

DR. STIRLING MCDOWELL
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FOR
RESEARCH INTO TEACHING



**TEACHING AND LEARNING
RESEARCH EXCHANGE**

Beyond the Mouse
and Modem:
Teacher Technology
Implementation
in Saskatchewan

Karen Schmidt Henderson
Wendy James
René Cannon

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Research Coordinator
Dr. Stirling McDowell Foundation
2317 Arlington Avenue
Saskatoon SK S7J 2H8
Telephone: 1-800-667-7762 or (306) 373-1660

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Finally, we would like to dedicate this project to Karen McLeod, a former teacher-librarian in Meadow Lake, who taught us, by example, what mentorship can do, both in and out of the technical arena.

Executive Summary

Beyond the Mouse and Modem, <http://www.saskschools.ca/~techsurvey/>, was an on-line survey of 2,172 teachers, approximately 20% of Saskatchewan's educators. Teachers came from 36 of approximately 95 school divisions and represented all grade levels, from Kindergarten through Grade 12, and all subject specialties. The survey was conducted from March 2002 through April 2003. The on-line survey was an anonymous teacher self-report survey containing 38 items. The purpose of this research was to determine what enables teachers to use computer technology, referred to from this point on as technology, effectively in the classroom. The survey examined teacher skill levels, objectives for technology use, level of technology implementation in the classroom, supports provided, and the barriers that have impeded success. Although the survey sample was large and distributed province-wide, care should be taken in applying these generalized findings to specific teaching staffs or school divisions.

TECHNOLOGY SKILL LEVELS OF TEACHERS

The survey found that the majority of teachers surveyed in the province did not have the skills needed for effective implementation of technology. The majority of educators reported six of the 14 basic skills and two of the 10 intermediate skills, as discussed in the final report.

Fewer than 10% of teachers possessed any specific advanced skill like using a Listserv. The use of computers as an instructional tool did not appear well established among a majority of teachers surveyed.

OBJECTIVES FOR STUDENT COMPUTER USE

Technology typically is used in classrooms to accomplish specific learning objectives. The majority of the survey respondents identified six of 10 objectives for student computer use: finding ideas and information (78%), learning to work independently (77%), improving computer skills (67%), expressing themselves in writing (64%), mastering skills just taught (56%), and remediation of skills not learned well (53%). These objectives corresponded to the ways in which teachers indicated they were employing computers in instruction.

PATTERNS OF CLASSROOM TECHNOLOGY USE

Teachers were asked about how often they were using computers in their classrooms. More than 30% of surveyed teachers reported that they used computers in 10 or more lessons per year in the following areas: word processing software (44%), Internet searching (41%), and instructional drills, games, and tutorials (32%). Fewer than 20% of teachers surveyed used any other computer-based instructional activities more than nine times per year.

SUPPORT FOR TECHNOLOGY IMPLEMENTATION

Seventy-four percent of teachers in the province stated that they viewed integration of technology in the classroom as important, and 66% of teachers reported that they were interested in implementation of technology in the classroom. None of the 2,172 teachers identified “lack of interest” as a significant barrier to implementation. In addition, 89% of teachers felt that their “current use of technology actually improves student learning”. Teachers also stated that support from administration and division office staff was substantial.

BARRIERS TO TEACHERS IMPLEMENTING TECHNOLOGY

Insufficient time at school was identified as the most serious implementation barrier. Ninety percent of teachers in the province cited time as some degree of barrier, with 51% reporting it was a significant barrier, the strongest rating allowed by the survey.

Another major barrier identified was lack of support. In general, many teachers reported receiving technical support, but not the “just-in-time” technical support that increases classroom use. (Just-in-time support is support available at the time it is needed, as opposed to later in the day or week.) In addition, teachers reported less than adequate levels of planning and instructional support.

Fifty-eight percent of surveyed teachers in the province stated that being unsure of how to implement technology in their courses was a barrier for them, and 59% of teachers also stated that lack of personal confidence was a barrier to implementation. There was a correlation between being unsure how to implement and lacking personal confidence.

Teachers’ responses regarding the focuses of the professional development they were receiving were very mixed. There were no professional development topics that more than 50% of the teachers recalled being taught. Likely this related as much to the style of professional development as the quantity: “traditional sit-and-get training sessions or one-time-only workshops have not been effective in making teachers comfortable with using technology or adept at integrating it into their lesson plans” (Killion, 1999). Technology-related professional development in Saskatchewan often takes the form of one-day sit-and-get workshops, which may be part of the problem.

CONCLUSIONS

The aggregated data suggested the possibility of improving technology integration in many areas. However, the most significant areas of reform from the perspective of Saskatchewan teachers were the areas of professional development, release time, and the provision of expert technology support. Ric Wiltse, executive director of the Michigan Association for Computer-Related Technology Users in Learning, stated that districts should be budgeting 50% of technology funds for hardware and 50% for training to keep up with the ever-changing field: “Even if we spent a third as much on training as we do on hardware, technology would be used more effectively in schools” (*Michigan Educational Report, 2001*).

The province's teachers need release time to develop technology skills, programs for learning how to effectively integrate technology that are rooted in their own classroom use, and just-in-time support for planning and instructional use of technology: "Most teachers want to learn to use educational technology effectively, but they lack the time, access, and support necessary to do so" (Guhlin, 1996).

Many people assume that as younger people are hired as teachers, the technical literacy of teachers will improve. This study found that surveyed teachers younger than 41 years old had similar skill levels regardless of their age. Young teachers are not entering the teaching profession with the technology skill set that is necessary to implement technology widely and effectively in the classroom.

The Saskatchewan Task Force on the Role of the School looked at the growing demands on schools, and suggested the School^{PLUS} model for the province because additional supports were needed to meet the needs of the students (<http://www.sasked.gov.sk.ca/k/pecs/docs/oncourse/fct2001-09.pdf>). Embedded technology instruction is another need that over-worked teachers are unable to meet for lack of resources. The need is compounded by the fact that a number of our students are more technologically literate than the people who are teaching them, leaving those students without lessons that improve their literacy, and neglecting a basic function of the school system.

Because technology changes rapidly, it is unrealistic to educate teachers once in the belief that they will then have definitive knowledge about effective integration of technology in instruction. While many principles may be the same over time, the hardware and software are always evolving, creating a need for regular release time for teachers to learn, and an effective planning and support system to help them do so. The current methods of teacher technology education are producing a subset of 10% of teachers with skills, and a majority of teachers without the basic skills they need. Given the levels of support for technology integration and the teachers' belief in the importance of that integration, as indicated in this survey, there is evidence that it is possible for current implementation barriers to be dissolved and for the province's learning community to make the effective integration of technology a reality in classrooms across Saskatchewan.

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Provincial Report

RESEARCHERS

Primarily three people conducted this research: Karen Schmidt Henderson, Wendy James and René Cannon.

Henderson is an On-line Learning Consultant in the Learning Technology Unit at Saskatchewan Learning. She was a high school Chemistry, Science, and Practical and Applied Arts teacher for 16 years. She has taught on-line and has developed Practical and Applied Arts and professional development Web-based resources for Saskatchewan Learning. Henderson recently completed her Master of Arts in Educational Leadership.

