Using Emerging Technologies to Help Bridge the Gap Between University Theory and Classroom Practice: Challenges and Successes

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ABSTRACT

The purpose of this manuscript is to describe and illuminate the challenges that we faced as we integrated a web-supported professional development system within and across elementary science methods courses housed at three different universities. We found the process of developing and sustaining an effective community based on collaborative reflection about inquiry-based teaching presented us with several challenges: (1) creating meaningful interactions for pre-service teachers, (2) supporting pre-service teacher reflection and articulation of their belief systems, (3) developing partnerships with in-service teachers, and (4) integration of a web-supported professional system across multi-university methods courses. As a result of our work we found (1) pre-service teachers highly valued viewing videos of real classrooms, (2) in-service and pre-service teachers valued discussion about inquiry-based teaching strategies, and (3) in-service teachers required considerable support and encouragement to participate. We close with recommendations concerning the implementation of a web-based professional development system into elementary methods science courses and share what we believe to be successful strategies in fostering a collaborative atmosphere between teacher educators, pre-service, and in-service teachers.
INTRODUCTION

Over the past decade, many teacher educators have grown dissatisfied with an individualistic approach to teacher education and have come to recognize that prospective teachers need experience as participants in collaborative learning communities in which they are afforded the opportunities to articulate, reflect on, and share their teaching experiences with their peers (Grossman, 1991; Stein, Silver, & Smith, 1998). A number of efforts are underway to transform existing teacher education programs’ course contexts into communities of learners which link the learning of pre-service teachers with experienced teachers and teacher educators (Cochran-Smith & Lytle 1999; Putnam & Borko, 2000; Thomas, Wineburg, Grossman, Myhre, & Wollworth, 1998). A fundamental premise of these interventions is that groups of individuals (practicing teachers, prospective teachers, and teacher educators) come together with the goal of developing relationships in which all members struggle with and construct the notions of not only what it means to teach, but also how to transform current teaching practices to be more aligned with current national policy (Cochran-Smith & Lytle, 1999; Thomas, Clift, & Sugimoto, 1996). In a similar vein with these previous efforts, we have been developing a web-supported professional development system, the Inquiry Learning Forum (ILF) designed to support a diverse community of teachers in better understanding how to teach in ways consistent with current national policies (Barab, MaKinster, Moore, & the ILF design team, in press). However, unlike these previous efforts, we are investigating how to use emerging technologies to foster and support collaborations across universities and schools rather than develop an isolated collaboration between a single university and single school system. In this manuscript, we describe the challenges and successes of our experiences as we integrated the use of the ILF in three university elementary science methods courses. Specifically, we examine and describe our implementation of the ILF to support pre-
service teachers in articulating their beliefs about inquiry-based teaching, developing collaborations with teachers, and integrating the ILF into multiple university elementary science methods courses.

BACKGROUND

In the past ten years, there have been many state and national efforts to study, encourage, and support increased use of electronic networking technology in schools to support student learning and teacher professional development (Willis & Mehlinger, 1996). However, only recently have educational researchers begun to explore the strengths and weaknesses of electronic networking technologies to support teacher professional development. One particular use of electronic networks that has shown great potential in encouraging participation and discussion has been teleapprenticeships (Levin & Waugh 1998; Thurston, Evangeline, & Levin, 1997). According to Levin and Waugh a teleapprenticeship is a framework that takes advantage of the unique functions available in electronic networks to create apprenticeship-like learning environments without requiring the participants to be in the same places at the same times. In examining the benefits of teleapprenticeships Levin and Waugh (1998) used a case comparison technique to examine how pre-service teachers accessed expertise from their more experienced peers and subject matter experts through the use of an electronic network. They found that beginning teachers could more accurately and completely answer their students’ questions about the content under study after participating in such on-line consultations. Similarly, Weis (1997) matched pre-service teachers with a content area mentor using e-mail and a listserv. Her results indicated that her students believed the content mentor was beneficial in helping them develop lesson plans and other classroom activities and felt such a resource would be invaluable once they begin their teaching careers. Waugh & Rath (1995) also implemented the teleapprenticeship framework in six elementary science methods courses and found that the majority of students indicated that they
perceived the networks as useful tools for enhancing teacher training programs and supporting work in their schools.

