MENTORING AS AN APPROACH TO PROMOTING THE TECHNOLOGICAL LITERACY OF TEACHERS

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ABSTRACT

Increasingly, teachers are being expected play a critical role in helping students learn how to use information and communication technology (ICT) effectively. Despite this expectation, there are many teachers who still feel that their own skills are lacking - effective professional development (PD) can help to address this shortfall. Research, however, has acknowledged that the traditional workshop approach is not that effective since it does not provide the opportunity to practice new skills. Without practice, there is often no lasting transfer of new skills to teaching practice. The strategy of technology *mentoring* seems to offer significant promise. This paper reports the findings of a research project that investigated the qualities of successful technology mentoring programs in schools. Administrators, mentors, and protégés indicated that mentoring, as a model of professional development, was beneficial in helping their teachers use technology both more regularly and more effectively with students. While the levels of expertise in using technology continued to vary, mentoring led to a much larger number of teachers who regularly integrated technology into their teaching. In several cases, the use of technology increased the capacity for technology leadership in the schools.

KEYWORDS
Technology mentoring, professional development, ICT in education

INTRODUCTION

Approximately a quarter of a century has passed since the microcomputer exploded onto the scene. Business and industry were quick to capitalize on its potential and it seemed to offer similar promise for education. As it turned out, the microcomputer was attached to a slow burning fuse as far as delivering on its potential in education (Wright, 2004). In the early 1990's, as educators explored the potential of the microcomputer, a quiet revolution was under way in the world of telecommunications. Suddenly, so it seemed, there was the Internet – the missing piece of the puzzle (Wright, 2002). The very powerful combination of computers and communications technologies spawned the use of a new term, information and communication technology and led to a renewed understanding of its potential in education.

The use of ICT in teaching can be thought of as falling into two broad (but not mutually exclusive) categories, notably, the promotion of technological literacy of students, and the use of ICT in teaching and learning. The fact that teachers are expected to play a role in the former is no longer questioned.

Increasingly, teachers are being encouraged, if not required, to *emphasize* the use of ICT. This fact is evidenced, for example, by the establishment of mandatory learner outcomes in ICT for all kindergarten to grade twelve students in the Province of Alberta (the fifth core curriculum), and the National Educational Technology Standards for students in the United States.

Within the last decade especially, the amount of information technology available in schools and at home has increased dramatically (Collins, 1991; Gilmore, 1994). Most students in schools today have grown up around computers and thus, have a sense of authenticity in using technology.

Despite the expectations, there are many teachers who still feel that their own skills are lacking. Effective professional development can help to address this shortfall. Research has acknowledged that the traditional workshop approach does not provide the opportunity to practice new skills - without practice; there is often no lasting transfer of new skills to teaching. The strategy of technology *mentoring* seems to offer significant promise.

PROFESSIONAL DEVELOPMENT AND THE CASE FOR MENTORING

In the last several decades, school culture, organization and teaching practices have not changed a great deal (Dooley, 1999; Norton, McRobbie & Cooper, 2000). Schooling tends to be conservative by nature. Within this context, teachers have been viewed as experts whose role it is to transmit their knowledge to students (Collins, 1991). Rapid changes in technology and society, however, are changing that perspective. Teachers are increasingly being called upon to change their *role*, as well as to use new tools and methods (Forcheri et al., 2000). In addition to its obvious use in the promotion of technological literacy, ICT can transform the nature and organization of the classroom into one that allows learners to pursue different questions at different speeds, using many technologies (Collins, 1991; Forcheri et al., 2000; Means et al., 1995). This type of learning has been referred to as constructivism, where teachers act as facilitators in helping students construct their own meaning about the world by helping them to engage in meaningful learning experiences (Collins, 1991).

The goal of technology integration is to have it embedded within the curriculum in the context of learning activities (Wetzel & Zambo, 1996). This can happen when teachers are able to use technology in a sustained way to support their students (Persky, 1990). But how does one go about accomplishing this goal? In large part, the answer lies in the provision of effective professional development for teachers.

