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ABSTRACT

Thirteen K-12 teachers participated in a technology integration professional development course that included course components such as peer modeling, peer collaboration, and reflection in an authentic learning context. The purpose of this study was to explore how teachers' beliefs, practices, and self-efficacy changed in this learning environment. The study was guided by the following research questions: (1) How do teachers' beliefs about technology integration (role of the teacher, assessment) change using reflection, collaboration, and modeling in a staff development program? (2) How do teachers' technology integration practices (assessment strategies, curricular emphases) change using this staff development model? (3) How do teachers' self-efficacy beliefs about integrating technology change using this staff development model? Preliminary results indicate evolving teacher beliefs and practices as related to these course components. Results also indicate a significant increase in teacher self-efficacy, based on pre- and post-course survey scores. (Contains 20 references.) (Author/AEF)

Technology Integration and Innovative Teaching Practices: A Staff Development Model for Facilitating Change

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Abstract

Thirteen K-12 teachers participated in a technology integration professional development course that included course components such as peer modeling, peer collaboration, and reflection in an authentic learning context. The study purpose was to explore how teachers' beliefs, practices, and self-efficacy changed in this learning environment. Preliminary results indicate evolving teacher beliefs and practices as related to these course components. Results also indicate a significant increase in teacher self-efficacy, based on pre- and post-course survey scores.

Introduction and Background

While literature shows that barriers and challenges to effective technology integration exist even among exemplary users (Becker, 1994), it may be possible to address some of these barriers through professional development strategies. For example, research suggests that peer modeling and reflection may be effective strategies to move teachers along the technology integration continuum (Bandura, 1997; Dwyer, 1996; Gilmore, 1995; Schunk, Hanson & Cox, 1987), such as moving from a traditional to a constructivist (or integrated) learning environment (Grabe & Grabe, 1998). Peer modeling of effective teaching and technology integration strategies may result in increased teacher confidence and competence (Bandura, 1997; Gilmore, 1995; Pintrich & Schunk, 1996).

Further, providing models of exemplary teachers in a staff development setting may facilitate changed teacher beliefs about technology integration through structured exploration of those beliefs (Ertmer, Gopalakrishnan, & Ross, 2000). Seeing other teachers similar to oneself in a successful technology integration capacity may cause one to examine and possibly revise those beliefs.

A related professional development strategy is teacher collaboration, whereby teachers share ideas and strategies through discussion with computer-using peers (Dwyer, Ringstaff, & Sandholtz, 1991; Hadley & Sheingold, 1993). Research suggests that peers provide emotional and technical support in the classroom (Dwyer et al., 1991; Hadley & Sheingold, 1993) and are found in exemplary-user environments (Becker, 1994). If such strategies are developed and implemented, we may increase the likelihood that teachers will use classroom technology to enhance the critical thinking and problem solving abilities of school children.

Research Purpose

Thirteen K-12 teachers participated in a professional development course, which included components such as peer modeling (including a CD-ROM model of exemplary technology-using teachers), peer collaboration, and reflection. The research purpose was to explore how this staff development model, incorporating such components as reflection, collaboration, modeling facilitated changes in (1) teachers' beliefs about technology integration; (2) teachers' technology integration practices; and (3) teachers' self-efficacy beliefs about incorporating technology. This study explores how teacher beliefs, practices, and self-efficacy changed in this authentic learning environment.

The study was guided by the following research questions:

1. How do teachers' beliefs about technology integration (e.g., role of the teacher, assessment) change using reflection, collaboration, and modeling in a staff development program?
2. How do teachers' technology integration practices (e.g., assessment strategies, curricular emphases) change using this staff development model?
3. How do teachers' self-efficacy beliefs about integrating technology change using this staff development model?

This paper will address preliminary results obtained from initial and post-course teacher interviews, course assignments, and a self-efficacy survey instrument.

Methodology

Participants

Thirteen participants in the technology integration professional development course comprised our purposive sample. Twelve teachers agreed to participate in the study at various levels of involvement. Five teachers participated in the study in a limited capacity, agreeing to share course assignments and complete surveys specific to self-efficacy relative to technology integration. One teacher agreed to participate in interviews, surveys and to share her course assignments. Six teachers agreed to participate in semi-structured interviews, observations and a self-efficacy survey, as well as share their course assignments.

The participants came from four private schools in a Catholic diocese in a Midwest city and represented a range of grades, levels, and content taught. School demographics of the course participants are provided in Table 1. Teacher information and demographics on participants and their classes are provided in Table 2.

