffusion. The magnitude of the variables that play a part in the adoption of an innovation (Figure 3.6) bolstered a view of the multifarious nature of the incorporation process. The decision process in Figure 3.7 also flagged the elements within the process and many of the challenging, often hidden assumptions. This researcher believes these aspects make for a more open and successful approach to the study and the use of CMITs.

This researcher has also had some time to reflect on the study and further develop his ideas about the use of CMITs. Meeting such enthusiastic and energetic faculty members who provided their time and insights was a pleasurable and excellent learning experience. It was evident from their comments that they are in the early use of CMITs and while they are not clear how CMITs are going to benefit them and their students in the long run, they have a positive outlook that the CMITs will be beneficial. Even though these faculty members comment on the newness of the online and web phenomena, they were leading the way into uncharted areas. Their excitement and sense of exploration were energizing. The eagerness

with which the faculty members shared their successes, failures, and concerns meant that this researcher too could maintain his interest in this fascinating topic.

### **Limitations of the research**

There were several limitations of this research. First, the unit of analysis was the individual faculty member incorporating CMITs into a course. As a result, the study was of individual people and their experiences not of each institution as a whole. The focus has been to draw out of the experiences of the twelve faculty members, the issues, processes and implications surrounding their use of CMITs in the specific time period of Spring-Fall, 1998. Second, there was not an attempt to justify or to negate the reasoning regarding the use of CMITs but to focus on experiences and the underlying issues. There was an attempt to use several sources to gather the information with the semi-structured interviews being the main source. The materials that the faculty members had available online and in print also served to provide background and corroborative evidence. This researcher also sent an e-mail question to the first nine faculty members to elicit further comments. There were no other steps taken to either corroborate the findings or verify statements. The experiences and readily available data were the sole sources. Third, there must be a caution on generalizing from this data. The small number of faculty at three universities precludes an extension to other faculty within the universities or to other universities. Nevertheless, many of the experiences and issues noted do resonate throughout the literature and amongst these faculty members in the three universities.

### **Implications of the study**

Heeding the caveat about generalizing from this study of twelve, there are, nevertheless, several insights that would be useful to others in their research on faculty members' incorporation of CMITs. First, this small study did extract many of the issues and concerns that were found in the literature. The insights of a few, diverse faculty members do encompass the high profile issues, e.g., the enthusiasm for information technology and its use in their scholarly communication, the concern for the impacts of using technology on their activities and the learning of their students, and the need for a balanced approach across the institution if CMITs are to have benefits for teachers and learners. Other researchers or

policy units might carry out similar studies without much difficulty and begin constructive action on their campus.

Second, the faculty members in this study were motivated by a pragmatic need to use technology to reduce workload or address some teaching problem. There was not a great deal of comment on educational approaches or use of any objectivist - constructivist terminology or formal instructional design processes. This is to say that these faculty members did not talk of these issues. They did, however, illustrate a keen desire to enhance their teaching, to address the individual learning styles of their students, and to accomplish these without a deleterious impact on themselves or their students. All of these faculty members expressed interest in learning more about how to use CMITs and to see how others were incorporating CMITs into their teaching to ease their students' learning. From their comments, these faculty members were attempting to move away from the transmission type of teaching and devolve more responsibility onto their students. To a considerable extent their approach was, as one faculty member expressed it, to use online material as an information dump, thus preserving class time for discussion. In order to move beyond this use of CMITs, the faculty members need to know more about how their students learn and how to enable them to learn at the various curricular levels. Using Jonassen's schema, noted in Figure 3.2, different approaches must be used for introductory, advanced and expert levels. Having a clearer understanding of learning styles and associated techniques to foster these styles would be very useful for faculty members in their use of CMITs. In addition, administrators and policy makers would find understanding of these issues very helpful in empathizing with faculty members and working with them to create an environment for success.

Third, associated with this latter issue is the one of awareness. There is a great deal of very creative work being done by faculty members as they incorporate CMITs into their courses. Incorporation ranges from the simple to complex and from general information storage to dynamic interactive courses. Universities could do more to celebrate this creativity and in the course of celebration spread awareness amongst faculty members of what is being done. On the three local campuses in this study, there have been workshops or

demonstrations to highlight some of these activities. Comments from the faculty members in this study reinforce the value of such displays of creativity and the need for this to occur in a regular fashion.