James is a teacher from Saskatoon. She has taught English, Drama, and Practical and Applied Arts for the past nine years. Currently teaching at Saskatoon's Walter Murray Collegiate Institute, she taught at Carpenter High School for six years. James has developed a Web-based resource for Saskatchewan Learning entitled Drama 30.

Cannon is in her sixth year of teaching and she is the newest recruit in the *Beyond the Mouse and Modem* project. She is currently teaching English Language Arts 10 and 30 in addition to Creative Writing at Carpenter High School in Meadow Lake.

SURVEY BACKGROUND

The project began in late 2001 as a survey of the teachers in the Meadow Lake School Division, where Henderson, James, and Cannon were teaching at the time. The researchers, to determine the needs of teachers in technology-related professional development, initiated the survey (see Appendix A). Henderson and Ian McCuaig, the teacher providing technical support at Carpenter High School, coded the survey. James designed the website to host the survey. Henderson and James completed data analysis.

The results from the Meadow Lake School Division sparked a number of questions regarding levels of teacher technology skill, effectiveness of professional development and the need for various supports for teachers. As a result, a proposal for a provincial study was submitted to the McDowell Foundation.

Teaching, Learning and Computing survey questionnaires developed by Dr. Hank Becker and Dr. Ronald E. Anderson (<http://www.crito.uci.edu/tlc/html/questionnaires.html>) provided the basis for this survey. Doug Johnson's Self-Evaluation Rubrics for Teacher Internet Use (2002) <http://www.ed.gov/pubs/EdTechGuide/appc-7.html> were used for guidance.

METHODOLOGY

The objective of the project was to collect data on teacher practice surrounding technology. The on-line survey asked teachers about their technology use, technology-related classroom practices, and the availability of computing technology in their schools. Questions were also included about the barriers teachers encountered in technology implementation, and the availability of technical, planning, and instructional supports.

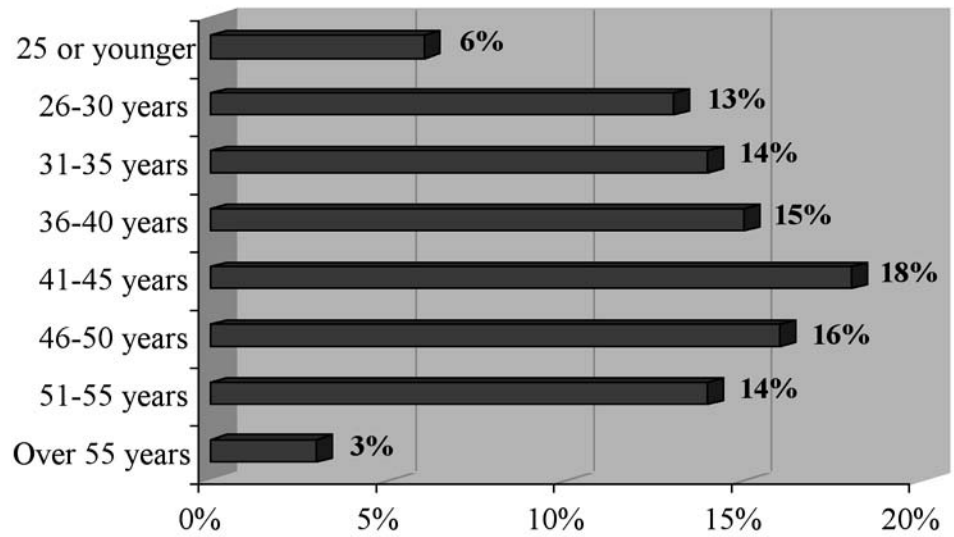
The survey remains available on-line at <http://www.saskschools.ca/~techsurvey/>. It consists of 38 questions to which teachers responded by selecting appropriate buttons or entering text. Individual teachers were able to complete the survey on-line to anonymously add their results to the provincial data. Teachers could submit data as a part of an interested school division, or they could do so on their own initiative.

As teachers identified their school divisions in the survey, individual school divisions were able to request an analysis of their teachers' responses. These reports covered a variety of topics including technology implementation barriers, strengths of the division's technology implementation, specific statistics on teacher use, and suggestions for future action. These individual reports allowed divisions to assess the strengths and weakness of their own implementation plans, as they compare their division's results to those in the province in general.

PARTICIPANT PROFILE

2,172 of approximately 11,500 teachers, from 36 of approximately 95 school divisions in the province, completed the survey. Ninety-seven percent of these teachers completed the survey as a result of their school division requesting their participation. Respondents came from six of seven education regions across Saskatchewan; 65% reported teaching in a rural setting, 35% in an urban setting and less than 1% on a First Nation's reserve. Of those who completed the survey, 68% were females and 32% were males, which is similar to the composition of the province's teaching force. Teacher age ranges are shown in Exhibit 1.

Exhibit 1: Ages of Surveyed Teachers



Seventy-six percent of the respondents identified themselves as regular full-time teachers, while 12% said they were part-time teachers, and 9% said they were administrators. The remaining teachers identified themselves as itinerant or long-term substitute teachers. Respondents taught in all subject areas and at all grade levels.

Findings

1. TEACHER SKILL LEVEL

A major barrier to teacher implementation of technology is the skill level of teachers themselves. The provincial responses indicated that teachers did not have knowledge in the majority of foundational skills, as only six of 14 basic skills were reported by over 50% of the teachers (see Exhibit 2). Additionally, the majority of teachers reported only two of 10 intermediate skills (see Exhibit 2).

Exhibit 2: Teacher Skill Levels

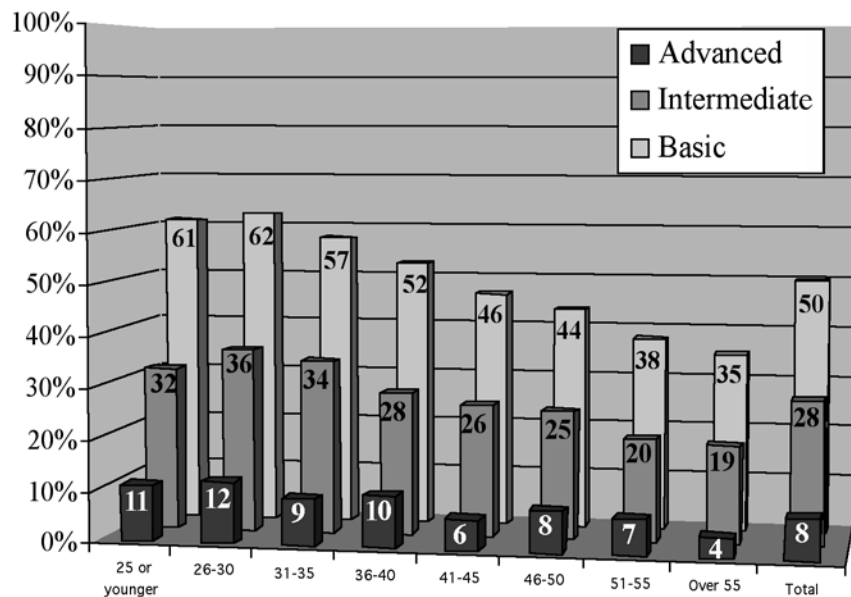
Level of Skill	Skills 50% or More of Teachers Have	Skills Less Than 50% of Teachers Have
Basic	80% - display contents of a disk 79% - use search engines to find information 70% - send and receive e-mail including attachments 62% - copy files 60% - use the WWW for recreational purposes 54% - put pictures in a word processing document	49% - name the critical components of my school's acceptable computer use policy 49% - use the Evergreen Curriculum 41% - use a drawing program 36% - use a spreadsheet 35% - scan a picture 34% - prepare a slide show (PowerPoint) 29% - use streamed video and audio applications 18% - compress or extract files
Intermediate	55% - install a program 53% - install virus software	38% - can download and install programs off of the Internet 30% - crop a digital image 25% - do an advanced search on the Internet 21% - understand what cookies do 19% - use instant messaging or real time chats 16% - make a Web page 11% - put a Web page onto the Web 10% - edit a digital video
Advanced	None	9% - am part of a Listserv or on-line discussion group 7% - write a computer program or macro