Table 1. School Demographics for Spring 2001 (Names are pseudonyms)

Name	Student Population	Ethnic Makeup	Grade Level
Hilltop	285	Approx. 4%	Pre-K to 3
Fairview	293	Approx. 9%	Pre-K to 6
Middleton	133	Approx. 4%	Grades 4-6
Elm Creek	375	Approx. 3%	Grades 7-12

Table 2. Demographics for Research Participants – Spring 2001 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
Caroline	Extensive	Hilltop	23	M.S., Elementary Education	3rd	All subjects	Began with 22; ended with 19	Mac and PC available; 3 classroom computers; printers, digital camera, scanner
Clara	Extensive	Hilltop	9	B.S., Elementary Education and Language Arts	1st	All subjects	18	Five computers; scanner, printer, 2 IBM computers, 1 I-Mac, 2 Macs
Greta	Extensive	Hilltop	18	M.S., Education	2nd	All subjects	19	2 I-Macs, printer
Kathy	Extensive	Fairview	6	B.S., Elementary Education	3rd	All subjects	Began with 18; ended with 19	1 I-Mac, 1 Apple, 2-Emates, printer

Table 2 (Cont'd.). Demographics for Research Participants – Spring 2001 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
Eleanor	Extensive	Fairview	10	B.A., Elementary Education	4th	All subjects	26	2 Apples, 2 Macs, and a printer. Library: 2 I-Macs, approx. 10 E-Mates. Several people in building to ask for help.

Jennifer	Extensive	Elm Creek	15	B.S., Math.	7th and 8th	Math and Geometry	21	Computer, scanner, Fax, printer; access to computer lab
Julia	Extensive	Elm Creek	5	B.S., Home Economics	7th and 8th	Family Living; Clothing Construction	17-18 (Est.)	Access to computer lab
Amelia	Limited	Elm Creek	25	B.A., Social Studies Ed., M.A., U.S. History	9-11	U.S. History, World History	--	Access to computer lab.
Anne	Limited	Elm Creek	--	Masters, English Education	11-12	English Literature	--	Access to computer lab.
Ruth	Limited	Middleton	47	B.A., Elementary Ed., M.A., Elem. Admin.	4th	All subjects	--	2 I-Macs in class room; 28 Macs in computer lab
Martha	Limited	Middleton	13	Masters, Admin. and Supervision	Principal (18 yrs)	--	NA	I-Macs; access to computer lab
Sarah	Limited	Middleton	--	B.S., Elementary Ed., B.S. in Special Ed.	5th	All subjects	--	2 I-Macs in classroom; access to computer lab.

Research Design

The study was primarily qualitative, using a case study methodology. Quantitative and qualitative data were gathered specific to self-efficacy about classroom technology use. The qualitative data were gathered to explore and describe teacher beliefs about technology integration, changes in technology goals and teaching practices, and their self-efficacy beliefs with regard to technology use. Quantitative data were also gathered to examine teachers' levels of self-efficacy with regard to classroom technology use. Data will continue to be collected during the Fall 2001 semester to allow time for changes in beliefs, perceptions, and practices to emerge.

Procedure

The Spring 2001 semester-long professional development course was conducted once a week in three-hour sessions. Using electronic and peer models of technology integration, the course was set up to facilitate discussion about technology integration issues and to identify different strategies that might be used in the teachers' classrooms.

The course components included (1) presentation of information on problem-based learning (PBL), (2) a series of facilitated discussions, (3) presentation of the electronic models with related discussions, (4) course readings, and (5) the collaborative development of a technology-based PBL unit. These course components were based upon ideas and strategies that the teachers found useful from their experiences and knowledge gained during the course discussions and activities. The teachers also were asked to submit reflections on the various parts of the technology-based PBL unit.

Instruments

Primary data sources included initial and post-course teacher interviews, observations of teacher classrooms, surveys, course discussions, and course assignments. Course assignments included teachers' visions of themselves as technology-integrating teachers (at course outset and course end), development of a technology-based PBL unit for their classrooms and accompanying reflections. During the class sessions, group discussions occurred specific to teacher ideas about what they were seeing and how that tied in with their views and goals.

Initial and post-course interviews were conducted to learn about changing teacher visions, beliefs (i.e. teacher views about classroom organization and management, assessment) and practices specific to technology integration, as well as changes in self-efficacy. The first interview was conducted in February 2001, approximately one month after the outset of the course; the second interview was conducted in June of the same year, the week following the end of the course. Two interviews were planned for the following term (Fall, 2001) to continue to explore evolving teacher beliefs and visions, classroom practices, and changes in self-efficacy.

