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Teacher Factors that Contribute to Implementation Success in Telelearning Networks

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Introduction

When planning the implementation of classroom telelearning projects in schools, administrators and project initiators tend to believe that a project will be a success provided that teachers are given sufficient training and support to use the innovation in their classrooms. Findings from recent research into technology utilization in the classroom provide a somewhat different perspective. While agreeing that traditional implementation supports such as training and *in situ* coaching remain crucial to a project's success, another consideration has been found to be equally important—the educational practices and contexts within which the technology use is embedded. In a recent review of research on computer use in education, the U.S. Office of Technology Assessment concluded that “it is becoming increasingly clear that technology in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction” (U.S. Congress Office of Technology Assessment, 1995, p. 57). An analysis of the state of the art by Thérèse Laferrière and her colleagues for Schoolnet makes a related point: “effective use of the technology is embedded within practices and activities that realize its functionality for specific purposes and situations...[T]he potential of new technologies is immense, but many conditions are required for this potential to become a reality in classrooms and schools” (Grégoire, Bracewell, and Laferrière, 1996).

The research being reported herein investigated the interrelationship of implementation, pedagogical perspectives and practices, and perceived outcomes in the case of two telelearning projects based on different pedagogical models and delivery systems, one of which was judged to be more successfully implemented than the other.¹ By means of a comparative analysis of the two programs, we seek to determine what teacher and practice factors beyond training and support contributed to the relative success and failure of the two programs and to describe how these factors interacted with traditional implementation concerns. Grounded in this analysis, a theoretical model of project implementation is then articulated and contrasted with other views of implementation.

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Telelearning Programs Studied

Satellite Network Schools

The first of the two programs studied, the Satellite Network Schools (SNS) project, links three Canadian schools via digital satellite to a commercial curriculum content provider headquartered in the United States.² Although the SNS service is well-established in many schools in that country, only three Canadian schools are connected. We studied all three of these sites during their first and second years of implementing the service. Two of the schools were located in Ontario: one is a large high school located in a middle- to upper middle-class suburb of Toronto; the other is a small, rural high school situated in the north eastern part of the province. The third is a middle school located in an affluent suburb of Vancouver, BC.

The SNS company provides to teachers in these schools unlimited access to their collection of over 12,000 videos indexed to the K-12 curriculum. Teachers interact with search personnel via a two-way television channel (the “Go Channel”) to search out and select relevant videos. In addition, the company will develop “custom curriculum” upon a teacher’s request, incorporating new or existing videos and live interaction with a subject specialist if desired. As part of its service, the company also provides printed curriculum resources via a faxback service and a selection of interactive software in CDI (Compact Disk Interactive) format called the “Discovery Package.” To ensure that all elements of the service interoperate, the company sells a complete turnkey installation to a school, including a file server, networked computers with Internet connections, fax machines, digital satellite receivers and an antenna, TV monitors, and VCRs.

At the beginning of the project, teachers at all sites were trained on how to access the network in a workshop led by a company consultant. This training was largely devoted to understanding the technical and operational aspects of the system. After the initial training the burden was on the teachers to decide what resources they wanted to use, how they would incorporate them into their curriculum, and when and how often they used the company’s services. If teachers had any difficulty with the system, they had several choices: (1) they could call the company’s toll-free number and a person would appear on their local monitor screen to answer any technical or curricular questions, (2) they could call the consultant personally, (3) they could wait for the

² SNS is a pseudonym for the commercial content provider.

consultant's next periodic visit, (4) seek help from the head teacher at the school who was specially trained to provide on-site support, or (5) wait for a periodic on-site follow-up training session offered by the consultant.

Writers in Electronic Residence

The second telelearning program investigated, Writers in Electronic Residence (WIER), uses a network conferencing system—First Class—to link writing and language arts students to Canadian authors, teachers, and each other for the exchange and discussion of original work. WIER is a relatively large telelearning network by Canadian standards, involving the participation of some 70 schools in any given year from all areas of the country and including students ranging from the junior elementary to the senior high school levels. It is also one of the few projects at a mature stage of development, having been in operation for about eight years now in its present form.

WIER has three primary learning objectives: 1) making use of computer and network media to enhance students' creative autonomy and to broaden the scope and shape of classroom experience; 2) helping students to (re)consider the value of revision in the writing process and the students' role in using language to interpret and understand as well as be understood; and 3) prompting these novice writers to revisit their creative efforts in the light of the ideas that they receive and generate in their conferencing interactions with both author-mentors and their peers. Students "post" drafts of creative works into forums which the assigned author reads and then responds to, posting back comments and suggestions for revision to the student. Students also read and respond to work posted by other schools. WIER requires that for every composition posted by a student he or she must read and provide a written response to two other student works. Classroom teachers incorporate this activity into their English or Creative Writing course, and are responsible for posting compositions to the conferences and printing off replies and other student works for the class.

Teacher development and support in this program is largely limited to online activities and some written materials: no in-person training or support is provided. In an initial two-week online orientation period teachers learn from written materials how to get connected and join the WIER forums, and how and when to post students' work. WIER does not dictate the way in which their service is integrated into the classroom curriculum or what pedagogy the teachers employ in using

it, but it does impose scheduled periods for posting new works and reading/responding to the efforts of others. A separate forum is available throughout the program for teachers seeking answers to technical or programmatic questions; certain experienced teachers act as teacher-moderators in this forum, providing answers and suggestions.

