

**TECHNOLOGY AT WORK: TO WHAT EXTENT ARE
SECONDARY TEACHERS USING TECHNOLOGY IN THEIR
CLASSROOMS?**

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Dedication

To my other little projects, Kate and Jack who inspire and delight me daily.

Abstract

The purpose of this project was to reflect the frequency of technology use by teachers in an Alberta secondary school. Most schools in Alberta are well equipped with technology due to the significant focus placed on students having access to up-to-date technology. This project will reveal how teachers are using technology in non-instructional and instructional ways. A survey was used to determine the frequency of use for the many software and on-line technology resources available to teachers. The survey also asked teachers to gage their own computer competence, access and technical support level. The results allowed for correlation between frequency of use and other factors influencing technology use. Interviews provided further support and clarifications of the survey results. The interview responses provided further insight into the issues surrounding technology use in the classroom. The interviewees were selected based on their experience with technology and their ability to represent the views of the staff. The results of the project indicate strongly that teachers must have more access to technology, more opportunities to participate in technology-related professional development and an efficient means of acquiring technical support if technology is to be more used more frequently.

Acknowledgements

To Dr. Gerald McConaghy for his guidance, encouragement and meticulous attention to detail. To the teachers surveyed for their time and thoughtful responses. To my parents for their continued support of a 'lifelong' learner. To my husband, Terry, for his patience, love and many pots of strong coffee. Thank you!

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Introduction

The relationship between teachers and their changing school environment is a tenuous one largely due to the massive influx of technology in the last five years. Teachers are able to adapt to new students and classes each semester, but many become defensive when their classrooms are outfitted with the latest technology. My project will determine the extent to which teachers are using technology currently available. The research question was " To what extent are secondary teachers using technology in their classrooms?" This is an area of particular interest to me, as a Career and Technology Studies teacher, since my assignment requires me to use technology often and effectively. Recently, I have come to realize few teachers share my enthusiasm. A small number have adequate access to technology and therefore many teachers are lacking technical skills.

Technology is changing the way we teach. The focus of my project was to determine the instructional and non-instructional uses of technology by teachers. For the purposes of this project, 'technology' includes those technologies made available to teachers during the last five years, specifically, e-mail, voice mail, various application software (Microsoft Office), on-line media ordering software, SIRS (Student Information Records System), grading software (Thinkwave, Gradebook, Integrate) and Internet access.

When I began my teaching career nine years ago, technology was slowly making its way into classrooms. Computer classes were introduced as options for students at the senior high level and a few computers were used in the office for basic administrative tasks. I have witnessed a technology infusion and now every classroom in our school employs some type of technology. Teachers in all subject areas are expected to meet

specified technology outcomes within the curriculum and must submit their grades using a software grading package. The purpose of this project was to determine how frequently secondary teachers are using technology.

Review of Literature

After reviewing several readings on the topic of my project, I soon discovered the most applicable and timely information was to found on the Internet. Although there are books relating to the topic of my research, I found them to be most relevant to the year in which they were written and therefore added little to the current issues surrounding the teachers' use of technology in the classroom. The large amount and high quality of information on the Internet demonstrates this issue has come into the spotlight only recently. The salient points in the readings seemed to fall into five specific themes.

The first major theme suggests that a general direction, goal or vision for technology use in the school must be established in order for teachers to use technology. Edmonds (1999) states a clear and concise vision is necessary if teachers are to have a point of reference when undertaking initiatives in order for them to understand the importance of their efforts. He refers to Kotter (1996) who found that an effective vision motivates people to take action in the right direction while coordinating their efforts. Edmonds (1999) also suggests that until teachers are able to understand what technology can do for them personally, they are less likely to buy into the vision of the organization. Horgan (1998) found that a vision is important, but prefers the term strategic plan, which she defines as the organizational document guiding the efforts of teachers and administration to a desired outcome. She stresses that the plan must be brief, readable and widely circulated. Horgan (1998) believes that without such a plan, efforts to integrate technology will be isolated and will not be sustained. She insists that a plan or vision is the key to the success and must be in place before other strategies are implemented.

Donovan and Macklin (1998) believe the “vision thing” is critical, but also note the path each individual or group in the organization takes to achieving the desired outcome should not be clearly stated. The key outcomes of better learning and teaching may be the focus of the vision, but individuals are encouraged to experiment with the technology and find the method most suited to their needs and abilities. It is hoped this method will encourage open lines of communication and foster an atmosphere of sharing. Donovan and Macklin also see the vision as a filter through which all activities and initiatives can be evaluated. Miles Grant (1996) writes that underlying principles serve as a foundation for successful professional development to support the introduction of technologies in schools. Teachers will be more likely to use new technology effectively if their school culture offers direction and support.

Miles Grant suggests the administration needs to play a leading role in developing community support and understanding the goals of technology use in schools. Teachers will benefit by being able to work within a wider framework of informed consent. This type of leadership and support will ensure the changes made in teaching are sustained over time. Gooden (1996) profiled several schools which have successfully integrated technology and found they all shared a common set of beliefs and strategies that help create a framework for practical application in a new setting. A common vision can be achieved if flexibility is allowed within the planning process.

The second theme stresses the need to provide adequate time and resources to learn the software and hardware capabilities. Edmonds (1999) explains how not supplying adequate time or resources necessary to implement new initiatives creates a barrier for teachers. The goals of integrating technology may be clear, but if teachers are

not given release time for training or are recipients of poor instruction, they will be unable to meet them. Donovan and Macklin (1998) used focus groups to determine the most significant barrier to technology adoption was lack of time. They also learned that teachers wanted specific "how-to" technical support along with curriculum-centered instructional suggestions. Northover (1999) sites insufficient time as a primary barrier to technological implementation. One suggestion he offers is holding short workshops for small groups in order for teachers to get sufficient one-on-one instruction and time for practical reinforcement of the newly acquired skills.

Miles Grant (1996) found access to equipment and extensive hands-on time with the technology is essential if teachers are to become proficient in the medium of their choice. Although she agrees that this level of access and training can be expensive, it is necessary if the new skills are to become common practice. Teachers also require on-site technical support to keep the equipment functioning optimally and to assist in daily trouble-shooting. This type of "just in time" support is crucial in order for teachers to feel comfortable with using the technology in a classroom setting. Gooden (1996) found principals are often faced with a persistent dilemma when trying to allocate resources toward computer training for teachers. Budgets are often built around acquiring hardware and software instead of teacher training.

Pisapia (1994) suggests the teachers' decision to use technology in various ways is dependent upon their knowledge of possible uses, availability and ease of use of technology. Vopal (1997) found that hands-on experience with the software and hardware allows teachers to allay their fears regarding technology. Teachers are able to absorb more information and improve computer skills if they feel comfortable using them.

Teachers must be given convenient access to computers in order to learn, experiment with new software and find the best methods to use with their classes.

Thirdly, the literature reviewed for this project sites the need for a strong infrastructure to handle the demands of teachers and students. Horgan (1998) considers a reliable, robust, ubiquitous infrastructure to be essential. Teachers must be confident that their machines are capable of running various software and communications packages. They must have access to technical support, well-equipped classrooms and adequate software and hardware training. Northover (1999) found computers in schools were often too old to run new software packages or the schools had difficulty keeping current software up to date. This is a significant barrier to progress and limits the ability of teachers to acquire new skills in a timely fashion. Miles Grant (1996) suggests broadening the base of technical support to include student experts and community members. This will allow schools to keep the costs of maintenance to a minimum. A school could also create a database that itemizes the skills and expertise of those within the school community. This would allow for a greater amount of efficiency.

Pisapia (1994) explains schools with an organized form of professional development activities and a full-time coordinator of technology resources are most likely to have teachers who use technology effectively. Teachers also need support from administrators and department heads for reviewing materials, scheduling lessons and coordinating lab time. Vopal (1997) emphasizes that a computer support system is needed to address the concerns and issues that arise as a result of learning new programs or becoming familiar with new hardware. Teachers need a support structure that allows them to share their knowledge and get answers to their questions. Yocam and Wilmore

(1994) found that access to hardware and software is essential, especially after new skills are acquired. Teachers needed the opportunity to reinforce their learning and try new skills in a risk-free setting.

Pedagogy must remain the focus. The literature reviewed for this project stressed the importance of using the technology as another tool in the classroom and not allowing it to steer the general direction of the classroom. Sulla (1999) believes educators have become focused on learning specific computer skills and have lost sight of the many ways computers can bring a new dimension to teaching and learning. She challenges teachers not just to use computers, but to infuse their classrooms with technology. Given this change in perspective, teachers will come to see the computer as a powerful tool. The objective of the lesson will remain the same, but students will use technology in different ways to achieve it.

Miles Grant (1996) writes that effective professional development activities will provide computer training that is both subject and teacher specific. This type of targeted training will allow for greater transfer into the classroom. It will also make experience more meaningful for the teachers involved. She expands on this idea by stressing the need for teachers to move from mechanical use of technology to a point where they can use the technology to facilitate inquiry.

Donovon and Macklin (1998) found that teachers were most likely to use technology effectively if the use was rooted in pedagogy. They assisted teachers in this respect by creating lesson plans using the new technologies, allowing teachers to become aware of the various technological applications. Horgan (1998) stresses technology

should be seen as another tool to improve teaching and learning rather than an end in itself. As teachers learn computer skills, they should keep learning outcomes in mind.

Integrating technology will only be sustained if pedagogy is the focus. Gooden (1996) found teachers who viewed the computers in their classrooms as a compliment to their teaching were able to successfully integrate it into the delivery of the curriculum. Once teachers were able to see how computers could be used in a specific application, they were more accepting of having and using computers in their classrooms. Miller and Olson (1994) used a case study and determined only those teachers with a strong understanding of their personal methods of teaching and intended learning outcomes are able to make the best use of the technology. They contend that teachers who are rooted in the past will be able to move forward with new trends in technology and incorporate each effectively. Pisapia (1994) found exemplary teachers integrate technology effectively by making it an integral part of their technique. They do not use it as a 'reward' for good behavior, or treat it as an add-on to a lesson. Successful teachers weave learning technologies into their existing patterns of teaching.

Vopal (1997) researched the area of in-house computer training for teachers and found that the instruction is most beneficial when it is individualized. It is only then that teachers will be able to have specific concerns addressed and receive the most learning from the session. Yocam and Wilmore (1994) researched teacher learning and concluded that new skills and techniques must build on the teachers' existing knowledge base. When new technology uses are introduced in this way, they are more likely to become a part of the repertoire of strategies used in the classroom.

Lastly, a culture of experimentation and collaboration must be fostered for teachers to feel supported in using technology. Donovan and Macklin (1998) have found an ethos of experimentation and collaboration is essential to the successful implementation of new ideas. The change process continues only when ideas are allowed to fail and improvements made. They also believe that the nature of technology creates an uncertain environment that requires an experimental outlook. Collaboration is necessary in this type of setting in order for each teacher to learn from the successes and failures of others. Miles Grant (1996) suggests that as the teachers' level of proficiency improves, they are more likely to experiment with other applications with their students.

Experimentation is one of the best modes of personalized learning. Northover (1999) blames personal barriers of inadequacy, lack of motivation and a lack of knowledge regarding new technologies as some of the reasons for a low level of experimentation and use of technology. If teachers are to incorporate new skills into their teaching, they need to be comfortable with their level of proficiency and excited about the new possibilities offered by technology. Horgan (1998) suggests creating a staff-mentoring program. Those staff members more proficient with technology could be offered special incentives or release time in exchange for working one-on-one with another staff member. This creates a supportive environment and fosters learning in a low-risk setting.

Edmonds (1999) states one way to combat barriers to implementation is to identify teachers who are innovative and adopters of new technology early in the process. These teachers will adapt easily to the new technology and will often have a positive perspective. They will be most excited about new uses for the technology and can

provide excellent assistance to anyone having trouble. This is one way to highlight the skills of some teachers and create a more positive approach to implementation. Yocam and Wilmore (1994) conducted extensive research and found that teachers were able to learn best in an atmosphere of collegial support, collaboration and experimentation. When given the opportunity to watch their colleagues implement new strategies with students, they were able to analyze the process and apply it to their own classrooms.

Project Design

The data was gathered using two main strategies: surveys and interviews. A pilot study was conducted with five teachers using the survey. The feedback from the pilot study allowed for clarification when the survey was presented to all participants in the group. The data from the pilot study was included in the final analysis and the five teachers surveyed were not surveyed again with the entire group.

The entire professional teaching staff (54 teachers) of a high school in Alberta was surveyed. The surveys were distributed during a staff meeting where I explained the purpose and my personal interest in the issue of technology use in schools. Teachers were asked to return the completed surveys to me before leaving the meeting.

The surveys generated quantitative data. The surveys, using the Likert scale, provided an efficient and accurate means of gathering the data. The results were interpreted by comparing the frequency of use with various other factors such as computer skill, computer access, technical support and professional development opportunities. Due to the extreme differences in course content between the option areas and core subjects, some of the data generated from teachers of the core subjects was extracted to increase the validity of the results. The findings presented the common experiences of teachers with technology in the classroom.

The interviews were the secondary data gathering strategy of the project. Three members of the professional staff were selected for the interview stage of the project: one administrator, one department head, and one teacher. The interview process required the interviewees to reflect critically on their technology choices and motivations for technology use. The reflections augmented the survey and engaged me in an enriching

professional dialogue. The interviews allowed me to delve more deeply into some areas and led to a more thorough understanding of the results gathered from the surveys. It also caused me to reflect upon the solitary nature of our profession. Although many teachers share similar frustrations, we are rarely given an opportunity to share or problem-solve together.

Survey Design

The survey was designed to identify clearly how frequently the technology is being used by teachers in their non-instructional and instructional duties. Although the survey could have been completed using a Scantron form, I felt it would appear more user-friendly if the teachers were able to respond directly on the survey itself. These teachers was also surveyed two weeks prior as part of a district wide Information Technology Implementation Review using a Scantron form and I did not want my survey to appear to be a repetitive exercise.

The survey was divided into six sections. The first, Background Information, provided feedback on the teachers' level of computer competence by asking questions about specific software applications and on-line resources. This section also asked them about their teaching assignment, teaching experience and classroom computer access.

The second section queried teachers on their use of e-mail, software applications and on-line resources for non-instructional purposes. Communication (with colleagues, students and parents) and grading software were the two areas surveyed in this section.

Instructional use of technology comprised the third section. The questions in this section related specifically to the teachers use of on-line resources, software applications and the Internet for curriculum delivery.