Technology integration is a very complex process and professional development is imperative in ensuring that it is effective (Dooley, 1999; Holahan et al., 2000; Kilbane, 1997). Studies have shown that lack of teacher training is one of the biggest roadblocks in making changes of any kind (Brand, 1997; MacArthur & Pilato, 1995). Helping teachers to use technology effectively requires an investment of time, money and support. Such investment is especially imperative in the field of technology because of the constantly changing nature of hardware and software (Brand, 1997; Dooley, 1999; Holahan et al., 2000; Parr, 1999). Effective professional development helps teachers become empowered in using technology as a cognitive tool (MacArthur & Pilato, 1995; Major, 1999). This training should have a focus on instruction, curriculum, and students rather than on the technology itself (Brand, 1997; Persky, 1990).

In the past, professional development has typically been pre-packaged, sporadic, and has required minimal participation by teachers (Gilmore, 1994; Little 1993). Even though classrooms tend to be complex environments, professional development has often engageds teachers superficially and, typically, has been delivered by outside experts. The effect of this type of training has been shown to be limited (Forcheri et al., 2000; Gilmore, 1994; Little, 1993; MacArthur & Pilato, 1995; Persky, 1990).

Recent research indicates that teachers need both inservice education *and* long-term, sustained support in order to effectively support their learning (MacArthur & Pilato, 1995; Parr, 1999; Wetzel & Zambo, 1996). The "one time workshop" approach has been shown to limit transfer to teaching practice (Polselli, 2002). As well, teachers must be involved in the decision-making regarding their own learning. Doing so requires a greater commitment and more active participation, but has greater potential for long-term effects (Gilmore, 1994; Parr, 1999). Ongoing professional development, linked to curriculum and student needs is a preferred model. In it, teachers have continuing support and training in an environment that considers their level of understanding and ability and their learning style. They are constantly engaged in interactions, have opportunities to share experiences, and have time to build relationships with colleagues (Brand, 1997; Cigarillo, 1998; Maor, 1999; Yost, 2002).

On-going professional development and support has been shown to be particularly effective when mentoring is a part of the process (Holahan, Jurkat & Friedman, 2000; MacArthur & Pilato, 1995; Mather, 2000). Mentoring has been defined as part of "an entire system of training development and improvement" where teachers engage in shared inquiry into their teaching practices (Hargreaves and Fullan, 2000). Teachers develop a one-on-one, ongoing, supportive relationship that takes place at their own school site (MacArthur & Pilato, 1995). Mentoring as a strategy for professional development has been used in many

different settings, from business to education. In fact, many institutions use mentoring as a means of enhancing recruitment and retention of new employees, upgrading skills, or improving employee satisfaction (Kerka, 1998). Mentoring supports much of what is currently known about effective adult learning structures. It takes place within the context of the workplace, includes learning directly linked to job-related duties, and is situational (Kerka, 1998). Also, building professional development into the working day facilitates collaboration between teachers (Richardson, 2003).

RESEARCH PURPOSE AND METHODOLOGY

Purpose
Through the experiences of mentors, protégés, and their school administrators, the purpose of the research was to examine the characteristics of successful mentoring programs.

Sample
The sample consisted of four schools that had been judged to have exemplary technology mentoring programs. These four schools were chosen from a much larger group of schools that participate in a Canada wide project called the Network of Innovative Schools (NIS). This unique project, funded by Industry Canada through Canada's SchoolNet, was developed to recognize and encourage schools using ICT in meaningful and creative ways to improve learning (Canada's SchoolNet, 2003). All Canadian, grade schools are eligible to participate in the NIS project - selection is based on a competitive application process. Using detailed scoring rubrics, applicants (schools), are judged by a national selection committee comprised of education stakeholders. Successful schools must evidence the following characteristics:

- Student-centered philosophy
- Long and short term technology planning
- Culture of innovation
- Readily available technology
- Ongoing professional development
- Established framework of support for using ICT
- Administrative support
- Culture of collaboration within the community and beyond
- Collaboration within the school

Ten schools met the criteria for having exemplary ICT mentoring programs, four of which agreed to participate in the research. Among these schools, a total of five administrators, six mentors, and nine protégés participated. Two limitations of the research are; 1) not all eligible schools will have applied to the project and 2) the NIS project attempts to balance participation on a geographical basis. Table 1 shows the demographics of the research sample by (school) site. To facilitate the reporting of qualitative findings, the location and distribution of protégés, mentors, and administrators is also provided.

