Integrating Information Technologies to Facilitate Learning: Redesigning the Teacher Education Curriculum

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Abstract: Research indicates that student teachers are frequently quite anxious about their use of, and graduate with limited knowledge of, learning technologies. Moreover, Teacher Education programs do not teach them to use these technologies. This paper describes a project to address this problem by integrating the use of learning technologies across the Teacher Education curriculum. We outline the change process used and report on the preliminary results of an evaluation of this process. Student and faculty attitudes were assessed at the beginning and end of the year using demographics and computer attitude questionnaires (Gressard & Loyd, 1986). Subsets of each group attended focus groups at the end of the year. Results indicated that, while faculty felt they had successfully integrated, students did not. Students criticized the self study approach to basic skills and stressed professors should have done more. These results pointed to several adjustments for Year 2.

Resume: La recherche nous indique que les etudiants-maitres sont souvent tres anxieux face a l'utilisation des nouvelles technologies en education et aussi qu'ils graduent generalement avec une connaissance limitee de ces technologies. De plus, le programme de Teacher Education ne comporte aucune formation sur l'usage de ces technologies. Cet article decrit un projet s'adressant particulierement a ce probleme en integrant l'usage des nouvelles technologies dans tous les cours du programme de Teacher Education. Le processus de changement qui a ete favorise et un rapport sur les resultats preliminaires de 1'evaluation de ce processus sont presentes. Les attitudes des etudiants et des professeurs ont ete evaluees au debut et a la fin de l'annee scolaire a l'aide de questionnaires sur la composition demographique et sur les attitudes face a l'ordinateur (Gressard & Loyd, 1986). Des sous-groupes d'etudiants et de professeurs ont participer a des groupes de discussions a la fin de l'annee. Les resultats demontrent que meme si les professeurs croient qu'ils ont bien integre les nouvelles technologies dans leurs cours, les etudiants croient que tel n'est pas le cas. Les etudiants ont vivement critique 1'approche autodidactique preconisee pour 1'acquisition des habiletes de base et ils ont aussi fait valoire que les professeurs auraient du faire plus d'effort. Ces resultats ont offerts des pistes pour de nombreux ajustements pour la deuxieme annee du projet.

Introduction

Faculty integrally involved in the teaching of learning technology in the University of Ottawa Teacher Education Program over the past five years, had been concerned for some time that this instruction had been happening in an isolated manner. Technology instruction consisted solely of two-credit (26 hour) directed courses focusing on technology and learning. Given the restricted time available, these courses concentrated on the basic skills of educational technology (mainly computing topics such as word processing, spreadsheets and databases) and were

insufficient in scope to address the use of technology in the curriculum in any depth, a problem common to most Teacher Education Programs (Office of Technology Assessment, 1995).

The best way to resolve these concerns was to integrate technology across our Teacher Education curriculum and make it central to the Teacher Education experience. Integration seemed advisable for several reasons. First, the use of learning technologies has been strongly emphasised in the Ontario school curriculum (e.g., the Ministry of Education, 1995). Second, the Report of the Ontario Royal Commission on Learning (Begin & Caplan, 1994) listed Information Technology as one of the 4 engines of change to improve schooling. It seemed imperative that we prepare our student teachers to use technology effectively in their own teaching.

Research strongly indicates that new teachers tend to graduate with limited knowledge of the ways in which technology can be used in their professional practice and most Teacher Education Faculty do not teach student teachers how to use learning technologies (Office of Technology Assessment, 1995; Topp, 1996; Handler & Strudler, 1997). In response to this problem in the United States, the National Council for the Accreditation of Teacher Education (NCATE), in conjunction with the International Society for Technology in Education (ISTE), has developed foundational standards in the use of computing and technology in education for all teachers, a wide range of outcomes intended to guide teachers to use computer technology to facilitate teaching and learning (e.g., Wetzel, 1993; Todd, 1993; Thomas, Wiebe, Friske, Knezek, Sloan & Taylor, 1994; Pryor & Bitter, 1995). While our technology and learning course was based on the NCATE / ISTE foundations, we saw integration as necessary to place these outcomes in context and to produce teachers who are skilled at using technology as a standard tool of teaching and learning (Friske, Knezek, Taylor, Thomas and Wiebe, 1995-1996).