Fourth, the question of whether the incorporation process can be portrayed accurately by a schematic runs through this work. A model of the incorporation process is suggested in the purpose and several models are used as illustrations. One diagram, Figure 1.5, Relation of courses and CMITs - an initial view, present a beginning attempt at modelling some relationships within the incorporation process. However, within the context of these experiential findings and recognizing these as initial, exploratory steps, a more detailed model may mislead readers in jumping to conclusions or attributing normative values to the model. This researcher is especially wary of oversimplifying processes, of falling into the reductive bias trap, and ending in the same prescriptive approach with which he started. Proceeding with an open-ended approach in examining this topic and encapsulating the findings in detailed descriptions does not limit or constrain thinking but produces a richer understanding of the nuances of the incorporation process facing faculty members.

### **Future research**

Such a small study points to more work that might be done in examining and learning from the experiences of faculty members during their incorporation of CMITs. This type of grass roots work is especially important in these times of exaggerated claims about the move to distributed and distance education. Are the revenues waiting to be made? Are the faculty members going to lose control over their intellectual property to business minded administrators?

Working closely with faculty members on these issues might allay their fears as this researcher found out during this study. Without thorough analysis of the claims for and against incorporating CMITs or for moving to online education, faculty members are likely going to remain skeptical and resentful of any heightened pressure to move in this direction. Examining the "cultural and social conditions in which the technology is applied" (Anderson et al., 1998, p. 72), understanding the adoption of computer mediated learning technologies "in relation to the overall use of computers by university faculty (Proulx and Campbell, 1997,

p. 1), and recognizing the general “failure to develop a coherent and informed policy” (Conrath et al. 1999, p. 1) are three elements that would provide administrators with a clearer understanding of faculty members concerns and insights into supportive actions. De-escalating the rhetoric and collaborating for success are essential if post-secondary institutions are to move forward in use of CMITs.

### **Concluding remarks**

Post-secondary education is facing difficult issues, such as diminishing budgets, increasing demand for access, and growing expectations from students. CMITs and the Internet are seen, by some members of the university community, as viable methods of addressing increasing costs, of answering the call for increased access and of responding to the growing expectations of students for better technical infrastructures within institutions. While installing a computer and telecommunications infrastructure is expensive, it is seen by many as a cost efficient solution and at the same time as providing a means of transforming higher education for the 21st century (Dolence and Norris, 1995). By others, however, such a move is seen as the wrong one especially in the face of growing concern about the lack of sufficient understanding of the underlying assumptions of such a move, or clear assessment of the learning outcomes of such instructional techniques, or the beneficial impact on faculty members (Noble, 1998, Fall).

The experiences of twelve faculty members who were incorporating CMITs into their courses was the prime focus of this study. In addition, to their experiences, the priority in what they considered important issues were exposed, the multiple processes subsumed under incorporation were described, and the important policy directions outlined. In accomplishing this, both sides of the issue noted in the previous paragraph were addressed.

This research points out the value of several educational approaches and specifically focuses attention on the constructivist approach embodied in the Jonassen’s stages of knowledge acquisition-construction (Figure 3.2) and Miller’s traits within his meta-orientations (Figure 3.3). In addition, this study also uses Rogers’ diffusion work (Figures 3.6 and 3.7) and Moore’s technology adoption life cycle as perspectives in analysing the

experiences of the faculty members. Using this breadth of approach, this study has tied the theoretical framework with the practical experiences of these faculty members in order to synthesize an understanding of these experiences and advance the insights into the incorporation process surrounding CMITs. Somewhere between the extremes of 'damn the torpedoes full speed ahead' and 'sink the juggernaut before it dooms us' there is a balanced approach. It is this balanced approach that this study of the experiences of faculty members has tried to provide.

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## **Appendix A - The Semi-structured interview guide.**

**A. Background** - This section is for gathering specific but readily available information on your background, on your course materials and what supports are available to you in developing your courses.

### **Personal -**

1. Department -
2. Gender -
3. Age -
4. Highest degree -
5. Current academic rank - Tenured - Y / N / NA
6. Length of teaching experience -

### **Course -**

1. Title of course on which you will focus -
  - Level of course - remedial, general, intermediate, advanced
  - Course character - full-time/part-time, day/evening, degree/certificate
  - Course content - description, outline and/or notes
2. Year and term last taught -
3. Number of students last time -
4. What other courses have you taught -
  - Without CMI techniques -
  - With CMI techniques -

### **Technologies and Supports available -**

1. Describe those CMI techniques that are available to you. CMI techniques are -
  - E-mail -
  - Web - internet -
  - intranet -
  - course templates -
  - CD-Rom/E-books -
  - Linked classrooms -
  - Multimedia classrooms -
  - Others -
2. Support infrastructure that is available to you. Examples are -
  - Student profiles -
  - Course design -
  - Computer use -
  - Teacher development -
  - Others -

**B. Teacher background and experiences** - This section covers your background in using CMI techniques and your experiences with the technology.