Table 1. Demographics of participating school sites

Site	Grades taught (K=Kindergarten)	Teachers (FTE*)	Mentoring time (FTE)	Mentors	Protégés	Administrators
Site 1	K-6	16 (13.3)	0.1	Mentor 1	Protégé 1 Protégé 2	Administrator 1
Site 2	K-7	29 (24.4)	0.3	Mentor 2	Protégé 3 Protégé 4	Administrator 2
Site 3	K-7	29 (26)	0.857	Mentor 3 Mentor 4	Protégé 5 Protégé 6 Protégé 7	Administrator 3 Administrator 4
Site 4	9-12	38 (24.8)	1.25	Mentor 5 Mentor 6	Protégé 8 Protégé 9	Administrator 5

* FTE= full time equivalent teaching positions

Methodology
The study consisted of two phases and a combination of surveys and interviews was used to gather data. The first phase consisted of surveying technology mentors and their administrators to determine the kinds of activities that were pursued as well as the time and money invested in these efforts. The second phase consisted of interviewing technology mentors, their protégés, and their administrators to gain a deeper understanding of their experiences in a successful technology-mentoring program.

Five instruments were used to gather data. These instruments were as follows:

Mentor survey: This instrument collected information regarding: (1) mentoring time (number of years/months spent doing formal and informal mentoring, the amount of time assigned for mentoring, the manner by which teachers request support, and when mentoring activities took place), (2) mentoring duties/role (what types of mentoring activities were undertaken), (3) time spent on mentoring activities (working one-on-one, working with teachers and their students, working with staff only, technology planning, etc.), (4) frequency of mentoring individual teachers (regarding hardware, software, communications tools, information access and retrieval) and (5) frequency of mentoring groups of teachers (regarding hardware, software, communications tools, information access and retrieval).

Administrator survey: This instrument gathered demographic information about the school including grades taught, number of teaching staff, number of computers and their location. It also gathered information about the school's mentoring program and how involved the administrator was in the professional development initiative. The survey also asked questions regarding expenditures on computer hardware, software, mentoring, and other technology related professional development.

Mentor interview: The interview instrument was designed to elicit more specific information about the mentors' experiences with the program. The mentor interview questions gathered information on the following topics: (1) description of background and education in using technology. This question was used as an "ice-breaker" as well as to determine whether mentors were primarily self-taught or had received university training on the use of technology, (2) planning (technology professional development planning, reasons for choosing a mentoring program, and the goals of the mentoring program), (3) definition of mentoring and its perceived role (what mentoring means, qualities of a good mentor, types of staff mentored, mentoring activities, and mentoring as a model for professional development), (4) success of the program (indicators of success, examples of how mentoring helped students use technology more effectively, and feedback regarding the mentoring program) and (5) support (where mentors received support and what form it took).

Administrator interview: This interview provided administrators with the opportunity to elaborate on their school technology mentoring programs and their role in supporting it. Interviews addressed the following topics: (1) background in using technology (again, an "ice-breaker" question), (2) mentoring (how technology mentors were selected, qualities of effective mentors, indicators of success, and mentoring as a model for professional development) and (3) support provided for the technology mentoring program.

Protégé Interview: This instrument was used to explore the protégés' experiences with technology mentoring and to determine whether the approach had helped them integrate technology with students in more effective ways. Specifically, protégés were invited to elaborate on: (1) how technology mentoring had helped them to integrate technology into the curriculum, (2) the type of activity on which they had received mentoring, (3) an example of how mentoring had helped them, (4) the qualities of an effective mentor and (5) mentoring as a model of professional development.

Surveys were administered online. Interviews were conducted either in person or by telephone.

FINDINGS

Two considerations affect the reporting of findings. First, it was anticipated that there might be very different viewpoints expressed by the three groups. Instead, however, five common themes emerged and a high degree of commonality of viewpoint was apparent. In light of this, findings are reported according to these five themes. Second, while detailed data was gathered regarding the nature and extent of specific

mentoring activities, these data require further analysis and interpretation. Due to this, and the limited scope of this paper, only qualitative findings are reported. It is anticipated that quantitative findings will be available by CBLIS 05 and will also be presented at that time.