Finally, from experience with our own courses, from course evaluation comments and anecdotal evidence, we were aware that our student teachers were often quite anxious about their use of computing - a point verified in a recent study of our student teachers (Gabriel & MacDonald, 1996) - and easily frustrated with computer lab malfunctions. In particular, student teachers identified access to the crowded facilities and time in a busy schedule to focus on computing as major problems in the program (Gabriel & MacDonald, 1996). Integration could potentially reduce such anxiety and frustration by providing extended exposure and practice with computing within the context of Teacher Education courses, with support from faculty and staff. This paper describes our integration project, outlines the technology outcomes that our student teachers have been asked to achieve and reports on the preliminary results of an evaluation of the first year implementation.

The Integration Process

Several writers suggest that the integration of learning technologies be combined with an introductory course (Wetzel, 1993; Schrum, 1994; Topp, 1996). Traditionally, student teachers in our Teacher Education Program have been required to take such an introductory course. However, when pressure to drastically reduce faculty budgets were imposed, our Teacher Education Program Council decided to replace the historically problematic technology course with a cheaper and more effective model. Therefore, for the 1996-1997 academic year, the Teacher Education Program developed and implemented a project to integrate various aspects of the use of technology to facilitate learning directly into other Teacher Education courses. The purpose of the project was to design a Teacher Education curriculum in which faculty would demonstrate by example the means by which technology could be used in the Kindergarten to Grade 12 curriculum.

To achieve this, the authors took on two tasks. First, we developed a self-study module for student teachers to achieve basic technology competencies. Second, we applied an instructional development process (e.g., Seels & Glasgow, 1998; Kemp, Morrison & Ross, 1998), combined with the approach described by Todd (1993), to assist remaining faculty members to integrate technology outcomes into the B.Ed. curriculum. The intent was to select or develop the technology knowledge and competencies that we intended our student teachers to have when they graduate; to examine our existing curriculum; and to decide how best to deliver this instruction.

An innovation as extensive as the integration of technology across the curriculum necessarily engages faculty in a substantial change process. It represents a serious and personal experience for those involved and is characterized by ambivalence and uncertainty. Such a process requires time and clear mechanisms to allow participants to develop their own personal meaning (Fullan & Stiegelbauer, 1991). In order to affect program outcomes, change must also occur in practice along three dimensions: a) the possible use of new or revised materials and technologies; b) the possible use of new teaching approaches; and, c) the possible alterations of beliefs, pedagogical assumptions and theories (Fullan & Stiegelbauer, 1991). To be successful, it was clear that we had to address all three dimensions. To do so, we chose to take a diffusion/adoption perspective (Kenny, 1992) and take the stance of external change agents working directly with faculty on both a collective and individual basis. This process consisted of a needs analysis, an instructional analysis, course development, implementation and an evaluation.

Needs Analysis

To determine what technology outcomes are important for today's teachers, the authors gathered information via a literature review; contacting other programs and surveying key contacts in local school systems. From this data, we were able to generate a set of 15 learning outcomes which we judged appropriate for our program (See Table 1). These outcomes were largely derived from the NCATE/

ISTE foundations outcomes but were updated to meet more recent advances in technology and to group the outcomes into meaningful categories.

Table 1: Instructional Technology Learning Outcomes.
By the end of the Teacher Education Program, the student teacher will:

I. Attitudes:

1. develop an attitude of openness to the use of information technology to facilitate learning.
2. develop a view of the global implications of the development and integration of information technology in society and a disposition to continue life-long learning in this area.