1. Would you outline the history of your use of CMI techniques by focusing on your use of instructional technology prior to moving into CMI techniques specifically?

- Probe - extensiveness of use of technology in teaching and/or other venues;  
- experiences, positive and negative, with technology.

2. Would you describe your first thoughts about moving to CMI, the process of your development during the period of use of CMI techniques and any changes in your teaching over this period of use?

- Probe - the reasons for initial interest or use of the techniques;  
- philosophical assumptions, preferred teaching styles or expected results;  
- the use of the specific techniques incorporated.

**C. Course specific insights** - This section covers the development of the course using CMI; your views towards CMI; the link between CMI techniques, teaching, and learning; and your perceptions of the results of the experience. There is also a consideration of the changes in your teaching as a result of using CMI techniques in this specific course.

1. Would you outline the development of this course and the reasons for your use of CMI techniques in this specific course? Please focus on any change in your course over time.

- Probe - the stages of development or sequence of events in incorporating the techniques;  
- the instructional design elements - course objectives, links between objectives and techniques used, evaluation of outcomes, successes and failures;  
- the reasons for moving in this direction - seek reasons and examples - e.g., colleagues' views, peer pressure, administrative incentives, students' interests, teaching style, educational philosophy.

2. During the creation and development of this course using CMI can you describe any major decision points or singular events of particular note? Focus on changes in your use of the technology, new insights into the use of specific techniques, and any impact on your teaching.

- Probe - the impact of CMI over the longer history of the participants course development;  
- the relationship of any change or lack of change to the departmental or the institutional context.

3. Would you describe the course as you teach it now? Describe the course objectives, your teaching style in the course and if it differs from your other courses, and the learning

expected of the students.

- Probe - the context of the course in the participants' course offering;  
 - the relation of any similar course not using CMI techniques;  
 - the difference between this course and others in regard to initiation, evaluation, participants' satisfaction, students' learning;

4. What is your view of your colleagues' use of CMI and what trends do you see for you and for them?

- Probe - the possible division between those who don't use CMI and those who do;  
 - the breadth of view of the participant on the impact of CMI techniques and whether these be negative or positive;  
 - the participant's view of his/her use as well as the use within the institution and the university environment.

**D. Technology insights** - This section focuses on the broader picture of technology, your assumptions, your use of it, and the implications of that use.

1. As a result of your experiences with this course and CMI, what are your views of specific techniques you used and your perception of their effectiveness in your course?

- Probe - the change in perceptions and uses over time;  
 - the relationships between technique and specific teaching/learning outcomes;  
 - barriers or incentives both pedagogic and institutional to using the techniques;  
 - views of technology in general and in education/instruction specifically.

2. Describe your view of technology as well as educational/instructional technology.

- Probe - definitions used for each term and the depth of consideration;  
 - specific assumptions and implications of these definitions and views.

**E. Significant items** - This section develops the list of items that you have taken into consideration and the general importance and relative ranking of these factors to you and your use of CMI techniques.

1. During your use of CMI techniques where there any items that you considered and that you feel were and/or still are significant? Which items do you think are important and that other teachers might take into consideration?

- Probe - specific items and the relation between them by using the handout; and  
 - those of most importance in this development of this particular course.

## List of significant items.

Use this list to suggest significant items in your incorporation of CMI techniques.

	Not at all	Not very much	Somewhat	Quite a bit	Very strongly
1. my beliefs about educational purpose -	1	2	3	4	5
2. my beliefs about teaching as a process -	1	2	3	4	5
3. things I learned in formal education courses -	1	2	3	4	5
4. things I learned in instructional workshops -	1	2	3	4	5
5. things I learned through teaching experience -	1	2	3	4	5
6. things I learned as a practitioner outside academe -	1	2	3	4	5
7. things I learned from my colleagues (face-to-face, listserves) -	1	2	3	4	5
8. my preparation as a scholar in the discipline (field of study) -	1	2	3	4	5
9. my preparation for practice outside of academe -	1	2	3	4	5
10. preparation of students in my class -	1	2	3	4	5
11. degree of effort my students typically exhibit -	1	2	3	4	5
12. ability of students in my class -	1	2	3	4	5
13. ethnic backgrounds of students in my class -	1	2	3	4	5
14. time pressures on students in my class -	1	2	3	4	5
15. life goals of students in my class -	1	2	3	4	5
16. educational goals of students in my class -	1	2	3	4	5
17. career goals of the students in the course -	1	2	3	4	5
18. successes and failures of students I have taught -	1	2	3	4	5
19. distinctive goals of the institution -	1	2	3	4	5
20. general education goals of my department -	1	2	3	4	5
21. specific disciplinary goals of my department -	1	2	3	4	5
22. extent to which my department prescribes processes/outcomes -	1	2	3	4	5
23. accreditation standards -	1	2	3	4	5
24. expectations of employer -	1	2	3	4	5
25. recommendations of professional associations -	1	2	3	4	5
26. institutional supports -	1	2	3	4	5
27. professional development possibilities (place in your career) -	1	2	3	4	5
28. technical infrastructure -	1	2	3	4	5
29. availability of facilities (labs, computers) -	1	2	3	4	5
30. availability of library collections/services -	1	2	3	4	5