Observations were conducted during the course to observe class activities and teacher discussions. In addition, classroom observations of the key participants were conducted on a weekly basis to observe teacher classroom practices and technology use.

Teachers also completed a pre- and post-course online survey relative to teacher confidence (self-efficacy). This survey is currently being administered mid-term Fall 2001 to revisit changes in teacher confidence.

This survey instrument, specific to teacher confidence about their technology integration practices (self-efficacy), is an adaptation of an instrument developed and tested in Fall 2000 (Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall). The constructed instrument has three categories (planning for classroom technology use, technology classroom implementation, and assessment of classroom technology use and impact, respectively), with 10 items each, for a total of 30 items. The instrument, based on a five-point scale, asks for responses ranging from "Very confident" to "Not at all confident." Item examples follow:

Relative to *planning* for technology use, I am confident that I can:

1) define teacher/student roles in a technology-integrated classroom.
2) plan classroom activities that facilitate technology integration.
3) plan for the use of computers with large-group instruction.

Data Analysis

Introduction

Initial course assignments have been analyzed, as have self-efficacy data. Specific to teacher confidence (self-efficacy), the preliminary analysis has been conducted on initial and end of term teacher interviews and surveys.

Quantitative Data Analysis

Data were analyzed for the 12 course participants, based on their pre- and post-course survey results. Paired t tests were conducted for the self-efficacy survey instrument; reliability was also measured, using Cronbach's alpha.

Qualitative Data Analysis

Interview data (pre- and post-course) for the key participants (seven teachers) and pre- and post-course teacher profiles on teacher technology visions (all 12 course participants) were analyzed and coded inductively specific to teacher beliefs, practices, and self-efficacy (confidence), using cross-case and within-case analysis. Examples of emergent codes include "Contributors to Learning," "Technology Practice," and "Contributors to Confidence." This coding was done using Atlas.ti®, a qualitative analysis software package produced by Scientific Software Development.

Results and Discussion

Quantitative Data Results

At the course outset, teachers'self-efficacy scores averaged from 1.1 to 3.0, with a mean score of 2.2 (five-point scale) and a standard deviation of 0.67. At the end of the course, teachers' scores averaged from 1.2 to 4.0, with a mean score of 3.4 and standard deviation of 1.0. Using the paired t-test on pre- and post-course data, a value of 6.66 was obtained, significant at 0.0001. Instrument reliability for the self-efficacy instrument, based on pre-course data was 0.98; post-course reliability was 0.99.

Qualitative Data Results

Preliminary data analysis suggests the following emergent themes:

- Contributors to learning (including components of the staff development model) viewed as useful varied with individual teachers, although, the more "active" types of learning—peer models and collaboration, hands-on experiences working on the PBL technology unit, and class discussions were mentioned most often as contributors.
- There are indications of some teachers' revising their beliefs with regard to technology (the role of the student, for example).
- Overall, at course end, teachers reported an increase in confidence with regard to technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, peer support, and feelings of accomplishment. Confidence indicators included experimentation (willingness to experiment with technology in the classroom) and increased student technology use.
- Teacher technology practices included increased student technology use, including using their students to teach them. Teachers still expressed concern about assessment, classroom management and classroom organization with regard to technology use.

Contributors to Learning: Consideration of the Staff Development Model

Course components valued as learning contributors varied with the individual teacher. The strongest contributors to learning, based on post-course interviews with those teachers who participated extensively in the research, appeared to be peer collaboration and peer models (other teachers), hands-on experiences, and class discussions. To a somewhat lesser extent, the course reflections, course readings and the electronic peer model (CD-ROM) were also mentioned as being contributors.

Clara, Greta and Caroline, all teachers at Hilltop Elementary in grades 1-3, respectively, collaborated together on their technology-based PBL unit. Of the contributors to their learning, Clara and Greta both mentioned peer collaboration as being valuable. According to Clara:

I think the biggest thing was the peer collaboration, because Caroline was so wise, in, you know, in her knowledge...where Greta and I were lacking...even the confidence...So that, and feeling that we had someone that did know part of what was going on; and it was neat working with Caroline because we found out she didn't know everything. And some of the things we learned together. [Post-Course Interview, June 4, 6, 2001]

Greta also appreciated the support that Caroline gave to her. Further, it appears that Caroline (who acted as an informal technology coordinator for the school) acted as a peer model for Greta.