II. Theory and Foundations:

1. explain the theoretical foundations which provide direction for the integration of information technology into the teaching / learning process.
2. apply current educational theory and research to facilitate the integration of information technology into the teaching / learning process.
3. apply information technology to facilitate the emerging roles of the learner and the educator

III. Technical Knowledge:

1. understand basic concepts and terminology related to information technology.
2. demonstrate knowledge and ability in the everyday operation of the two main computer operating systems (Windows, Mac OS) in order to comfortably utilize software.
3. demonstrate basic skills in using productivity tools, including word processing, database, spreadsheet and print/graphic utilities, to support the teaching / learning process and for administrative and personal uses.
4. demonstrate knowledge of the uses of interactive multimedia and the Information Highway to support the teaching / learning process.

IV. Integration:

1. identify resources for staying current in applications of information technology in the teaching / learning process.

2. will be able to select and evaluate information technology resources appropriate for their own subject area(s) and/or grade levels in accordance with selected learning goals, outcomes, and methods.
3. be able to integrate information technology resources in their own subject area(s) and/or grade levels in accordance with selected learning goals, outcomes, and methods.
4. be able to demonstrate uses of computers for engaging student in higher-order learning (knowledge- building. reflective thinking, problem-solving, data collection, information management, communications, presentations and decision-making).

V. Issues Pertaining to the Use of Technology to Facilitate Learning:

1. be able to demonstrate knowledge of the implications of the role of computers in society and of such issues as equity, ethics, privacy and legal implications.
2. be able to design and develop student teachers learning activities that integrate computing and technology into instruction for diverse student teachers populations.

Instructional Analysis

After selecting our technology outcomes, we next matched the outcomes with the content of existing courses with a view to where they could be best integrated. To do so, we developed a curriculum matrix similar to that of Todd (1992). This matrix was discussed, modified and ratified by our Teacher Education Program Council.

Course development

After completion of the matrix, faculty were left to work individually with the project managers to develop course activities. For the first year of implementation, faculty agreed to try to incorporate at least one learning activity in their respective courses which might meet one or more of the indicated outcomes.

Implementation

Support staff at the Faculty of Education's Learning Resource Centre (Desjardins & Kenny, 1997) and computer labs were also available to provide assistance to individual faculty. Professors could make use of up-to-date IBM and Macintosh computer labs for their learning technology activities and eight multimedia cabinets in the main centre for media viewing and development on an individual basis. They also had access to two portable computers and LCD display panels and a mobile computer station for use in classrooms.

The self study module was a requirement introduced to the student teachers during their second week of the Teacher Education Program in September. As indicated in the Course-Outcome matrix, the self study module was intended to

cover only very basic computing skills (system use, elementary word processing, spreadsheet and database use, email and web searching). Student teachers were to complete the activities as needed and take a competency test. The regular computer lab assistants and a graduate teaching assistant were available each week to assist student teachers with the self study and to evaluate them.

Evaluation — Preliminary Results

Methodology

As a part of the instructional development process, we conducted an evaluation of the first year implementation of our integration efforts. The purpose of the study was to determine any changes in the attitudes of student teacherss and faculty toward using technology to support learning, to ascertain their growth in their knowledge of the use of technology to facilitate learning, and to judge how effective the integration project had been. The evaluation was conducted in two phases.

During the first phase, in September, 1996, we endeavoured to assess the initial knowledge and preparation of student teachers and faculty. Student teachers and faculty were asked to complete a demographics questionnaire, a computer attitude scale (Gressard & Loyd, 1986), and write brief answers to a set of seven questions. The demographics questionnaire invited respondents to provide information on their gender, age, and computer experience. Computer experience was assessed in this questionnaire using a computer use form originally developed by Hannaford (1991) and modified by Gabriel and MacDonald (1996). Respondents were asked to rate their knowledge and use of such computer applications as word processing, email, CAI and the World Wide Web by assigning a number from 1 - 6. Experience ranged from "unfamiliar with this application" to "use this application daily". Scores of 4 and up indicated that the respondent had actually learned and used the application.