Teachers were asked about the time required to use technology in their classroom in the fourth section. Having a sufficient amount of time to prepare lessons incorporating technology and to improve ones' skills is a common concern expressed by educators in the literature reviewed for this project.

The fifth section focused on another crucial factor in technology implementation, technical support. The purpose of this section was to determine to what extent technology failure or difficulties lead to the non or limited use of technology. Again, the literature reviewed for this project asserts technical support within the context of a strong infrastructure is essential to the effective use of technology.

The final section explored participation in technology-focused professional development activities. Teachers were asked to evaluate the effectiveness of the sessions in which they had participated.

Each section was followed by a space for comments or further explanation. There were 76 questions on the survey and teachers completed it within the thirty minutes allotted during our regular staff meeting.

The data was summarized in a spreadsheet which allowed the results to be accurately and efficiently analyzed. The Likert scale was represented using a five point system (1=Never, 5=Always). Formulas were applied to generate correlations and data analysis. The spreadsheet also allowed the data to be grouped and sorted. Technology use in specific departments and in comparison to the teachers' computer competence level were two areas highlighted for discussion and analysis.

Any written comments entered in the spaces provided below each of the survey sections were listed under the particular theme or nature of the comment. Subjective observations and conclusions about the comments will be given following the statistical analysis of the survey findings.

Administration of the Survey

All of the 54 surveys were completed within the thirty minutes given during staff meeting and returned to me. About 15 teachers stayed after the meeting to discuss the survey and their experiences with technology. Several of them commented on the survey design and I was pleased to hear they were able to complete it without any difficulty. They commented specifically on the organization of the survey and on the clarity of the questions. Many also found the five levels of responses (Never - Always), represented their feelings better than a yes/no or three level response scale. Although the Scantron form would have made the data easier to tabulate, my survey design met my objective of being engaging and easy to complete.

Some questions caused confusion, but I was able to respond to most of the questions during the meeting. Some teachers were not sure how to respond to "Is E-mail a secure and private form of communication?". Some thought they could not respond because they did not know if e-mail was secure or private. Others felt they should not respond since they did not use e-mail. The results from the voice-mail questions also indicate confusion. Most teachers surveyed reported not using voice mail at home, when in fact, virtually everyone has and uses some sort of phone messaging system. I did not anticipate the possible confusion in terminology and should have used another term for these questions.

Interview Design

The interview was designed to augment the issues raised in the survey portion of the project. Three teachers were selected based on their ability to represent the staff and on their experience with technology. Although all three candidates have used technology extensively, either at home or at school, none of them would be considered strong advocates of technology use in schools. They are reflective, experienced teachers with strong feelings about technology and a passion for education. All three individuals answered the same group of questions. The interviews were conducted in the teachers' classroom after school hours. Interviews were taped and salient points transcribed. The three interviews also flesh out the department-specific survey data since the individuals represented the Mathematics, Social Studies and Science departments.

Survey Results and Analysis

The survey was designed to determine the frequency of technology use by secondary teachers. This information is most useful when it is compared to specific demographic information such as the teachers' computer skill level and area of teaching specialty. Before presenting the survey findings in relation to the themes discussed in the literature review, I will provide a demographic overview of the survey sample. The survey finding relating to the demographic information provided by the survey are presented in Figures one through three and are found on pages 18 - 20.

The sample of secondary teachers (grades 7 – 12) surveyed is typical of many of the schools in Alberta with 35% of teachers having more than 20 years of experience (Figure 1). This school also has a significant portion, 45%, of teachers with less than 10 years experience. It is often assumed that teachers with many years of experience are less likely to adapt and use new technologies. This particular sample of teachers did not support that assumption. As will be shown later, technology use is heavily dependent on the individual access and skill level more than on years in the profession.

This group of teachers demonstrated a high level of computer competence with 83% of teachers rating themselves with at least 'average' abilities (Figure 2). Most teachers have basic computer skills but, only half know how to perform a search on the district on-line library catalogue or order videos and materials on-line (Figure 3). Teachers can send their documents for photocopying on-line, but only 28% of teachers have the skills to do it.

Years of Teaching Experience

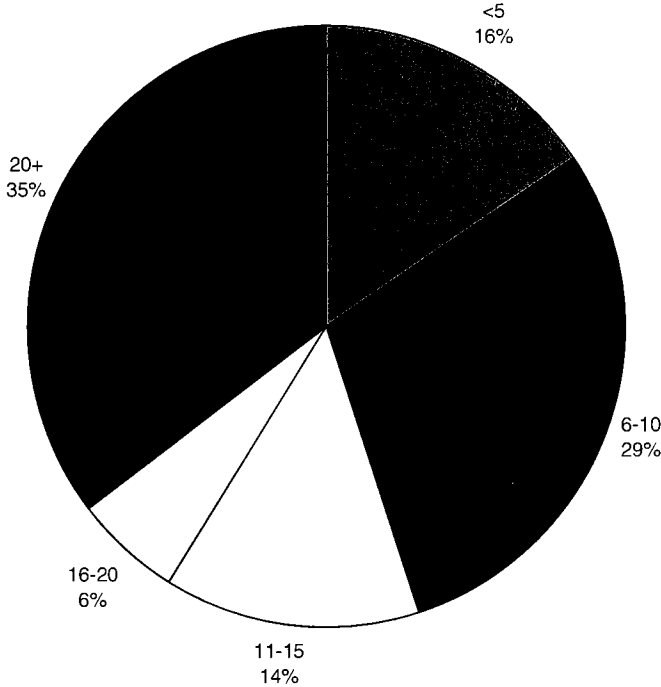


Figure 1: Years of Teaching Experience

Computer Competence

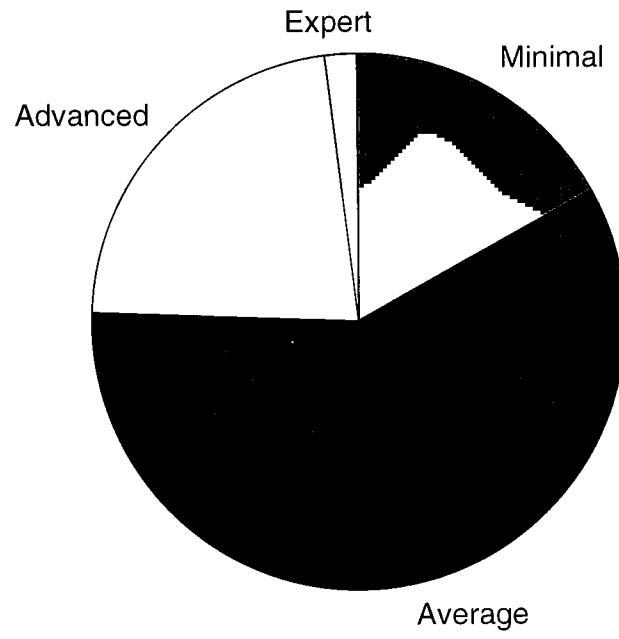


Figure 2: Level of Computer Competence

Do you know HOW to:

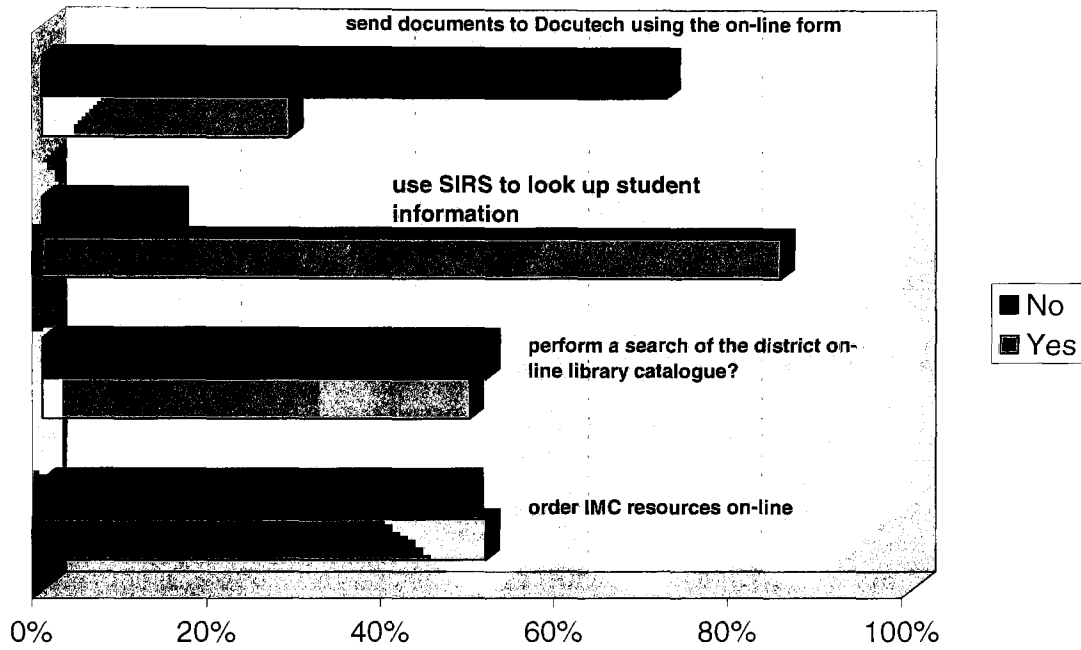


Figure 3: Teachers' Ability to Use On-line Resources

The first major theme drawn from the literature reviewed for this project focuses on the importance of having a strategic technology plan in place to guide technology use. I chose not to make this a focus of my survey since it was such a large part of The Information Technology Implementation Review conducted in January, 2001. This review found that 63% of survey respondents were unaware of a District Technology Plan and 69% were unaware of a School Technology Plan. They recommended "the district and schools should develop educational plans that guide the implementation of technologies, specifically computer technologies, into the core curricula." They also stated that "strategic planning is required to align future decisions and priorities".

The second major theme found in the literature reviewed for this project addresses the issue of time and access to resources. The survey findings strongly support the need for more time to access, use and implement technology in the classroom. The results are presented in Figures four through ten which appear on pages 25 - 31.

The majority of teachers, 38%, indicated the primary reason for their limited use of technology in the classroom was insufficient time (Figure 4). In discussion, many teachers explained that when faced with the day-to-day demands of the classroom and the need to keep abreast of developments in the curriculum most simply did not have the additional time required to incorporate technology. Teachers willing to incorporate technology must first find the time to acquire the skills necessary to apply the software effectively within the context of their lesson. Next, teachers must find the time to secure a lab or book the necessary equipment for their classroom. Finally, teachers must add the needed technical instructions to the lesson to ensure the students are able to use the technology to fulfill the outcomes of the lesson. Before teachers decide to use

technology, they must decide if the students will benefit from the extra time and effort required to prepare the lesson.

Access was another significant limiting factor for 27% of teachers. Seventy-one percent of classrooms currently have only one computer and of those 75% have access to the Internet with that computer (Figure 5). Teachers who wish to use technology with their classes must gain access to one of the four labs available in the school. Due to the high demand for these labs, they are often booked weeks in advance. This problem has lead some teachers to give assignments which require the students to use their home computer or access a computer in the library during their free time. However, many teachers indicated the frustrations associated with limited access to technology have led to the non-use of technology entirely.

Over 75% of teachers 'never' use e-mail to communicate with students or parents and 18% use it 'often' to communicate with colleagues (Figure 6). Many teachers confirmed the results in the survey and commented that e-mail is not a reliable communication option for students, parents and teachers at this school.

Additionally, at least 50% of teachers 'never' use on-line resources (Figure 7). If teachers have access to a computer in this district they can order videos, search and place holds on books and send photocopying on-line. They can also use SIRS to look up student demographic or timetable information. SIRS is the most used on-line resource and is used either 'often' or 'always' by one third of teachers (15%, 20% - Figure 7). Videos and resources are available to be booked on-line but almost half of the teachers do not use this service. Forty-five percent and 48% 'never' book resources or videos on-line from the Instructional Materials Center. Teachers could also make photocopying requests

on-line by sending the master document to the district printing services office. Currently, 75% of teachers do not use this service and continue to send the document through inter-school mail which has a three day return rate. The on-line process is faster and more efficient but formal training has not been given to individual teachers.

If teachers would like their classes to use computers or the Internet for an assignment, 90% of teachers would have to move to a lab (Figure 8). I have chosen to highlight only the core courses (Mathematics, Social Studies, Science and English) since many of the option areas, for example, Fine Arts, Food Studies, or Physical Education, rarely require a computer lab with Internet access for their entire class.

The logistics of moving into a computer lab for a lesson can be difficult to manage. Technical glitches occur regularly in a lab of 25 computers. The teachers expressed concerns about the difficulties of solving the technical problems while giving instructions on the lesson. Teachers who are not comfortable trouble shooting in a lab is apt to avoid the frustration by not using a computer lab. Despite the technical difficulties and limited access, a significant majority of English and Science teachers (75%) move their classes to a computer lab 'occasionally' (Figure 8).

Having adequate time to use technology and prepare is a concern for a large majority of teachers who reported they would use technology 'often', 41% or 'occasionally' 34%, if they had more time (Figure 9).

Many teachers felt they 'seldom', 52%, or 'never', 12%, had the necessary time to incorporate technology into their teaching. Incorporating technology requires teachers to effectively match the intended learning outcomes of the curriculum with the most appropriate technology application. Once this step is complete, they must make sure they

are able to use the technology well enough to adapt their assignments and provide technical instructions for their students. The successful incorporation of technology into an assignment can result in hours of preparation. Teachers expressed the need to see significant benefits in the technology use before they make the decision to add a technology application to a lesson.

Not having adequate time to prepare or access to technology also contributes to a lower skill level. Most teachers felt they would use technology 'always', 14% or 'often', 41%, if they had a higher level of computer skill. Technology training has been offered sporadically by the district and often not reinforced by supplementary training sessions or practice time. The yearly upgrading of computer software often necessitates the quick acquisition of new skills.

Sixty four percent of teachers reported using their home computer to prepare assignments using the Internet (Figure 10). In discussion following the survey, the majority of teachers appreciate the Internet as a valuable classroom resource, but limited time and access at school has caused them to use their home computer and leisure time for Internet research. Finding web sites on the Internet on a home computer can occasionally lead to disappointment in the classroom if the screening software on the network does not allow the class to access the particular site the teacher has chosen. Teachers may chose to use the Internet simply as a research tool to augment their lesson in class and never intend the class to access the site.