In some cases the skills that teachers reported were very limited and the reporting of skills may have been inadvertently inaccurate. For example, 79% of those surveyed said that they searched the Internet for information. However, only 25% could do an advanced search. This means that while most teachers were able to use a search engine, they could not limit the search enough to prevent wasting time with irrelevant hits. Teachers' report of their skills might also have been inaccurate due to a lack of familiarity with terminology.

Of particular concern were three key areas. First, many of the surveyed teachers lacked the basic skills to use computers in an effective instructional manner. Second, the basic skills reported by teachers indicated use in two main areas, word processing and Internet searching. This finding was confirmed when teachers were asked how they use computers in the classroom (see Section 2.1). Third and last, the use of computers in professional activities, such as Listserv discussions or access of the Evergreen Curriculum was reported by fewer than half of respondents. In fact, the majority of teachers reported that none of the nine ways of using computers for teaching or other professional activities identified in the survey were done weekly or more often. These uses included making handouts, recording and calculating grades, and obtaining information from the Internet.

Use of technology in the classroom requires a greater degree of comfort than does use for professional planning or dialogues, because the teacher does not feel the same pressure to be "the expert" when not instructing. Since teachers will often employ a tool personally or in planning to gain familiarity before instructional use is attempted, lack of such utilization indicates that the use of computers as an instructional tool is clearly not well established in the majority of surveyed teachers.

Exhibit 3: Percentage of Teachers Reporting Computer and Internet Skills by Age



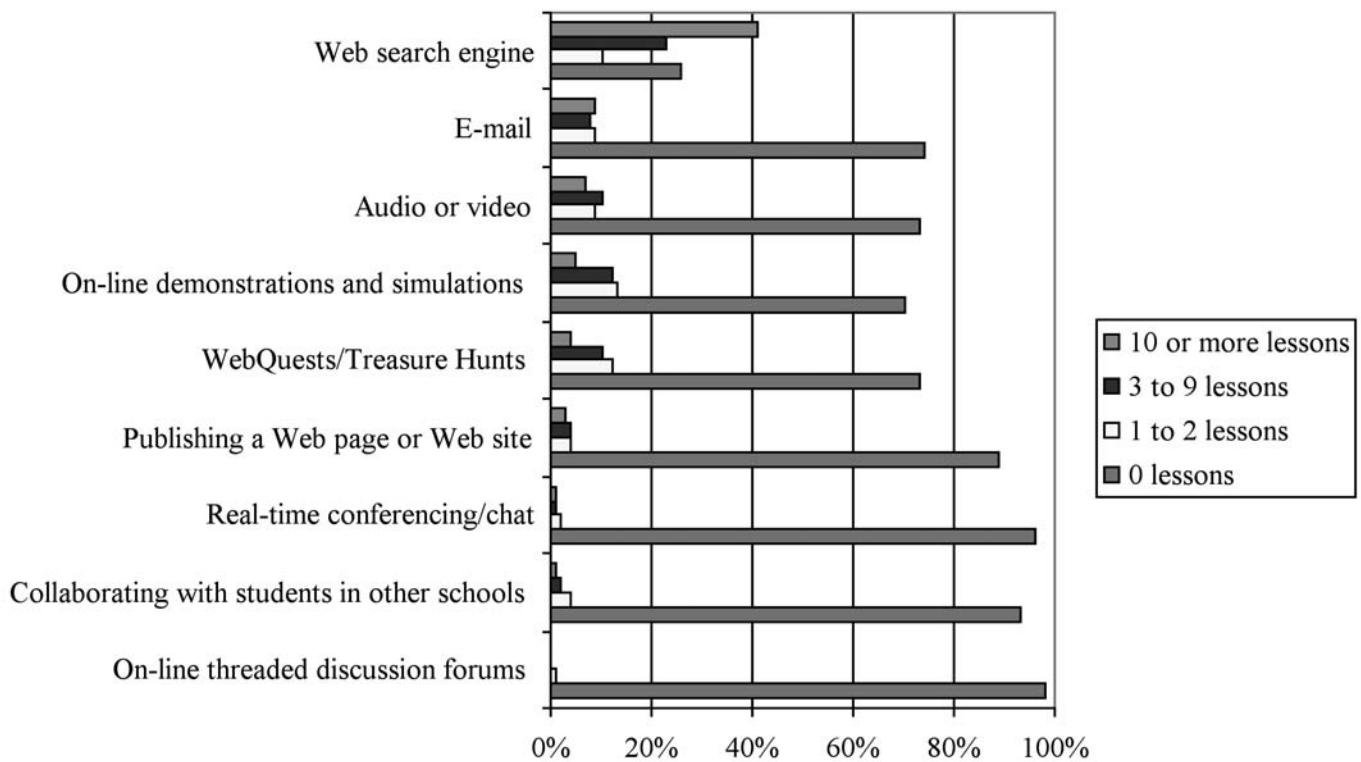
Some may assume that hiring young teachers will solve the problems related to technology implementation; however, the survey found that this was not the case. In this research, teachers under 41 years of age reported possessing similar levels of basic skills. Young people are not entering teaching with a technology skill set that is any better than that of experienced teachers. While the majority of respondents younger than 41 years of age reported that they had basic skills, they did not state that they had intermediate or advanced skills (see Exhibit 3). This age group, despite reporting the highest levels of skills, did not report that they had skill levels for effective use of technology as an instructional tool.