Methodology

Data Collection

In order to investigate teachers' experiences in the WIER and SNS programs and to collect their reflections on program implementation and its effects, interviews were conducted with staff directly participating in the programs. In the case of the SNS program, we conducted preliminary interviews at each of the three schools at the beginning of the project and returned a year later to interview the teachers on their experiences during the intervening period. A total of 38 partially structured interviews were conducted. For WIER, we interviewed teachers using the program in eleven participating schools across Canada. These teachers had recently completed or were completing twelve weeks of WIER activities with at least one class in either Creative Writing or Language Arts. (The normal duration of a WIER project is twelve weeks, however schools may elect to participate in many projects.) All interviews for both programs were audio taped and transcribed.

Analytic Framework

A qualitative coding and analysis of the transcripts suggested that at the end of two years the SNS project was perceived by most teachers to be only a very limited success. This was especially true at the two high school sites. On the other hand, WIER was roundly praised by teachers as being a very successful online experience. The apparent success or failure of a program is a function of many factors; however, this study focuses on the teacher-related dimensions that determine the success of an online program. We found that the SNS and WIER programs could be differentiated on two factors related to teachers beyond training and support. These factors were (1) the teachers' perceptions of the value of the program, and (2) the congruence between the pedagogy implicit in the program and the teachers' own practices. Our contention is that these two aspects together with training and support played a significant role in determining the ultimate success and sustainability

of the program. We begin by discussing the training and support provided in each of these two programs.

Findings

Training and Support—Satellite Networked Schools

When teachers at all three sites first heard about the SNS project from colleagues or their principal, they were as a whole extremely optimistic about its potential. “It looked fabulous...it would pique the kid’s interest” said one teacher. Another thought the program would bring “an infinite amount of resources” to the classroom, while yet another saw it as a “resource bank...that we could tap into and use the resources that somebody else had already done the elbow work for.” There was little or no realization at this stage of the complexity of the system and burden it would place on teachers to incorporate it into their curricula and practice.

This reality began to set in after the initial orientation and training workshop. This workshop, which lasted between two and four days depending upon the site, introduced teachers to the capabilities of the SNS system. Teachers were shown how to request a video from the Go Channel, operate a VCR, download a video, use the Discovery disks, and operate the faxback system. Time was allotted for hands-on practice, however teachers—even experienced ones—still had many questions unanswered at the end of the orientation. Said one teacher:

I had probably more experience using the [SNS system] than anyone before the training; during the training I felt more at ease. But then I still had probably more questions that were coming to mind after the training session, because the initial questions were answered, and now I wanted to know more and more. The training sessions were only for basic introductory of what the system can do and how to use the basics.

Teachers cautiously began to experiment with the system after the introductory workshop. The critical question on the minds of teachers was how to integrate what the system offered into their curricula. They were largely left to their own devices to figure this out. One high school had a teacher management and implementation group that they could draw upon, while the two others largely depended on teachers helping each other or getting individual help from the company

consultant. Typically, teachers would try one part of the system at a time to see if it yielded worthwhile results. For instance, they might take their students into the computer lab to use the Internet and Discovery disks, request and download a video, or use the faxback service. A few teachers began to request custom curriculum because they couldn't find material that suited their needs from the company's stock collection of videos.

Some successes were had during the year intervening between our visits. A teacher at the middle school was surprised and delighted to get a collection of magazine articles from the company on a topic her class was studying. "While I was on the phone to them," she went on to tell us, "I wanted a clip of Martin Luther King addressing the march on Washington with his 'I have a Dream speech.' And they gave me that, just like that!" Another teacher requested a video on the Biosphere settlement in Arizona:

They gave us a five-minute clip, and I was amazed at the speed and facility that that came through. I watched it on the screen and said, "Yea, that looks like we can use that." They zipped it through instantly, [I] put the machine on, it came over the satellite and it's a nice production and it works.

One of the Discovery disks, *Body Works* (a third party program licensed by SNS), was praised by biology teachers. "It was a perfect match...[supplying] the basic content of the senses and how they operate," said one teacher.

Unfortunately, these successes appeared to be the exception rather than the rule. Teachers supplied a litany of complaints about the SNS system, some of which arose due to their own inexperience. For example, one teacher ordered a video on cryogenics from the Go Channel and set up the VCR to record the download. To his surprise, when he later previewed the tape it contained a segment of a chef talking in Spanish about how to prepare Valentine cupcakes. As it turned out, the teacher had simply made an error in setting the VCR.

Content errors, technical difficulties and glitches, and the company's failure to deliver what teachers thought was promised or expected were conditions encountered all too often. One mathematics teacher simply gave up on the faxback service after discovering factual errors in some of its content: "I felt it to be either irrelevant or too diluted for high school purposes, factual

errors...I just don't have the time to correct it. There is nothing really that makes me want to use it." He pointed out these errors to the company, but had no acknowledgement and the errors remained uncorrected. Another teacher reported that she and her colleagues made numerous requests for custom videos, but she said that "half of them we haven't heard anything about, because they lost the requests and the other half have been coming in drips and drabs." She goes on to say that even when she does get the videos, she's not satisfied: "The reason I'm not using the videos is because what I've received I've found not useful, not at the grade level I wanted, and not containing the objectives."

The Discovery disks caused teachers much grief and lost time. One teacher said, "When I sit down with it and click on it, I expect it to work. And I'm getting so frustrated because it doesn't work that I'm saying 'you know I've just wasted a half hour trying to get the thing work.' I don't know whether it's the computer or whatever that's crashing but when it does the same thing three or four times on three machines, you know...you just lost a half hour minimum." He went on to call the disks basically just a "beta test product," even though the company considered them to be final products. This reaction was not uncommon, particularly among the high school teachers.