These studies suggest that pre-service teachers need and want opportunities to observe, visit, interact, and collaboratively reflect with teachers attempting to implement reform-based teaching strategies if they are to develop the skills and confidence they need to teach in accordance with current national reforms (Abell, Cennamo, Anderson, & Bryan, 1996). For example, the National Research Council (1996) points out “one of the best ways to understand school science as inquiry is through a visit to a classroom where scientific inquiry is practiced” (pg. 6). That is, by anchoring pre-service teacher experiences to actual classroom practices they will be able to observe the craft of teaching as a basis for analysis, discussion, and reflection (Siegel, et al., 2000). Unfortunately, for many schools of education it is logistically difficult to locate a sufficient number of teachers who are teaching through inquiry-based approaches in which to place their pre-service teachers to learn how to teach in ways that are consistent with the national standards. As a result, many beginning teachers frequently observe instruction that contradicts current reform movements and as such continue their apprenticeship into a system that does not value inquiry-based approaches to teaching science and mathematics. This limitation can be addressed, in part, by using video to capture and share teacher classroom experiences (Abell, et al., 1996). Videotaped classrooms can provide teachers with a common framework for discussion, allow multiple viewings of the same classroom, and support multiple perspectives as all students watch and reflect on the same video (Lambdin, Duffy, & Moore, 1997). However, these video-based systems have been localized to distribution via CD-ROM or videotape, limiting their collaborative potential. In the next section we describe the ILF and the collaborative features that are afforded by using a web-based professional development system.
THE INQUIRY LEARNING FORUM

The Inquiry Learning Forum (ILF: http://ilf.crlt.indiana.edu) is a web-based professional development system explicitly designed to support a community of in-service and pre-service mathematics and science teachers sharing their beliefs about inquiry and their experiences in implementing inquiry-based teaching practices in their classrooms. The ILF design differs from previous web-supported teacher development systems in that the ILF centers around the vision of a community in which teachers can virtually visit each other's classroom by viewing video vignettes of other teachers’ classrooms coupled with other teaching artifacts such as teacher reflections, student work, and discussion forums. Visiting teachers can observe and engage in asynchronous dialogues around the video vignettes (see Figure 1). The ILF website is meant to support observation and reflection on actual classroom experiences, which provide a powerful opportunity for reflecting on one’s practice and articulating one’s epistemological and pedagogical beliefs (Parjares, 1992). This is of considerable value, especially when considering that the craft of teaching is frequently driven by teachers’ beliefs and tacit skills that are difficult for most teachers to articulate (Kagan, 1992).

An important part of the ILF structure for teachers are the 7-8 separate 3-5 minute video clips of a lesson or curricular unit totaling 20-30 minutes. These video vignettes provide access to teachers’ practice within the context of their actual classroom setting. That is, the videos are not staged or special cases but represent teachers’ real experiences in implementing inquiry-based strategies in their classroom. The intention is to capture teaching in a variety of settings from teachers who have a variety of strengths and weaknesses particularly regarding reform based teaching strategies. We felt that by attempting to capture the everyday practice of teachers we were
more likely to foster a greater amount and quality of discussion. Complementing the videos are the teachers’ lesson plans, examples of students work, classroom resources used (i.e. books, websites), and asynchronous discussions linked to each video typically seeded with a question by the videotaped teacher. The asynchronous forum serves as an archive that can be visited and revisited by students and teachers so they can continually interact with their peers as they begin to formulate their pedagogical beliefs and learn about inquiry-based teaching.

The ILF also has the feature of allowing university instructors to customize their own virtual ILF space, called an Inquiry Circle, to meet their particular needs (see Figure 2). For example, an instructor can set up their own private discussion forums, add external links, and add other ILF objects and resources to their inquiry circle such as lesson plans, classroom video, and external websites. At its core an Inquiry Circle is a collaborative group space in which instructors, pre-service teachers, and in-service teachers can come together to share resources, ideas, experiences, discuss teaching strategies, and work together to create lessons. In our collaboration we leveraged this collaborative space to connect our respective methods courses.