2. HOW TEACHERS IMPLEMENT TECHNOLOGY

2.1 Types of Software and Internet Services that Teachers Use Frequently in Class

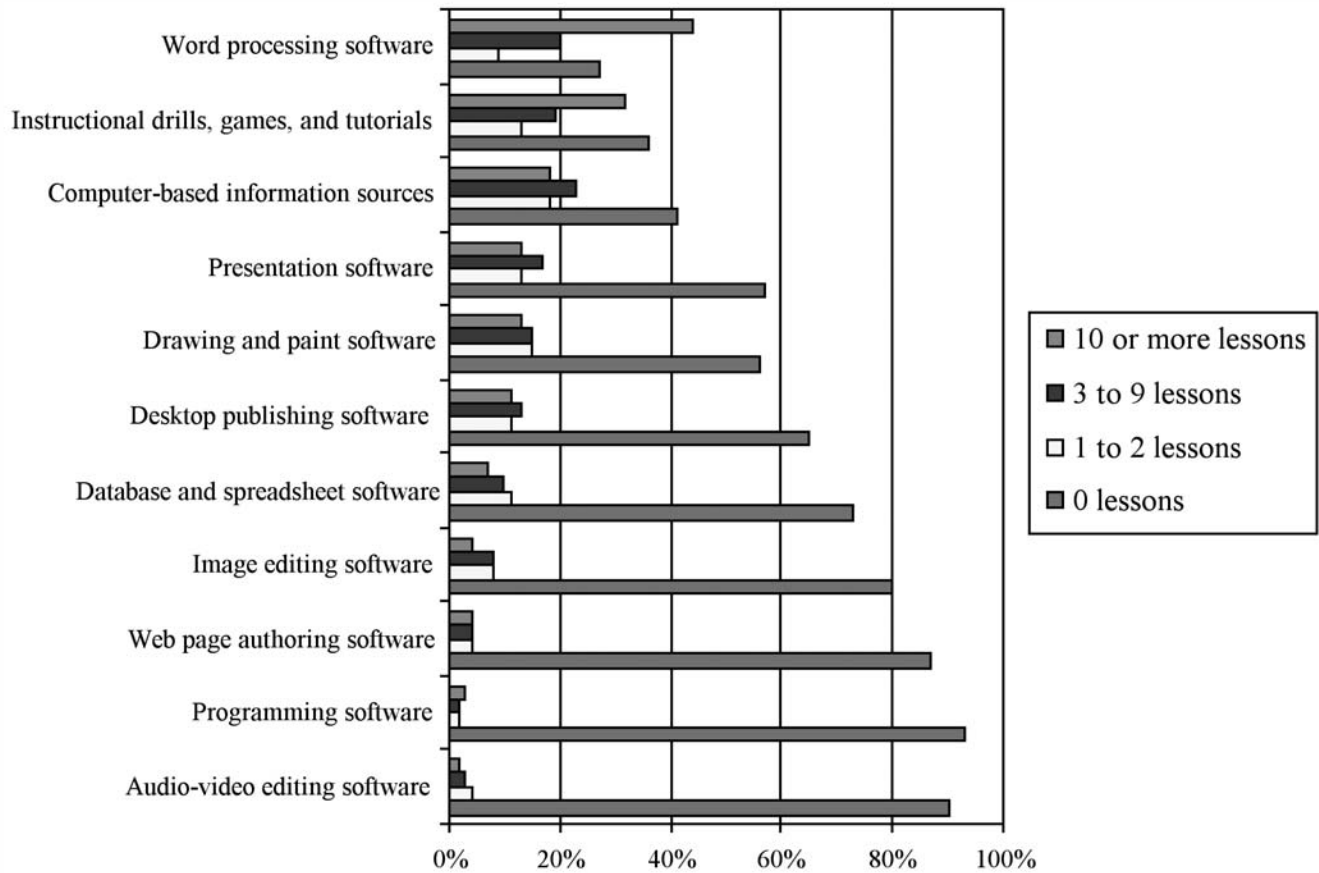
Teachers were asked to characterize their use of computers in the classroom based on any of the classes they taught. They were asked to indicate the number of lessons in the 2002-2003 school year in which they had used the following types of software or Internet services (see Exhibits 4 and 5).

Exhibit 4: Percentage of Teachers Reporting Use and Number of Lessons Used in a School Year by Type of Internet Service



Of the 20 types of software and Internet services listed, only three activities were used in 10 or more lessons per year by at least 30% of surveyed teachers: Word processing software (44%), Internet searching (41%) and instructional drills, games, and tutorials (32%). Less than 20% of teachers used any other technology-enhanced instructional activities this often.

Exhibit 5: Percentage of Teachers Reporting Use and Number of Lessons Used in a School Year by Type of Software



These levels indicate that computer use in the classroom is both limited in scope and infrequent. Even applications like paint and drawing software were not used with any regularity. To put this in perspective, an example is useful.

A high school teacher with ten classes per year would only have to word process in a single lesson per class to be in the 44% who used word processors most frequently. Fifty-six percent of teachers could not say they were in this category.

It is unlikely that this data can be explained by confusion regarding the question or the terminology. The areas where the teachers reported more use closely matched the areas where they reported more skill.

2.2 Teacher Objectives for Student Computer Use

Teachers utilize technology in their classrooms to accomplish specific objectives. Of the 10 objectives for student computer use available for selection in the survey, the majority of the province's teachers identified the six objectives displayed in Exhibit 6.

Exhibit 6: Teacher Objectives for Student Computer Use

Objective for Students	Percentage of Teachers Identifying this Objective
Finding ideas and information	78%
Learning to work independently	77%
Improving computer skills	67%
Expressing themselves in writing	64%
Mastering skills just taught	56%
Remediation of skills not learned well	53%

The remaining four objectives in the survey that were not identified by a majority of teachers as ones they have for student computer use were analyzing information (49%), presenting information to an audience (48%), learning to work collaboratively (44%) and communicating electronically with other people (24%).

The stated objectives of the teachers matched the ways in which they indicated they utilized computers in instruction. For example, remediation, independent work and mastery are well suited to tutorials and games (consistent with data in Section 2.1). However, some of these objectives do not require a greater level of skill (working collaboratively might require e-mail, for example), yet they remain largely unused.

Teachers who reported that they believed that their current use of technology actually improved student learning "a great deal" indicated that they had nine of the ten objectives for student computer use. The percentage of teachers who identified these objectives was higher than for the teacher sample as a whole. As well, these teachers reported more frequent software use.

3. STRENGTHS OF THE PROVINCE'S TECHNOLOGY IMPLEMENTATION

3.1 Leadership

Seventy-four percent of teachers felt positively about the presence of a vision for implementation of technology at their school division office. Seventy-seven percent stated that support from administrators was positive. Less than 5% identified as significant a barrier created by either level of administration. It is important to note, however, that responses came primarily from teachers

whose divisions had requested that they complete the survey. Since these divisions were requesting reports to examine the efficacy of their own technology implementation, they are more likely to have devoted resources to supporting technology-related initiatives. As a result, the teacher perception of support from administration is encouraging, but may or may not reflect the thoughts of the teaching body in the province.

3.2 Teacher Dedication

“Not viewing such development as important or necessary” was not a problem for 74% of the surveyed teachers. Of the 26% who said it was some degree of barrier, only 4% said this barrier was significant. Although teachers are generally interested in technology implementation, there is a fairly large pool of teachers who would resist implementation.