Although the service provider's staff on the Go Channel were often described as "helpful," "friendly," and "going out of their way to help teachers," followup to teachers' queries seemed to be a problem. One teacher commented that "once you're out of touch with them, it's the last thing you may ever hear again...you know, 'We'll call you back,' ...and yea, right, in this life?" Another asked for a math video using sports and they sent one on basketball. He replied to the operator, "That's good, can you give me—we're a northern community—the same...build me some curriculum on hockey?" "Yea, we can do that," answered back the operator. "Well, I never got it, I never got it!" said the teacher. He aided that he was "all keen at the start" of the project but this experience made him decidedly reluctant to use it again. A third teacher described her experience as "nauseating" when she called the Channel back and no one answered the phone. She saw on her video monitor that people were walking around the studio totally ignoring the ringing phone.

Moreover, even though the company claimed that their staff were "master teachers," nearly all high school teachers found their subject matter expertise wanting. Commented one teacher when asked about this issue:

The competency there is poor...there's one person who understands something about physics and I talked to him at some length and he seems to be okay. But in general, I would say, no; they're trying to stretch very, very hard to cover things. In one lesson for elementary teachers [that this teacher saw], the staff were trying to explain Newton's three laws of motion...Newton was probably turning in his grave!

Overall, the combination of insufficient training and the service provider's staff not being able to support the teachers in meaningful ways was discouraging. As one middle school teacher said:

There are no real exemplary models to show [the service's] full potential. It's kind of like stabbing at the dark, you're just reaching out and grabbing things and hoping that when you pull them through the darkness that they're going to be effective. And I think for a lot of people the time it takes and that hit and miss [approach] has really had a negative impact on people's desire to use the services.

This sentiment, whether expressed directly by teachers or not, sums up well the frustration that teachers felt. It undoubtedly contributed to the SNS project not being implemented as successfully as it could have been.

Training and Support—WIER

The great majority of the teaching staff did not feel that the lack of on-site or in-person training for the WIER program created any difficulties. The initial training materials provided along with the two weeks of orientation activities taught them to access and use the conferencing system with little difficulty, although in schools with networked computers some onsite technical support to establish an initial connection was sometimes provided by a computer teacher or technician. Teachers found the opportunity to raise questions and issues with more experienced peers and WIER staff in the online staff forum met nearly all of their support needs beyond localized technical issues. A few teachers did remark that they found the initial exposure to the WIER FirstClass desktop, with its numerous salon folders, a little overwhelming, and thought it should have a simpler user interface for the orientation period.

At the time of the interviews, WIER required that participating teachers undertake the uploading and downloading of compositions and responses—only one access account was given to each

classroom. This forced those teachers without onsite support to personally upload each student story or reply individually to the appropriate salon, and to print off each reply from the author/mentors and other students. Even more time-consuming was the task of printing out large numbers of compositions submitted to salons by students in other schools, in order that a class set could be available from which students would choose stories to respond to. About half of the teachers interviewed did have onsite assistance with this process, usually from a school librarian. Those who did not would typically spend one to two extra hours a day uploading and printing materials. This drain on teacher time was considered to be by far the biggest drawback to participation in WIER. Occasionally it took time away from supervising and guiding students' writing activities:

I was spending so much time organizing things and getting everybody's folders to them, making sure that everybody knew what they were doing, that their things were getting posted. But I wasn't reading anything of their writing and in a way that's good, because I wasn't intervening, but the thing is I am sending out a lot of unedited work and a lot of spelling and grammar errors....

Most of the teachers found that the rigid timetable that WIER followed for posting stories and responses—students could only post three pieces of new work per term, and only during two three-week “windows”—constituted a considerable frustration due to class and school scheduling incompatibilities, such as difficulties in gaining access to computers for students' use at the needed times. The wide range of school schedules across provinces and between public and private schools meant that the WIER timetable was a difficult fit for many classes. Sometimes students could not meet posting deadlines, or class priorities set by the teacher limited the time available for reading other students' posted stories and replying to them.

Several teachers noted that schedule incompatibilities contributed to difficulties in actualizing extended dialogs between an author and a student cycling over several revisions of a students' work. Such extended interactions were (and still are) a goal of the WIER program, but are not often seen in practice. More typically, once a student has received a first response from an author to a work, he or she sends a “thank-you note” making some comment about the value or appropriateness of the author's remarks (but posts no revised draft) and no further interaction

occurs beyond a “glad you found my remarks useful” reply from the author. A few teachers noted that when a revised version was posted, the response from the author could be perfunctory. As one teacher put it:

For example, if there was a student weakness [in a composition] and she revised it and made a strength out of it, the writer could have said, “Perhaps you can try something that would demonstrate this strength and hand it in.” It became cut and dried too much.

Perceived Value—Satellite Networked Schools

A perception was held by nearly all teachers that the SNS system represented the “wave of the future,” so they felt compelled to try to use the technology to help students learn difficult concepts and to enrich their curriculum. During the earlier stages of implementation, teachers, on the whole, were open-minded and experimented with various parts of the system to see what would work with their students. A middle school teacher, for example, found she was able to use the Discovery disks to advantage in teaching a difficult concept:

Well, I like some of the interactive parts of the Math...there is a unit on integers where the students can go in and use blocks on the computer and manipulate these blocks and look at adding and subtracting negative and positive integers. And that was those types of activities, which I think, are very helpful in gaining and understanding, say, the concept of a negative number, which can be time-consuming in the classroom.

The same teacher had less success, however, when using the Go Channel to obtain videos that dealt with exploring careers in mathematics. Of the four or five videos she downloaded, she reported about 10% of the material in them would be useful because the videos described careers such as a TV reporter or camera operator where the requirement for math was not made explicit.