Technology Use is Limited in the Classroom Due to:

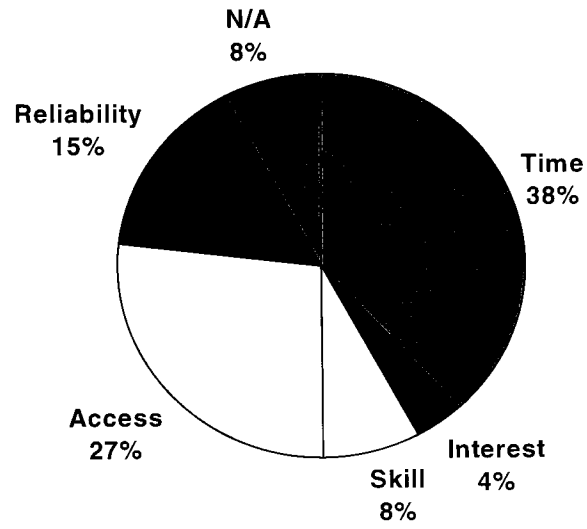


Figure 4: Reasons for Limited Technology Use

Computer Access

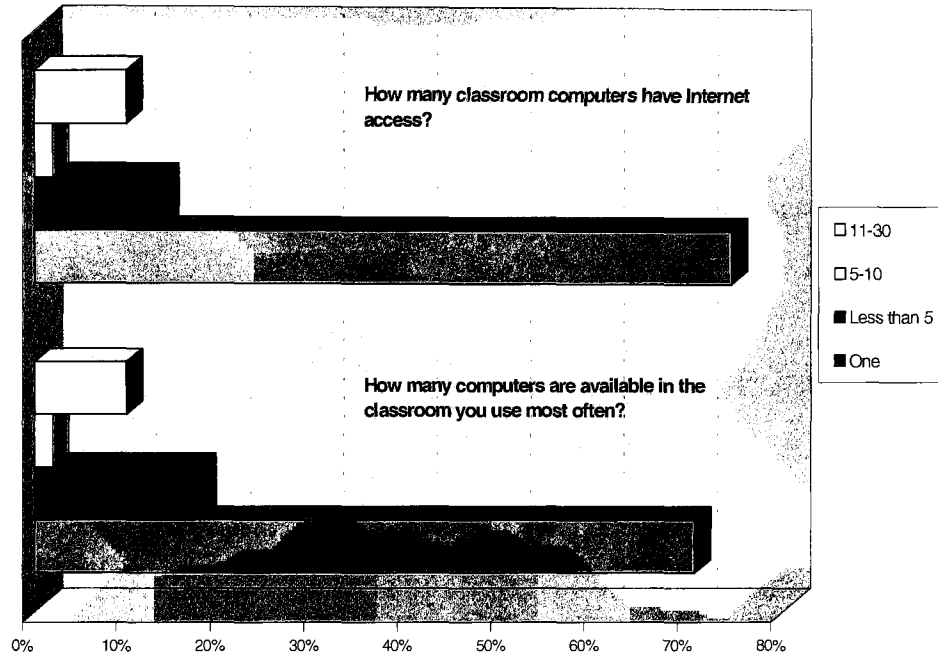


Figure 5: Computers in Classrooms

E-mail Use

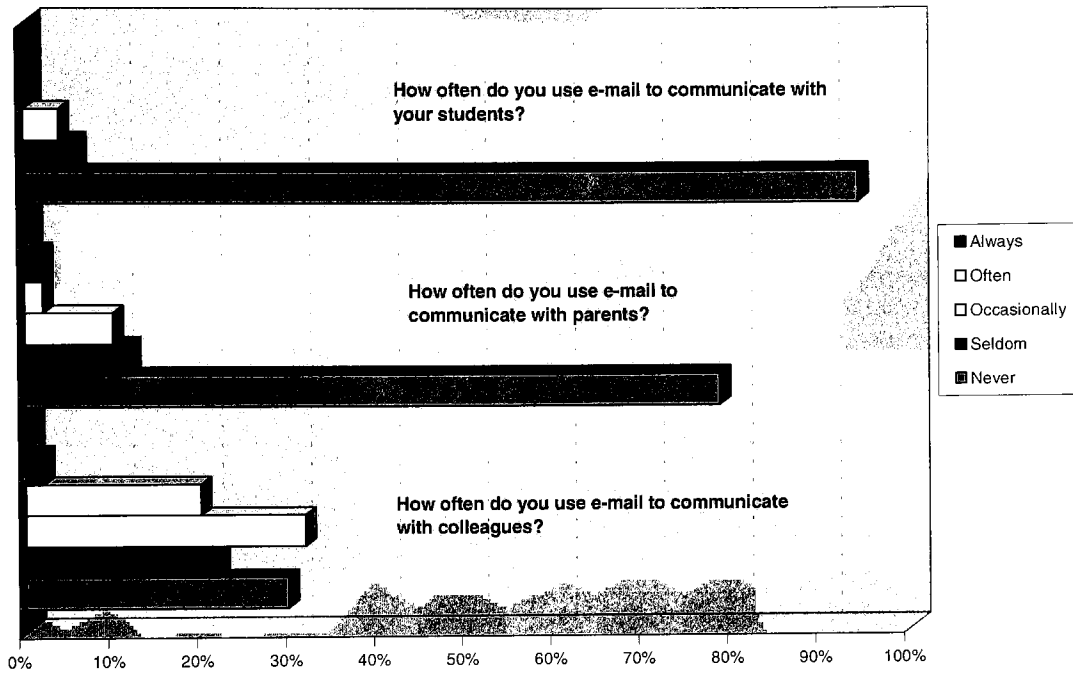


Figure 6: E-Mail Use

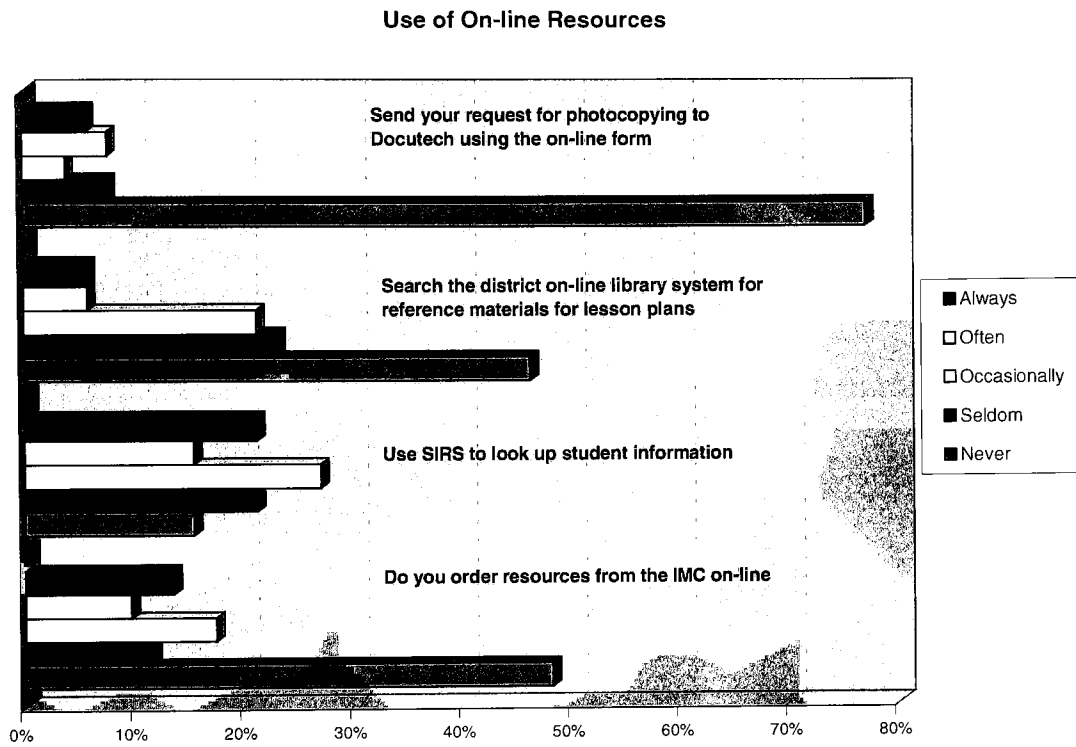


Figure 7: Use of On-line Resources

How often do you move your class to a computer lab for instructional purposes?

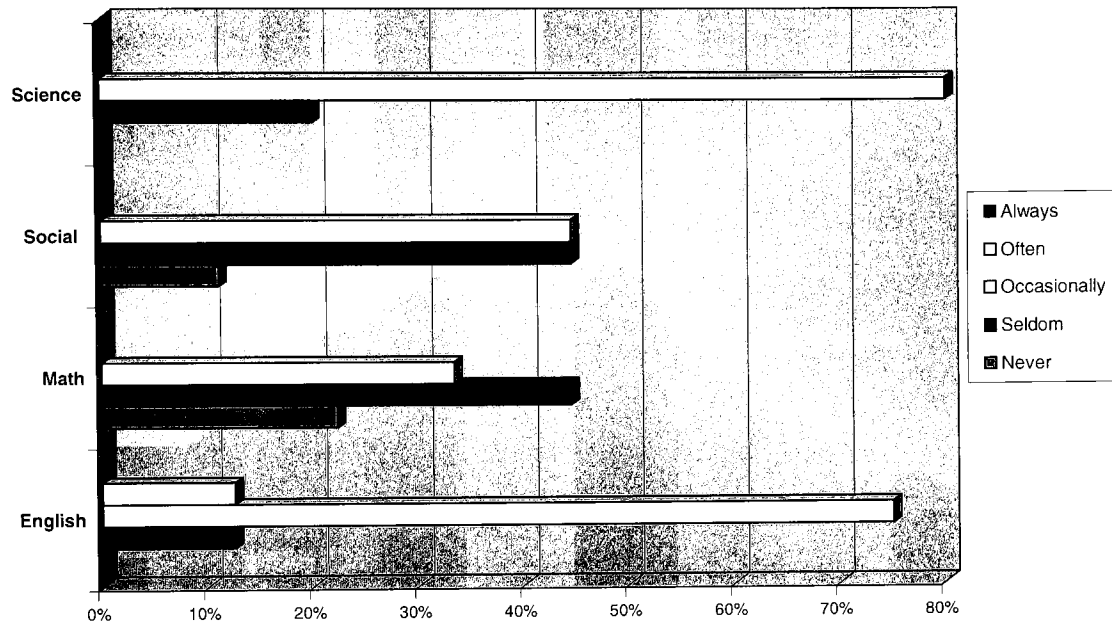


Figure 8: Class Use of Computer Labs

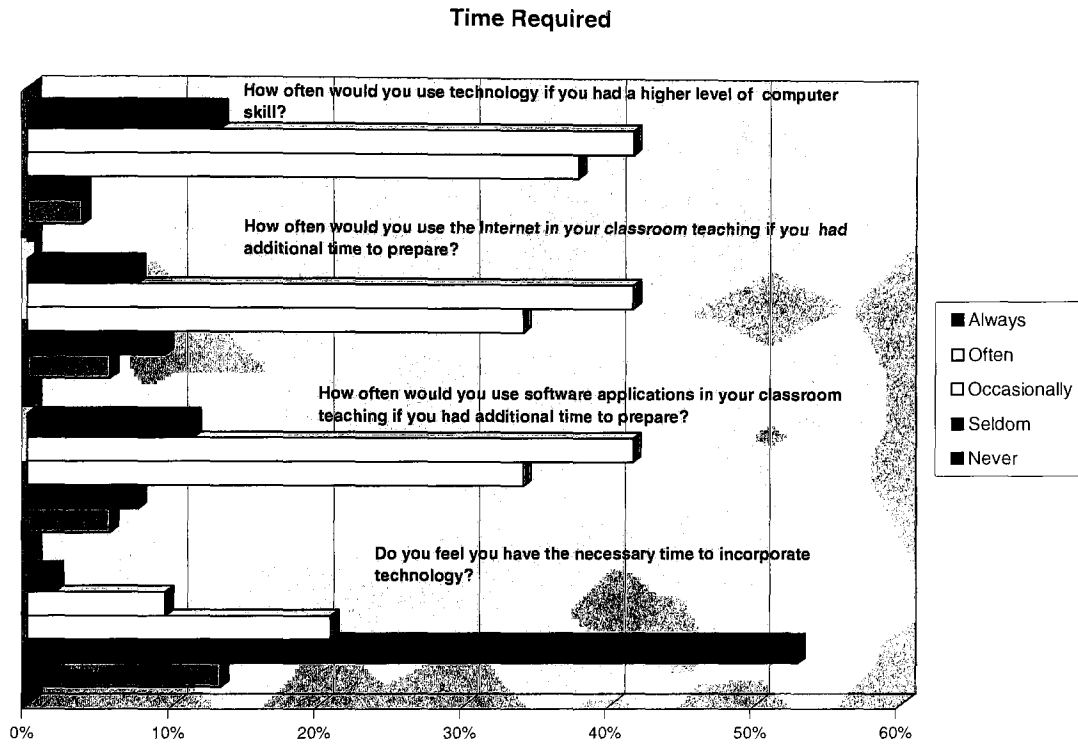


Figure 9: Time Required to Learn Skills and Incorporate Technology

Home Computer Use

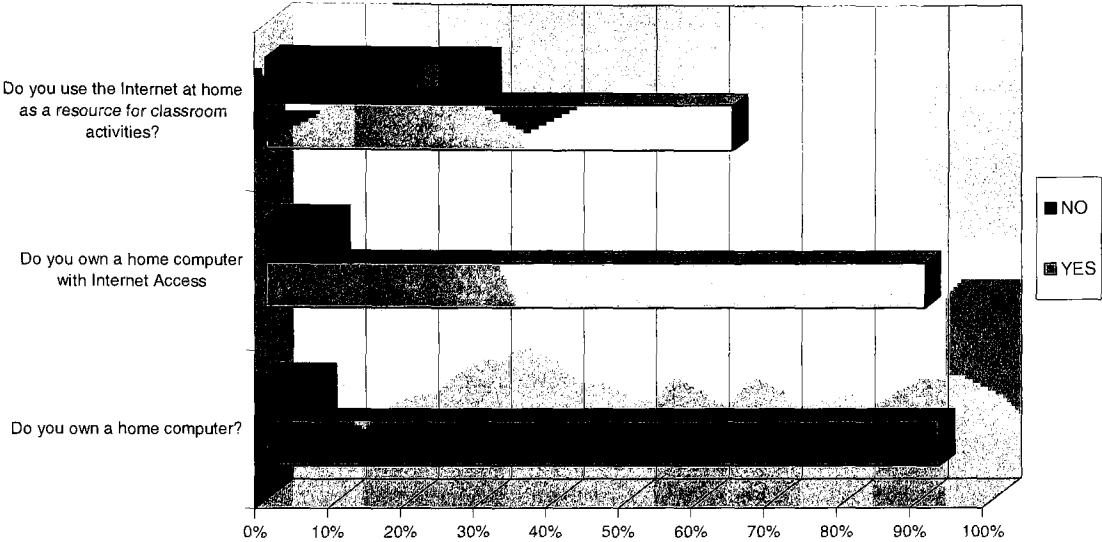


Figure 10: Home Computer Use

The literature reviewed for this project also stressed the importance of having a strong and reliable infrastructure for the successful use of technology in schools. The survey findings addressing the second theme are presented in Figures 11 through 15 on pages 35 - 39.