[insert Figure 2 about here]

ELEMENTARY SCIENCE METHODS COLLABORATION CONTEXT

As stated previously, this paper describes how we leveraged the ILF to connect students our respective elementary science methods courses. Specifically, we collaborated with eleven in-service teachers in five school districts and four university teacher educators located Indiana University Bloomington (IUB), Indiana University-Kokomo (IUK) and Boston College (BC). The methods course at IUB consisted of 26 (25 female and one male) juniors working toward a dual certification in elementary and special needs education that were a year from beginning their student teaching practicum. The students were a year from beginning their student teaching practicum. The 25
students (2 male and 23 female) in the IUK course were juniors and would begin their student teaching practicum next term. The 24 students (2 males and 22 females) at BC were masters-level students and practicing teachers. The majority of the students were simultaneously engaged in a pre-practicum experience in a Boston area elementary school, ranging in inner-city to suburban. Hence, we believed that the diversity offered by having our three classes interact with one another would bring unique perspectives concerning how students learn and what it means to teach through inquiry-oriented strategies.

The foundations of our collaboration was to facilitate our students in discussing inquiry-based teaching strategies with one another, examine teacher practice, reflect on and articulate their pedagogical beliefs, and provide students with the experience of using web-based collaborative technologies so they could evaluate potential utility they might have for their own classrooms. To this end, we created asynchronous discussions around: (1) two specific ILF elementary science video vignettes, (2) on special topics such as “How children learn science?” and “What is inquiry?” (see Figure 3). Using guidelines from research (Guzdial, & Turns, 2001) and our own practical experience with orchestrating the use of asynchronous discussion forums for course discussions, we assigned students to small groups of 3-5 students from each method course. These small discussion groups also served to alleviate the students’ fear that they would be overwhelmed by the number of posts they would have to read and increased the probability of deeper and richer discussions.

Further, we asked in-service teachers to participate in the discussions to bring in a “voice from the field”, which we believed would increase the motivation of our pre-service students to participate in discussions. Of particular importance was the participation of the two teachers whose classroom video vignettes served as the focus of much of the asynchronous discussions. These two in-service teachers (Jill and Barbara) agreed to participate and answer students’ questions concerning their teaching strategies for teaching elementary school science through an inquiry-oriented approach. To
prevent overwhelming the two in-service teachers with posts to read and to respond, we split each class into two umbrella groups. The first group focused on watching one teacher, while the second group watched the other teacher. After several weeks of discussion the two groups switched and new discussions ensued.

[insert Figure 3 about here]

The process of developing and sustaining an effective community based on collaborative reflection about inquiry-based teaching has presented us with several challenges. These are listed here with a discussion of each item below.

1. How could we create meaningful interactions through technology for pre-service teachers?
2. How could we support pre-service teachers in articulating and reflecting on their pedagogical belief systems?
3. How could we develop partnerships and collaborations with in-service teachers within the context of a science methods course?
4. What are the challenges in integrating a technology innovation across multi-university science methods courses?

**Challenge 1: Creating meaningful interactions through technology for pre-service teachers.**

There have been numerous studies that have reported on the use of computer mediated communications (e-mail, asynchronous discussion boards) to extend the traditional pre-service classroom (e.g. Powers & Dutt-Doner, 1997). Unfortunately, to date many of these studies have reported that pre-service students perceive the use of the electronic networks as nothing more than another course assignment (i.e. Barab, et al., in press). Therefore, it is crucial to develop participant structures that pre-service teachers find valuable when using computer mediated communications.
In integrating the ILF into our elementary science methods courses, we built upon and extended the concept of teleapprenticeships (Levin & Waugh, 1998).

Central to our collaboration was the use of the ILF’s video vignettes and asynchronous discussion forums to support the sharing of teachers’ beliefs regarding inquiry-based instruction. Rather than simply asking the students to watch the videos and critique the teachers’ classroom practice, we provided initial guiding questions to support the students and teachers in critically analyzing each classroom. For instance, for Jill and Barbara’s classrooms, we started each class with a set of focused topical questions as recommended by McGinnis (1996). Our initial questions were as follows:

1. How does the teacher engage her class in the activity? In what ways did it work? What would you change and why?
2. Is this an inquiry-oriented classroom? Why? What are the indicators or non-indicators that it was an inquiry classroom?
3. What do you think worked well? What would you have done? Why?

