Using Web-Based "Snapshots of Practice" To Explore Science Learning and Teaching in a Course for Prospective Teachers[1]

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How can science teacher educators engage prospective teachers in exploring pedagogical issues? One approach is to discuss written cases (e.g., Tippins, Koballa, & Payne, 2001); another is video cases (e.g., Abell, Bryan, & Anderson, 1998). Although useful, such cases are limited in the complexity that they can portray. Transcripts of discussions, for example, cannot convey as well as video clips the facial expressions, intonations, and mannerisms of speakers and listeners. Video cases, however, rarely include extensive documentation such as relevant curriculum, examples of student work, and written reflections from the participants. Recently such documentation has become accessible in support of video clips embedded in complex electronic cases on the World Wide Web.

Prospective teachers can examine documentary websites known as "snapshots of practice" in an on-line "Gallery of Teaching and Learning" (http://gallery.carnegiefoundation.org). Developed by the Carnegie Foundation for the Advancement of Teaching, the Gallery of Teaching and Learning includes a wide variety of web-based "snapshots" developed by college instructors and teacher educators as well as K-12 teachers. These multi-media websites provide enticing visions of the possible. By that I mean that prospective teachers can learn about inquiry-based instruction, for example, by exploring electronic examples with video clips of students in action, reflections by their teachers, copies of student work,

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relevant curriculum, and commentaries from a variety of perspectives. These complex websites represent what Lee Shulman (2004a) calls the "wisdom of practice." They are examples of the scholarship of teaching and learning, artifacts that examine pedagogical issues in ways that can be shared, discussed, evaluated, and built upon (Shulman, 2004b). Such documentary websites are excellent resources for instructors who conceptualize their courses with a reflection orientation (Abell & Bryan, 1997).

With support from the Carnegie Foundation, teachers are developing their own "snapshots of practice" by formulating issues that seem important to them, collecting data in the context of their own teaching practices, developing interpretations, and presenting these on their websites. Now that such rich documentary websites exist, how can they be used to improve instruction in teacher preparation? In particular, how can teacher educators incorporate web-based "snapshots of practice" in courses for prospective teachers? This case study documents my experience using these innovative technological resources to foster learning to teach science.

Methodology

This is a qualitative case study in the tradition of teacher research (Cochran-Smith & Lytle, 1993; Hubbard & Power, 1993, 1999). As the instructor of an undergraduate course on methods of teaching science in elementary school, I have documented my use of the web-based "snapshots of practice" to teach science teaching through inquiry. In the study reported here, participants were prospective teachers enrolled in my course in Fall 2003 (n = 25) and Fall 2004 (n = 23), elementary and middle school teachers who were authors of the documentary websites (n = 6) (see Table 1), and myself, an associate professor of science education. Data sources included the six "snapshots of practice" summarized in Table 1, the prospective teachers' postings on an electronic bulletin board provided by my university (WebCT), responses posted on WebCT to email inquiries from students in my courses by some of the authors of the "snapshots of practice," final exams, and ungraded self-assessments submitted by the prospective teachers.

I constructed an interpretative narrative (van Zee, Hammer, Bell, Roy, & Peter, in press) to describe how I approached using the documentary websites initially during Fall 2003, and built upon that experience during Fall 2004. In the interpretative narrative about the Fall 2003 course, I drew examples from several prospective teachers' WebCT reflections about Emily Wolk's "snapshot of practice." For the Fall 2004 course, I traced reflections written by one prospective teacher for her

Table 1.
Science-Based "Snapshots of Practice"

Teacher & Location	Project Title	Statement
Vicki Baker Alvarado Middle School, Union City, CA	*Linking Assessment with Learning*	It is frightening how often I teach what I believe to be an interesting, engaging lesson, only to find out that the learning I intended to take place never did. What are some ways that I can better learn what my students really understand? Once I find out what they really understand, what are some ways that I can help them, as individuals, to make meaning out of what is being taught? I share some tools I have developed that have helped me to begin to answer these questions.
Claire Bove Bancroft Middle School, San Leandro, CA	*Feeling at Home in the Science Classroom*	I want to know whether my students are engaged in what they are learning in science. Do they find the work interesting? Meaningful? Relevant? Is the science classroom a place where they feel comfortable and at home? That is one set of questions. A separate but related question is whether engagement in the class affects the achievement of the student in science. My data sources include: copies of student work, teacher responses to student work, videotapes of class and interviews, and teacher observation of student actions.
Ellen Franz Bayside Elementary School, Sausalito & Marin City, CA	*Beginning Physics and Engineering Concepts in an Urban Primary Grade Classroom*	The purpose of this work has been two fold: to have students work with beginning concepts and language in the areas of Physics and Engineering, and to provide a means for students' parents to see and understand the scientific thinking in which their children are engaged as they construct and reconstruct vehicles, bridges and a variety of other objects. My primary focus across the course of this work has been on learning to lessen the cultural dissonances that exist between myself (a white female teacher) and my African American students and their families. Data include videotape of students' work over time and parent responses.