The Computer Attitude Scale (Gressard & Loyd, 1986) consists of 40, Likert-type items assessing computer anxiety, computer liking, confidence in one's ability to use computers and computer usefulness. This scale was chosen because it has been shown to be a valid and reliable measure of computer attitudes (Gabriel and MacDonald, 1996) with Alpha coefficients ranging form 0. 82 to 091 in four studies. The seven questions were used to provide more detail on respondents' attitudes to aspects of computing in the Teacher Education Program and consisted of questions such as, "In your opinion, would learning be made easier or more difficult with computers?" and "How do you feel about the integration and self study approach to learning to use technology in teaching?"

The second phase took place in March and April, 1997. It's purpose was to re-assess the knowledge and preparation of student teachers and faculty upon completion of the 1996-97 Teacher Education Program and survey their views on the outcomes of the process. Student teachers were again asked to complete the Computer Attitude Scale (Gressard & Loyd, 1986) and to respond to a brief, written questionnaire asking similar questions to those asked during phase one of the research. For example, they

were asked, "In your opinion, would learning be made easier or more difficult with computers?" and a modified version of, "At this stage in the Teacher Education Program, how do you feel about the integration and self study approach to learning to use technology in teaching?". In addition, three focus groups of approximately 8 members each (one faculty, one elementary student teachers and one secondary student teachers) were conducted to detail and expand on participants' views about our integration process. Both faculty and student teacher groups were evenly matched according to Phase One computer experience and attitude measures.

Time One Results

Computer experience and attitude ratings. Table 2 reports the mean scores on the computer attitude scale and computer experience data for both student teachers and faculty. A total of 234 student teachers completed the questionnaires at this time for a response rate of 67.8%. Twenty faculty completed the questionnaires at Time 1 for a response rate of 35.1%. While the mean scores are slightly higher for faculty, the range is similar for both. Further, the results indicate that both groups had, on average, experience with computing and a positive outlook toward the use of technology.

Table 2: Time 1 mean scores for student teachers and faculty overall ratings of computer experience and computer attitude

	N	Mean	Low	High
Computer Experience - Student Teachers	234	42.1	15	78
Computer Experience - Faculty	20	53.2	33	80
Computer Attitude - Student Teachers	234	120.4	66	160
Computer Attitude - Faculty	20	130.3	68	157

Note: Maximum score for Computer Experience is 90 and 160 for the Computer Attitude Scale.

Mean ratings by application (Table 3) show that faculty report having experience with a wider range of applications than student teachers. On the average, student teachers came to the program with experience with the Windows operating system, word processing and email. They reported having little experience with applications such as desktop publishing, databases, computer-assisted instruction and simulations, all of which could be quite useful in their future instruction. Faculty, on the other hand, reported having prior experience with many of those applications.

Table 3: Mean Scores for Student Teachers and Faculty Computer Experience by Application.

Application	Student Teachers	Faculty
Macintosh Operating System	2.80	3.80*
Windows Operating System	4.60*	4.45*
Word Processing	4.98*	5.95*
Graphics	3.03	3.70*
Desktop Publishing	2.35	2.85
Spreadsheet	2.96	3.40*
Database	2.52	2.85
Email	3.91*	5.60*
World Wide Web	3.28	4.45*
Multimedia	2.30	3.35*
Authoring languages	1.31	1.70
Instructional Games	2.67	3.10*
Computer-Assisted Instruction	2.41	3.35*
Simulations	1.85	2.80
Microworlds	1.20	1.80

50% or more indicated had been trained in the application and / or used it at least once a week.

Finally, there was a strong positive correlation between experience and attitude for both student teachers and faculty. This correlation was especially pronounced for student teachers (r 0.59) and statistically significant (p 0.0001).

Student teachers questionnaire responses. The qualitative data allows a more complete understanding of the varied thinking behind student teachers' self-ratings of their technology experience and attitudes. Table 4 shows a frequency count of student teachers' answers to two of the questions on the Time 1 and Time 2 questionnaires. Student teachers, when asked about the concept of integrating technology into their own instruction (i.e., with children), were extremely positive. Essentially, they saw the use of technology as a modern day reality and something with which children needed to develop comfort. Thus, when asked if they agreed with the Ontario Ministry of Education's thrust toward integrating technology in the classroom, one student teacher stated, "I think it is good because computers are a part of our lives, so student teachers should learn how to use them, not only for games but also for basic programs such as spreadsheets, word processing". Similarly, another student teacher commented that, "Yes, as our world becomes more technological based, our school children need to be trained for what they will be using."