In addition to focusing students’ initial thoughts and discussion, these questions served to inform the other participants regarding the goals of the ILF discussions. Namely, how does one, as a teacher, teach science through inquiry-based approaches and, consequently, is the videotaped classroom a good representative of inquiry-based teaching?

In general, the students found the on-line videos coupled with the asynchronous discussion to be valuable in helping them to understand what an inquiry-based classroom might look like. In particular, the videos were considered valuable because the pre-service teachers could actually observe and watch another teachers’ classroom unfold. For example, after watching Jill’s classroom a student posted the following comment:
I really enjoyed getting to see her lesson because it allows students like us who want to be teachers to go over what she is teaching and look at how things went. It is almost as if we are in there observing her and it is nice because we can watch her while at home. I thought the students were using inquiry because she was prompting them to give out information and open ended questions allowed students to reply. I really like watching the examples.

In a similar vein, another student posted:

I agree with what everyone has said about how effective and useful it is for us to watch these lessons. We do so much reading for our courses about methods and lessons and how kids learn. However, I do not think we get enough experience with real lessons and classrooms with students as future teachers. This looks like what promises to be an effective inquiry lesson. The Y2K Zoo [the name of the project] incorporates a variety of science units as well as other curriculum in this ongoing project.

As hinted at in the previous student posting, the fact that the videos were of real classrooms and not special cases provided a great deal of motivation and incentive for our students to watch the videos. That is, the videos represented real teachers, in real situations, teaching a wide range of students through an inquiry-based approach. Further, the students could watch the videos anywhere they had an internet connection and web-browser, increasing the amount of time students could spend watching the videos because they were no longer limited to watching the videos at the university. However, in interviews and discussions with our pre-service students, we found that the coupling of the on-line video vignettes with the asynchronous discussions provided the most value. For instance, in an e-mail sent to the instructor and to one of the participating teachers a student stated:
I want to thank you for your time in participating in the discussion forums. It has been really helpful to have you in the discussions as we discussed your class. It shows that what we are learning is something that is really tried in real classrooms. Your comments have been helpful in helping me to design lessons that are inquiry-based. Thanks for your time!

Through the coupling of on-line classroom videos with asynchronous discussion and other teaching artifacts our students could see actual teaching practice and engage in conversation with their peers who brought different perspectives and interpretations to the meaning of the artifacts and the teacher’s classroom teaching context.

One particular challenge that we faced were the limitations of using the on-line videos to illuminate teacher practice. For example, videos lack interactivity and provide the viewer with only the vantage point of the camera. The camera does not necessarily capture the significant interactions occurring among the students or between student and teacher. This limitation was pointed out by a student as they were watching Barbara’s classroom:

I think that I would have made the cave experience more interactive for the students. Though this may have occurred off-camera, I think that the students listened to a lot of direct instruction from the guide, but did not do very much exploring and investigating on their own.

In a later post Barbara was available to address the pre-service teachers’ concerns in the discussion forum. Without Barbara’s presence in the discussion forum, our students would not have been able to understand the larger context in which Barbara’s lesson was embedded.

**Challenge 2: Support pre-service teachers in articulation and reflection on their beliefs and practice**
According to Larry Cuban (1993) most school improvement changes are propelled by teachers that have changed their beliefs concerning what will best support their students learning. There have been a number of studies that have examined the characteristics of both pre- and in-service teacher beliefs and found that a majority of teachers believe that students learn best by being exposed to didactic lessons where the goal is to memorize content (Simmons, et al., 1999). However, these beliefs stand in contradiction with current national policy and recent research on how students learn (Bransford, Brown, & Cocking, 1999). Thus, a challenge in science methods courses is to develop structures that not only support pre-service teachers in reflecting and articulating their pedagogical beliefs, but also in supporting teachers to see value in teaching science through inquiry-oriented approaches.