—Table 1 continued on next page—

Table 1 (continued)

Teacher & Location	Project Title	Statement
Laura Kretschmar Lighthouse Community Charter School, Oakland, CA	*Transparency in Teaching and Learning: Strategies to develop inquiry, data analysis, and high quality work*	This past year I have been continuing to develop and implement science curriculum guided by Expeditionary Learning Outward Bound's philosophy and practice of teaching through expeditions, an extension of project-based learning. I have been working on using models and scaffolding tools to help my students produce high-quality culminating products. This spring, I have been teaching the process of inquiry through explicit modeling of my own inquiry (of my students' changing attitudes of our content of study) as a tool to help them in their own inquiry projects.
Deborah Roberts Montgomery County, MD	*Learning Physics Through Inquiry: From First Graders to Teachers*	This is the seventh year in a row that I have continued to use microcomputer-based laboratories with students and teachers after having taken an inquiry-based physics course myself as a prospective teacher. I discuss four settings where this has taken place. The first was my personal experience when taking the course; the second was when I brought my first grade students to the physics lab; the third, when I co-taught the course to other teachers; and the fourth, was the year with my sixth and seventh grade students. I reflect on the differences and commonalities of these experiences.
Emily Wolk Pio Pico Elementary School, CA	*Pio Pico Researchers Participatory Action Research: From Classroom to Community, Transforming Teaching and Learning*	My teaching tools are slightly different than most. Sure, I use textbooks and pencils. But, along with these, I use a radar gun, a computerized mapping system, clip-boards, Polaroid cameras, video equipment and research notebooks. My students learn in a classroom setting. But, they also use their paper and pencils to collect data on our neighborhood streets. My name is Emily Wolk, and I am a teacher of a remarkable group of children called the Pio Pico Researchers. I teach using an alternative inquiry methodology called Participatory Action-Research (PAR).

postings on WebCT, her final exam, and her ungraded self-assessment. Finally, I developed several assertions supported by evidence drawn from the data from both courses (Gallagher & Tobin, 1991). I developed these assertions by identifying common themes (Strauss, 1987) in the prospective teachers' reflections posted on WebCT and on their final exams and ungraded self-assessments.

Table 1 shows the 6 "snapshots of practice" relevant to teaching science in elementary and middle school that I use in my courses. Emily Wolk's "snapshot" is posted on the Carnegie Foundation's Gallery of Teaching and Learning (see http://gallery.carnegiefoundation.org/ewolk). This website documents ways in which she engaged students in participatory action research (PAR). The other "snapshots of practice are still under development as this article goes to press. (If the URLs are not up on the Carnegie website, please email the author for developmental URLs.) Vicki Baker's website focuses on assessment issues. Claire Bove has documented ways in which she tries to make her middle school students feel at home in her science classroom. Ellen Franz's website raises social justice issues by reflecting on ways she as a middle-class white female teaches African American first grade males. Laura Kretschmar presents strategies to develop inquiry, data analysis, and high quality work. Deborah Roberts reports upon her experiences in learning physics through inquiry as an undergraduate and ways in which this has influenced her own science teaching practices.

Interpretative Narrative

First I briefly describe the undergraduate course on methods of teaching science in elementary school. Then I provide examples of ways I used the web-based "snapshots of practice" during the Fall 2003 and Fall 2004 courses.