31. availability of teaching assistants -	1	2	3	4	5
32. availability of secretarial assistance -	1	2	3	4	5
33. availability of audio-visual services -	1	2	3	4	5
34. availability of opportunities (clinics, field trips...) -	1	2	3	4	5
35. Counseling office -	1	2	3	4	5
36. Instructional development office -	1	2	3	4	5
37. departmental chairperson -	1	2	3	4	5
38. departmental colleague -	1	2	3	4	5
39. non-departmental colleague -	1	2	3	4	5
40. articles or books by experts -	1	2	3	4	5
41. class size -	1	2	3	4	5
42. class schedule -	1	2	3	4	5
43. assigned workload -	1	2	3	4	5
44. required mode of instruction -	1	2	3	4	5
45. promotion or tenure pressures -	1	2	3	4	5
46. intellectual property (ownership, contracts, control, ...)-	1	2	3	4	5
47. incentives (compensation, awards, recognition, ...) -	1	2	3	4	5

**Are there any other aspects that you think were/are important but not mentioned above?**

## **Appendix B - The Letter of information to the participant.**

### **Letter of Information to the Participant.**

Dear ... ,

I am a PhD student in the Higher Education Program at the Ontario Institute for Studies in Education of the University of Toronto. I am conducting research on the processes of transformation that occur as faculty incorporate more and more computer mediated instruction techniques into their courses. This research also focuses on the important issues and decision points in these processes of change and development.

Your experiences prior to and during this incorporation process, as well as your insights into the use of various computer mediated instruction techniques, are of value in my research. I would like to ask you a number of questions dealing with your experiences both past and present. These questions range from your ideas about teaching, your course objectives and expectations to assumptions on technology generally, on techniques specifically and on the outcomes of their use. I would also gather information on your specific courses and how these may have developed over the period of your involvement with these techniques.

While there has been a great deal of work on the aspects of technology and computer techniques, there has been less on the transformative process that teachers move through as they incorporate these many new techniques. Your viewpoints will provide a foundation on which to build insights and with which to offer suggestions to others. The research is not intended to evaluate your course, but to explore your opinions and views which are themselves based on practical experience.

I would like to interview you at a time and place of your choice. The interview should initially take about an hour of your time. I expect that there will be some follow up questions at a later date but do not expect this to take more than another one half hour. Participation in the interview is voluntary. Once in the interview, you may decline to answer any question or withdraw at any time.

To facilitate my analysis of the interview materials, I would like your permission to tape the interview. If you would like to read the transcripts and make comments, that would be most acceptable in assuring accuracy. The transcription of the interview will be identified

only by a code number. In this way the data will remain anonymous to all but my thesis supervisor and myself. For reporting, data will be grouped and if quotations are used, any references which could identify an individual will be avoided. The tapes, transcriptions and coded data will be kept in a locked cabinet. These materials will be destroyed within two years after all thesis steps are completed. I will provide you with summary of the thesis and make a copy available for your perusal if you would want such materials.

I will be contacting you shortly to talk about this research and to find out your willingness to provide your insights. I hope that you will participate in this study.

Yours sincerely  
Richard Malinski  
BLS, MA, MBA, PhD candidate

## **Appendix C - The Participant's letter of consent form.**

### **The Participant's Letter of Consent**

I have read the Letter of Information to the Participants sent out by Richard Malinski. I have also discussed the purpose and process of the research study which examines the processes of transformation that occur as faculty incorporate more and more computer mediated instruction techniques into their courses. My questions about the study have been answered. I agree to participate.

I understand that my participation in the study is voluntary and that I may withdraw from the study at any time.

I agree to the taping of the interview and any necessary follow up questions. I understand that the tapes will be transcribed and analyzed, that anonymity will be assured through codes, that the tapes and data will be kept in a locked cabinet and that access to this material will be limited to Richard Malinski and his thesis supervisor. The tapes and transcriptions will be destroyed one year after the completion of the thesis process.

Date - \_\_\_\_\_

Signature - \_\_\_\_\_

Address - \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_