Theme 1: Technology mentoring programs
Mentors and administrators provided insights into their experiences that included; why they had chosen mentoring as a way to increase technology integration among teachers, what mentoring meant to them, and how they planned for mentoring. Schools identified a variety of needs that led them to implement a technology mentoring program. These needs included the implementation of ICT outcomes for students, and past models of PD that simply hadn't worked. Two sites were required to implement ICT outcomes but did not have many teachers who were able to do this. Mentor 6 said:

> …we just found that actually we had a greater need for teaching technology than we had a supply (of teachers). We had some people who were keen to do it and were interested in technology but were a little afraid to go there alone. And so we had some people, myself being one of them, who were willing to work closely with them to get them up to speed.

Administrator 3 said that that his staff felt technology had to be a priority and so he hired someone who would champion necessary changes. Site 2 had a similar need and Administrator 2 felt that hiring a mentor "would revolutionize how we do technology in our school." Mentor 1 explained that their technology planning team had looked at research and felt that mentoring was the best way to bring about more effective technology use. Mentor 2 had advocated a mentoring program because of past experiences at the school - she commented, "We knew pull-out technology teaching didn't work."

Since there are many definitions of mentoring, mentors were asked to describe what mentoring meant to *them*. All of the mentors described it as a collaborative relationship, as opposed to having an expert simply impart knowledge to the learner. Mentor 2 went on to say that mentoring cannot be a "power" relationship if it is to be successful. Mentor 6 described mentoring by saying, "I think it is a two way street. I think people are getting exposure to skills. Just as important, people are getting a chance to share theirs with someone else and see value in that." The mentors acknowledged that they needed to be confident in using technology but didn't necessarily need to be a "guru". Mentor 5 described the process of mentoring as helping a colleague feel "…solid enough ground that they can go off on their own".

Schools articulated the goals for their programs in a variety of ways. All four sites had some sort of a technology committee that helped to set directions for their school and to plan for things like mentoring, professional development, and purchases of hardware and software. Mentor 1 said that their goal for technology mentoring was simple. It was that "all children… would have technology integrated into their curriculum and use it in a meaningful way". Mentor 4 said that their goal was "to support teachers in whatever project they want to do in technology". The mentors at Site 4 indicated that they had incorporated district-level goals and ideas into their school's plan.

All of the schools provided support for small groups of staff members. Activities took place at a variety of times, including, during staff meetings, at lunch breaks, after school, and on designated professional development days. Typically, small group mentoring was initiated the mentor(s) who either chose an area of perceived need or worked with a technology planning or professional development committee to focus on an identified area of desired growth.

Several mentors felt that group work on specific skills, helped to establish both a comfort level and an understanding of what could be accomplished with technology. Some teachers took what they learned and immediately began to work on their own with students, others required ongoing mentoring support in order to begin implementing technology in their classes.

Technology mentors also worked in a variety of ways with *individual* teachers. At times, support was as simple as an informal exchange of ideas in the staff room. On other occasions, a mentor would work with the protégé's class so that the protégé could watch how the technology lesson worked with their students. Mentor 3 indicated that their approach to finding protégés was through "simple sign up and informal chats".

In addition this mentor was available to provide immediate help with any urgent concerns. This approach was apparent in other schools. Very significantly, none of the mentors said that they were *directed* to work with staff members - participation was strictly voluntary.

Interviews confirmed that decisions on the types of activities that mentors undertook with protégés were arrived at in an informal, collaborative manner. Typically, mentors and protégés would chat about curricular topics and pedagogy, and then discuss how technology might be used to both enhance the area and address ICT outcomes.

Informal mentoring took place in all of the schools. Some schools created the opportunity (either during lunch or after school) for teachers to receive help on a drop-in basis. One school created an innovative support that they called the "Tech Café". The Tech Café consisted of an open lab that teachers could use to "play" with technology. The café was open after school on designated days and a mentor was always present. Coffee and snacks added to the allure and ambience of the café. Mentor 6 commented on the value of having "experts right around the corner, in the same building."