The majority of teachers are 'seldom', 44%, or 'never', 10%, able to receive an adequate level of technical support in their classrooms. Technology failure results in many teachers canceling their lesson 'occasionally', 33%, or 'often' 8% (Figure 11). Technology failure requires teachers to quickly switch gears and create a new assignment while maintaining classroom control. Students quickly become frustrated if the Internet is down or their computer 'freezes'. Teachers commented that most students have computers at home and expect the computers at the schools to be reliable and fast. Teachers who have been faced with a class of restless and impatient students time and again, told me they now choose to avoid using technology entirely.

The vast majority, 75%, of teachers stated their ability to effectively use technology in their classrooms was limited due to technical difficulties (Figure 12). The literature reviewed for this project stressed an unreliable technology infrastructure causes frustration among teachers and students which eventually leads to the non-use of technology. Technical difficulties limit the abilities of all teachers to use technology regardless of their computer skill level or subject area. Many teachers expressed an interest in using technology 'often', 50% or 'always', 14%, if their level of technical support and access were to improve. The survey findings revealed that teachers and students are motivated to use technology but the infrastructure must be able to meet the demands of both parties reliably.

When asked about specific computer assistance, most teachers were able to access technical assistance 'seldom', 35%, or 'never', 5% (Figure 13). Almost half of the teachers were 'seldom' or 'never' (42% and 49%) able to get assistance with the Internet or e-mail. Teachers receive technical support for the Internet or e-mail from one of the three technicians employed by the district. The technical assistance needs at this school require an on-site technician for at least half of every day. The three technicians employed by the district must share their time between nineteen schools. Technical assistance with voice mail proved much easier to access with teachers receiving assistance 'often', 43% or 'always', 11%. Assistance with voice mail is available from the office support staff in the school at any time. The survey findings demonstrated that on-site support for voice mail has allowed it to be a highly used and reliable form of communication for teachers.

Technical assistance for non-instructional teaching aids proved easier to obtain. About one third of teachers were able to get assistance with the on-line district library catalogue 'often', 15% or 'always', 17% (Figure 14). This assistance would come from within our school, either from the teacher-librarian or library aide. Teachers have been offered one-on-one training and can call the library whenever they are having difficulties. The successful use of the technical assistance available in-house for the on-line district library catalogue further demonstrates the value and need for on-site technical personnel.

Use of grading software is split among a few software packages, but most teachers are able to get some assistance 'often', 44%, or 'always', 21% (Figure 15). Many teachers mentioned receiving assistance from colleagues during report card time.

It has been difficult to find a grading software package that meshes well with SIRS. SIRS is used for student timetabling, grade reporting and the collecting of demographic data. Gradebook seems to work best with SIRS, but because it is not user-friendly many teachers continue to use Integrate for calculations and then enter final marks manually into SIRS. Thinkwave has recently been purchased for use by the district and has the advantage of posting marks to the web. It is not being used by many teachers and there has not been any formal training offered yet. After first using Integrate and then struggling to use Gradebook, some teachers expressed reluctance about trying Thinkwave even though they have been told it is a superior grading software package. Despite the many grading software packages available, a relatively high number of teachers are still using a calculator to verify the results from the grading software.

Teachers are required to use SIRS daily to report attendance and four times a year to record marks. Teachers may choose to use it to look up demographic and time-tabling information, but this information is also available in printed form in the main office. The majority of teachers report being able to obtain assistance with SIRS 'often', 46% or 'always', 23% (Figure 14). Teachers mentioned referring to the main office support staff when they had difficulties. Again, the survey findings demonstrate the advantages of providing on-site technical assistance.

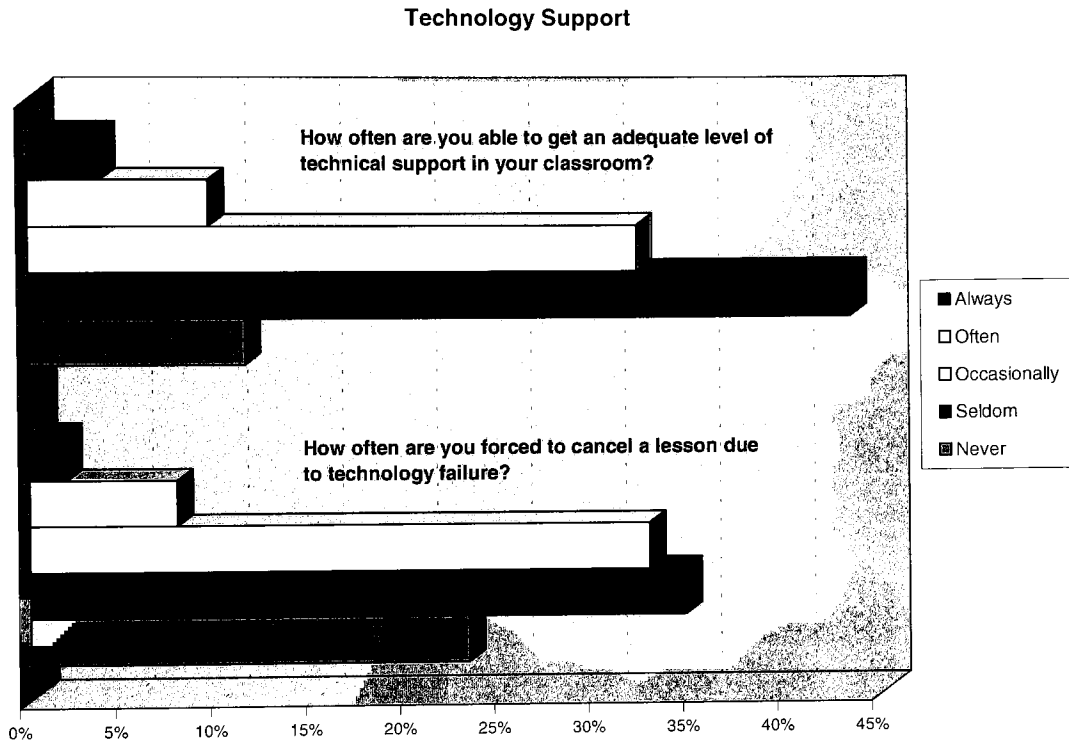


Figure 11: Technology Support in the Classroom

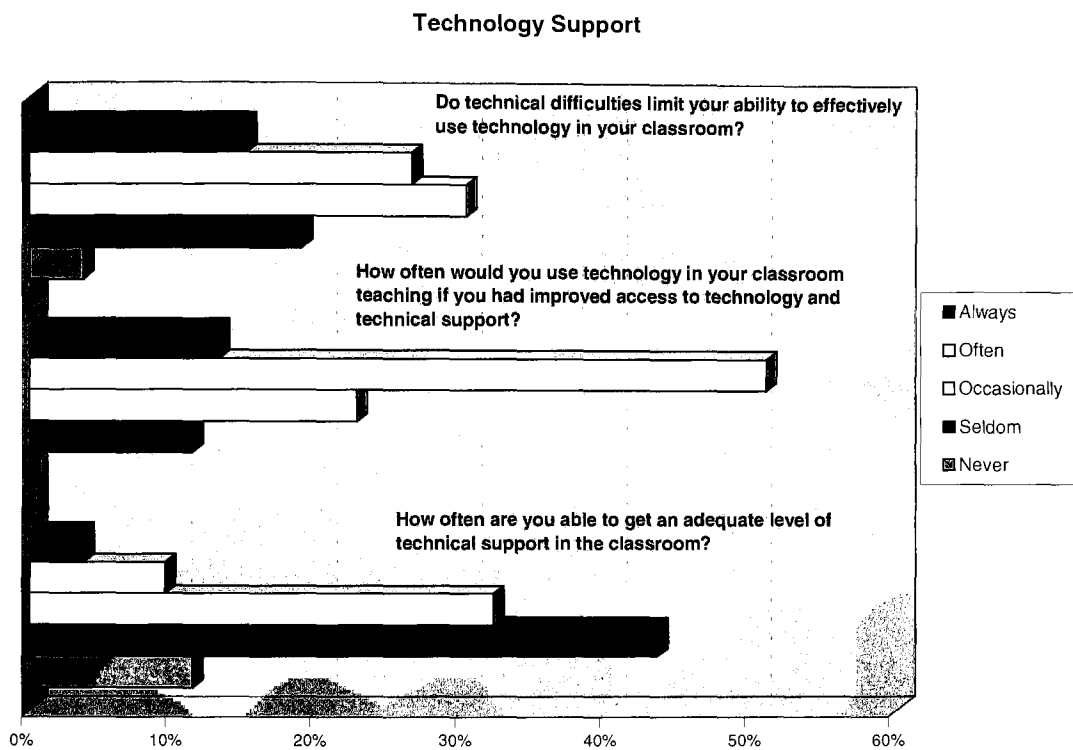


Figure 12: Technology Use in the Classroom and Technical Support

How often are you able to get technical assistance with:

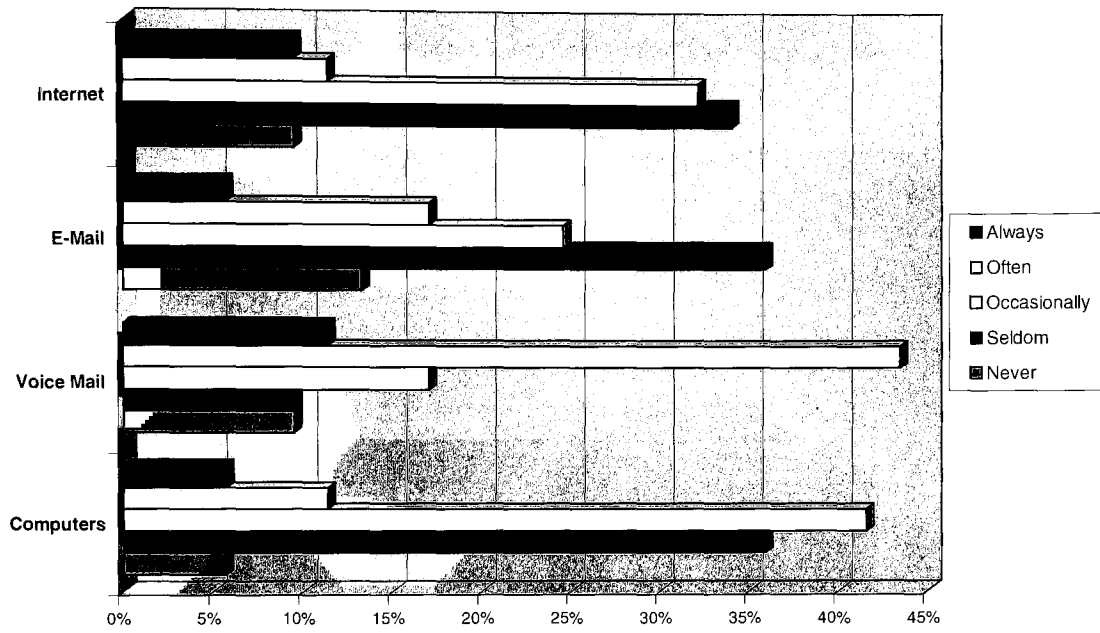


Figure 13: Technical Support for Computers, Communication and the Internet

How often are you able to get technical assistance with:

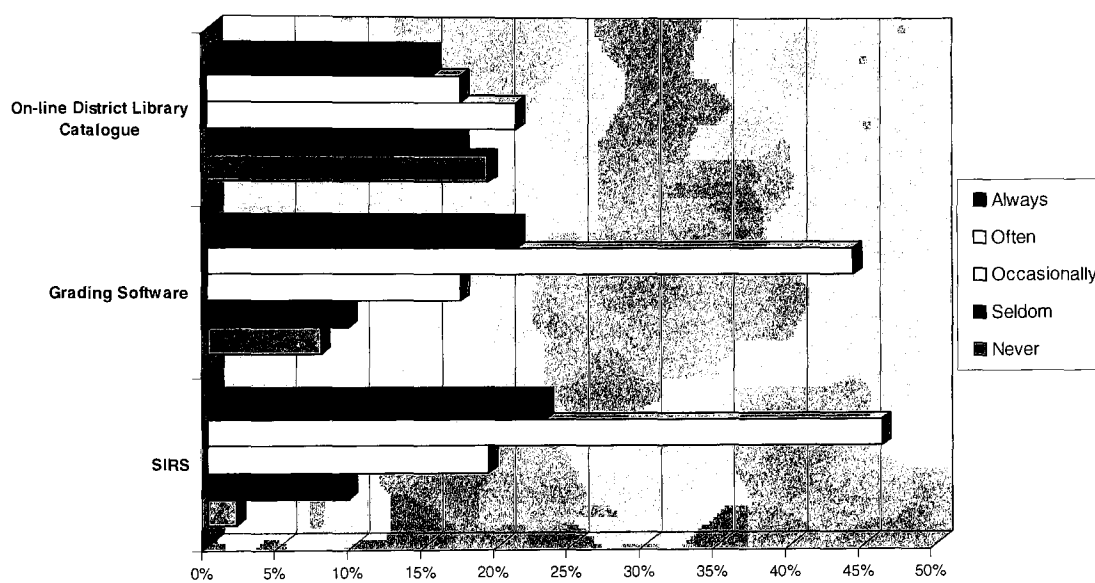


Figure 14: Technical Support with Non-Instructional Technology

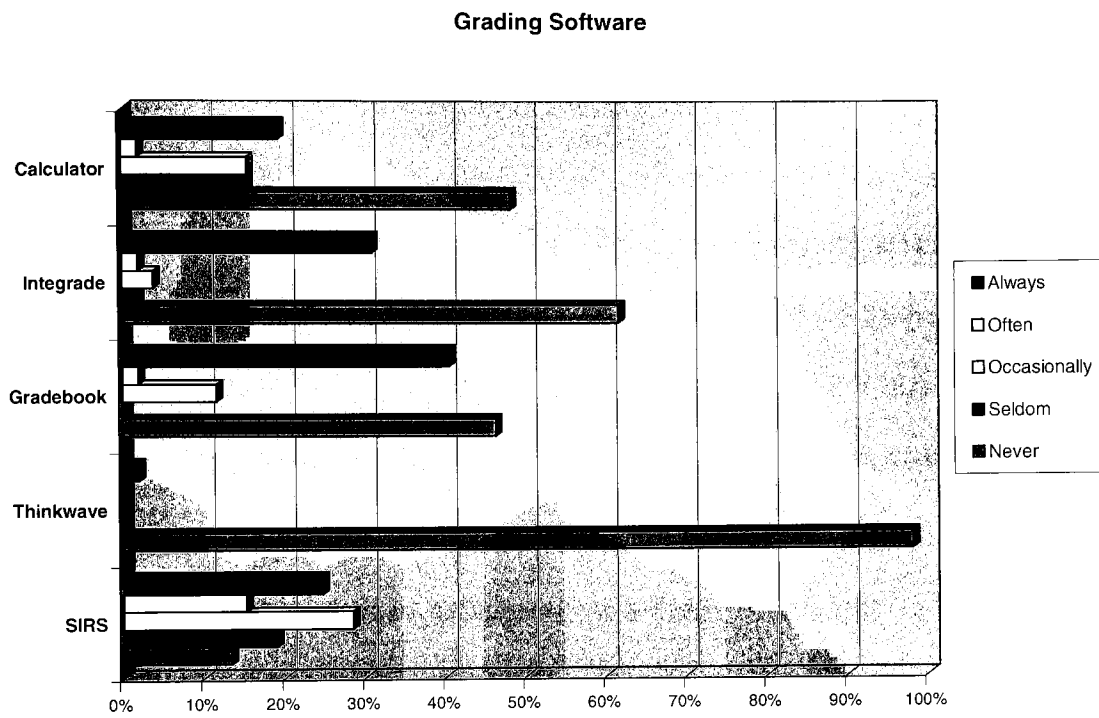


Figure 15: Use of Grading Software

The fourth theme drawn from the literature reviewed for this project emphasized the need for technology use to be pedagogically focused. Figures 16 through 22 present the findings of the questions in the survey which pertain to this theme and appear on pages 43 - 49.

About half of the teachers surveyed use software applications to develop lesson plans 'often', 33% or 'always', 18% (Figure 16). Having a computer on every teacher's desk facilitates this high use of software applications. However, only one third of teachers require students to use software applications to complete assignments with the same frequency ('often', 25% and 'always', 7% - Figure 16). Teachers commented on the access problems for students who do not have a home computer. Some teachers expressed a reluctance to create assignments requiring software applications if it would put any of their students at a disadvantage.

Interestingly, the majority of teachers use the Internet to create assignments and they also require students to use the Internet to complete assignments at least 'occasionally' (Figure 17). Most teachers agreed the computer in their classroom does allow students to use the Internet as an educational tool. However, most classrooms only have one computer with Internet access, so the majority of teachers rely on the students to use their home computer for Internet access. Teachers can access the Internet from the computer in their classroom when students are not using it, and many also use their home computer.

The literature reviewed for this project often referred to a correlation between the individual teachers' skill level and the extent of student use of technology. My survey results were less than conclusive for software applications. Half of teachers with an

advanced level of computer skill reported having students use software applications 'often', 32% or 'always', 23%. However, one third of teachers with a minimal level of computer skill asked their students to use software applications 'often' (Figure 18). The survey results show teachers are aware that many students have a high level of computer skill and will therefore encourage them to use technology whenever possible.

A higher correlation between teachers' computer skill level and student technology use is evident when comparing Internet use for assignments. Most of advanced skill level teachers require their students to use the Internet 'often', 58% or 'always', 8% compared to only 11% of teachers with a minimal skill level (Figure 19). In discussion, skilled technology users expressed more confidence in their ability to navigate students through the Internet to ensure it had educational value than did less-skilled technology users.

Another way to compare and contrast technology use among teachers is by department. The four core departments (Social Studies, Mathematics, Science and English) were selected from the data because the curriculum is best suited for technology applications. Although other departments, such as Physical Education and Fine Arts, may use technology, it is not with any regularity and therefore not relevant to the discussion.

When the four core departments were selected from the data, English teachers stand out as the most frequent users. Two-thirds of English teachers use software applications at least 'often', 50% or 'always', 12% (Figure 20). This high use is largely due to the nature of the course work, which naturally lends itself to word processing applications.

The other three departments have slightly less than half of the teachers using software applications. English and Science also have the highest level of student use of software applications with 63% of English students using it 'often' and Science students a close second with 60% (Figure 21). Science teachers commented on their efforts to incorporate a wide variety of technologies in the classroom. They also enjoy a high skill level among the department members. Social Studies reported 89% of students using software applications at least 'occasionally'. The Social Studies department has focused on using the Internet as a research tool and on the importance of determining the credibility of information found on the web.

When teachers were asked if technology added value to their lessons, 80% of Science and 88% of English teachers believed it did so at least 'occasionally' (Figure 22). However, 33% of Social Studies teachers and 44% of Mathematics teachers believed it 'seldom' or 'never' added value. The survey findings demonstrate a strong positive correlation between the frequency of technology use and the degree to which it added value in the classroom.

Use of Software Applications

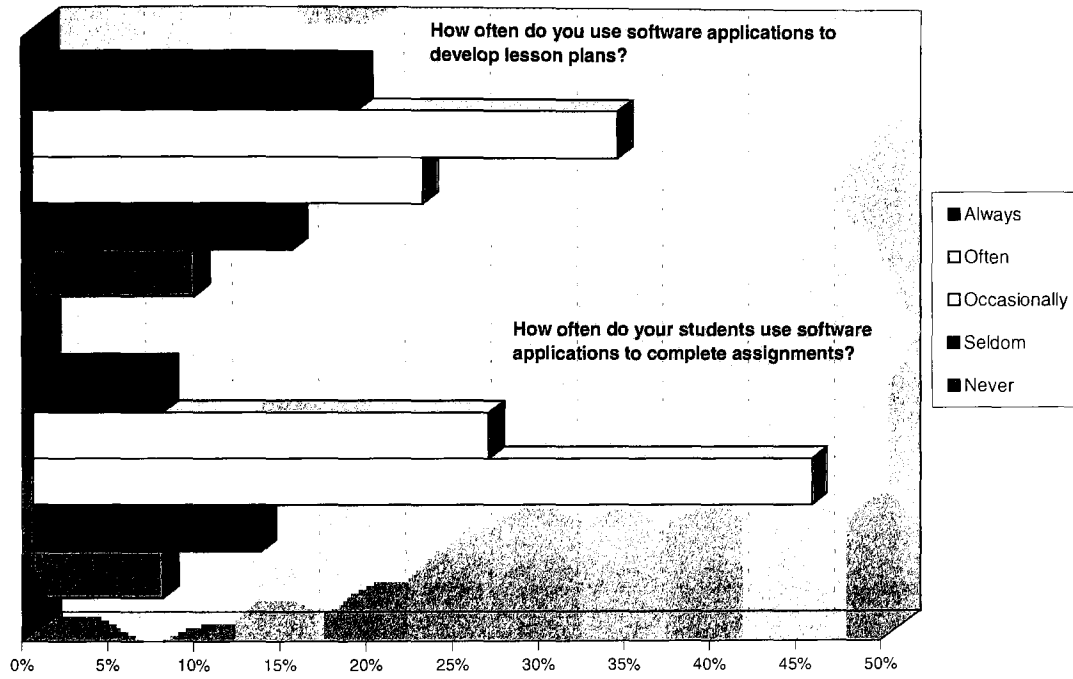


Figure 16: Teacher and Student Use of Software Applications

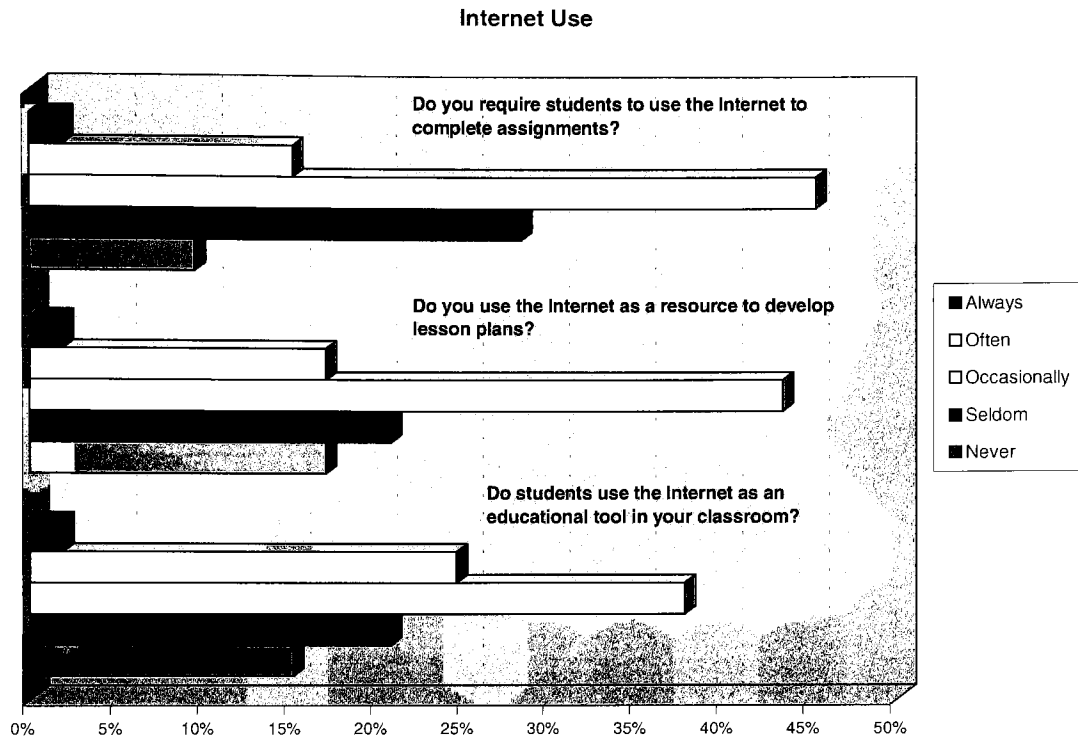


Figure 17: Teacher and Student Internet Use

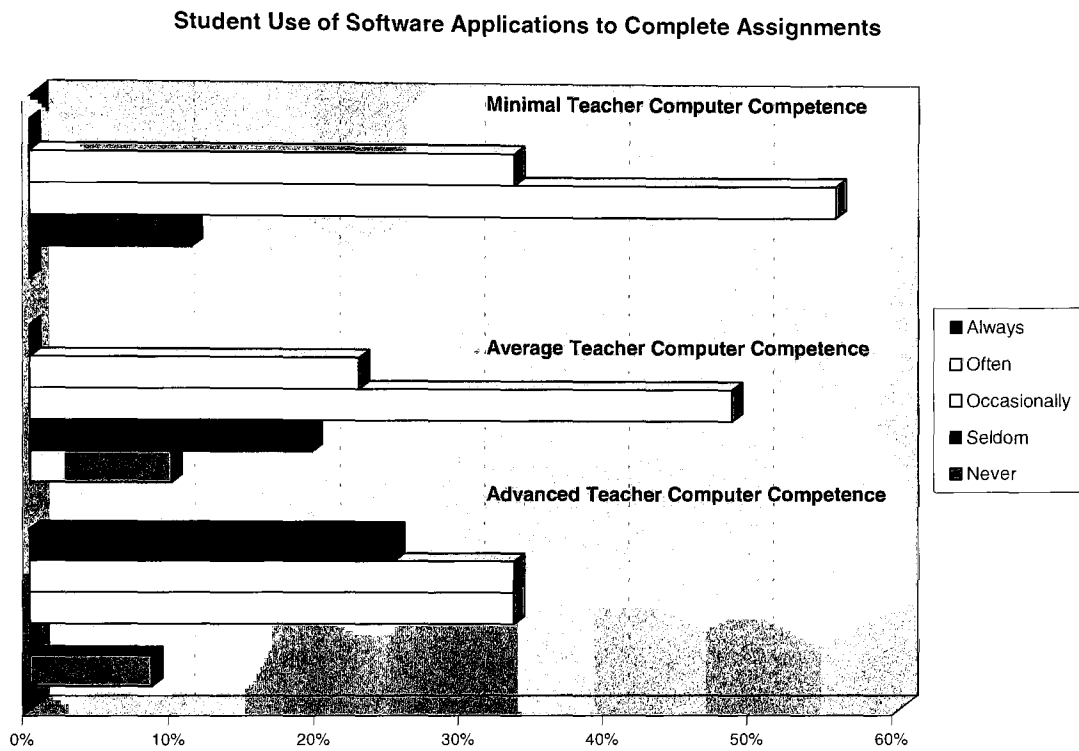


Figure 18: Teacher Computer Competence and Frequency of Student Use of Software Applications

Student Use of the Internet for Assignments

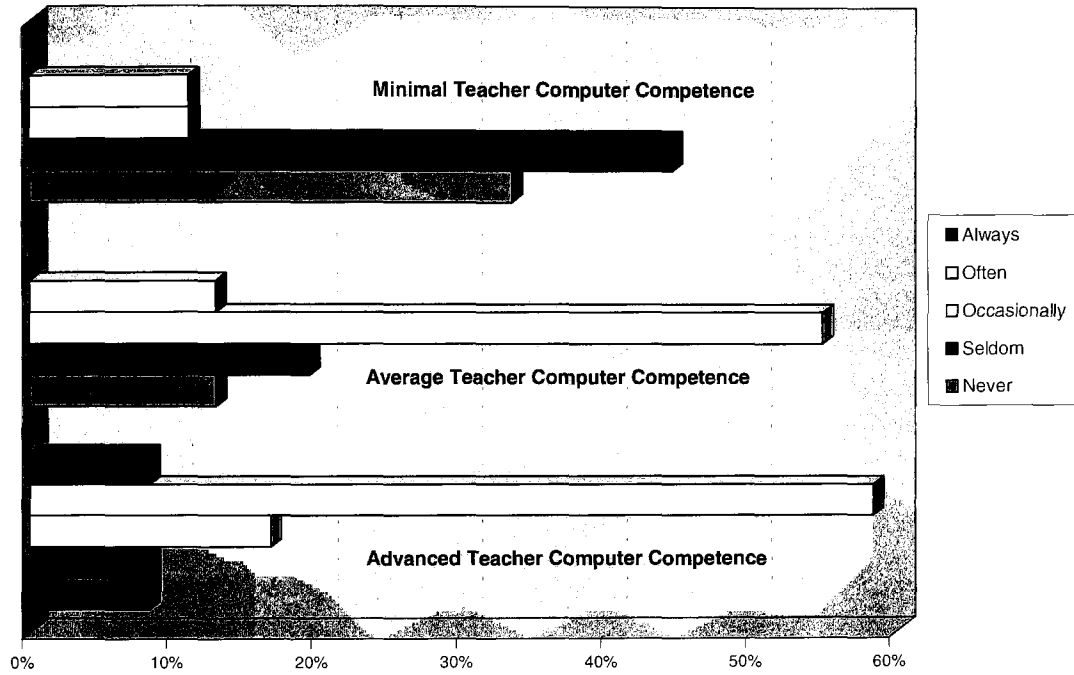


Figure 19: Teacher Computer Competence and Student Use of the Internet

Do you use computer software to develop lesson plans?