Nonetheless, a group of teachers at the same school arranged for a live interview, via the Go Channel, with Canadian Astronaut Marc Garneau that they found particularly valuable. One of the teachers described the broadcast as a “Wonderful! Wonderful piece of work! That to me was a joy.” Unfortunately, the broadcast had to be scheduled at a time when there were no students in the

school, so students had to be invited back to see it. The teacher was excited about the potential of the SNS system because of this event, however she added that “it seems like a huge package just to get a half hour of this kind of feature.”

All of the teachers felt that the technology was valuable in that it motivated students to want to learn. A high school teacher, for example, when talking about taking her class to the computer lab set up specially for the SNS project said:

The main thing is that the kids like being there. That’s a huge asset. Some of the things on the disks are kind of fun. There’d be a little game the kids can play, like answering against a certain time and they’re given a score. And there are things that we’re doing in class, so it’s kind of fun for them and it practices certain skills. One thing though that I don’t use the disks for is to teach the kids new things. I teach [the topic] and then I use the disks for them to practice or to reinforce. I don’t think the disks are set up well for a kid to sit down and learn the material [on their own].

She also liked the Body Works program that came with the Discovery materials and used it when teaching about the various parts of the human eye in her biology class. Normally, she found that students were bored with the topic when it was taught; however using this program her classes found the topic much more interesting to learn.

On the topic of whether they felt the investment made in SNS by their school district was worthwhile overall, teachers generally conceded that it wasn’t. Said one teacher,

It was sold to us as making a huge number of videos accessible to us. And later...I may be wrong about this, but my sense of things is that they [SNS company] mainly make their own videos. At first I was so excited. The other thing that’s changed, I think in the last couple of years, is our ability to use commercial video, we can use commercial films legally now because of a copyright agreement.

A final concern expressed by most teachers was the lack of Canadian content in the materials. Common complaints were that the mathematics materials did not use the metric system, word spellings were American, many terms and definitions were related to American geography; there was little on Canadian law or history; and no Canadian authors were represented. Much of the

video material had a distinct American feel to it because of speakers' accents and background images. A middle school social studies teacher, for example, highlighted this latter point when she commented:

Personally, I'm looking forward to Canadians having a handle on control over the system, because it has a real flavour of American content in it. The video "Behind the Scenes of a Newsroom" was very American, it was American accents, it was American stories. I think the quality of news is excellent in Canada, so I think if we were asking for that kind of information, we would get better quality videos. I wasn't that impressed...

One teacher even felt annoyed when speaking to the Discovery Channel operators because of Canadian and U.S. accent differences:

It's a problem. Like when you go to order something, you got to explain to the person on the other end that you, no, you don't mean Zee, you mean Zed...there are real differences.

A related problem that teachers had was the grade level for which the SNS material was purportedly recommended. One middle school teacher told us that she routinely requested Grade 10 material so that it would fit her Grade 7 or 8 curriculum. High school teachers similarly reported that they would have order material for higher grades than their own classes in order for it to be appropriate.

Perceived Value—WIER

Despite the perceived difficulties and limitations of the program, all of the teachers interviewed (with one exception) considered the educational value of the WIER experience to be very significant, with its benefits outweighing all the challenges and demands it imposed. Even the one teacher who was "somewhat disappointed" with the outcomes from her classes' involvement with WIER considered this to be an artifact of the rushed implementation and her lack of experience—it was her first exposure to WIER—and she still hoped to use it the following year as she thought it had great potential.

The most frequently cited desirable outcome was a significant jump in students' motivation to write. For the great majority of students, having access to professional authors as an audience for their creative efforts generated considerable enthusiasm for writing and posting stories and poems. "You could see the enthusiasm" was a typical comment. One elementary teacher remarked: "Once they get their first comment, which is always positive, I can't stop them. They are rearing to go. They just need some kind of motivational force to get them to go..." Students would take home printouts of stories from other schools home to read, and would read the responses they received from authors to their classmates. Most teachers could cite a few examples of students whose attitude to writing shifted dramatically from indifference or resistance to high levels of involvement and achievement:

I have several students who derive tremendous benefit from this program. One boy came to grasp the art of paragraphing—he hadn't been able to paragraph by himself before, now he can. Another boy who normally is often quite, not very well behaved, was totally engrossed on every occasion with the program and had a new story every time. Ah, another boy who hadn't done a lot of work, really, in fact two boys together haven't done a lot of work, wrote the kind of Sci-fi stories that they really enjoyed. [The stories were] beyond what was necessary to even post and involved each other as names and heroes and evil figures in the stories...very successful indeed and relished the visits to the lab. In fact, my class really enjoyed the experience.

The contributions made by the professional authors were considered valuable for several reasons. Teachers saw this as bringing an element of expertise and authenticity to the writing process they could not provide on their own:

I think it's a fantastic opportunity for students to have feedback from published authors. People who are working daily at writing. That's a kind of experience that I, although I'm a teacher, can't bring...to bear on their work. I have to say that I've learned a lot about teaching writing, and the kinds of things that you can tell students to do, ways you can tell them to improve their writing.

Said another teacher:

They get the idea that ‘okay this is actually someone who has been published and so it’s not someone pulled out of thin air’ that is responding to my stuff.

The quality of the commentary that these authors provided was praised by most of the teachers. The following quotes are representative of their comments:

I loved how positive the comments were—how constructive they were...every little thing, a spelling error was well looked at and deeply and thoroughly just considered and I think the kids really appreciated that. It made me realize, well, the kids really do like to have a lot of time spent on their stuff...but also that maybe you can achieve it verbally.

Looking at the responses from the writers, I thought it was absolutely wonderful, because the writers were so positive and encouraging, and at the same time, giving the kids ideas as to how they could make their writing better and, it was almost like the writers who were giving responses were teachers.