Theme 2: The importance of the mentor
Each of the groups interviewed was asked about the qualities of an effective technology mentor. Among the traits mentioned most frequently were the need to have a certain level of knowledge about technology, communication and interpersonal skills, empathy and patience, risk taking, and passion for technology.

Administrators and protégés pointed out that the mentor must have a level of comfort and proficiency in using technology. However, several mentors, protégés, and administrators mentioned that mentors do not have to be "gurus". Administrator 2 said that mentors must "understand that it's not computers that you're teaching, but you're teaching kids to learn and you're using computers as a tool and it's to interact with to work through projects". Interestingly, none of the *mentors* mentioned that technology proficiency was one of the important qualities of a mentor. Protégé 1 felt that having someone who was *not* a total expert was a benefit. She said, "I think we can take heart from somebody who doesn't know it all, but can figure it out or find out. It gives the rest of us hope we can get there someday too." All six mentors commented that they were primarily self-taught and felt that this "self-teaching" was done out of an initial personal interest, rather than formal training or self-professed expertise.

All three groups felt that the ability to communicate was very important. Administrators 3 and 4 thought that being able to make technology understandable to both adults and students was a critical quality. Protégé 1 said that it was important for learners to have "somebody on site that knows the curriculum and is able to explain things". Mentor 5 stated that mentors must be "comfortable enough with their communication skills to actually be able to explain things to people".

Interpersonal qualities were mentioned as being very important for the success of the programs. Several of the administrators commented that it was important that mentors were personable. The majority of mentors and protégés said that strong interpersonal skills or "good people skills" were definitely necessary in building a mentoring relationship. Kindness, caring, and having a sense of humour were examples of other interpersonal skills thought to be important. Mentor 1 commented that mentors needed to be able to "laugh at themselves".

Since many protégés did not have a great deal of experience in using technology, it was important for mentors to have empathy and patience with novice technology users. Administrator 4 thought that mentors must understand that "many people have a technology block and be sensitive to that". Several mentors felt that it was important to be able to put themselves in the shoes of a new technology learner. Mentor 2 stated it was important to function as someone who "hasn't forgotten how it feels to learn something new with technology". All protégés believed that patience was a key.
Protégé 1 commented that it was important that protégés feel that "no question is too stupid" and that the mentor "doesn't mind repeating, and going over and over again". Mentor 6 acknowledged "if you don't have the patience for it, people are going to get turned off".

Flexibility was also seen to be an important quality, as mentors were called upon to do a variety of other technology duties in addition to a wide range of mentoring

Participants in all three groups mentioned risk-taking as a valuable trait. Administrator 5 stated that risk taking is important "because I think they have to be open to ideas and approaches because they are working with a lot of different personalities within one building and not everybody thinks and does things in the same way."

Protégé 4 thought that it was "important that mentors be capable of trying unknown things." Mentor 1 commented that a good mentor is "someone who is willing to step out of their zone and try things that maybe they are not comfortable with."

Protégés also felt it was important for the mentors to encourage them (the protégés) to also venture out of their comfort zone. Protégé 7 described her experience with the mentor by saying, "He allowed you to experiment and discover yourself, and then it [technology learning] became that much more meaningful". Administrator 1 also said it was important for mentors to always be quick to compliment protégés for every small step that they took.

Having passion for using technology in teaching was thought to be an essential characteristic of a mentor. Administrator 5 explained that effective mentors are:

> …passionate about technology and they are passionate about teaching and learning. I mean, they are excited about technology and what it does to their teaching, and what it does to learning and they want everybody to know about it.

Protégé 9 felt that it was important that mentors "care about technology so everybody is more competent" and be able to provide inspiration to others. Most of the mentors *also* expressed that having enthusiasm and motivation were important in having staff members join in the process of learning about technology.

Theme 3: Mentoring as a model for professional development
All three groups spoke strongly about mentoring being an effective model of professional development. Some of the benefits they described were development of relationships, opportunities for cooperative planning, just-in-time support, active continuous learning, and needs-driven learning.