Undergraduate Course on Methods of Teaching Science in Elementary School

At my university, prospective teachers enroll in a block of courses on methods of teaching language arts, mathematics, reading, science and social studies during the semester before student teaching. Each course meets for two hours once a week for fifteen weeks. The prospective teachers spend two days in class on campus and two days in their placements in local elementary schools. A few are fortunate to be placed with mentor teachers who use science as a focus for learning but most report that they rarely see or participate in science instruction other than what I require for their assignments in my course. For readings, I use as resources the *National Science Education Standards* (National Research Council, 1996), a text that emphasizes project-based learning (Krajcik, Czerniak, & Berger, 2002); a book with chapters by teachers reflecting upon their own teaching practices (Saul, Reardon, Pearce, Dieckman, & Neutze, 2002); and a book by a first grade teacher with many examples of student work, transcripts of conversations, and delightful commentary (Doris, 1991).

My approach is to teach "science teaching" through inquiry (van Zee, in press). By that I mean that I engage the prospective teachers in inquiries into science content (e. g., what causes the phases of the moon?) as well as science pedagogy (e. g., what fosters science learning?). Major assignments include a collaborative inquiry (van Zee, Lay & Roberts, 2003), an individual reflection about their own learning about the moon, and a small research project in which they formulate questions about learning and teaching science, design ways to explore these issues while teaching science lessons in their placement classrooms, collect data while teaching, develop interpretations of these data, present their findings to one another on posters at a research festival, and submit reports (van Zee, 1998; van Zee & Roberts, 2001). Each session of the course has evolved into activities crafted to prepare the prospective teachers to undertake these assignments, which they seem to find unusual and challenging.

Use of Web-based "Snapshots of Practice" during Fall 2003

Making time and crafting a coherent context in which to add something new to an already complex course was difficult. With some reluctance, I condensed my usual opening activity (van Zee & Roberts, 2001) in order to explore Emily Wolk's website on the first day of class. I also asked the prospective teachers to respond to three prompts on WebCT, an electronic discussion board provided by my institution. This also was my first semester using WebCT so I was able to combine these technological innovations into one new assignment, which was:

> (i) Post a question: What has exploring this "snapshot of practice" prompted you to wonder? Or respond to a question posted by a classmate.
>
> (ii) Reflect: What have you learned from exploring this view into the world of this teacher and these students?
>
> (iii) Provide constructive feedback to the author.

Periodically throughout the course I included an assignment to post on WebCT a reflection on one of the "snapshots of practice" in Table 1. Because each class session was so packed already, we only discussed these briefly in class along with other readings.

Examples below are drawn from the prospective teachers' reflections on Emily Wolk's website about engaging students in participatory action research (PAR). Viewers can watch video clips of students using tools such as radar guns to document traffic at a dangerous interaction near their school. The website includes video clips of the teacher and several students reflecting upon the process through which they convinced officials to install a traffic light at the intersection. There is also a thoughtful reflection by Emily Wolk on the theoretical underpinnings of her approach to instruction.

Many of the prospective teachers wondered how to implement such a project in their own settings. In response to prompt (i), for example, one prospective teacher wrote:

> As I reviewed Emily Wolk's "Snapshot of Practice" several issues came to mind. First, I wondered how much a project such as this would cost for one individual school. But then I realized that this type of a project and the main ideal is not necessarily supposed to be conducted on such a large scale such as the traffic issue she examines. Mrs. Wolk states that "I want my students to learn basic skills. That is, I want them to learn the basic skills necessary to transform their world." I felt that this mirrors the main objective I will have when I have my own classroom, and it was reassuring to see that such a large and meaningful project could be conducted with such a modest start. So this website prompted me to wonder how I would be able to implement a PAR project with such relevance in my own school. (Prospective Teacher 17, WebCT, 9/17/03)

A detailed analysis of the prospective teachers' responses to prompt (ii) is posted on my own "snapshot of progress." This is under development but viewable at http://www.cfkeep.org/html/snapshot.php?id=25417632. One common theme was that they learned about different possibilities for teaching. One prospective teacher, for example, wrote the following reflection about Emily Wolk's "snapshot of practice":

> This website has allowed me to explore and learn about a method of teaching that I would probably have never thought of before… It simply proves that when given the opportunity, students can greatly contribute to both their classroom and neighborhood communities. Additionally, it shows that children do have a great interest in learning and often feel more confident about working on and preparing presentations for projects that are hands-on. I would be interested to have my class participate in a project such as this one because I think that it would allow me to become very familiar with how my students learn as well as how well they work together in groups. (Prospective Teacher 11, WebCT, 9/8/03)