...I think Caroline was such an awesome...leader for us. She gave us a lot of—but, at the same time, a lot of the things she did—we just watched...And so, I'm hoping that I can take what I saw her doing and try and do myself. [Post-Course Interview, June 4, 6, 2001]

Greta found that her contributors to learning included the electronic peer model and the class discussions, as well as the hands-on experiences provided.

Hands on--I liked the opportunity to do the things...but class discussions, seeing what the other people were thinking and feeling and--and doing in class. Like we would watch a video...where we would go...and see some of the teachers in action. [Post-Course Interview, June 4, 6, 2001]

Caroline found that her contributors to learning were based on the course readings, the class discussions and the reflections. With regard to the reflections:

And the thing that's least--we griped about those reflections...But...it did make you think...and--and then I would re-examine something--even though I'd said it two reflections before, now maybe I'm looking at it in a little different way...or, um, I see where I can improve it or know that it's not even possible... [Post Course Interview, June 4, 6, 2001]

At Fairview, Kathy (a third grade teacher) and Eleanor (a fourth-grade teacher) also collaborated together on their project. Kathy found working with Eleanor helpful, as well as the class discussions.

Well, definitely the class discussions, especially the one that we had on the security issues and privacy...I liked that one a lot. Um, and working with Eleanor helped a lot...She --she'd always have so many great ideas--I love working with her. [Post-Course Interview, June 6, 2001]

Eleanor found the hands-on experiences of the project most useful: "...All of that contributed. And, but actually doing it....The hands-on was the most--yeah, for me..." [Post-Course Interview, June 7, 2001]

It is interesting to note that these teachers overall selected more "active" methods of learning—hands-on experiences, working with others, participating in class discussions. While these components were mentioned frequently, it should also be noted that reflections and course readings were also mentioned as learning contributors. It is also possible that the electronic peer model (which was used in the course a couple of times) might have been a stronger contributor with more use.

Changing Teacher Beliefs

For some teachers, existing teacher beliefs about technology changed or were enhanced with regard to technology use. Clara learned early in the term that technology could be used as a tool, rather than her earlier conceptions of how she should use it in the classroom.

I've learned, mainly, that technology is a tool; and I think before I thought, in reading these things and really thinking about it, I was thinking technology more as a subject?...And that-- that--I teach across curriculums...I was looking at technology as another subject area, rather than seeing is a tool that enhances subjects areas I already have, so that's where my whole thinking has changed, and I can see now that this can be a really great, effective way to teach some of the--my areas to enhance them... [Initial Interview, February 8, 2001]

When asked at course end what the main thing that she had learned was, Clara reiterated, "All right, the biggest thing for me is that I know the computer is a tool. Where before...I had the idea that they wanted me to use the computer for almost everything." [Post-Course Interview, June 6, 2001]

Although her beliefs about the value of technology had not changed, Jennifer, a 7th grade Math teacher, spoke of revising or revisiting her beliefs about the role of the teacher, specifically teacher-directed learning in the classroom. Class discussions and course readings reinforced her beliefs.

To a certain degree I would have to say that my ideas about technology have not changed that much. Prior to this course I felt technology was an important tool for educators to use to help better educate our students. I think that the ideas we have discussed and the material that I have read have just reinforced this belief. In fact, I am more motivated and convinced that I need to find even more areas to implement technology into the curriculum.

As a result of developing my problem-based unit, I have learned, or been reminded, that technology makes learning more student-centered. I think I would be very naive, even wrong, to believe that all students learn best in a teacher-centered classroom. I have found myself asking "Do the students really need me to show them how to solve a linear equation (any math concept for that matter) or could they discover this on their own?" [Technology Vision Revisited, April 24, 2001]

Julia found that the course reflections helped her reach an insight about her students and active teaching methods, with regard to the student role in the classroom and the benefits to them long-term.

When Amelia and Jennifer and I were working on the PBL Group Presentation, we had three different ideas as to what was expected of us, three different propositions on how to approach it and three different thoughts on how to organize it...I remember commenting that I wanted my classwork organized for me and presented in a neat little package because the whole rest of my life consists of problem-based learning. As the semester unfolded, I became aware of how very true this was of me and the adults around me. What better way to teach my students skills for life than to engage them early in PBL! Could I really teach them anything more important? [Technology Vision Revisited, April 24, 2001]

Teacher beliefs are not easily changed, and traditional roles in the classroom can be hard to overcome (Ertmer et al., 2000; Fullan, 1993; Schrum, 1999; Van Haneghan & Stofflett, 1995). As Schrum stated, "Teachers need compelling reasons to change their practice" (1999, p. 85). In the above examples, it appears that the components of the model may be helping some teachers consider and possibly revise their beliefs with regard to classroom technology integration.