Student teachers were less certain about the integration approach for their own learning. From the outset (Table 4), the student teachers were quite divided on their answers to the question, "How do you feel about the integration and self study approach to learning to use technology in teaching?" At Time 1, those in

favour of integration and self study tended to cite the differences in entry knowledge between student teachers and to stress the value of individual pacing. One student teacher commented, "1 like it because it gives student teachers with different levels of knowledge a chance to advance at (their) own pace."

Table 4: Student Teacher Question Answers - Time 1 and Time 2.

Question	Agree	Disagree	Ambivalent	No Opinion
Tl - Integration & Self Study in Teacher Education	34%	29%	10%	27%
T2 - Integration & Self Study in Teacher Education	27%	60%	2%	11%
T1 - Integration of Technology in Classroom	75%	7%	6%	12%
T2 - Integration of Technology in Classroom	76%	0%	19%	5%

Even those in favour, however, tended to report reservations. Another student teacher pointed out, "I feel some instruction is needed prior to use but learning can take off in so many directions (i.e., the Internet) that I feel self study is wonderful." Those who disagreed from the outset, expressed a great deal of anxiety about learning technology, cited time problems and essentially demanded a specific course on technology. A student teacher, for example, noted this about time:

> There is no instruction and you are assuming people know or have some experience of computers. Mature student teachers are particularly disadvantaged and they also tend to have an additional level of other commitment in their life. Therefore their time to learn independently is compromised. I resent it.

Another student teacher focused on a perceived need for guidance, noting that "I personally don't like it. I'm the type of person that needs a teacher to teach it to me. It's a new concept and I don't really know a lot about it."

Time Two Results

Student teacher questionnaire responses. The frequency count of student teachers' answers (Table 4) also indicates a trend, with a strong majority disagreeing with the integration and self study approach by the end of the year. While there were strong concerns among student teachers at the beginning of the year, one might expect that a good integration process would win over the majority as they succeeded in their learning. The opposite appears to have happened. These results are supported by experience and attitude ratings data, student teacher questionnaire comments and by student teacher focus group responses. The mean scores for the Computer Attitude Scale, completed at Time 1 and Time 2 (Table 5), indicate that

there was little growth in student teachers' attitudes towards computing throughout the year.

Table 5: Time 1 And Time 2 Mean Scores for Student Seacher Computer Attitude Ratings.

	N	Mean	Low Score	High Score
Computer Attitude - Time 1	234	120.4	66	160
Computer Attitude - Time 2	127	123.5	81	157

Student teachers focus group themes. While the quantitative data highlights the (lack of) overall trend, the student teachers focus group interviews brought out several themes which identify their concerns. First, student teachers reported a desire for an educational technology course. They stated that the lack of an educational technology course in the Teacher Education Program was unacceptable because technology in education was extremely important. Time and money should be made available for this discipline. The student teachers suggested that they would be at a disadvantage when applying for jobs because other Teacher Education Programs have educational technology courses and the student teachers in those programs would know more about this area than they would. One student teacher pointed out:

> I just want to say that I think technology and computers and things like that are one of the most important things that we can learn right now. And I just find it strange that it's been eliminated from this particular section of the program... . Like giving this little sort of self-study little thing. And it's a little component here, a little component there. And if other schools are teaching, they are going to be way ahead. And... what are we going to say at an interview or a job at school when they say, "Well do you think you learned this?" and ... we're going to say "Well no, we were just suppose to go learn that on our own and frankly, I didn't have time.