The importance of having and developing relationships with mentors was mentioned frequently. For example, Protégé 5 talked about the existing relationship between herself and the technology mentor, and how that helped increase her comfort level at the beginning of the project. She indicated that, "knowing [the mentor] was the big thing that happened that gave me the opportunity to start integrating it [technology]". Mentor 1 described the mentoring relationship as a kind of friendship. She went on to say that mentoring "has to be that feeling of intimacy almost between people. They [protégés] have to feel comfortable with the person." She also described an effective technology mentor as having "all the qualities that would apply to a good friend". Administrator 3 also believed that "in order to have a mentoring situation in a school you have to have a personal relationships first".

The mentoring relationship facilitated cooperative planning between mentors and protégés. Protégé 5 described this type of planning:

> We brainstormed ideas and we came up with ideas. I had lots of ideas but no way of implementing them because I did not have the skill level [in technology]. He [the mentor] supported that implementation of ideas that we brainstormed together.

Protégé 8 discussed a similar process. She explained, "I'll come up with the ideas and then I'll have a tech expert help me take what I have of an idea and make it work".

Administrator 2 described the cooperative planning process in a mentoring relationship:

> It's a back and forth thing, it's a give and take, and I think the key reason that it works is that one, those people who are working together are professionals. Both learn from each other and the line of communication is consistent throughout the project. That's the biggest key between that and any other form of inservicing one can get.

Participants spoke enthusiastically about these types of cooperative planning experiences and said that they benefited both the protégé and the mentor.

Having support available when they were ready to try a new idea was important for protégés. Protégé 2 described her experiences with workshops as opposed to having mentoring support:

> Most PD is a variety of workshops. You go and you are bombarded with a million different things and you try to remember them all. You leave and you have no one to ask and you can't even remember some of the great things that you thought you might try. So mentorship, having someone there who can teach you some things you remember, but you can't remember everything so you can go back and ask the person. It just gives you such a sense of freedom and the willingness to try because you know you have help. I guess that's the big thing. You know there is someone there to help you.

Protégé 6 agreed that "immediate feedback is important" and Protégé 7 added "you do a lot at a workshop, but sometimes they can be too big, or you're too removed from the immediate task at hand." Administrator 1 said, "Onsite is the key and during the days – not having mentoring happening after they [teachers] have taught a full day and going to a workshops where everybody's tired. You release people at their prime time for learning." Having on-site help (just when protégés were ready to implement new ideas) was thought to be valuable in promoting the integration of technology.

Mentoring provided active, needs driven learning. Mentors, protégés, and administrators all spoke about the immediate relevance of mentoring. Administrator 3 said that workshops provide "snapshots" and "while they are whetting the interest of a teacher, teachers tend not to use stuff unless it is readily accessible and they can just pick it up and do it." Administrator 4 said, "I think that what tech mentoring does it that you're being mentored on what is relevant to the learner's need". She went on to say:

> You're empowering them to take that back to their classroom to use it, where the other way around, 'we're all going to do spreadsheets. Well, what good is that to me? I don't need that' It becomes a waste of time.

Theme 4: Support for technology mentoring programs
Participants were asked about supports in a technology mentoring program. They discussed administrative support, time, funding, and a supportive environment as keys to program success.

Administrator 4 felt that his role was "primarily one of support and making sure they [the mentors] have the resources. Their job is to work with other teachers and work with kids." Administrator 1 agreed and said that her role was that of an encourager, and that she needed to learn about mentor and protégé needs. Three of the five administrators mentioned that it was important to model the use of technology. Mentor 6 echoed this sentiment by saying that his school administrators "try to model it, which I think is pretty important". All of the administrators said that they had done this through their own participation in school-based technology PD and that they had received support from a technology mentor in some way. All of the mentors said that they had received support from their school administration. Mentor 2 acknowledged, "Support of school administration is critical for generating enthusiasm for the program". Mentor 5 agreed and stated, "If you don't have admin behind it, it's not going to happen".