In many methods courses, students are given assignments that encourage them to reflect on their beliefs about teaching and about their teaching practice. These assignments are often in the form of science autobiographical statements, journals, or watching videotapes of practicing teachers. All of these approaches can support pre-service teachers in learning the processes of reflection, yet they are of limited duration and are frequently abandoned after the assignment is turned in to the instructor. In our collaboration we chose to first provide focused questions to spark student thinking and discussion about their personal belief system regarding inquiry and how children learn science. Using the focused questions supported students in focusing on a specific topic of concern and exploring their ideas and beliefs as demonstrated in the following conversation between a student and an in-service teacher concerning what an inquiry-based lesson would look like.

Poster: Sally (student)

I am not really sure yet what an inquiry lesson would look like exactly. However, from what I have learned thus far, I would imagine that students would be actively
engaged in learning tasks and solving problems. The students would be coming up
with their own questions and discovering their own ways to solve these problems. I
think the teacher would be present as a facilitator, pushing the students to be creative
and use their own minds and knowledge that they have. I think that an inquiry lesson
would involve a topic that is of importance or relevant to the students.

Poster: Fred (in-service teacher)

You are right on track! Inquiry has all of the characteristics that you mentioned.
And you are right; it doesn't always work well with every topic or lesson.
However, keep in mind that it is also not just one method. There are a ton of
"methods" that fall under the heading of inquiry. Let me know if you have any
questions. Keep up the great work!

The previous excerpt is just one brief example of the type of conversations and exchanges
that occurred between participants in the ILF discussion forums. Occasionally more involved
exchanges occurred that brought several ideas from more than one respondent in the discussion set.

Poster: Susan (student)

I completely agree! I think that the best way to teach science is through a
combination of lecturing/explaining and hands-on experiment. First of all, all
children learn differently. If we can develop lessons that integrate several different
learning styles together, we will be more likely to accommodate and adapt to each
child's needs. Also, as a student, I always felt lost and confused and when teachers
would throw us into a lab or experiment without providing any background
information or explanation as to why or how the experience is relevant to our lesson
and our everyday life.
Poster: Lori (teacher educator)

How do your views fit with inquiry learning? Do I understand that you feel that the experiments should be basically demonstrating what was done in lecture? Do you disagree with Vygotsky that learning occurs when the student is challenged beyond his comfort level? Is there any room in your views for the discrepant event to challenge your students?

Poster: Jane (student)

I agree with you that we need to provide sufficient background information but I think we also have to make sure that we provide context. We need to be sure that students understand how these concepts affect their everyday lives and also, as pointed out in the article, they need to know the relevance they hold in the scientific community. If we don't make this link clear then we may be creating an artificial disconnect between every day life and scientific endeavor.

Over time a significant challenge was determining how to empower the pre-service teachers to constructively critique another teachers’ classroom practice. When the students first started watching the classroom videos, the discussions focused mainly on identifying how the classroom was inquiry based and how much fun the lesson appeared to be for the students as represented by the following student post:

I feel that this project is a wonderful idea. It really lets the children experience hands-on, which is very valuable in learning. It also allows them to get into other environments for learning, not just the classroom.

Although such comments are valuable in that they reflect what each student believes constitutes a quality lesson that captivates students’ interest and supports their learning. On the other hand, if
discussion does not move beyond simple praise and acknowledgement of the quality of the lesson and toward constructive criticism then further examination of one’s belief system regarding teaching is unlikely to be undertaken.

**Challenge 3: Developing partnerships and collaborations with in-service teachers.**

Historically, collaboration technologies such as e-mail and listservs have been used as an extension of the face-to-face classroom (McGinnis, 1996). The use of these technologies has given us valuable insight regarding how to integrate such communication tools into pre-service classrooms. Yet we wished to leverage the community building power of such technologies by connecting pre-service and in-service teachers together in our respective methods courses. Based upon previous research that indicated that pre-service teachers typically find the use of discussion forums as an add-on and nothing but extra work (Barab, et. al.), we chose to develop relationships with practicing teachers and invited them to participate in discussions regarding how to teach through inquiry based approaches. The challenge then became how to develop relationships with in-service teachers who were willing and excited to participate in discussions with pre-service teachers but were short on time.