Increased Confidence, Confidence Contributors and Indicators

Post-course interviews and post-course teacher profiles (visions of technology-integrating teachers) indicated increases in confidence for five out of seven course participants with regard to classroom technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, support, and feelings of accomplishment, as well as the opportunity (and willingness) to experiment with technology in the classroom.

For Kathy, the third grade teacher at Fairview, an increase in knowledge also related to her confidence in classroom technology use, as well as willingness to ask for support.

I still believe that technology is a wonderful and exciting way to teach and motivate students. I feel somewhat less overwhelmed by the amount of information and software available. I have more confidence in myself and my abilities to utilize technology. In addition, I no longer feel embarrassed to ask for help when I need it. [Technology Vision Revisited, April 24, 2001]

According to Ruth, a fourth grade teacher at Middleton, fear and lack of knowledge has been replaced by less fear, more knowledge, and a sense of accomplishment, as well as experimenting with technology in her classroom.

I have to admit, I came into this class fearful, apprehensive and knowing -- not much -- about computers or their use. Now I have to admit that I have enjoyed this work and I am definitely not as fearful about computers as I was at the beginning. I even try things and often am successful at what I try e.g. making vocabulary charts --using e- mail -- using the internet. I can even talk a little intelligently about some areas in the use of the computer. [Technology Vision Revisited, April 24, 2001]

Ruth's successes with technology use appeared to result in increased classroom technology use:

Since I'm less afraid and apprehensive I've changed my mind about computer use in the classroom too. I have learned to use the internet productively. Finding work that fits with my class especially for science. I have encouraged the students to use the internet for reports for class. I have used the computer to make charts for classroom use. I am planning to use the computer for my grading program this fall. [Technology Vision Revisited, April 24, 2001]

Peer support and accomplishment continued to contribute to confidence, as well as hands-on experience. Greta found that working with Clara and Caroline helped her confidence and her learning, as did the hands-on experience. When asked about confidence contributors, Greta answered:

Yes, and doing it with Caroline, you know...and working on our—just getting that whole page together, as I just said, it turned out marvelously because of Caroline, I think...But--cause having her-in the group, that made me be able to say, "Yeah, I can do that," you know, or "How did you do it, Caroline?"...Trying to get so that I would learn from her. [Post-Course Interview, June 4, 2001]

Kathy believed that the changes in her classroom could be attributed to her increased confidence and hands-on experience, which led to her increased technology use and experimentation.

I guess, mainly my confidence has gone up, so that created a change. And that started with the discussions and...actually getting in and using the computers, and finding new things to do with the computers myself. [Post-Course Interview, June 6, 2001]

As their technology journey continued, teacher confidence with regard to technology use increased overall, due in part to hands-on experiences, support, increased knowledge, and feelings of accomplishment. Indicators of such confidence were reflected in their encouragement of and confidence in increased student computer use and willingness to experiment with technology.

Teacher Technology Practices

Perhaps in part due to their overall increased confidence with using technology in the classroom, many teachers are trying out new ideas with regard to technology. In doing so, they are addressing challenges such as classroom organization and management, as well as time constraints.

Clara described a successful use of technology for her, one that she had only tried out that term with her students:

Each one wrote a little, um, paragraph about themselves...and then they had to find some Clip Art or something that looked...that showed--reflected them...and put it on their--their paper...and print it out. And we did get that done! So that was successful...I think because the children enjoyed it so much. They were able to follow the directions. They ended up with a good product...and they had fun. [Post-Course Interview, June 4, 6, 2001]

Clara also had her students working on researching a dinosaur project on the Internet, using the students to help each other.