All of the school sites had allocated part of a teacher's full-time equivalent (FTE) towards a technology mentor (see Table 1). Administrator 5 commented on the importance of designating time for a teacher to do mentoring. She said, "I maintain the tech mentoring position. I think it is important I find time." Many comments echoed the fact that having on-site support during the school day was a key component in the program's success. Protégé 1 commented:

I have really appreciated the time to learn in this school, not the twenty minutes after school's over when you're trying to think of all the things you have to do before you go home, or the early morning sessions, but actually having the time off with my colleagues to learn together, and then having the mentor on site to help us if we can't remember some of the things they told us.

Funding for adequate levels of hardware and software was also seen to be an important support for the programs. One administrator mentioned, however, that there were never enough computers and that the mentors still had more requests than time available. This was seen as both a measure of program success and the desire to have the program continue. Though there was definitely a commitment in terms of finances, the combined money spent on hardware, software, professional development, and mentoring was small – only one to two percent of the school budget.

Working with the same hardware and software as the students was considered to be important. Mentor 2 stated, "Teachers don't need the added anxiety of unfamiliar equipment". Mentor 5 described a scenario that a teacher new to using technology might experience:

If you are at a workshop and it is being done on a Windows platform and it is just slightly different where you save, and the interface looks slightly different, it is enough to throw somebody who is already taking a risk in their teaching.

Administrators felt that that making technology a priority at the school, and creating an environment where collaboration, innovation and risk-taking are encouraged was extremely important. Administrators 1 and 5 said that mentoring created a culture of collaboration that benefited both staff and students. Administrator 1 stated:

I believe that you tap into the best resources you have, namely people. You acknowledge their strength and I do that in any domain, not only technology. You encourage them to step out of the box and share the knowledge that they have in their strength areas. That's with anyone and I believe that we are all good at something. The key is to find what we are good at and you celebrate that and continue to celebrate it. Celebrate human strengths.

Mentor 1 commented that "together, there was a learning process. That's why I say a mentor doesn't have to be the all-knowing, sometimes just a co-learner." Administrator 1 felt that an important mindset for a good mentor is for them to be open to learning things from the protégés. She stated that mentors are "still going to learn from every individual they are interacting with", and that they must be "willing to learn with and learn from the people they are mentoring". Mentor 1 mentioned that she felt that, in many ways, she had benefited from the experience even more than protégés. She said, "As a mentor, you grow a fair amount." Mentor 3 said "It has been a great personal growth experience for myself." Administrators 1 and 4 also reported that their mentoring projects helped to develop a sense of there being "a community of learners" amongst the staff. Protégé 8 confirmed, "It [the technology mentoring program] built the learning community between staff".

Theme 5: Indicators of success

While schools had very informal measures of their technology mentoring programs' successes, they *were* able to articulate what had changed. They had seen increasing use of technology by staff, increasing demand for computers in their schools, and some changes in perceptions towards using technology in the classroom. An increase in the number and quality of projects by students and satisfaction of parents with technology learning were also observed. New mentoring opportunities emerged, and staff expressed a desire to have their mentoring programs continue.

Administrator 1 said that prior to the start of their technology mentoring program, only two people on a staff of sixteen were integrating technology on a regular basis and that now, one hundred percent of the staff were regular technology users. She further indicated that about five percent of the (initial) non-users had been *very* opposed to using ICT and went on to state:

A huge measure of our success was to have those same people, that five percent who were resisting this, come out of it [the technology mentoring program] after three years and say, 'I love what I am doing and I feel really good about what I have learned and I can't wait to share it with the kids.' They were probably some of the most enthusiastic members of the team.

Administrators were excited to talk about how everyone's expertise had increased and how protégés were becoming increasingly independent in using technology. Mentor 2 stated that the "participation rate in using technology is much higher than it used to be". Protégé 6 declared, "I use IT all the time. I didn't five years ago."

Several protégés mentioned that their attitude towards using technology had changed since they began receiving support from a technology mentor. Protégé 2 articulated some of the fear that novice users often have. She acknowledged, "I was afraid to try anything in case I wrecked everything." She went on to explain that the biggest benefit for her was "not being afraid to try things with my kids, and that's huge." Protégé 1 echoed, "Well, it's been incredible. I mean, I never thought I would be doing anything on the computer. I was computer illiterate, but now I'm pretty comfortable". Another protégé commented that watching the mentor's own use of technology created interest in it. "I think it took [the mentor] to come here and mentor with somebody else and I got to see that, and that inspired me to work with her". Protégé 6 noted her own growth in saying, "I used it [computers] for report cards and word processing and that was the exact limit of it and then [the mentor] came to our school and then the world opened up and I got to understand that I could do it." Protégé 7 confessed, "I'm 55 and so I thought that it [technology] was for young people, so I was really excited that I was able to learn it plus I was able to use it."