Developing the necessary relationships with in-service teachers was challenging on multiple accounts. First, IUB does not have access to a professional development school in which a set of teachers works closely with the university faculty and students. Second, many teachers have expressed concern about taking on more responsibilities in the current climate of high stakes testing. That is, many teachers feared that concerned that the cost of participation would be large amounts of time spent reading and responding to pre-service teachers’ questions and concerns rather than spending their time preparing their students to do well on standardized tests. For example, one
teacher was interested in discussing her ILF classroom videos, but was very concerned about the
time commitment as demonstrated by her comment when first approached about being a participant:

I would love to help out. However, I am already pretty busy and not sure if I will be
able to squeeze the time into my schedule. Is there a way that when the students post
on the ILF their post can be sent directly to my e-mail. I check my e-mail everyday,
but may not have the time to go to a website to check to see if there are new posts.”

This teacher’s comments and concerns were typical of the other teachers. Therefore, we
found it was crucial to develop structures to ensure teachers’ time and ensure that our students
respected the teacher’s time. Therefore, prior to the beginning of this collaboration we visited each
teacher at their school and walked each teacher through the use of the ILF and discussed what
would be expected of them regarding participating in the ILF. We also discussed with the in-service
teachers what would be expected of the students. In that regard, if an in-service teacher did make a
post to the ILF, our students were instructed to respond to the in-service teacher’s post out of
respect for their time. At first, this participant structure was required by the instructor so the in-
service teachers would feel that their time and contributions was being valued. However, over time
this structure evolved from one of instructor-mandated to a student driven structure. That is, as the
pre-service teachers began to interact with each other and the in-service teachers they began to
value more and more the input of the in-service teachers and their peers. As a result, discussion
moved from simply thanking the in-service teachers for their posts and evolved into opportunities
for reflection on teaching by both the pre-service teachers and the in-service teachers. For example,
in an e-mail sent by one in-service teacher to one university instructor concerning her participation
in the ILF discussion:

Just wanted to let you know, that I have responded to many of your students’
postings. They have asked really good questions and made me think a lot about how
I will do this activity [her project shown in the video]. Thank you for inviting me to participate, it has been helpful. I hope my responses are helpful to your students too.

Similarly, another teacher, who was in his first year of teaching when approached about being a participant, was excited about the opportunity, but a bit concerned about the time commitment. Nevertheless, he wanted to help other teachers in learning how to teach science:

It was not that long ago that I was a student, and I remember thinking that I would love to had the opportunity to talk with teachers before I got to teach. I wish I would have the opportunity that is being provided to your students.

Later, he sent an e-mail to one of the instructors that expressed the value he found in participating:

I had many questions about what it means to teach through inquiry. I responded as best I could to their postings and questions, but not sure how helpful I have been. This experience has helped to better understand my beliefs about how to teach science, particularly through inquiry.

In summary, we have learned that when developing collaborations with in-service teachers, it is crucial to clearly articulate the specific time commitment required, the outcomes for them and their students as a result of participation, and to strongly encourage pre-service students to respond to in-service teachers postings so that in-service teachers feel that their investment of time was valued. Further, it is important for methods instructors to continue and maintain significant contact with the in-service teachers by not only e-mail, but by phone-calls and visits to their classroom to support them in using the technology and addressing any concerns that the teachers might have. For instance, near the conclusion course one teacher stated:

I’m not sure that I could have used this [the ILF] without your help. I’m not much for technology, and probably would have just given up. But now I think I might use the ILF in the future when I have a question about inquiry.
Though only one example, we feel that further investigation concerning how to leverage emerging technologies like the ILF can be used to support new teachers in continuing to reflect on and develop their pedagogical knowledge concerning how to teach science.

Challenge 4: Integrating a technology innovation across multi-university methods courses

The challenges experienced during our collaboration were the differences in our school’s respective schedules, each instructors’ philosophical perspectives regarding the preparation of elementary science students, and our respective students’ comfort level with technology and science. For example, our students (as is typical of many prospective elementary teachers) have traversed through a system where science is traditionally taught through didactic approaches which does little to alleviate prospective elementary teachers’ fears concerning their ability to do and teach science. Therefore, each instructor struggled with first transforming our students’ perception of doing science to one that is more inquiry-oriented and improving our students self-efficacy toward teaching science. However, each instructor had their own philosophical and epistemological beliefs concerning how to best to accomplish this (i.e. doing inquiry oriented activities in class). These different philosophies influenced how our collaboration unfolded, particularly in regard to the use of the ILF. For example, one instructor viewed the ILF videos as an opportunity for his students to view real teachers attempting to implement inquiry in their own classrooms and so emphasized discussion and watching the videos. Another instructor wished to see more focused videos that showed the ILF teachers weaving the tricks of the trade into their inquiry lessons, and as such the ILF was not quite a match and the ILF was deemphasized in his course.