What I tried to do there is put someone that was more computer-literate, someone that could read well...with someone that was a little bit lower...so they could work. So sometimes, I didn't have as many high students, so sometimes the high student would work with three or four...students at different times. [Post-Course Interview, June 4, 6, 2001]

Eleanor had her students teach her how to use KidPix, preparatory to using her technology unit, which she had developed with Kathy, the following term: In doing so, she and her students used KidPix to run ads on the VCR monitor during their Mini-Economy activity:

Um, I've kind of--we've had classes before on technology, so I was aware of a lot of this stuff, but planning our unit, we were planning on using KidPix and I had never done that before...and so I did go ahead and, um, look at it and then use it at the end of this year, so that I'll, um, be more able to jump into the unit next year.

hat was a lot of fun. And here, um, a couple of my student experts helped me cause...they had it at home and helped me how to use it and, um, so I had no idea what I was going to do with the kids, but we ended up doing, um, our ads with our Mini-Economy on there...with the--the music and the--the slide show and that--that was really cool. [Post-Course Interview, June 7 2001]

Kathy began organizing her classroom and time such that her students had greater access to and time to work on the computer.

Um, we set up a time during the day when people would have to go back. They couldn't just...you know—because sometimes some of the kids are intimidated by it, and they would...kinda say, No, I don't want to today, I'll do something else," but...we'll say, "Yes. You go." [Post-Course Interview, June 6, 2001]

As might be expected, teachers are still evolving in various aspects of technology practice. Caroline expressed concerns about assessment:

You know, I still--I was--the assessment issue is still something that--I feel better about it. I don't know that it's something I do as well as--as I could or should. Sometimes I fly by the seat of my pants. [Post-Course Interview, June 4, 6, 2001]

Greta discussed her challenges in dealing with classroom management, ensuring that all students had the opportunity to work with the computers.

I think that--yeah--the challenge is—is still how to give everyone the opportunity. How to utilize my time...The management of it. Um, this room is small...And so, my stations were never really--so they went to one station and did this, whereas in our project, t he whole thing set up. So there would be four different groups or so and they would be doing different things, so that I would be working with one group...hopefully at the computer, or moving about to help some of the others, but I was hoping to make the groups such that there would be a leader type in each one, who could keep the group kind of going. [Post-Course Interview, June 4, 2001]

Conclusions and Future Implications

Impact of the Staff Development Model

It appears that the course components were (perhaps, not surprisingly) of value to different teachers in different ways. The hands-on experience, as part of the PBL technology unit, was mentioned often as being useful in terms of increased knowledge and confidence. Peer collaboration was particularly useful to those who looked to "leaders" to help them in skill building and developing web pages. Reflections were useful for "rethinking" where they were and where they are going. In some cases, reflections may have contributed, in part, to changing teacher beliefs.

Overall, the impact of the staff development model appeared helpful in terms of changing teacher beliefs and practices. Participants did not directly say, "This component helped me change my practice." However, in the sense that the various components contributed to increased knowledge and confidence, it may be termed useful. Pre-course profiles indicated that teachers vary from traditional teaching approaches toward more integrated approaches to classroom technology use (Grabe & Grabe, 1996). While further analysis is needed to confirm these initial results, this may lead to an interesting contrast relative to changes that may occur as a result of the professional development course, given the diversity of approaches.

Further Data Analysis Needs

Initial interview data with seven teachers appeared to indicate that their school cultures encourage collaboration and reflection, with some teachers also referring to other teacher "models." Given the existing culture, it will also be interesting to see how teacher beliefs and technology integration practices are facilitated by such cultures, in conjunction with (and supported by) the professional development model, which also encourages collaboration, reflection, and modeling. Further analysis is needed to confirm these impressions.

As indicated above, further analysis remains to be done on course data obtained, as well as teacher interviews and observations. While preliminary data analysis has focused on teacher beliefs, practices, and self-efficacy, as well as learning contributors, results are yet to be determined in greater depth.

With regard to efficacy data analyzed to this point, results are consistent with those of Stein and Wang (1988). While many studies have examined teacher efficacy in professional development settings, often self-efficacy is measured at one point in time (Ross, 1995). However, research has shown that teacher efficacy may be curvilinear across time (Stein & Wang, 1988). According to Stein and Wang (1988), teacher self-efficacy may increase during a professional development course, then decrease as the teacher attempts to put what was learned into practice, then later increase again as the teacher masters what was learned. It may then be useful to measure teacher self-efficacy, not only during a professional development course, but also as a follow-up (as in the following term) in the teachers' classrooms.

From the results on self-efficacy collected thus far, it appears to support Stein & Wang's (1988) conclusions. The survey instruments are currently being completed by the teacher participants (mid-term Fall 2001), and these data will contribute to the knowledge base on the curvilinearity of the results specific to teacher self-efficacy, as well as idea generation. Repeated measures data may confirm (or disconfirm) the nature of teacher efficacy across time.

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