A key value of the WIER program for most teachers was its ability to expand the students’ sense of having a meaningful audience for their writing:

It makes them think about it more, because somebody else is going to read it. And in fact, there’s the realization: “a whole lot of kids are going to be reading this like I’m reading theirs.”

Our kids have become more aware of writing styles, they’ve become more aware of writing for a purpose to an audience rather than just for themselves or for their classroom teacher....We can see it in the structure of the sentences and adding details and things like that.

WIER was seen by many of the teachers as helping students develop the ability to take constructive criticism in the way it was intended rather than as a personal affront. As one teacher put it,

They are more comfortable with me looking at the criticism and asking me for suggestions or direction as a result of the criticism.

Another teacher, reflecting on students' growth as writers over the course of the WIER program, cited the importance of being critiqued:

[They're better writers] because they have gone through that experience of having people respond to their work. And that's a huge hurdle to get over, to be willing to expose your writing to other people. So I would say all of these kids who come through it, partly as a result of WIER, will be more ready to have their writing looked at by other people.

The value of the WIER experience in making salient for students the centrality of revision to the writing process was also mentioned by several of their teachers. Two elements of the program—receiving written critiques from authors and students, and developing critiques of others students' work—were thought to make many students more cognizant of the need to rewrite and edit one's work.

Several teachers indicated that for some of their students WIER seemed to promote the growth of their sense of competence as a writer, which in turn influenced their sense of self-esteem. Two teacher comments touch on this from different angles:

They are learning to trust themselves as writers...I think that they're learning themselves, 'Hey, this is mine, I can do this.' They're not waiting for me or for some other outside buddy to tell them yeah that one is okay, that's all right. I think with this process—I guess that's another insight too, I have somebody else confirming them as well as writers and as human beings, not just the teacher.

I think a good thing that may have happened [with WIER] is that it's opened up the discussion about their writing. The discussion is not necessarily confined just to...it's not like, "I write it; the teacher corrects it." But it's become bigger...they realize there's a bigger world in terms of their writing. That there are lots of people that are interested in what they have to say. And have something to offer them, you know.

Pedagogical Congruence—Satellite Networked Schools

According to the company's Web site, SNS is promoted as

An educational technology solution that integrates multiple forms of media—satellite broadcast, video, Internet, telecommunications and print—into one easy-to-use educational package...Resources come together as never before to engage students in learning...Students connect through relevant events, which are then connected to core curricular areas and aligned with educational standards.

Although there is no explicit pedagogical approach or theory associated with SNS, clearly the service is designed to appeal to those decision-makers who believe that technology is the key to reforming schools and raising educational standards. Classroom teachers were not involved in the decision to acquire SNS, except for one teacher at the middle school.³ The decision was made by senior school board personnel. The expectation was that teachers would make routine use of the service: at the middle school SNS was to be used by all classroom teachers; at the high schools the focus was chiefly on mathematics and science teachers. This expectation put pressure on teachers to change their practice in ways that were not necessarily congruent with their pedagogical beliefs or goals. Said one teacher at the middle school:

We were told we had to use SNS within two months. We had to use it, we were given a deadline. You know, it wasn't even up and running, it wasn't ready for us to use. And that kind of pressure is not fair, particularly because nobody really knows what this item is.

This pressure was openly acknowledged by the principal of one of the high schools:

...their backs are being broken, because they've had to make this work, make it a success. We thought we bought a mature product and found that it was less than a beta product...They've had to twig the product to be able to use it, whereas they thought they were buying into something that was supposed to make the job easier. Now that's compounded, because instead of making their jobs easier, they're spending hours a week finding ways to use it to keep me and [the Director] happy.

³ This teacher was part of the school district's team that visited the company's headquarters to learn more about the system before purchasing it. He subsequently recommended against purchase of SNS.

Teachers responded to the pressure by attempting to find appropriate teaching and learning resources from the pre-existing SNS material or by ordering custom curriculum. As described in earlier sections, neither of these responses was entirely satisfactory: existing material often had technical problems or factual errors, was not on topic, or had too much American content; custom ordered material did not arrive on time or, in some cases, was not produced at all, and when it did arrive teachers were often disappointed with it. When teachers did obtain material that was on topic, they were not particularly happy with the pedagogical approach employed by the SNS producers. Said one middle school teacher:

I personally don't like the approach that they tend to take with a lot of the Social Studies things. They seem to have a lot of B movie actors, dressing up in strange costumes and acting silly and pretending to be Einstein or whatever. I guess the disappointment for us is that as a middle school, it's the sort of thing where we would have the kids dress up in silly costumes and do the research, find out enough about it and put their own skit on. Instead, this is adults doing it for kids.

On the surface ordering custom curriculum appeared to be the solution to inappropriate stock materials. However, as another teacher explained, even the custom material was found to be wanting because of its design:

Each teacher has a reality of what he's trying to get across and in most cases, when this material is being presented from a different way of life or bias, it doesn't come across the way you want it. So if it was Canadian, perhaps, Canadian oriented to the courses of study, then I would [make use of the Go Channel material]. But I would be hesitant to order anything in now.

The one way many teachers saw the SNS system being most helpful in achieving their pedagogical goals was by providing students with varied learning opportunities. As one high school teacher stated:

One [advantage of SNS] is to provide a different medium for the kids to learn in. Rather than me delivering the information, they can find the information through the computer and a video. And I think one of the advantages is just variety, keeping the kids interested. Also, any concepts that they learn through a Discovery disk, for example, if they don't understand it the first time, they can go back and go through the exercise again and again and again. Whereas, once I teach something, if they don't understand it the first time...yes, they can hear it again, they won't get the entire lesson again, although they can get extra help. It'll give them a little more control over how they are learning and what they are learning. So the variety is a neat thing.