Second, the general feeling among the student teachers was that the self-study technology module [for basic computer skills] was inadequate. Those with considerate previous knowledge and experience with technology and those with little or no technology knowledge or skill all agreed upon this point. Student teachers who had minimal computer knowledge felt they had not obtained enough knowledge and or skill to feel comfortable to use computers in their classroom. For instance, one student teacher stated:

> Because I didn't know anything about computers, that certainly what I got was too minimal. It was very minimal experience and training. And I do not feel ready to use it in the classroom at all.

Student teachers with a lot of previous experience with or knowledge about computers prior to entering the Teacher Education Program reported that they learned very little, or nothing from the computer component of the program. They went on to say that they thought there was a lot they could learn if the computer component of the program were more organized. One student teacher's comments exemplify this point of view:

> I have the computer abilities that don't necessarily, directly apply to teaching. But, I really wanted to learn more and increase my works' ofteaching programs and what have you. And. I don't feel that I've learned that.

Third, student teachers repeatedly claimed that one of the biggest disappointments with the self learning module was the lack of emphasis on technology for the classroom. This was intended to be covered in courses through the integration process and indicates a wide-spread confusion between the purpose of the self study component and the integration process. Student teachers wanted more information about how to use computers as an authentic classroom tool to enhance their teaching:

> A lot of what we learned... in the self-study module was the use of applications such as Word Perfect or spread sheets, or whatever. But there was very little focus on educational... software. Or specifically how computers can be used in the classroom. It's all on learning to use the computer for yourself. It is not really focusing on education in the classroom,

A fourth theme identified during the focus group was that the computer equipment in the Learning Resource Centre was quite good and that it wasn't being well utilized. Several student teachers revealed that they did not realize that there was a scanner in the Learning Resource Centre until a student teacher mentioned it during the focus-group interview. Another mentioned that the tour of the Centre that was given to them early in the year, but it didn't mean much at that time because they were feeling overwhelmed with information. The student teachers suggested that they be shown the equipment and what can be done with it in a more meaningful way. One student teacher noted:

> The facilities that this University has, in the learning Resource Centre, I think are fairly good. Especially with the booths [multimedia cabinets], and some of the scanning equipment. However, if we had not requested a session in our seminar with that equipment, some people still don't know it exists.... You got the equipment here. Let's notjust give people kind of an introductory look. Offer them workshops where they can see how you can apply these things in the classroom.

Fifth, student teachers reported that the professors did not do an adequate job of integrating computers into their program. Moreover, they implied that they didn't feel the professors had the knowledge or skill to do so. Student teachers said that there was variation in the amount of technology implemented by various professors, that professors appeared to be implementing token assignments because they had been mandated to do so, and that the majority of assignments were not useful. One secondary student teacher pointed out:

> I think there should be more implementation of computers with professors. And I know in one of classes we've had to use, make an assignment with using some form of technology with CD ROM and that was a good assignment. But, the majority of the professors haven't used computers in any of the courses that I've taken.

Another student teacher noted:

> Because the instructor was basically trying to familiarize us with how to use the internet to find resources... "Well just find the lesson plan, download it, print it. Hand that in. And if you want to modify it go ahead. I basically went up to him and I said, "Well here's my URL from my own Web page. You'll find the whole listing of various lesson plans for all kinds of things. He looks at it and checks it out and says. Don't bother. Don't even bother to do the assignment. You can leave now. So that sort of discrepancy I don't know, frustrating.

A sixth theme focused on the computer labs, which were frequently a source of frustration. Several student teachers teachers said that a factor contributing to their perception that the self-directed module didn't work was problems with the lab and not enough support in the lab. Moreover, a number of student teachers who had a lot of computer knowledge said they found it frustrating that there was not more support in the lab because they were under constant pressure to help their peers and were not able to get their own work done. One student teacher noted that:

> I think a lot of times we went to the computer room for something in class and there were too many problems.... The lab wasn't ready to have a class of thirty of us go in and try and do all the same thing, or even try to work and stuff. It wasn't working and there was so many problems and... the internet thing couldn't take all of us or something and there's always problems and that's what frustrates us even more.