Administrators and mentors felt that their programs had helped to increase the number and quality of technology projects in their schools. Two administrators noted that students were creating a larger number of projects than before, and that the projects were becoming increasingly more sophisticated. Mentor 2 stated, "The quality of work has improved tremendously". Mentor 4 also made a similar point. She said that the number of projects that students were involved in had gone up, and that "everything has expanded so much from just sitting in front of the computer doing 'All the Right Type'" (a keyboarding program). Mentor 5 articulated that he was "seeing people integrate technology into their learning in interesting ways".

Two administrators noted that parents were highly satisfied with the kinds of technology learning that their children were engaged in. Administrator 2 commented that parents had expressed that they were positive and excited about the nature of the projects that their children were doing with technology. Protégé 1 observed that parents would come to school events and be "blown away with what their little sweethearts could do with a computer". Mentor 1 added, "Parents were very excited about what their kids were learning," and so thrilled that they had donated money from the school council to extend the school's hardware and software purchases.

An unanticipated part of schools' successes was the emergence of new mentors who often developed an interest and expertise in a particular application. Mentor 5 said that his former protégés formed a "mentoring database, mentoring other people in the stuff [the skills] they originally came and got help from." He added, "It [the technology mentoring program] started with two of us, [the other mentor and I] mentoring and I noticed last year out of a staff of thirty some-odd people, there was as many as fifteen people doing mentorship at some level." Two school sites mentioned that other schools and districts were attempting to replicate their successful technology mentoring programs. Mentor 2 remarked, "Our school is beginning to train student technology mentors".

Participants mentioned that there had been an expressed desire to have their mentoring programs continue. Mentor 1 said that the mentoring program was a "priority with them [the staff] and they want to see it carry on." Mentor 4 also observed that teachers are "anxious for it to continue." She continued that they "certainly see the validity of it and why it is needed and that it is needed." Mentor 2 commented, "Teachers are absolutely enthused about our mentoring project". Administrators and mentors both mentioned that there continued to be a large number of requests for mentor support, which indicated to them that the program was both necessary and successful.

Two protégés mentioned that they felt that an important step in the mentoring process was to wean support from learners somewhat. Protégé 6 remarked, "It's important that a mentor is eventually able to cut their ties with who they're mentoring. Not totally – I don't think it's a total thing." Protégé 1 also commented that it is a good idea to "wean off from mentoring". They felt there was a need for the protégés to be able to carry on, on their own.

CONCLUSIONS

In examining the models and experiences of participants in various successful models of mentoring at four different sites, this research has provided a deeper understanding of how this type of professional development can help schools to bring all teachers to a place where they are comfortable integrating technology into their teaching. Technology mentoring programs are an example of professional development that uses the expertise of site-based leaders in building a community of professionals who are excited about using technology as an effective tool for teaching and learning. Participants in this study were certainly enthusiastic about sharing their journey in using technology with students, and the relationships that evolved through the programs.

Administrators, mentors, and protégés all indicated that mentoring had helped their staff become more comfortable in using technology more regularly and more effectively with students. While the levels of expertise in using technology continued to vary among staff members, mentoring led to a much larger number of teachers who regularly integrated technology into their teaching. As well, mentoring led to an increase in the quality of projects in the schools.

In several cases, the use of technology also increased the capacity for technology leadership in the schools - several protégés even became mentors themselves after receiving support for a period of time.

The mentoring programs in this study evolved in a variety of ways yet they manifested many similar qualities. Participants indicated that, while it took time and effort to establish an effective mentoring program, they felt strongly that mentoring had enabled them to integrate technology more effectively throughout the curriculum. This would seem to indicate that a mentoring program should be given a period of sustained time, effort, and funding if technology is to be integrated effectively by the majority of teachers in a school.

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