As noted by one of the instructors, the ILF is complex and potentially confusing for newcomers to online environments. In particular, several students in each location had difficulty in
getting the streaming videos to play. At times some students grew quite frustrated as is clear from an e-mail that was sent to one of instructors from a student. An excerpt from that e-mail follows:

I have tried everything. I tried downloading the QuickTime plug-in, but it always freezes my computer. I would like to watch the videos at home since I have young children and if I can’t get this to work I just don’t think I am going to watch them. Can you help?! I am very frustrated and beginning to think this is not such a good idea.

This problems our students had in getting the videos to play created considerable difficulties in having our students discuss the same videos during a particular week. This meant that discussions focusing on one video lasted 3-4 weeks rather than the expected two weeks which aggravated an already fragile time schedule.

Getting our schedules aligned was quite challenging as like each instructor, each university had its own unique calendar. For instance, the students at Boston College began their term one week later than the students at IUB and IUK. Couple these distinct calendars and schedules with each instructors need to cover what they felt were the important grounding concepts that pre-service teachers need in an elementary science course and maintaining a fluid collaboration was difficult, yet we still managed to have significant and valuable interaction on-line regarding teaching science through inquiry. Adding to schedule conflicts several students also reported that the on-line environment was difficult to navigate. This could have been due to their lack of familiarity with such environments, but nonetheless, several problems arose due this lack of navigability. For example, students would frequently post their responses to the videos in the incorrect discussion forum which led to confusion as other students would visit a particular discussion forum expecting to see posts or have replies to their posts, but when they found little or no posts in that particular
discussion forum they would either not post or go to another forum and post there which only complicated the situation. This type of semi-random posting posed great difficulties as it was quite challenging to keep track of our students’ line of thinking as their postings were scattered throughout the site.

CONCLUSIONS AND RECOMMENDATIONS

Despite the challenges and difficulties that we experienced in implementing our collaboration, we found that the benefits of using the Inquiry Learning Forum outweigh the difficulties that we and our students experienced. In particular, we found that through our collaboration our students engaged in conversations in which they articulated and clarified their beliefs regarding teaching using an inquiry-oriented approach. In addition, through this collaboration our students began to form a cohort that they may be able to call upon for support and guidance as they begin their teaching careers. This latter point, as noted by Hargreaves (1994), is crucial if we hope to induce and sustain change within the teaching profession (i.e. teaching through inquiry approaches). Yet many pre-service teachers do not typically interact with students from other universities and typically have minimal interaction with in-service teachers when enrolled in their methods courses. Therefore, one goal of our collaboration was to provide a structure in which our students could engage one another in conversation where they challenged each others and their own thinking and critiqued actual in-service teachers’ classrooms.

Through our experience we found that the ILF appears to create favorable conditions for collaboration, sharing, and support that can aid teacher development. In particular our pre-service teachers were afforded opportunities to develop their own their personal pedagogical beliefs and could gain considerable insight through extended discussions with experienced in-service teachers regarding specific teaching situations and strategies. However, to promote such sharing of teaching
strategies and expertise we recommend that any teacher educator who is planning on using technological tools similar to the ILF first examine what social and technical structures need to be in place to ensure a successful collaborative experience. We also recommend that teacher educators should (1) determine if the in-service teachers have convenient access to computers and are comfortable in using the technology, (2) determine what discussions in-service teachers feel will have immediate relevancy to their teaching and their students’ learning, (3) make sure the on-line discussions are focused so that in-service teachers feel that their time is being well spent (this is particularly important for time-strapped in-service teachers), and (4) make sure the innovation has social supports (i.e. a way to develop trust and collegiality among participants) in place that encourage pre-service teachers to not only engage in but also sustain longitudinal discussions.