Faculty focus group themes. While the student teachers' views were, perhaps, more vociferous, the themes which emerged form the faculty focus group interview were quite similar to those from the student teachers groups. First, while a strong sentiment to re-establish our technology and learning course was not expressed,

faculty acknowledged the problems that the differences in technology knowledge and skills among student teachers brought to the integration process. The problem, they thought, emanated from the lack of fixed dates for the completion of the self study. This comment from one faculty member exemplifies the point:

> In terms of building on the comment of pacing the independent study, I found that by January, my feeling was that some of the student teachers hadn't yet really approached the independent study package which puts them at a decided advantage in terms of when we get into the lab, our one time in there, some were far more prepared based on their own previous experience on coming into the faculty but also in the amount of time that they had spent on the independent study package. If you're going to go that approach again, perhaps having some critical, intermediate deadlines, might get people into the labs earlier to do some work on the independent study and allow them not to be at a disadvantage when they're actually in with their classes doing various assignments.

Second, like the student teachers, faculty expressed the opinion that the self study module was inadequate in scope and nature. While it had been intended only to introduce the student teachers to very basic computing skills, some professors felt it needed to be more extensive and, in fact, that this was why the integration process was less effective than it might have been. One faculty member had an especially strong view on this:

> Ah, well we've had a lot about this computer self-study module and I want to reiterate that it isn't a self-study module. It's a shopping list of things which have to be done and four pages on how to log in to a computer. That's it, there is no self-study guide. We want a self-study module, we need a self-study module for the people who are naive, but this isn't it. We don't have one. So, I mean, that in itself, is the number one impediment to successful integration. If the student teachers are faced with a full two or three pages on the stuff they've got to do, they've got to demonstrate knowledge of all this stuff and then, it's called self-study and then it tells you how to log on to the system, period. That's it.

A third theme pertained to the integration of technology into Teacher Education courses. Student teachers had strongly suggested this process was inadequate and placed the blame both on the self study module and professors (themes 3 and 5). Overall, faculty members thought that they had made an effort to integrate and cited a number of examples where and how this took place. One professor noted:

> I teach the history and personal and social studies, pedagogic course at the intermediate and senior level. There has been, I think, a fair amount of integration in that course for about the last four years, maybe five years. It's integrated through exposing student teachers to the value of ah,

> computer technology in a social science and history classroom. It is integrated through school-based models. Typically, we go to one of the local schools that integrates, especially computer technology into its history, social science program every year and see how a single department at the intermediate and senior level deals with this and it's integrated also by exposing student teachers to the latest software available in our area. They are required to work with the software by developing a lesson plan or a collection of plans that would be used in my subject area; the intermediate/ senior level. It is evaluated, it is an essential component of the course.

Faculty did, however, stress that there was room for personal improvement in the integration of computers. Several thought there was a lack of expertise in technology among faculty, as indicated by this comment from a professor:

> I would say that my awareness has grown but, and my desire to want to be able to do different things with my computer is certainly growing.... I guess I need some focus time would allow me to be able to explore in ways that would allow me to know how to use it better because. I mean, you have to be familiar and comfortable with it to be able to show it to your student teachers and to me, that is my major concern.

Faculty members also thought that there was not a strong supportive culture in the faculty for technology integration to develop. One professor pointed out when asked by the moderator if he felt that our professors were on the cutting edge of technology:

> No, all I said was that we need to be on the cutting edge, okay? I don' t think we are because we do not have the support system in place through the administration. Again, I'm not trying to attempt to put blame. I'mjust stating a fact. I do not believe that we are on the cutting edge. Individuals may be on the cutting edge. But... the latest equipment in our offices does not exist to this point.... I mean we don't have the tools even to get on the main circuit.