Sixty-seven percent of teachers reported interest in classroom implementation, and none of the 2,172 teachers identified “lack of interest” as a significant barrier to implementation.

Teachers also stated that they believed that the use of computers improves learning. Eight-nine percent of teachers felt their “current use of technology actually improves student learning”. However, of these, 30% felt that it improved student learning only “somewhat”. Given the level of implementation in the classroom (Section 2.1), their view that they are improving student learning only “somewhat” seems legitimate.

It may be concluded that teachers in general believe technology implementation in the classroom has value, and they are ready to be partners in an implementation process.

3.3 Availability of Computer Hardware

Fifty-five percent of teacher respondents said lack of hardware was not a barrier. Of the 45% of surveyed teachers who identified lack of hardware as a barrier, 10% rated it a significant barrier. Considering that the majority of the funding for educational technology is devoted to hardware and software (Wiltse, 2001), and that school boards cannot dedicate one-time expenditures to improve available hardware because an on-going budget is necessary for maintenance and upgrading, this area remains a challenge for many school divisions.

When examined on a division-by-division basis, there was considerable inconsistency in the availability of hardware. Of those school divisions in which over 75% of the division’s teachers responded to the survey, the percentage of teachers who stated that lack of hardware was a significant barrier ranged from a high of 42% in one rural division to only 1% of teachers in another rural division. Clearly, these findings suggest a disparity in hardware availability across Saskatchewan that must be addressed.

4. BARRIERS PREVENTING TEACHER TECHNOLOGY USE IN THE CLASSROOM

Teachers were asked to classify a total of 11 barriers to developing and implementing their technology knowledge. They were asked to rate these barriers by the degree to which the barrier affected them (see Exhibit 7).

*Exhibit 7: Barriers to Teachers Developing and Implementing Their Technology Knowledge, Skills, and Abilities**

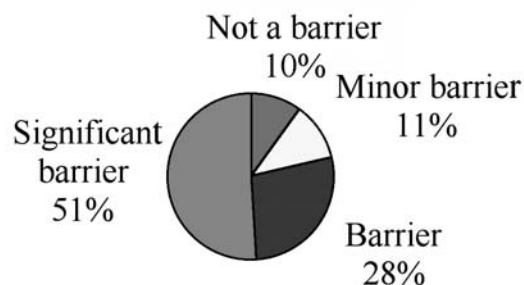
Barriers to developing and implementing technology knowledge, skills and abilities	A significant barrier	A barrier	A minor barrier	Not a barrier
1. Insufficient time at school	51%	28%	11%	10%
2. Lack of personal confidence	12%	21%	26%	41%
3. Lack of quality professional development	11%	23%	27%	38%
4. Lack of interest	0%	12%	21%	67%
5. Lack of hardware	10%	16%	19%	55%
6. Lack of software	13%	20%	24%	42%
7. Lack of technical support	8%	17%	23%	51%
8. Lack of administrative support	3%	6%	13%	77%
9. Lack of vision in your school or division	4%	9%	13%	74%
10. Not viewing such development as important or necessary	4%	7%	15%	74%
11. Unsure of how to effectively implement technology in my courses	10%	22%	26%	42%

* Due to rounding, not all totals equal 100%

4.1 Insufficient Time at School is the Most Significant Barrier

Ninety percent of teachers who completed the survey cited time as a barrier to some degree, with 51% reporting it as a significant barrier, the strongest rating allowed by the survey (see Exhibit 8).

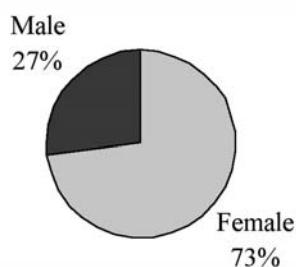
Exhibit 8: Insufficient Time at School as a Barrier to Teachers Developing and Implementing Their Technology Knowledge, Skills, and Abilities



Saskatchewan's Task Force on the Role of the School looked at the growing demands on schools and suggested the province adopt the School^{PLUS} model because additional supports were needed to meet the needs of the students (<http://www.sasked.gov.sk.ca/k/pecs/docs/oncourse/fct2001-09.pdf>). Embedded technology instruction is another need that over-worked teachers are unable to meet due to lack of resources. The need is compounded by the fact that a number of students are more technologically literate than the people who are teaching them, leaving those students without lessons that improve their literacy, and neglecting a basic function of the school system.

Ninety-two percent of women found a lack of time at school a barrier to some degree, while 87% of men stated lack of time at school was a barrier to some extent. Fifty-one percent of respondents identified lack of time at school as "a significant barrier". Of those, 73% were females and 27% were male (see Exhibit 9). The results indicated a statistically significant relationship between gender and the identification of time as the most imposing barrier to technology implementation. Since 68% of the survey respondents were women, this finding represents a particular challenge for public education in the province. Of all of the barriers rated by respondents, time was the most significant barrier identified, particularly for female teachers. As school divisions work to address the issue, the needs of female teachers will need specific consideration.

Exhibit 9: Gender and Reporting Insufficient Time at School as a Barrier



4.2 Problems Regarding Technical Support

Teachers need technical support. Sixty-four percent of teachers surveyed reported needing technical support at least once a month, and 24% of these said they needed it on a weekly basis. However, few reported that they received adequate levels of support.

Software products with good technical support are more likely to build a strong base of users, and a number of companies strive to have technical support available 75% of the time. When people cannot access help, they cease using the product. When teachers were asked how available each type of technical support was when they needed it, 67% indicated they did not receive this level of support.

The survey results indicated a clear relationship between availability of technical support and the likelihood of teacher technology utilization. Having a skill did not mean that teachers necessarily used it in the classroom. When adequate technical support was available, the research found that utilization of search engines, word processors, and presentation software was also prevalent. As the

availability of support increased, so did the levels of use teachers reported, especially in those who used the technology most frequently.

Fifty-one percent of teachers said “lack of technical support” was not a barrier when asked to rank it among a host of other barriers (Exhibit 7). In conjunction with the findings regarding technical support, it must be concluded that, in general, teachers in the province received some technical support, just not as often as they needed it. However, they appeared to regard it as a less crucial issue than many others.

Teachers were generally pleased with the quality of support they received. Eight-one percent of teachers rated the quality of support favorably, even if they did not report receiving timely support. However, there was a correlation between viewing the quality of the support as excellent and having the support available more than 75% of the time. The timeliness of support primarily affects increased risk-taking and growth in the use of technology in the classroom, not the use of technology with which the teacher is already familiar. Increased support is only necessary if use beyond occasional word processing and Internet searching is desirable. Since the most educationally beneficial outcomes are the result of scaffolding skills and advanced applications, it is in the interest of the Saskatchewan’s educational community to provide more timely support for teachers: “The best way to win widespread use of new technologies is to provide just-in-time support, assistance, and encouragement when needed. Not tomorrow. Not next week. Now!” (McKenzie, 1998)

4.3 Planning and Instructional Support Problems

Many members of the educational community are not sure exactly what planning support and instructional support are. Supports provided to teachers in the area of planning and instruction may include increasing the teacher’s awareness of available resources and assisting the teacher in identifying appropriate and viable uses of technology to achieve curricular objectives. They may also include helping the teacher to develop some proficiency in using the chosen technology, assisting the teacher and students during instruction, and providing support to students outside of instructional time.