She added that,

I would strictly use this entire package as support for what I am already doing. I can't see it replacing me. Perhaps for small lessons I could completely rely on the computers to do that. Probably very rarely...The main thing is that the kids like being there. That's a huge asset. Some of the things on the disks are kind of fun. There'd be a little game the kids can play, like answering against a certain time and they're given a score. And there are things that we're doing in class, so its kind of fun for them and it practices certain skills.

Apart from this motivational and individualization aspect of SNS, teachers generally found that the system was not sufficiently supportive of their pedagogical goals to sustain their long term use of it. As one high school teacher said,

I'm still kind of puddling along finding out enough ways to use it...I could cheerfully—for all that I've used SNS and it's been frustrating—throw the whole thing out the window.

Said another teacher,

To me it removes that presence in the classroom and changes it somehow, a lot. And I just haven't seen some of the material they have produced that's been of a high enough quality to let me think that this is something I want my kids to watch.

Both of these comments, which are representative of the views of many of the teachers we interviewed, provide a bleak epitaph for such a costly telelearning system.

Pedagogical Congruence—WIER

While most of the teachers interviewed considered the implementation of the WIER program to be suboptimal in certain respects, they were nearly unanimous in their view that it provided a very meaningful enhancement of their writing programs. It was this sense of the program's worth which largely led them to want to continue to participate in it despite the extra burden it imposed on their schedules. Two other elements also contributed to its sustainability and success. First, its process-writing orientation was in accord with the pedagogical approaches to writing taken by the more expert teachers, who were for the most part employing a manner of instruction modeled on the Writers' Workshop; and second, it offered less experienced teachers opportunities for professional development which they came to value.

Most of the teachers were initially drawn to WIER because they saw it as supporting and augmenting their own process-oriented writing pedagogy. As one teacher put it, "It's sort of like a chicken and egg situation, you know. You get involved in WIER because you have a certain philosophy of how students should write, and you stay with it because it supports what you believe. Right? And so I don't know whether I can actually say there's been a change...a philosophical shift. You know. I think there have been some practical shifts in how I approach writing."

Most of the teachers when asked indicated that making use of WIER had not changed their basic approach to the teaching of writing; rather they saw it as providing a very valuable adjunct that increased the efficacy of their pedagogy: "I think it was parallel to what I believe for the writers workshop. So it seemed like in writers workshop the more people you can have interacting around the students writing, the more valuable it is. So it's something that I would keep in my program, because just me responding to the students' writing or just other students responding I think is not enough". Another teacher commented, "What delighted me most was that all the comments were spot on. It reinforced the very kinds of things that I was trying to do."

This sense that the authors' comments were validating their own responses to students' work was mentioned by several other teachers. It was seen to be of importance in helping students see the

value of the teachers' own feedback: "What I really value is the authors responding to the kids' work. Because what I have found consistently is the authors say the same things that I've already said on their work. So my student will hand something in to me, and I'll look at it, and we'll have a mini-conference on it, and I'll make some suggestions and if they choose not to make those and they post them to WIER, that's fine, that's their choice. And it is neat to see that the authors tend to say the same things I've said, 'cause then the kid finally goes "Oh, I guess somebody's right."

A second group, consisting of substantial minority of the teachers interviewed, found that engagement with WIER led to changes in method of teaching writing, ranging from minor to major. The most commonly cited was a shift away from the evaluator of the finished work or draft to the facilitator helping students prepare compositions for posting or interpreting feedback from other WIER participants. One teacher commented:

We became probably friends and we were side by side looking at the computer screen and experiencing together....They were just kind of coming to me as a buddy, as someone who could help them through it and I didn't feel as pressured to look over their work and say, okay, change this. A lot of pressure of doing that was put onto the authors...

Other teachers noted that reviewing the authors' comments on their students' efforts gave them considerable insight into how to more deeply and effectively respond to young writers. One discovered "how phrasing things in a wider context is helpful to students. You know. Rather than saying, you know, you should look at this, or that, or whatever...like not just go...not just looking at their particular work, but talking about something that I've been trying to do. And I've been trying to do this. And this is what worked for me. You know. "What do you think about this?" Another teacher said: "The only difference is...having somebody who is a professional author. I find I've learned from this in terms of his responses to the kids. I found that very insightful as a teacher. I'm not a published author, well I've written a thesis. But I wouldn't consider that in terms of what he's written. Especially Kevin Major, he stands out. When I look at some of the things he has said to the kids I don't know if I ever would have thought of having said those—if you understand what I'm saying."

One librarian who coordinated and oversaw the WIER activity at her school talked about how the teachers making use of WIER over the past several years had come to alter their whole approach to writing: “It made them more aware. They have searched out different techniques as to how they can teach writing, different ideas that they can use, they maybe are more aware that they can write in the other areas of the curriculum and it is still considered writing as opposed to your basic creative writing lesson.”

A long time user of WIER at the middle school level who has students use WIER over two school years stated, “My second year kids, they automatically post a chapter. And it’s interesting because when I first started WIER, never having been taught the craft of writing but learning as I’ve learned with the children over the years—I never felt that I would ever be able to have a child post a chapter, because I would never know how to get a child to that stage. And now I’ve developed sufficiently that, that is just a demand if you’re in the second year of this program, that I expect a chapter because I now have some concept as to how it is that you go about writing a chapter. I know what they look for. But I’ve had to learn that from the mentors.”