The fourth and final theme that emerged related to perceived problems with computer resources. Like the student teachers, faculty felt that we had good resources available in the Learning Resource Centre. However, it was difficult to make good use of these resources because of a lack of access to the labs and because of problems booking out equipment. This comment from a professor sums up the feeling among professors about lab access and integration:

> The concerns that I did have, and this is not to lay blame, but, it's, it is getting time in the lab. and then when you do have a large group of people in there, we found difficulty running some of the programs because the computers were being set for different levels of memory or we had some

> difficulty overall in trying to explore the internet at the same time, the speed on the computers, etc... So, I realize that there are some things that are beyond immediate resolve, but those were some of the difficulties and dilemmas that we did come across. And, ah, I just wanted to point that out. That's one thing that I found inhibiting.

One professor had these concerns about booking equipment to use in his class outside the Learning Resource Centre that created an impediment to a more complete use of technology in instruction:

> The other thing is, availability of equipment. It would be nice to have more lap tops to, and so on and ah, some of the policies are a bit eyebrow raising about, you know, signing the things out. For example, my class started at eight o'clock in the morning. You know, if I'm having a demonstration, I want to get set up before that and I'm told I can't sign the thing out until eight o'clock in the morning. I can't take it out the night before for example. So I, you know, I have to sort of waste class time setting the thing up and there was some other bizarre policy about, you couldn't just take out the lap top, you had to take the LCD with it even if you didn't need that.

And finally, some faculty expressed a need for more stand-alone computers that could be taken to classes to ameliorate access. A professor summed this point up this way:

> I want to support this notion about the problems of taking the free-standing computer into the classroom. That, that the very evident problems that were pointed to of getting bookings in the lab, suggest to me that more stand alone units would be very useful.

Conclusions

The preliminary analysis of our integration process indicated that our first steps were halting and that several changes would be in order as we entered the second year of our project. From the student teachers' point of view, our integration process was not very successful. They strongly regretted that we did not retain our previous structure with a dedicated course on technology and learning, even though student teachers in previous years had expressed strong concerns with the deficiencies of that approach. They had problems with the quality and nature of the self study approach to learning basic computing skills and they were confused about its purpose. It did not, for instance, address the integration of technology into classroom instruction. Student teachers also expressed concerns about the efforts and abilities of faculty to carry out the integration, despite the fact that professors reported to be both more knowledgable than student teachers about computing applications and felt that they had, indeed, integrated technology into

their teaching. On the face of it, the results are discouraging and highlight the strong anxieties for student teachers inherent in the use of learning technologies (Office of Technology Assessment, 1995; Gabriel & MacDonald. 1996).

It is, however, heartening to revisit the conclusions of Fullan and Stiegelbauer (1991) that an innovation as extensive as the integration of technology across the curriculum represents a substantial change process, one characterized by ambivalence and uncertainty. During such change, participants require time to develop their own personal meaning. It is fruitful, in concluding to review some of Fullan's and Stiegelbauer's (1991) "do" and "don't" assumptions basic to a successful change process in relation to our project.

First, they stress that successful implementation consists of a continual development of ideas. While we were not able to introduce a course into the mix for Year 2, our Teacher Education Council is planning the introduction of options in technology for the following year. Meanwhile, we have revised our self study module and various course teaching strategies on the basis of our dialogue with the various concerned parties.

Second, Fullan and Stiegelbauer (1991) also point out that effective implementation is a process of clarification and that conflict and disagreement are fundamental to successful change. All significant implementation efforts will experience dips in the initial stages. Given the strong criticism our process has drawn, we can perhaps cautiously take heart that our initial stumbles are a part of the normal process and continue on.

And finally, Fullan and Stiegelbauer (1991) caution change agents not to assume that the reason for a lack of implementation is outright rejection of the values embodied in the change. Rather, the reasons may relate to various factors, including inadequate resources to support implementation and insufficient time elapsed. Our project was initiated by a vote of the Teacher Education Program Council and, while some faculty continue to have their reservations about the approach, the faculty focus group data indicate that professors still support this change. More likely, as seems clear from our evaluation results, is that our implementation problems have stemmed from a combination of resource / support problems and time. Fullan and Stiegelbauer (1991) stress that effective change takes time and that it is a process of "development in use". Even specific innovations can be expected to take a minimum of two to three years. Hopefully, the completion of our second year will see us further down the path.

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