Analysis of mean responses indicates that teachers felt far more positively about levels of technical support than levels of instructional and planning support. Only 11% of teachers said they needed weekly planning support, and another 11% said they needed weekly instructional support. In both cases, more respondents selected “seldom” than any of the other available responses when asked how often they needed planning and instructional support. Perhaps because teachers have little personal experience with planning or instructional support, they did not indicate that they needed it.

While less than half of the teachers reported needing planning and instructional support frequently (more than 1-3 times per month), 53% of teachers stated that when using technology, “often too many students need my help at the same time”. This result indicated that they felt overburdened with instruction and/or planning. Since planning and instructional support translate directly into computer use in lessons, findings regarding low levels of use, and teachers’ need for guidance, clearly indicate the necessity of both planning and instructional support.

Twenty-four percent of teachers reported having planning support available more than 75% of the time, while 22% reported that instructional support was available when needed. Higher levels of planning and instructional support, in particular, translated into greater frequency of technology use in the classroom and a greater variety of uses. In excess of 30% of teachers with instructional support available more than 75% of the time used nine of the 11 types of software 10 or more times per year. Thirty percent of the teaching body as a whole were only able to report that level of use in two, word processing and instructional drills, games, and tutorials (see Exhibit 6). Planning support and instructional support appear to be key factors in increasing classroom use (see Exhibit 10).

Exhibit 10: Expected Effect of Increased Technology Support on Technology Use

More technical support = 68% of teachers would use technology more.

More planning support = 71% of teachers would use technology more.

More instructional support = 70% of teachers would use technology more.

Responses from the teaching body corroborated the finding that additional support increased classroom use.

4.4 Problems with Professional Development

Teachers' responses regarding the professional development they were receiving were very mixed. None of the technology-related professional development topics listed were identified by a majority of those surveyed as topics that had been a main focus of professional development. Teachers who recalled particular topics were most likely to mention "use of the Web", "the mechanics of using computer technology and software", and "integrating computers into instructional activities in your subject area". The other five topics listed received little attention.

Despite the focus on technology professional development by many school divisions, the Saskatchewan Teachers' Federation, and Saskatchewan Learning, the majority of teachers still believed that lack of high quality professional development remain a barrier to technology implementation. Sixty-two percent of teachers identified this lack as a barrier to implementation in the classroom. Of those, 11% noted it was "a significant barrier".

The problem may lie in the type of professional development rather than the quantity. Research indicates that one-day professional development sessions on technology are largely ineffective unless the learning from them is immediately utilized (Killion, 1999). Such workshops rarely translate into increased classroom use of technology. The exception is directly applicable software work, particularly if accompanied by corresponding long-term professional development. Since the majority of teacher professional development on any topic is provided through one-day workshops, it is logical to conclude that this is a substantial problem.

4.5 Teacher Skill Level Needs Improvement

As discussed in Section 1, one of the greatest barriers to classroom use is teacher skill level. Since the skill set of the teachers surveyed did not include the majority of basic skills (Exhibit 2), it is safe to conclude the average teacher is not comfortable with a wide range of technology applications. Given teacher

responses regarding lack of time in school, support, and professional development, it is unlikely that teacher skill level will improve without a change in the supports provided to teachers.

4.6 Knowing How to Implement Technology and Levels of Confidence

Fifty-eight percent of teachers in the province stated that being unsure of how to implement technology in their courses was a barrier. However, 26% stated that not knowing how to implement technology was “a minor barrier”. Fifty-nine percent of teachers also stated that lack of personal confidence was a barrier to implementation, with 26% of these respondents stating that the barrier was “minor”. There was a strong correlation between being unsure of how to implement technology and lacking personal confidence. The lack of confidence about how to implement articulated by teachers is a logical extension of their lack of skill and the lack of support provided for their learning.

Female teachers were much more likely than male teachers to rate lack of confidence or being unsure how to implement as “a significant barrier”. Of those who reported lack of personal confidence as a barrier to this degree, 81% were females and 19% were males. The gender split for respondents who identified “being unsure of how to implement technology” as “a significant barrier” was 75% females and 25% males. Since the majority of the province’s teachers are female, this lack of confidence represents an important challenge that needs to be addressed.

4.7 Availability of Software

Fifty-eight percent of teachers in the province reported that lack of software was a barrier. Thirteen percent of these rated the barrier as “significant”.

While 58% of teachers felt that lack of software was a barrier, lack of software is one of the easiest technology barriers to dissolve. It is one of the least expensive of the barriers identified by this study, and dissolving it does not require a change in vision from the teaching or divisional staffs of individual school divisions.

If the lack of software remains unresolved, the purchased hardware and development of trained staff are wasted. More traditional technologies make a good analogy. One can build a library and retain a highly effective teacher-librarian, but if no books are purchased, the library is useless. Learning is hampered by even the purchase of a limited number of books, books for use in only one classroom, or books that are outdated. Software plays a similar role in the learning process to that of books, and the perception among teachers that it is insufficient for learning is very troubling.

Recommendations

The Saskatchewan educational community continues to work towards establishing a solid process for technology implementation. A number of initiatives intent upon developing a sound technology skill set and increasing teachers' understanding of how to use technology as an effective instructional tool are currently underway on both the provincial and school division levels. Saskatchewan Learning and the Educational Technology Consortium are partnering with school divisions to move forward the use of technology in the province. This research revealed that teachers were largely on side and interested in learning how to use technology to improve their students' learning. School administrators were acknowledged as having a vision for technology implementation. Hardware has been purchased and support exists from school division administrations. However, low levels of assistance in terms of release time to learn, effective professional development, and technical, planning and instructional support have hampered implementation. In general, teachers were applying only basic technologies in the classroom and lacked the skill level and knowledge of effective implementation strategies to use technology in ways that provide for the best learning outcomes. The majority of the surveyed teachers demonstrated only two of 10 intermediate skills and only 7% had advanced skills. Fifty-eight percent of the respondents were unsure how to implement technology in their classrooms effectively and 59% of teachers indicated a lack of personal confidence. Teachers need assistance now.

DIALOGUE

The organic nature of technological change requires a mechanism that promotes dialogue and reflection. Hard and fast goals are inappropriate in an arena where technology is a large factor. Dialogue is often instrumental in moving implementation forward, particularly in the areas of teacher support and the purchase of software or hardware. The fact that teachers in the province articulated so many barriers to implementation suggests that increased dialogue between decision-makers and the teaching body is needed. Such dialogue must involve all education stakeholders, including both the early adopters of technology and those who are reluctant to adopt it.

RELEASE TIME

Release time creates opportunities for teachers to work on learning during the regular school day. It is a key factor in teacher implementation of technology. Identified by teachers in the province as the most reported barrier to implementation, addressing the lack of time in school needs to be a major focus of the province's educational administrators. Research has clearly established that this need extends beyond Saskatchewan: "Teachers need large blocks of time to gain initial familiarity with new hardware or software, learning and practicing for sustained periods" (Renyi, 1996). Ninety percent of teachers in the province identified lack of time at school as a barrier, with 51% of those identifying this lack as strongly as possible.