Discussion

This study examined two substantively different online learning networks, SNS and WIER, that varied in their degree of implementation success. SNS was viewed by teachers as a far less than optimal implementation, while teachers found WIER to be a very successful program. Our analysis focussed on teacher factors that contributed to one program being judged more successful than the other. We found that in addition to training and support, two other teacher factors largely accounted for the differences in implementation success: (1) the value of the network as perceived by the teachers; and (2) the congruence of the network with teachers’ pedagogical practices. While we discussed these factors separately, the differences in implementation success were almost certainly due to their cumulative impact.

Teachers viewed the WIER program as valuable because the student-author dialogs that it enabled furthered their students' development as writers in ways that otherwise would not have been possible. Among other things, it brought deeper levels of meaningfulness to the writing process, increased student enthusiasm for writing, and helped them learn about the importance of reflecting

on and critiquing draft materials. It also provided a complementary "fit" to their extant process-oriented writing activities, since WIER shares that pedagogical orientation..

The perceived value of the SNS network was considerably less. While teachers felt that the use of the technology did help motivate students to learn, for the most part the limitations of the curriculum materials readily available combined with the difficulties inherent in having custom curriculum developed, and its often deficient quality, caused most staff to regard SNS as having little educational merit in its current form. And many of the SNS teaching resources were perceived to be ill-suited to the pedagogical styles and preferences of the teaching staff, reducing further the motivation to make further use of them despite administrative expectations that they do so.

Towards a Teacher-based Model of Online learning Implementation

Our analysis of the two networks suggests that these teacher-related factors influence program implementation and outcome in the following manner: At the beginning of the program implementation process, the first steps towards success depend upon teachers' initial perceptions of the program's quality and potential impact on students. If teachers feel it shows promise as an environment to help support improved student learning, they then will be willing to expend time and effort to introduce it into their classrooms. The extent to which they continue to use it in their classrooms is determined by how well it matches their own teaching practice, and their recursive and ongoing assessment of its quality and impact. If the program resonates well with their current practices and its perceived value is high, implementation will likely proceed smoothly (barring other difficulties). On the other hand, if it conflicts with their practice or is of little apparent worth, teachers are likely to decide that any putative advantages it offers to students are outweighed by the time and effort required to modify their practice, and will be resistant to attempts by administrators to impose it on their classrooms.

Those teachers whose initial experiences are positive will continue to use the network and, indeed, seek to extend and/or intensify its use. Further training and/or support is likely to be required for this, and will be actively sought where necessary. This training may or may not be formal. Teachers may learn more about using the innovation from workshops, support staff, colleagues in the same building or online, or on their own. As they gain more experience and success in utilizing the

program with their students, they will continue to modify their practice and seek to learn more about how to use the innovation, which will ultimately lead to a more successful implementation. It is at this point that the technology can become what John Richards has referred to as a "Trojan Mouse", precipitating and enabling teacher change (Soloway, 1996). This process has also been observed in the Telelearning Professional Development School Project (Bracewell et al., 1998) and the Apple Classrooms of Tomorrow sites (Haymore-Sandholtz, Ringstaff, & Dwyer, 1997).

This cyclical implementation model is illustrated in the two telelearning projects studied here. As teachers began to use WIER, they soon perceived its value as an adjunct to their standard techniques of teaching writing. The evident enthusiasm for the program on the part of nearly all the teachers interviewed rested primarily on their perception of how it increased student engagement in meaningful composition and the consequent effects this had on students' writing practices. Teachers' willingness to do the extra work necessary to make WIER work was further enhanced by the fact that the pedagogy implicit in the program was fully congruent with the process-oriented models of writing instruction that they tended to favour. Moreover, some teachers found rewarding professional development opportunities from reading the comments made to student work by the professional authors as the comments helped reorient their perceptions of student writing and how it should be taught. Other more "expert" teachers of writing process considered WIER activity to be an extremely valuable adjunct to their Writers Workshop pedagogy (e.g., Graves, 1983), reinforcing the concepts and practices of writing they sought to impart. And although WIER teachers did not have the in-school training and support provided to the SNS teachers, they were able to seek online assistance and discuss their ideas in a special conference of WIER teachers across the country. This available support, together with the teachers' strong motivation to use the program due to the perceived student benefit, congruence with practice, and/or professional development opportunities it offered, led to greater implementation success, leading in turn to improved student writing and further incorporation of WIER into the teachers' practice.

In the case of the SNS project, this pattern of success was not evident—the positive feedback loop between the program, teacher practice, and perceived outcomes seen with WIER was largely replaced by a negative feedback loop. After the initial excitement over its introduction wore off and staff began to explore the resources it offered, teachers largely began to perceive SNS as offering their students only a moderate motivational incentive and some limited opportunities for

reinforcing student skills using different media. Although teachers made an effort to incorporate it into their activities, SNS did not appear to provide significant educational value to their teaching practice, nor was its “delivery” model of pedagogy consistent with the constructivist approach to teaching that nearly all of the teachers tended to favour. Because of the lack of perceived value of the system and the lack of congruence with their practice, teachers were not strongly motivated to master the many technical aspects of the SNS system, nor to take full advantage of the training and support opportunities available to them. Thus implementation was a piecemeal process: some teachers no longer felt they wanted to spend the time and effort to continue to use the resources available from SNS, while others persevered and found a limited degree of success.

Laferrière has proposed a model of professional development for teachers integrating information and communication technologies into the classroom. It includes six stages: 1) the awareness of the network phenomenon; 2) the mastery of access to online resources and tools; 3) the exploration of new possibilities for learning and teaching; 4) the establishment of new classroom routines; 5) the involvement of learners in project-based learning; and 6) the pursuit of collaborative knowledge-building (Laferrière, 1997). Our model seeks to elaborate some of the processes that occur within these stages of development based on teacher perception of perceived impacts and congruence of the new activities with established pedagogical approaches. It further expands upon these linear stages by arguing that there is an iterative process at work; initial successes with stage three and four activities in the six-stage model can lead a teacher to return to stage two, deepening their knowledge of the online program. Alternately, failure as perceived by the teacher at either the stage three or four levels can preclude any further pursuit of the projects at the fifth and sixth stages.