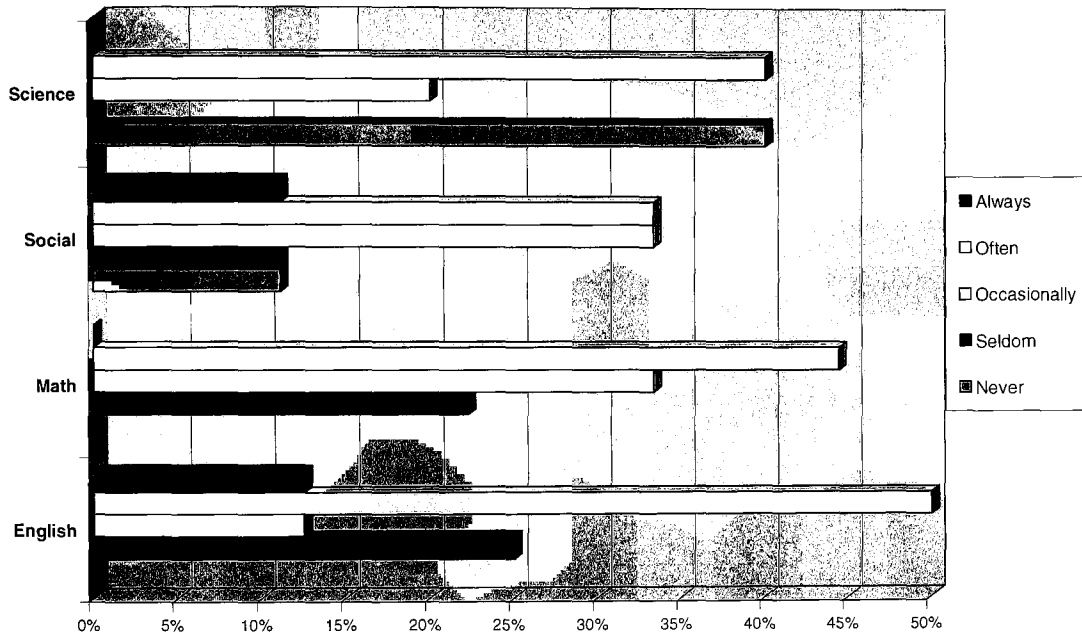


Figure 20: Teacher Use of Software by Department

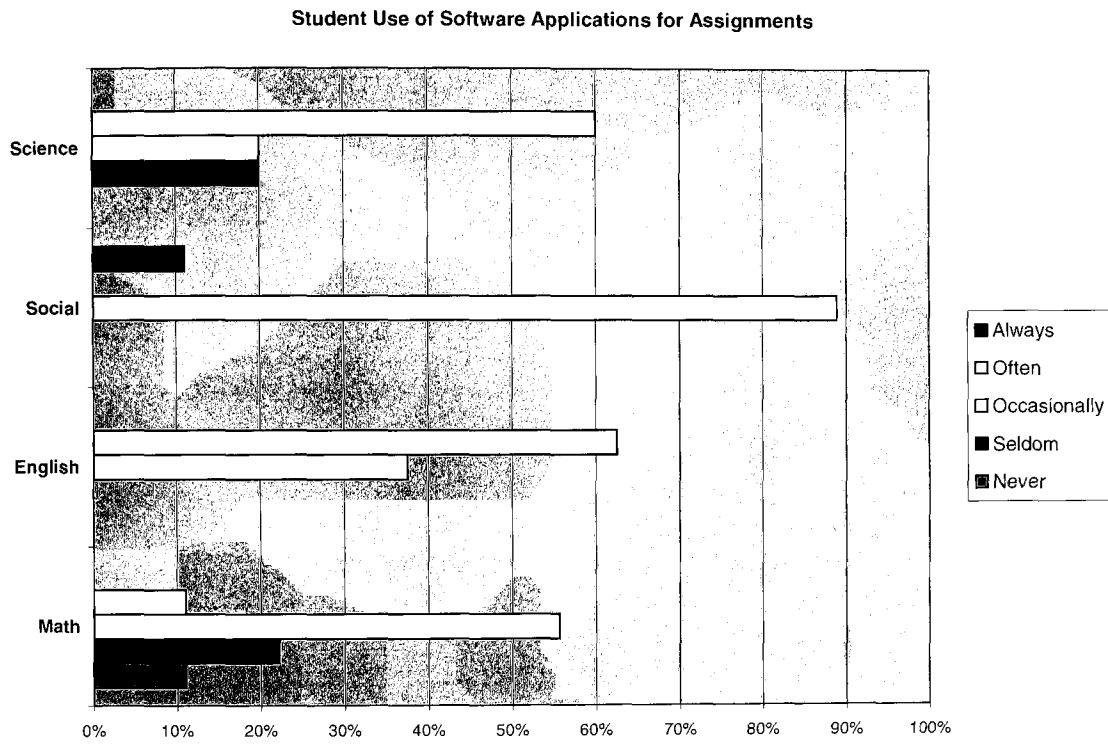


Figure 21: Student Use of Software within Departments

How often does technology add value or meaning to your lessons?

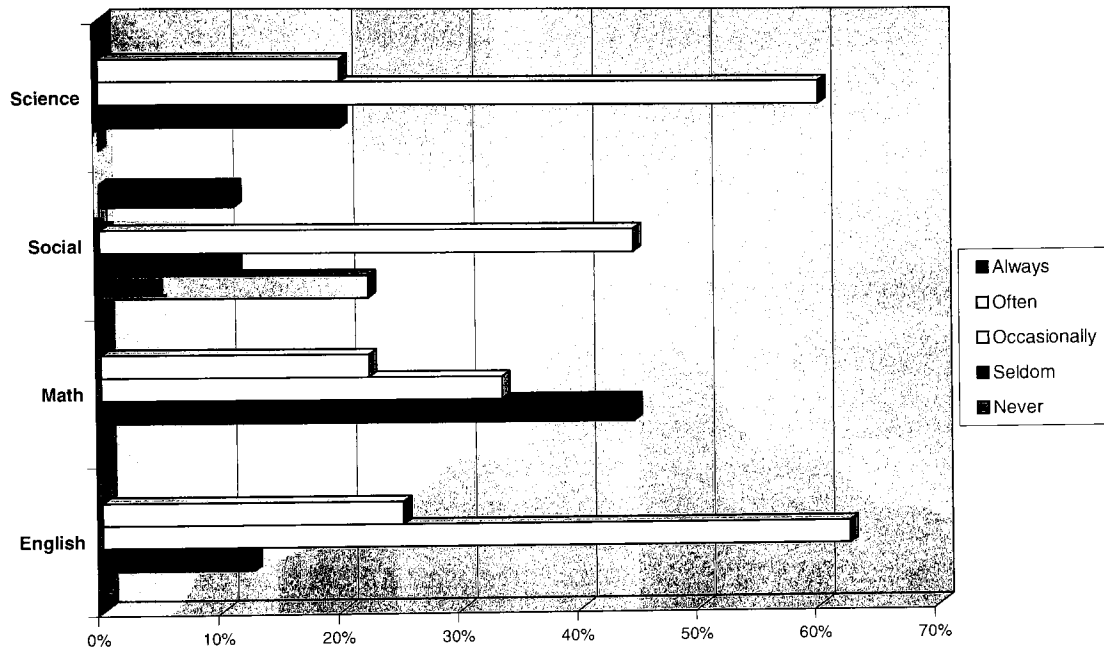


Figure 22: Value Added by Technology within Departments

The fifth and final theme taken from the literature reviewed for this project stressed the importance of the school having an atmosphere which fosters collaboration and experimentation to allow teachers to become more comfortable with technology. The survey findings relating to this section are presented in Figures 23 through 25 and appear on pages 52 - 54.

Teachers comments revealed they are most comfortable learning on their own in the classroom. More formal technology-focused professional development activities have been offered recently. When asked if these types of activities were a priority, at least 80% of teachers in Science, Mathematics and English stated they were at least 'occasionally' (Figure 23). This high level of interest demonstrates the need teachers feel to improve upon their technology skills and learn new ways to incorporate technology into their classroom teaching.

When evaluating the professional development sessions they attended, teachers seemed most pleased with the Microsoft Office sessions with 40% of teachers being satisfied at least 'often' (Figure 22). These sessions have been available during school wide professional development days and during teachers' convention.

A significant number of teachers, 34%, felt they have had little or no access to technology-related professional development (Figure 25). When asked if they would use technology more if they were more aware of possible uses and benefits, most teachers would still use technology 'seldom', 39% or 'never', 8% (Figure 25).

A high percentage of teachers, 64%, access the Internet at least 'often' to stay current on developments in their specialist council, the ATA or Alberta Learning. Despite the many demands on their time and the plethora of documents available from these

sources, teachers are still referring to the web for updates on issues effecting their curricular areas and their professional associations.

Are technology related professional development activities a priority for you?

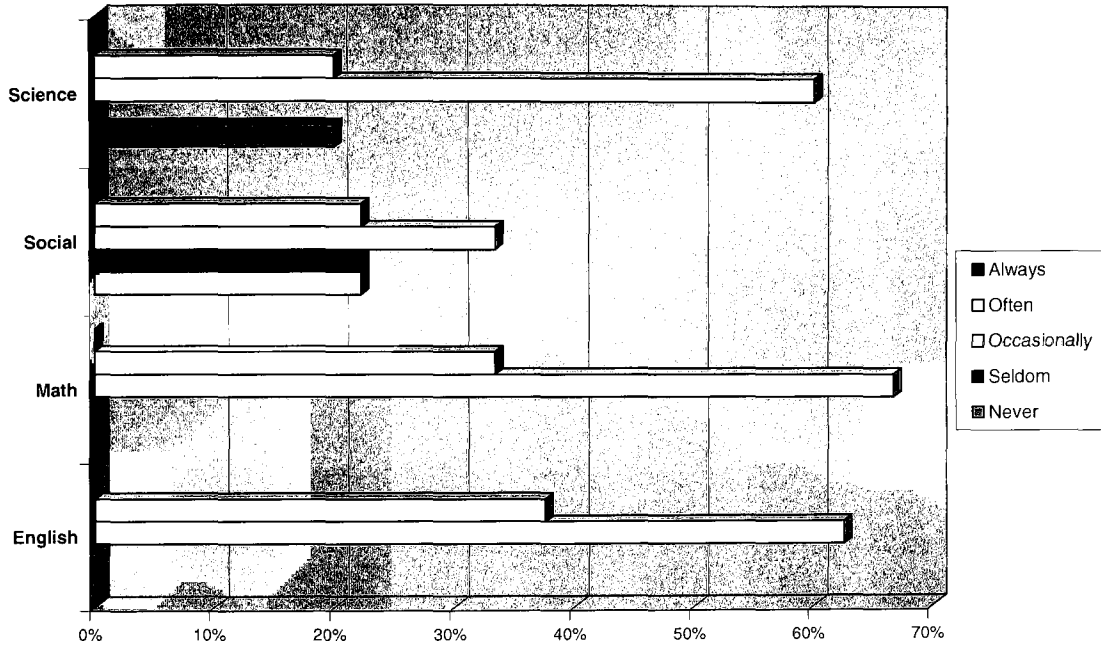


Figure 23: Teacher Interest in Technology Related Professional Development

Have professional development activities met your needs?