TECHNICAL, PLANNING AND INSTRUCTIONAL SUPPORT MECHANISMS

Technical, planning and instructional supports are the keys to improving the breadth and depth of technical implementation in the classroom. This research established strong links between the availability of that support and teacher implementation. If schools wish to increase the use of technology as an instructional tool, additional investment in support is an essential step.

PRE-SERVICE LEARNING

Pre-service learning is the learning that occurs for teachers in training. These aspiring teachers are commonly taught a number of instructional strategies to allow them to meet curricular objectives well. Education students do not receive enough intensive instruction in computer-enhanced learning as an instructional tool. In addition, for learning regarding technology-enhanced instruction to be truly meaningful, it must be effectively modeled by an instructor. This research found that young teachers have not been successfully equipped to implement technology in the classroom. Education students must experience the effective use of technology as an instructional tool if they are to utilize technology to facilitate learning in their own classrooms.

However, the task of providing learning regarding technology cannot be a one-time offering for pre-service teachers. Since the scope and specifics of computer-related instructional tools evolves rapidly, on-going in-service is necessary.

LARGE-SCALE PROFESSIONAL DEVELOPMENT

Large-scale professional development, as opposed to one-day workshops, has been found through research to be an effective way to increase teacher use of technology in the classroom (Killion, 1999). Since the research indicates sit-and-get is the least effective format for professional development, the educational partners may wish to consider focusing professional development dollars more directly on the following alternative forms of professional development: mentoring, modeling, partnership, short courses, special projects, joint preparation time, and summer institutes.

Conclusion

The quality of technology-enhanced learning and teaching in Saskatchewan requires attention. While some may argue that technology can be taught in classes dedicated to that topic, it is fundamentally the same as arguing that the ability to talk and write needs to be a focus only in English Language Arts classes. Since the majority of the province's teachers surveyed did not possess the technical literacy to facilitate the use of technology in their classrooms effectively, resources must be dedicated to the problem immediately. It is not sufficient to hope that teachers will learn skills independently or that neophyte teachers will already have the necessary skills. Concerted efforts in terms of release time, effective professional development and support are needed in order to create real change.

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Appendix A: Beyond the Mouse and Modem On-line Survey

This is a summary of the original survey without the text boxes and buttons (the original survey may be viewed at <http://www.saskschools.ca/~techsurvey/>). In this version, questions are stated in bold to distinguish them from potential responses.

HARDWARE

1. How many computers are available for your students in each of these locations?

a. My own classroom, b. School library, c. Computer lab

2. What kinds of technology resources has the school provided for your use?

a. Digital still camera, b. Data projector, c. Scanner, d. Video camera, e. A desktop computer for your own use while at school, f. A laptop computer for using both at work and at home, g. A computer printer in your room or nearby, h. Access to electronic mail from your classroom, lounge, or office, i. Modem access to the Internet from your classroom, j. High speed access to the Internet from your classroom, k. Other (text entry option)

3. How valuable do you think the following equipment might be for your teaching, whether or not you currently have access to it? (Essential, valuable, some value, not needed)

a. Digital still camera, b. Data projector, c. Scanner, d. Video camera, e. A desktop computer for your own use while at school, f. A laptop computer for using both at work and at home, g. A computer printer in your room or nearby, h. Access to electronic mail from your classroom, lounge, or office, i. Modem access to the Internet from your classroom, j. High speed access to the Internet from your classroom, k. Other (text entry option)

4. For how many years, if at all, have you had a computer at your home? An Internet connection? If you don't have a computer or an Internet connection at home, please enter "0".

a. Computer at home, b. Internet at home

SOFTWARE

5. How adequate is the supply of useful software at your school? (Excellent, very good, good, fair, poor, don't need or don't know)

a. Instructional drills, games, and tutorials, b. Computer-based information sources (e.g., CD-ROM encyclopedia and databases), c. Word processing software, d. Presentation software, e. Database and spreadsheet software, f. Drawing and paint software, g. Desktop publishing software, h. Image editing software, i. Web page authoring software, j. Audio/video editing software, k. Programming software

TECHNICAL SUPPORT

- 6. How often do you need each type of support? (Weekly or more often, 1-3 times a month, seldom, not at all)**
 - a. Technical support (e.g., hardware and software fixes), b. Planning support (e.g., incorporating technology into your lessons), c. Instructional support (e.g. technical support during the lesson and activity)
- 7. How available is each type of support when you need it? (More than 75% of the time, between 51-75% of the time, between 26-50% of the time, up to 25% of the time, not available)**
 - a. Technical support (e.g., hardware and software fixes), b. Planning support (e.g., incorporating technology into your lessons), c. Instructional support (e.g. technical support during the lesson and activity)
- 8. What is the quality of support you receive? (Excellent, very good, good, fair, poor, no support received)**
 - a. Technical support, b. Planning support, c. Instructional support
- 9. How much more would you use computers in your teaching if you always received adequate support in these areas when you needed it? (Much more, more, somewhat more, no more)**
 - a. Technical support, b. Planning support, c. Instructional support
- 10. Which of the following have been a main focus for professional development for your staff in the past two years?**
 - a. Technology related content to teach your students, b. Using technology to improve how well students work in groups or how well they conduct peer discussions, c. The mechanics of using computer technology and software, d. Integrating computers into instructional activities in your subject area, e. How to use the Web or other on-line activities, f. How to enable students to create multimedia presentations, g. Connecting technology skills instruction with real-world applications, h. Other, please specify (text entry option)
- 11. Think about the professional development opportunities you selected in Question 10. To what degree have you been able to apply the knowledge and skills you acquired in your current teaching? If you did not select any opportunities in Question 10, please go on to Question 12. (A great deal, somewhat, not at all, not applicable)**
 - a. Technology related content to teach your students, b. Using technology to improve how well students work in groups or how well they conduct peer discussions, c. The mechanics of using computer technology and software, d. Integrating computers into instructional activities in your subject area, e. How to use the Web or other on-line activities, f. How to enable students to create multimedia presentations, g. Connecting technology skills instruction with real-world applications, h. Other, as specified in question 10.
- 12. Which of the following are barriers to your developing and implementing your technology knowledge, skills and abilities? (A significant barrier, a barrier, a minor barrier, not a barrier)**
 - a. Insufficient time at school, b. Lack of personal confidence, c. Lack of quality professional development, d. Lack of interest, e. Lack of hardware, f. Lack of software, g. Lack of technical support, h. Lack of administrative support, i. Lack of vision in your school or division, j. Not viewing such development as important or necessary, k. Unsure of how to effectively implement technology in my courses