Our suggested model should not be taken as precluding on the teacher's part the development of a new pedagogical approach (or even a deep change in a teacher's educational philosophy over time) as a result of exposure and involvement in an online program such as WIER. While a lack of initial congruence with one's existing pedagogical stance may inhibit many teachers from pursuing new projects, if an online program is perceived to offer strongly positive educational outcomes this resistance may be overcome and teachers inspired to try a new approach or attempt to meld it onto an existing pedagogy. In the case of WIER, a few teachers hearing about its effects from colleagues did in fact begin tentatively participating in the program without modifying their relatively undeveloped style of writing instruction, but as a result of their exposure to the comments and

feedback from the authors began to see and actualize different possibilities for working with their students and responding to their compositions. With the SNS program, however, this pattern was rarely found, since teachers failed to see value sufficient to foster an adaptation of this type.

Implications for Telelearning Implementation and Teacher Training

Several implications with regard to implementation success and teacher education arise from our study. First, teachers who will be using a telelearning network must be involved in the initial decision to acquire it. This involvement has an essential purpose that is beyond local school or district political considerations. Teachers must be given a hands-on opportunity to experiment with the network, study its design and underlying philosophy, carefully consider the scope and quality of its materials, and examine the support services and documentation. A positive recommendation from teachers at this stage is necessary; otherwise a costly mistake could be made because implementation is not likely to proceed smoothly. It bears repeating that the teacher's role is crucial. From the perspective of the TeleLearning Network of Centres of Excellence Theme 7 research team investigating the training of educators to use these technologies, "the effective use of online resources and tools for teaching and learning purposes is a matter of constant deliberative professional judgment on the part of the teacher" (Bracewell et al, 1998). In the SNS project, only one teacher at one school was involved in the early stages. This teacher, in fact, recommended against proceeding to acquire the service. His recommendation turned out to be prophetic for all three schools! With regard to WIER, many of the teachers in the schools we studied were involved in the decision to participate. Nevertheless, in the schools where they were not involved, decision-makers had nearly a ten-year track record of teacher satisfaction in other schools to draw upon. No such track record was available to SNS decision-makers. Our field notes indicate that decision-makers often received only vague, incomplete information when they asked SNS personnel about the system's use and success in other schools.

Teachers themselves are very aware of the importance of their involvement in decisions about technology use. A New Zealand survey conducted by the New Zealand Ministry of Education in conjunction with a college of education found that teachers had "pressing concerns about participating in long-term technology planning....Our teachers wanted greater involvement in policy and decision-making about technology" (Ham, 1997, pp. 67-68).

As more and more schools adopt telelearning technologies, the need for teachers to have a thorough understanding of the basic principles of these technologies increases if they are to participate effectively in the early decision-making process. Consequently, both pre-service and in-service teacher education programs need to provide teachers with opportunities to study about and learn with these technologies. Having done this, they will be better prepared to contribute to the deliberations when a district or school considers acquiring a new online technology. They will also be better prepared to make effective use of these new resources. Recent research reviews make it clear out that teachers must have a significant level of knowledge and skill to effectively use online learning environments (Grégoire et al., 1996; Bracewell et al., 1998).

Another implication of this study is that the pedagogy associated with a telelearning network should be largely congruent with that of the vast majority of teachers who will use it, since the degree of congruence appears to be related to implementation success. Significant divergence in pedagogical perspectives can seriously impede implementation (but *vide* the caveat above). As the Schoolnet review points out, technology infusion "does not diminish the controversies and conflicts that pertain to school improvement efforts. On the contrary, it illuminates existing debates from new positions. It acts as a debate catalyst, as individuals bring to the debate their own perceptions of what technology can do or not, and of what school is about" (Bracewell et al., 1998, p. 22). This was very clearly evident in our two case studies. Teachers did not see SNS as building on their constructivist views of teaching, whereas WIER teachers found that its pedagogical foundations in the process writing model were consistent with their own approaches. Unfortunately, the implicit pedagogy of a network may not always be evident during the early stages of use. SNS teachers, even though they were not involved in the decision to purchase the service (except for the teacher mentioned above), were generally quite open-minded and willing to give the network an honest try. In the end, however, they found that the resource delivery pedagogy was too difficult to integrate into their regular teaching practice given their concerns about the quality of the materials and little apparent educational value for their students. Nor were many staff happy with the static, "canned" nature of the knowledge delivery.

A final implication is that providing teacher support and assistance is a necessary but not a sufficient condition for implementation success. The necessity of such support is not in question; it has been found in numerous studies to be critical in fostering innovation (Maddin, 1997; Benton

Foundation, 1997). But regardless of the amount of support available to teachers, they need to see that a distinct advantage for their students will accrue for the implementation to proceed smoothly. In the present study, we saw that SNS teachers had an abundance of support, yet they were loath to take advantage of it because they did not see sufficient benefit of the network to students. On the other hand, WIER teachers had a modest level of support, however they took it upon themselves to learn the system because they felt that their students would profit. Therefore, when a telelearning network is implemented, a wise strategy would be to structure network activities so that teachers obtain successes with their students early on during the implementation process. This approach would encourage teachers to learn more about the network either from taking advantage of formal support services or from collegial discussion and sharing. And it would provide a window of opportunity for professional development, by providing staff with the knowledge, experience, and motivation to gradually begin experimenting with variations in their traditional practices and roles.

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