Fortunately, the authors of the websites were willing to answer the prospective teachers' questions. In providing feedback about Emily

Wolk's website for prompt (iii), for example, one prospective teacher wrote:

> I would also like to know what the biggest obstacles she encountered during this project were, and how she handled them. (Prospective Teacher 18, WebCT, 9/9/03)

Emily responded:

> Dear (Student 18), I think my biggest obstacle to the research was me. There were times when I didn't know what to do. I lacked the skills to make decisions such as how should we collect data. Other times, I knew what to do but was resistant to do it. I like the way that we as teachers can insulate ourselves but when someone is engaged in this kind of research with children and the community, it is impossible. I think I have really changed as a person. I can tell because now I find myself just taking a deep breath and just doing what is uncomfortable. I have my kids to thank for this. They have changed me. (Emily Wolk, WebCT, 9/29/03)

Such expressions of uncertainty and personal growth are rare and important for prospective teachers to see. They need to know that feelings of self-doubt are common, even for experienced teachers, and that "taking a deep breath and just doing" what needs doing often works.

Use of the Web-based "Snapshots of Practice" during Fall 2004

Perusing the "snapshots of practice" during the Fall 2003 course seemed to have deepened the prospective teachers' understanding of science pedagogy even though we had not been able to devote much time in class to discussing the many issues that these websites raised. In planning for Fall 2004, however, I wanted to integrate use of the web-based "snapshots of practice" more fully into my design for the course.

I decided to ask the prospective teachers to analyze their WebCT reflections for common themes and to use these themes as the basis for developing the personal frameworks for science teaching that they would be submitting for the final. This interpretative process for the final exam had evolved over many years in the context of analyzing weekly journals. I had asked earlier classes to write journals (i) describing instances of science learning that they observed or experienced and (ii) reflecting upon factors that fostered learning in those instances (van Zee & Roberts, 2001). Many of the prospective teachers had complained, however, that they could not write such journals as they never observed science being taught in their placement classrooms. Using the web-based "snapshots of practice" would give access to detailed examples of science learning for everyone in the course. Also, posting reflections on WebCT would give the prospective teachers access to one another's thinking and perhaps would prompt electronic discussions. Therefore I revised the three prompts I used in Fall 2003 to the following for the Fall 2004 course:

(i) What fosters science learning in this classroom?

(ii) What you are wondering now that you have explored this "snapshot of practice?" Or what ideas do you have about a classmate's question(s)?

(iii) What feedback can you give the author to improve this snapshot?

In addition to accessing the six elementary and middle school teacher "snapshots of practice" that the Fall 2003 students used (Table 1), the Fall 2004 prospective teachers responded on WebCT to similar prompts for reflections about several writings by teachers (Iwasyk, 1997; Kurose, 2000; Pearce, 2002) and to a science website of their choice for a total of 10 WebCT reflections.

The prospective teachers analyzed their WebCT reflections during the last day of class by highlighting statements in their weekly journals that articulated factors that fostered science learning, cut these out, sorted them into piles, taped similar statements to sheets of paper, and wrote claims at the top of the sheets. Each claim articulated a factor that fostered science learning; the assembled statements provided evidence to support the claim (van Zee, 1998; van Zee & Roberts, 2001).

One of the prospective teachers, for example, wrote the following WebCT reflection about Claire Bove's website (Table 1; http://www.feelingathome.org) on ways to help students feel comfortable in her middle school science classroom. The italicized statement highlights a factor that fostered science learning that the prospective teacher used to support a claim:

> Claire fosters learning in her classroom by creating an environment in which *students are able to feel comfortable in asking questions*. I think it's important that she realized the need to have those students who do not come from science backgrounds to want to learn science and to be motivated and engaged in what they are doing. She uses hands-on approaches to learning and makes the tasks students are to complete apply to what is going on in the real world. In doing so, students are able to see the importance and purpose of what it is they are doing. Because Claire teaches middle school, could her same approach be used in the primary grades? Specifically, how could this work with first graders? (Prospective Teacher 20, WebCT, 11/28/04)

This prospective teacher cut out the italicized statement and taped it to a sheet with similar statements from her other WebCT reflections.