13. I would like more information about the following on-line teaching strategies:

- a. Direct Instruction (e.g. Mastery Lecture, Drill and Practice, Demonstrations), b. Indirect Instruction (e.g. Problem Solving, Case Studies, Concept Mapping), c. Experiential Learning (e.g. Field Trips, Focused Imaging, Role Playing), d. Independent Study (e.g. Computer Assisted Instruction, Research Projects, Learning Contracts), e. Interactive Instruction (e.g. Debates, Brainstorming, Interviewing)

14. Assess your current computer skills. I know how to: (Yes, somewhat, no)

- a. Display the contents of the disk, b. Copy files from one disk to another, c. Install a new program on a computer, d. Put pictures into a word-processing document, f. Make a Web page, g. Put a Web page on the World Wide Web, h. Use a spreadsheet to create a chart, i. Write a computer program or macro, j. Crop a digital image, k. Scan a picture for use on a Web page or document, l. Edit a digital video, m. Use a drawing program (e.g. Paint)

15. Assess your current Internet knowledge, skills and abilities. (Yes, somewhat, no)

- a. I can list some of the critical components of a good Acceptable Use Policy and I am familiar with my school's policy; b. I can send and receive email including attachments; c. I have virus software installed on my computer and update it regularly; d. I use a ListServ, and/or am part of an on-line discussion group; e. I use the WWW for recreational purposes; f. I use search engines to find information; g. I search the Web using Boolean Logic search terms (e.g. +, " "); h. I understand what cookies do; i. I can download and install programs off the Internet; j. I can compress and extract files (e.g. WinZip, Stuffit); k. I can use streaming audio and video applications (e.g. RealPlayer); l. I use instant messaging/real time chat applications (e.g. ICQ, AIM, MSN Messenger); m. I use Saskatchewan Education's Evergreen Curriculum.

16. In the class in which you (or your students) use computers the least, how often does a typical student use a computer?

- 1. Less than once a week, 2. once a week, 3. 2-4 times a week, 4. daily

17. In the class in which you (or your students) use computers the most, how often does a typical student use a computer?

- 1. Less than once a week, 2. once a week, 3. 2-4 times a week, 4. daily

Think of the class in which you most often accomplish your teaching goals.

Refer to this class as you answer question 18.

18. What objectives do you have for student computer use?

- a. Mastering skills just taught, b. Remediation of skills not learned well, c. Expressing themselves in writing, d. Communicating electronically with other people, e. Finding ideas and information, f. Analyzing information, g. Presenting information to an audience, h. Improving computer skills, i. Learning to work collaboratively, j. Learning to work independently, k. Other (text entry option)

Please indicate the letters of the three objectives from above which are most important to you. (ranked 1-3, or choose not applicable)

The remaining questions refer to any of the classes that you teach.

- 19. Indicate the number of lessons in this school year in which you have used the following types of software. (10+lessons, 3-9, 1-2, 0)**
a. Instructional drills, games, and tutorials, b. Computer-based information sources (e.g., CD-ROM encyclopedias and databases), c. Word processing software, d. Presentation software, e. Database and spreadsheet software, f. Drawing and paint software, g. Desktop publishing software, h. Image editing software, i. Web page authoring software, j. Audio/video editing software, k. Programming software
- 20. Indicate the number of lessons in this school year in which your students have used the following Internet services. (10+lessons, 3-9, 1-2, 0)**
a. Web search engine, b. E-mail, c. Audio or video, d. On-line demonstrations and simulations, e. Real-time conferencing/chat, f. On-line threaded discussion forums, g. WebQuests/Treasure hunts, h. Collaborating with students in other schools, i. Publishing a Web page/Web site
- 21. How do you use computers to prepare for teaching your classes or in other professional activities? I use computers to: (More often, weekly, occasionally, do not use)**
a. Record or calculate student grades, b. Make handouts for students, c. E-mail parents or teachers, d. Write lesson plans or related notes, e. Get information or pictures from the Internet for use in lessons, f. Use camcorders, digital cameras, or scanners to prepare for class, g. Exchange computer files with other teachers, h. Post student work, suggestions for resources, or ideas and opinions on the Internet, i. Put lessons on-line
- 22. How many years ago, if at all, did you first use computers in the following way? (10+ years, 6-9, 3-5, in the last 2 years, never)**
a. For assigning tasks to students in your classes, b. For your own work (e.g. grading, handouts, etc), c. For other activities (e.g. personal e-mail, word processing, games)
- 23. Compared to five years ago, are you using computers more frequently or less frequently in these ways? (Much more frequently now, more frequently now, stayed the same, less frequently now)**
a. Trying out new software programs, b. Using computers for class preparation (e.g. handouts, overheads), c. Using computers for non-work activities, d. Professional development, e. Requiring the use of computers in student projects
- 24. Evaluate the following statements about student use of computers. (True, not true, no opinion)**
a. Students create better-looking products than they could do with just writing and other traditional media; b. Computers provide a welcome break for students from more routine learning activities; c. Students help one another more while doing computer work; d. Students take more initiative outside of class time; doing extra research or polishing their work; e. Students' writing quality is better when they use word processing; f. Students work harder at their assignments when they use computers; g. Having my students use computers enables me to offer more creative, student-centred assignments.

25. Do you believe your current use of technology actually improves student learning?

(A great deal, generally, not at all, not applicable)

26. In general, what is your opinion of each of the following statements? (True, not true, no opinion)

a. Computers are too unpredictable—they “crash”, or the software doesn’t work correctly; b. Computers are hard to figure out how to use; c. Many students use computers in order to avoid doing more important schoolwork; d. Many students are not careful enough with this expensive equipment; e. It is difficult to integrate computer activities into most of my regular lesson plans; f. Often too many students need my help at the same time; g. Students often get so wound up, I can’t get them to settle down afterwards; h. A teacher has to give up too much instructional responsibility to the computer software—I feel I’m not really “teaching”; i. Students can cheat more easily; copying work and turning it in as their own.

GENERAL INFORMATION

27. Please indicate all of the grade levels that you currently teach:

K-2, 3-5,6-7, 8-9, 10-12, other (Administration, Guidance, etc.)

28. Please select all of the subjects that you currently teach:

All subjects in a grade, mathematics, sciences, social sciences, language arts, fine arts, languages, physical education, vocational education, computers, special education, other (text entry option)

29. Your main assignment at the school would be considered:

Regular full-time teacher, regular part-time teacher, itinerant, long-term substitute, administration, other (text entry option)

30. As of the completion of the 2001-2002 school year, how many years of teaching experience will you have?

1, 2, 3, 4, 5, 6-10, 11-15, 16-20, 21-25, more than 25

31. What is the total number of individual students you teach?

Numerical options

32. What is your average class size?

Numerical options

33. In which of these settings do you teach?

Urban, rural, reserve

34. Who funds the school in which you teach?

Public system, separate system, federal system, private school

35. Do you teach in a northern community?

Yes, no

36. Your age

Numerical options

37. Gender

F, M

38. School Division

Select from a list of divisions

**2317 Arlington Avenue
Saskatoon SK Canada S7J 2H8
Phone: 306-373-1660
Toll Free: 1-800-667-7762
Fax: 306-374-1122
E-mail: mcdowell@stf.sk.ca**

www.mcdowellfoundation.ca