Hence, a crucial design challenge when integrating on-line technologies into a methods course is to utilize participant structures that represent and facilitate the sharing of tacit knowledge, a process that is central to effective sharing of expertise (Brown & Duguid, 1998).

Through the use of the ILF’s discussion forums, novice teachers can access a wide range of distributed expertise ranging from more experienced teachers to university faculty (Johnson, 1997). Further, through on-line discussions pre-service teachers can develop a better understanding of the complexity of real classrooms (Schlagel et al., 1996). This can be of particular help in those institutions whose pre-service teachers are not afforded significant amounts of teaching time before they begin their student teaching practicum. However, instructors who use technologies similar to the ILF in their courses must pay particularly attention to using the technology in ways that provide access to resources and knowledge that cannot typically be gained through a traditional methods course or else the technology innovation will likely be perceived as simply “busy work” by pre-service teachers (Nonis, Bronack, & Heaton, 2000). Further, teacher educators who want to integrate WWW media rich resources such as the ILF will need to provide adequate time for
students to learn the technology. For example, in our collaboration we found that students struggled in getting the on-line videos to play and grew frustrated regarding their ability to use the technology. In addition, the ILF is a diverse and media-rich site with numerous discussion topics, inquiry circles, lesson plans, videos and as such the sheer volume of information is intimidating. To alleviate this intimidation factor, the ILF design team has developed a guide that can be viewed online and printed that walks the students through the major features of the ILF and provides trouble shooting techniques. We strongly recommend that teacher educators who implement such a complex technology into their courses provide similar support.

**IMPLICATIONS AND FUTURE WORK**

In the past twenty years, members of the educational community have accumulated a wealth of information about improving teacher practice through professional development (Lieberman, 1995). However, this knowledge base is a significantly underused resource for teacher development because of the lack of a mechanism to facilitate *sustained* information sharing and access to distributed expertise such as other teachers, university faculty, curriculum developers, and pre-service teachers (Loucks-Horsley & Matsumoto, 1999). However, when active sharing of expertise is supported, all parties (in-service teachers, pre-service teachers, and university teacher educators) become part of a community with the deliberate goal of improving both their own teaching and student learning. Yet, there are many questions that remain concerning how technology can support such sharing between such a diverse community. For example, do pre-service teachers who used web-supported professional developments systems such as the ILF in their undergraduate courses (in which use of the technology is mandated by the instructor) continue to use the network after the course has concluded and there is no longer a mandate by the instructor to use the technology? Further, if pre-service teachers do continue to use collaborative technologies (i.e. the ILF) what are
their reasons for doing so and how can professional development designers reify the teachers’ reasons into the design of an on-going professional development program that leverages technology? Some possible avenues for exploration could be to examine if teachers continue to use such technologies because they have access to expertise such as more experienced teachers or university educators, or do teachers continue use collaborative technologies simply because the facilitator of the on-line discussions is particularly skillful in engaging teachers in discussing their practice, or is it simply because of teachers desire to communicate with teachers outside of their local environment? Finally, there needs to be an examination of teachers’ social network (i.e. do teachers who use networks have colleagues who support them) to determine what factors influence, support, or inhibit the use of collaborative technologies for the sharing of teaching practice at both the pre-service and in-service level. It is through investigation of these questions that we as a research community can not only support our students’ professional growth, but also become more d nurture them as they grow as a teachers.
REFERENCES


Bridging the Gap


Figure 1: A teacher’s classroom in the ILF

Lesson Overview

Lesson Description
[Note: Mike is a guest teacher and teaches in cooperation with another teacher who is always in the room. During this particular lesson the second teacher was working with a group of students to learn the same material as the students. The video clips here captures multiple days of a three week unit (9 class periods of one hour each) on the solar system with a special emphasis on the Earth, Moon and Sun system.]

There are eleven students in class and there are four laptops in the room. There are three groups of three and one group of two. The class lasts...
Figure 2: A Collaboration Space set up in the ILF
Figure 3: A Discussion concerning what is inquiry and how to teach using inquiry-based approaches

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