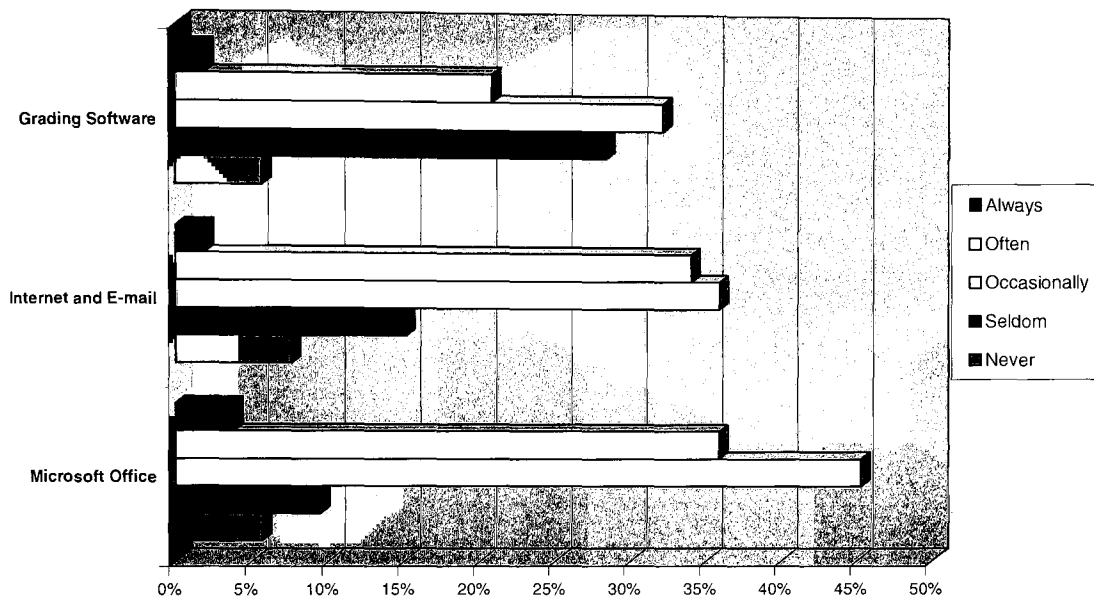


Figure 24: Evaluation of Professional Development

Professional Development

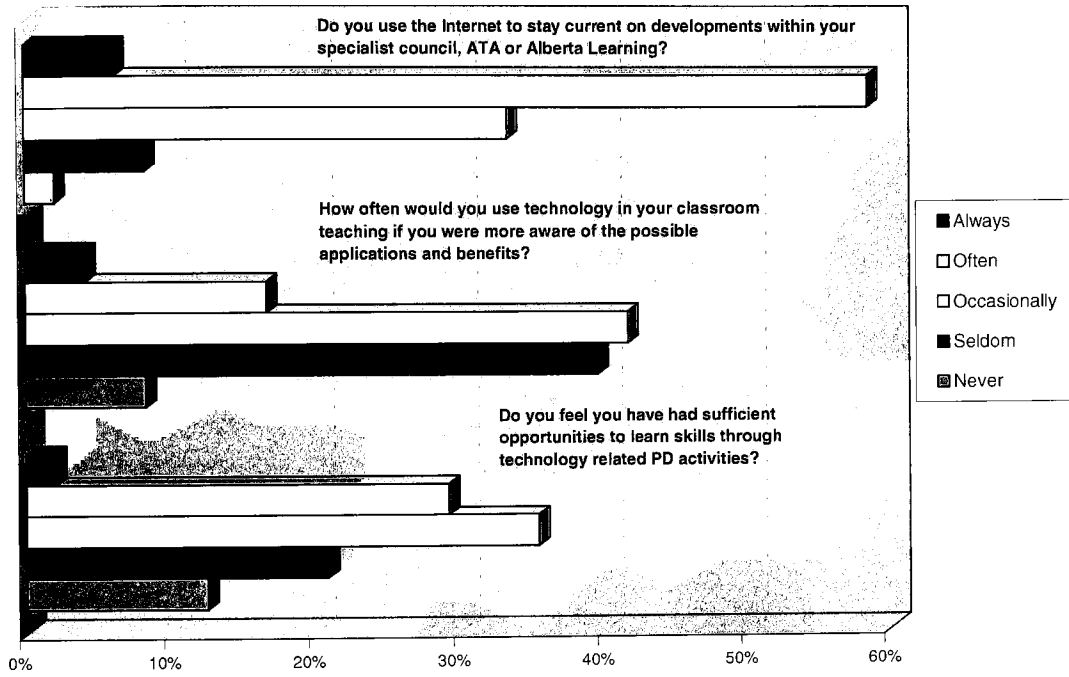


Figure 25: Professional Development and the Curriculum

Written Comments

The quality and amount of the written comments demonstrated a high level of interest and engagement by the teachers. I was pleased to see many thoughtful comments, some quite detailed, throughout the completed surveys. The comments written by teachers on the survey are included below and have been grouped according to the specific themes identified in the literature review. The strong language and sheer quantity of the comments on "Adequate Time and Resources" and "Reliable and Strong Infrastructure" further underscore the results of the survey data. Teachers expressed frustration with the current level of technology support and the unreliability of the network. The comments confirm that most teachers are aware of the benefits of using technology in their classrooms, but are unable to access the proper resources or time to integrate technology.

Adequate Time and Resources

- I use the computer primarily as a word processor at home and school. However, I keep hoping I'll find the time to learn more applications/skills.
- I would like to use e-mail more often at school but I'm not sure who will access.
(different levels of usage on staff)
- Time and available computers are my two biggest roadblocks to use more technology in the classroom.
- It is accessibility more than the time. I have Powerpoint units but the LCD projector is shared. The LCD projector and my computer location do not work well in my room. Some of my Powerpoint presentations have sound but there is no sound card in my computer.

- Time is the key factor. I have several people who I could access but I feel inhibited about asking for their precious time, this learning in the appropriate context, for the best and most effective use is very time consuming.
- We use the Internet and Encarta but limited with 1 computer. No labs because difficult to work with all students who require increased instruction and assistance.
- You have to search for safe Internet sites. Sometimes hours.
- CTS teachers are not given extra time to learn new programs, but often give up their time to assist others to learn.

Reliable and Strong Infrastructure

- Any of my support appears to come from peers who have a free minute - very little formal support comes into play.
- The support usually must come after a frustrating lesson when the students and I have wasted our time. Support must be onsite and immediate.
- The science department for a number of reasons is ahead of many depts. in the school. However, we feel that we have taken a large step backwards with the NT server and its associated problems. We are using a number of 'probes' that are excellent learning tools.
- I am not allowed to change the things I can and they can't change (or won't) the things that need changing. Control and direction of computer use has been absconded by the secretary-treasurer and his vision.
- What works at home may not work at school and visa-versa- in addition what programs a person may use at home may not be available or obtainable at school.
- Communication is a big problem.

- If you are going to use technology, you had better be familiar with it first and be able to trouble shoot.
- 97% of technical support is from fellow teachers who know more than I do - NOT from 'techies'
- I am often frustrated by the fact that we no longer have an on-site person to help us with technical problems. Use of the software seems to be answered by other staff but no one to come in and fix.

Pedagogically Focused

- SS30/33 is developed through discussion/Socratic exploration. The mere presentation of information is done either through reading or lecture. The Internet could be used to enrich or amplify the degree of information but it isn't essential. It is primarily a research tool, an exploration tool.
- Software that is curriculum specific and truly interactive is rare. We find the Internet more valuable for biology. Physics, on the other hand, tends to lend itself to experimentation via the computer. This is probably due to the mathematical nature of the subject and the similar nature of the computer. Biology requires complex animation which is a heavy load of data for computers. Some aspects of chemistry are more amenable to computer use.

Experimentation and Collaboration

- I find it frustrating that most PD activities are for the beginner learner and a lot of time we as advanced users are asked to teach these PD activities. When will something be offered for the advanced users?

- The online search for reference material is too cumbersome for searching and booking.
- We need to be allowed, as professionals, to choose the PD activities rather than always being directed. This way I can choose the direction of my technology needs.

Interviews

The interview was designed to provide further insight and more detailed responses to the topics covered in the survey. The three individuals were asked for their participation after completing the survey. The interviewees were asked the same questions. Like the written comments, the interview responses are grouped according to the theme they best represent. The interview responses emphasize the need for improved access to reliable technology, technology support and preparation time.

The Social Studies teacher's perspective on technology use was strongly rooted in pedagogy. He stressed the need for technology to be used as a research tool and not to be the focus of the program. He was not impressed by the 'bells and whistles' but with finding out how technology can be used to promote improved understanding and learning in his classroom.

The administrator was frustrated by the centralized control of the network. He felt resources have been mismanaged. The possibilities offered by technology excite him but, he felt significant changes need to be made to the current technology infrastructure before benefits can be realized.

The Mathematics department head shared similar concerns regarding access and technology support. Due to her high level of technology skill and experience, she is also aware of the benefits of technology. She expressed concern about the direction of the program. She felt the strong emphasis on the use of the calculator left students without a clear understanding of basic Mathematics theory. She felt many students are able to program the calculator to produce the correct answer, but few could explain the theory behind their answer.

Summary of Interview Responses

1. Background information	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ 4 years in current position of Vice Principal ▪ Science teacher with 20 years experience ▪ High level of proficiency with technology
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ High school social studies teacher with 30 years experience ▪ Above average level of proficiency with technology
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ Mathematics teacher with 15 years of teaching experience with the district ▪ High level of proficiency with technology

General Direction, Goal or Vision

2. What is your goal with respect to technology use by students and teachers in the your classroom?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "technology isn't an end onto itself and I think technology serves as, or should serve as, a conduit for learning...to facilitate and speed the learning process"
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "to use it almost exclusively as a research tool"
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "next year the applied course extends to grade 11 and is heavily based in technology. We will increase our use of technology, primarily the use of spreadsheets and calculators"
3. Would you describe yourself as a proponent of technology?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "Oh ya, you bet. It does open doors, it's a highway, it's the information highway."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "A proponent, yes but not a cheerleader. The use is obvious, it doesn't need cheerleading. It's just another tool, it has value."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "I think in mathematics what's happened is, students are using technology without knowing the basic principals. Technology speeds things up but students must understand the theory."

Adequate Time and Resources

4. How many networked computers do students have access to in your classroom?	
Interview 1 - Administrator	N/A

Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ 1
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ 1 is in operation in the row of 5 ▪ access to a shared lab of 10
5. Is this a sufficient number? If not, what would be?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "Our school has concentrated the computers in the CTS area. We need more computer access for the other disciplines"
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "One more would be sufficient for student use. We access the bank of computers in the library quite often."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "No. The shared lab would be more useful if it had more computers. It would also be helpful if all the computers in the classroom were functional."
6. What personal barriers have you had to overcome when using technology?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "One of them is that computers have been a focus inside the school but they haven't been a focus in the university, where teacher training takes place. Another frustration is the restrictions and limited access for staff on the network."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "Certain addresses change, which is a problem. The amount of effort and time to use PowerPoint for example, the awkwardness, it isn't worth it. "
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "Access. Quantity and reliability of technology. Technology support may be out there, but I can't find it."
7. Do you feel you have been given the support, in terms of time and training, to use technology optimally?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "It's a business tool for me. It does everything I want it to."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "I would like to have more time. Most of my training has been on my own."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "No. I rely mainly on my colleagues who have expertise in computers but I know they are very busy with their jobs."
8. Describe some of the obstacles that may have caused teachers to use technology less in their classrooms.	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "Their comfort level is probably key. Their access to sufficient technology that works routinely is also a factor."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "Time. Occasionally access for an entire class is a problem."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "Time to learn new programs."

Reliable and Strong Infrastructure

9. What would allow the use of computer technology to improve in our school?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "Support from Central office, someone who knows education, to deal with technology."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "There should be more focus on student research."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "Improved access and support."
10. If you were hired as the technology coordinator for our district, what changes would you make with respect to technology in our schools?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "Decentralize control and authority to the schools. Also, make sure the technology is appropriate for the school. I know there's a lot of computers collecting dust in some elementary schools."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "More computers at the disposal of students. More guaranteed internet access. Improved security and Smart Boards in every classroom."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "Hire an on-site technology support coordinator with an education background."

Pedagogically Focused

11. How are students, in classrooms and the library, benefiting from the current level of technology use?	
Interview 1 - Administrator	<ul style="list-style-type: none"> ▪ "I don't think they see the benefits yet. We really need greater freedom so we don't lose those teachable moments."
Interview 2 - Teacher	<ul style="list-style-type: none"> ▪ "They would say it's great for e-mail and chat rooms because it's fast. Some would say information can be found easily."
Interview 3 - Department Head	<ul style="list-style-type: none"> ▪ "The calculator makes things faster. It reduces arithmetic errors. I don't know if kids are really that excited about technology."

Experimentation and Collaboration

12. What types of PD activities have been most useful to you as a teacher?	
Interview 1 - Administrator	▪ "Trial and error on my own."
Interview 2 - Teacher	▪ "Specific programs in a PD session. Web page design would be helpful now."
Interview 3 - Department Head	▪ "I like to learn on my own but a general overview of the program is good. I also like to have a contact person in case I run into difficulties."

Discussion

The purpose of this project was to determine how frequently secondary teachers are using technology. After reviewing the survey findings, written comments and interview responses, the reasons for limited technology use soon became apparent. For this reason, I will analyze and discuss the data by first looking at how the technology is being used and then propose possible reasons for the frequency of use.

E-mail is not used by teachers to communicate with parents or students and only a small group use e-mail routinely with colleagues. Since only four teachers indicated they did not know how to use e-mail, non-use is due to limited access and the unreliability of the network. The Information Technology Implementation Review found a similar pattern of non-use and recommended e-mail not be used as a primary form of communication, since only a fraction of the teachers were accessing it.

The on-line resources are also rarely used, and a greater number of teachers reported not knowing how to send documents to Docutech, search the on-line library catalogue or order IMC resources. It is unfortunate that although a high percentage of teachers feel comfortable using technology, the majority are lacking the specific skills required to benefit from the services offered through the district network. Access and reliability would contribute to the lack of these skills by not allowing the teachers to have sufficient opportunities to learn and practice the skills. The fact that half of the teachers are not utilizing these capabilities is waste of resources and time. Teachers have lost faith in the system and are not willing to invest their time on a system that is consistently unreliable.

Teachers are making use of the SIRS software to access the student demographic information frequently because it is a school-based program. Our secretarial staff provides instruction whenever teachers are having difficulties. The survey and comments by teachers strongly suggest in-house technical assistance is the more effective than accessing assistance through the district technicians.

Teachers use Gradebook and Integrate most often to calculate report card marks. Over the past five years, professional development focusing on these two software packages has been available. Thinkwave is the least used package, but it has only been available in the last six months. It is the most user-friendly and powerful grading software available to teachers but only a few are aware it is available. It would likely quickly replace Integrate and Gradebook if teachers were offered training. Perhaps the most surprising response to this question was the significant number of teachers who use calculators. Teachers explained they occasionally used a calculator to verify the final marks after inputting them using grading software.

The Internet can be a rich resource, a vast wasteland of unsubstantiated information or an electronic playground. Student use of the Internet for assignments increased proportionately with the level of teachers' computer competence. Teachers with a low level of computer competence rarely expected their students to use the Internet, while teachers with a high level expected students to use it frequently. Teachers who are more experienced and skilled users of the Internet are more comfortable with their students accessing it for class work.

Social Studies teachers commented on the value of the Internet for research. However, roughly one third of the teachers rarely used the Internet as a resource to

develop lesson plans. Since three quarters of the teachers have at least an average level of computer competence, this limited use of the Internet is due to Internet access or reliability.

The use of software applications to complete assignments is high among students and does not seem to be strongly influenced by the computer competence of teachers. Since student access to computers is often limited to one computer in classrooms, it can be inferred students are using their home computers to complete assignments. A high number of teachers use software applications to develop lesson plans, which is facilitated by having a computer at their desk.

Teachers in the English department use software applications the most often. Almost all of the English 30/33 students chose to use a word processor to write the essay portion of their final exams this semester. The department was faced with some logistical challenges and had to utilize all of the labs in the school in order to accommodate the students.

The English and Science departments lead in moving their classes to computer labs. Teachers are able to book time in one of three labs or use the bank of computers in the library. The high demand for these labs often means teachers must book ahead by at least two weeks and this allows for little flexibility in scheduling.

When asked if technology adds value to their lessons, the majority of teachers agreed it did so only occasionally. Again, the degree of value would largely be determined by the access to technology and the computer competency of the teacher. The English and Science teachers, who have the highest level of technology use and a higher level of computer competency, experienced value added by technology use most often.

The degree to which technology could add value is greatly diminished by limited access or limited preparation time. Science and English teachers at this school have made technology integration a priority and have actively sought out regular access for their students. Consequently, it is not surprising to see the most frequent users of technology, English and Science teachers, extract a greater degree of value from incorporating technology in their programs.

Teachers consistently cite time as a factor contributing to their limited use of technology, both in the interview and in the survey. The majority of teachers surveyed stated they would use the Internet and software applications more frequently if they had additional time to prepare for their integration. Teachers are expected to incorporate technology into the curriculum, but most of those surveyed seldom had the time necessary to do so. This demonstrates the high value teachers place on the usefulness of technology but it also reveals the frustration they experience by not being able to use technology more often.

The majority of teachers also believed they would use technology more if they had a higher level of computer skill. Teachers in all departments expressed an interest in pursuing technology-related professional development activities. Teachers are most satisfied with the Microsoft Office sessions. One third of teachers found the grading software session seldom met their needs. Teachers generally do not feel they have had sufficient opportunities to learn skills through technology-related professional development. Teachers can choose to give up a week of their summer and pay a fee to attend sessions offered by the district. Teachers must be given sufficient professional

development time to learn how to use the technology resources available before they can reap the benefits of the time saved by using technology.

Technology training is frequently an afterthought and the onus is on the individual teacher to learn on their own and on their own time. Resourceful teachers who are motivated by the possible applications of new technology will learn what they need to in order to use the technology within the context of their teaching. The trial-and-error methods used to accomplish this type of professional development often results in wasted time and undue frustration. For some teachers, the learning curve imposed by the technology infusion experienced in the last five years has been overwhelming.

Other teachers are caught in a cycle causing them to re-learn skills they have not had the opportunity to practice since they attended the professional development session. A routine schedule of technology-related professional development opportunities throughout the year would lead to a higher level of skill and increased technology use in the school.

Critical to any technology infrastructure is access to timely and reliable technology support. If teachers choose to incorporate technology into the curriculum, they must be assured a high level of reliability or they risk wasting valuable classroom time using the technology. Unfortunately, the majority of teachers were seldom able to receive this type of support. The best technology support is clearly for the 'in-house' programs (Voice Mail, SIRS, On-line District Library Catalogue and grading software) and the least amount of support for the network programs (Internet and e-mail) and computer equipment. An adequate level of technical support would mean an overall

increase in technology use for most teachers. Technical difficulties were often listed as being the cause of ineffective use of technology.

The survey also revealed preparation and training time are not the most significant factor limiting technology use. Almost half of the sample felt they would *not* increase their use of technology if they were more aware of possible applications or benefits. This could be interpreted one of two ways. Teachers may already be aware of the benefits offered by technology and can not use technology more often due to limitations of access. It could also mean teachers are not interested in learning about possible uses and benefits of technology because they do not wish to use it as a tool in their classroom. I believe most teachers are interested in learning and using technology more to capitalize on the benefits of it in their classroom, but they are hindered by insufficient access and/or preparation time.

Despite the many obstacles impeding their technology use, most teachers are using the Internet to stay up to date on developments within their specialist councils, the ATA and Alberta Learning. Again, having a computer with Internet access on every teachers' desk has made this possible. Clearly, the resources used to maintain these web sites are well spent as the majority of teachers at this school have come to rely on them as a source of current information regarding their profession.

Concluding Statement

This project has shown secondary teachers to be frequent users of technology, in spite of having an unreliable infrastructure, limited access to resources and inadequate preparation time. Teachers appreciate technology as a valuable tool in the classroom and most would welcome an opportunity to use technology more often.

Recommendations

The survey findings show a need for a reliable technology infrastructure which includes timely access to technical support. Additional computer labs should be added in this school since teachers are willing to move their classes to a computer lab for instruction, but are unable due to the current lack of availability. Finally, regular professional development activities should be made available to enhance teachers' technology use and improve their skill level.

The literature reviewed for this project provides a framework of the components essential for the successful integration of technology in schools. Often in our haste to outfit schools with the technologies available, we neglect to provide an environment that will allow the technology to be used efficiently and optimally. Secondary teachers at this school are interested in using technology as a tool in their classroom, but their efforts must be met with improvements to the current level of access and technical support.

Personal Reflections

Although the primary purpose of this project was to determine the frequency with which teachers were using technology, I have come away with a new understanding and empathy for secondary teachers in this technology-driven age. The comments made on the surveys, the discussion after the survey was administered and the interviews gave me valuable insight into the everyday challenges of teachers faced with technology integration. I was an active proponent of technology before completing this project, but I have become much more conservative, even cautious, about placing technology in our schools. This project has demonstrated technology in the classroom as the classic 'cart before the horse' in that we have placed valuable teaching tools in schools without the necessary infrastructure.

My new understanding, regarding technology use by teachers, has led me to conclude it is my responsibility to actively support colleagues in their use of technology. In addition, I will become more involved in decisions regarding technology infrastructure and professional development. However, my enthusiastic endorsement of technology use in schools has been dampened by the project findings. I am now more cognoscente of the elements necessary to integrate technology optimally and look forward to being a part of this process.

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Appendix A
Survey Instrument

Technology Use Survey

'Technology' is defined as only include those technologies made available to teachers during the last five years, specifically, **e-mail**, **voice mail**, **various application software** (Microsoft Office), **online media ordering software**, **SIRS software**, **grading software** (Thinkwave, Gradebook, Integrate,) and **Internet access**.

Section A: Background Information

Personal Information

1. How many years have you been using a computer?

- N/A Less than 2 years Less than 5 years More than 5 years

Do you know how to:

2. use e-mail?

- Yes No

3. use voice mail?

- Yes No

4. order IMC resources online?

- Yes No

5. perform a search of the district online library catalogue?

- Yes No

6. use SIRS to look up a demographic or timetable information for a student?

- Yes No

7. send documents to Docutech using the on-line form?

- Yes No

8. use any form of on-line form of evaluation? (e.g. LXR testing software)

- Yes No

9. How would you rate your level of computer competence?

- None Minimal Average Advanced Expert

10. Do you own a home computer?

- Yes No

11. Do you own a home computer with Internet access?

- Yes No

12. Do you use e-mail at home?

- Never Seldom Occasionally Often Always

13. Do you use voice mail at home?

- Never Seldom Occasionally Often Always

14. Do you use your Professional Development or Co-Curricular funds to pay for a portion of your home computer?

- Yes No N/A

15. Do you use your Professional Development funds to pay for a portion of your Internet access at home?

- Yes No N/A

16. Do you use the Internet at home as a resource for classroom activities?

- Yes No N/A

Classroom Information:

1. Indicate the primary focus of your teaching assignment:

- Math Science English Social Studies Physical Education
 CTS - Business Education CTS - Home Economics CTS - Industrial Education Fine Arts
 Special Education Other, please specify: _____

2. Indicate your years of teaching experience.

- 0 - 5 6 - 10 11 - 15 16 - 20 More than 20

3. Check each grade level you are teaching this school year.

- Grade 7 Grade 8 Grade 9 Grade 10 Grade 11 Grade 12

4. How many computers are available in the classroom you use most often?

- One 5 or Less 10 or Less Between 11 and 30

5. How many classroom computers have Internet access?

- One 5 or Less 10 or Less Between 11 and 30

6. If you use technology less than you would prefer, indicate the factors which limit your use in the classroom. (prioritize using '1' as the most significant and '6' as the least significant)

- lack of time lack of interest lack of skill lack of access lack of reliability N/A

Section B: Non-Instructional Use of Technology

E-Mail Usage:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Do you use e-mail to communicate with colleagues? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Do you use e-mail to communicate with parents/guardians? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Is e-mail a secure and private means of communication? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Is e-mail a reliable form of communication? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Voice Mail Usage:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Do you use voice mail to communicate with colleagues? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Do you use voice mail to communicate with parents/guardians? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Is voice mail a secure and private means of communication? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Is voice mail a reliable form of communication? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Software Applications and On-line Resources:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Do you use applications software (e.g. Word) for written correspondence (e.g. Letters of reference)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Do you order resources from the IMC online? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Do you use SIRS to access student timetables? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Do you use:

- | | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 4. SIRS to access parent/guardian phone numbers? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Thinkwave to assist you in calculating report card marks? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Gradebook to assist you in calculating report card marks? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Integrate to assist you in calculating report card marks? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. a calculator to assist you in calculating report card marks? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Estimate how many hours per week you spend using technology to complete non-instructional tasks. | | | | | |

- 0
 1 - 3
 4 - 6
 7 - 10
 10 or more

Please provide additional comments clarifying or explaining your use of technology in your daily, non-teaching routines.

Section C: Instructional Use of Technology

E-mail and Internet Usage:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Do you use e-mail to communicate with your students regarding assignments? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Do students use the Internet as an educational tool in your classroom? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Do you use the Internet as a resource to develop lesson plans? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Do your students use the Internet to complete assignments? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Software Applications and On-line Resources:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Do your students use software applications (e.g. Word, Power Point) to complete assignments? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. How often do you <i>move</i> your class to a computer lab for instructional purposes? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. How often do you provide technical instructions with lessons which require students to use technology? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. How often are you forced to cancel a planned lesson due to technology failure? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Do you use computer software (e.g. Word, Excel) to develop lesson plans? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Do you search the district online library system for reference materials to develop lessons? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Do you use technology applications (e.g. LCD projector) to present information to your students? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Do you use an on-line form of evaluation? (e.g. LXR testing software) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Do you send your requests for photocopying to Docutech using the on-line form? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. How often does technology add value or meaning to your lessons? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Please provide additional comments regarding your use of technology for curriculum delivery.

Section D: Time Required to Incorporate Technology

1. Complete this statement: It takes _____ time to develop a lesson incorporating technology than a traditional lesson.

N/A Less About the same Slightly more Significantly More

- | | Never | Seldom | Occasionally | Often | Always |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 2. Do you feel you have the necessary time to prepare lessons incorporating technology? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. How often would you use software applications in your classroom teaching if you had additional time to prepare? (e.g. Word, Powerpoint) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. How often would you use the Internet in your classroom teaching if you had additional time to prepare? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. How often would you use technology in your classroom teaching if you had a higher level of computer skill? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Please provide additional comments regarding the amount of time required to prepare lessons incorporating technology.

Section E: Technical Support

How often are you able to get:

- | | Never | Seldom | Occasionally | Often | Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. an adequate level of technical support in the classroom you use most often? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. assistance when you have difficulties using computers? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. assistance when you have difficulties using voice mail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. assistance when you have difficulties using e-mail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. assistance when you have difficulties using the Internet? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. assistance when you have difficulties using SIRS? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. assistance when you have difficulties using grading software? (e.g. Gradebook) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

- | | Never | Seldom | Occasionally | Often | Always |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 8. assistance when you have difficulties using the on-line district library catalogue? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. How often would you use technology in your classroom teaching if you had improved access to technology and technical support? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Do technical difficulties (e.g. hardware problems, Internet crashes) limit your ability to effectively use technology in your classroom? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Please provide comments on the current level of technical support available to you.

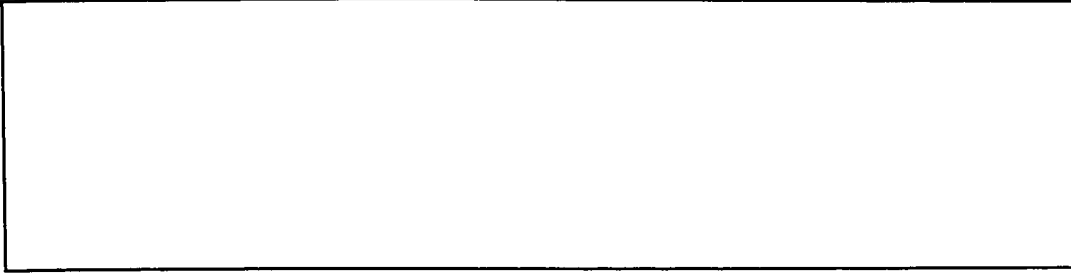
Section F: Professional Development

1. Indicate the type of technology-focused professional development activities you prefer.

Large group workshops Small group sessions One-to-one Individual trial and error

- | | Never | Seldom | Occasionally | Often | Always |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 2. Are technology related professional development activities a priority for you? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Have the professional developments activities you have attended for Microsoft Office (or similar) met your needs? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Do professional development activities for the Internet and e-mail meet your needs? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Do professional development activities for marks-based software (e.g. Gradebook, Thinkwave, Integrate) meet your needs? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Do you feel you have had sufficient opportunities to learn skills through technology related professional development activities? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. How often would you use technology in your classroom teaching if you were more aware of the possible applications and benefits? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Do you use the Internet to stay current on developments within your specialist council, ATA or Alberta Learning? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Please provide comments on the professional development activities available to you on the following page.



Thank you for participating in this research project.

Appendix B
Interview Instrument

Technology at Work: To what extent are secondary teachers using technology in the classroom?

Section B: Interview

Introduction:

Before we began the formal interview process, I will review my research questions and the basic objectives of the project, which focus primarily on determining how teachers are using technology in the classroom. Each interview will be taped and I will inform the interviewee that portions of the interview will be transcribed and used as part of the results of the project. I will assure the interviewee that the interview will be confidential and their insights will be beneficial in determining how our district can improve the way we use technology and train our teachers.

Interviewee Selection:

Three members of the professional staff will be selected for the interview stage of the project: one from administration, one department head, and one teacher. I will choose interviewees based on three criteria; some experience with technology, representative of their group and ability to communicate their opinions well.

Interview Guide:

1. Background information
 - Role at CHHS
 - Experience at CHHS
 - Professional development and training related to technology and responsibilities at CHHS
 - Current level of technological proficiency
2. What is your goal with respect to technology use by students and teachers in the your classroom?
3. How many networked computers do students have access to in your classroom?
4. Is this a sufficient number? If not, what would be?
5. Would you describe yourself as a proponent of technology?
6. What personal barriers have you had to overcome when using technology?
7. Do you feel you have been given the support, in terms of time and training, to use technology optimally?
8. Describe some of the obstacles that may have caused teachers to use technology less in their classrooms.
9. What would allow the use of computer technology to improve in our school?
10. What types of PD activities have been most useful to you as a teacher?
11. How are students, in classrooms and the library, benefiting from the current level of technology use?
12. If you were hired as the technology coordinator for our district, what changes would you make with respect to technology use in our schools?