Figure 1 presents the full set of claims that she developed by analyzing her WebCt reflections. These formed her personal framework for science teaching. For the final exam, she submitted a copy of her WebCT reflections, the claim sheets from her analysis of common themes for factors that fostered science learning, and recommendations based upon her claims. For example, she wrote:

> The key to having students successfully participate in open discussions is to establish a sense of community within the classroom… Students learn that they are allowed to share their thoughts and ideas, no matter what they may be, with their teacher and peers. (Prospective Teacher 20, final, 12/04)

As part of her final, she also designed and submitted a first-grade lesson about animals, and used this as the context for discussing how she would meet her own recommendations, the *National Science Education Standards* (National Research Council, 1996), and her county's guidelines for science teaching. She wrote:

> I am following my own recommendation for claim #2 by planning for discussion time in my lesson design… The majority of the lesson, then, will be inquiry based (Standard A) with students being responsible for researching and experimenting for themselves. In addition, I am guiding and facilitating science learning (Standard B) by recommending that students participate in open discussions as much as possible.

Figure 1.
Set of claims formulated by a prospective teacher by analyzing her own reflections on WebCT about factors that fostered learning during the science instruction portrayed in the "snapshots of practice"

Claim #1	Parent involvement leads to more active students in the classroom.
Claim #2	Open discussions allow students to confidently express their thoughts, ideas, and questions to further their understanding.
Claim #3	Hands-on learning tasks allow students to deepen their understanding because they are able to participate and experience what it is they are learning.
Claim #4	Designing lessons that include students' interests capture their attention and motivate them to want to learn more.
Claim #5	Using technology as a learning tool and resource allows students to see how what they are learning fits in to real world situations.

> In doing so students are able to reflect upon what their peers are saying and think deeper and more critically in order to answer their own questions…The recommendations I have made, based on my claims, target each of the 5E's [engage, explore, explain, extend, evaluate; the instructional model recommended by her county]…Hands-on learning tasks allow students to explore, while open discussions give students the opportunity to explain their thinking and reasoning… (Prospective Teacher 20, final, 12/04)

In addition, she reflected on ways to address issues of diversity and to integrate across the curriculum in the context of her lesson. For the last section of the final, she wrote a title and abstract for a small research project that could be undertaken while teaching science during the student teaching semester. She wrote that she wanted to examine the influence of students' reading and writing levels on their depth of response and level of understanding during inquiry-based science instruction.

Access to a variety of examples of science learning in progress seems to have helped shift this prospective teacher's view of herself as a science learner and teacher. In the ungraded self-assessment that she turned in with her final, she wrote:

> I feel I have made significant progress in this course with regards to my attitude towards science. Science was never really a subject that I particularly enjoyed or looked forward to during my own education; however, seeing the alternative ways to teach the subject has definitely made me change my feelings towards it for the better… I see myself using an inquiry-based approach to teaching science when designing future lessons… (Prospective Teacher 20, ungraded self-assessment, 12/04)

Such comments suggest that exploring the web-based "snapshots of practice" contributed to this prospective teacher's construction of an image of herself as a successful science teacher.

Interpretations

Analyses of the prospective teachers' reflections on WebCT, finals, and self-assessments suggest several interpretations that I present here in the form of "assertions."

Assertion 1:
Reflecting upon the web-based "snapshots of practice" contributed to positive shifts in attitude about teaching and learning science.

In both courses, prospective teachers often commented upon changes in their attitudes about teaching and learning science. One prospective teacher in the Fall 2003 course, for example, attributed such a change to viewing just one "snapshot of practice":

> Through [Emily Wolk's] website, I have learned so much. It really inspires me to not follow just text. Science is a hard subject for me, and I am not confident enough to be creative. However, reading this website and educating myself with all these wonderful ideas makes me want to think about future projects with my future classroom. (Prospective Teacher 22, WebCT, 9/10/03)

Others mentioned changes in attitudes on their ungraded self-assessments. For example, one prospective teacher in the Fall 2004 course wrote:

> During this semester, I think that this course has made me see science differently and appreciate its significance. Science I admit has never been a personal strength of mine and something in fact I typically dreaded, despite the fact that science is my emphasis. I learned through the way the sun and moon explorations were modeled, through the WebCT readings, as well as the book, what science can be… I feel less like I have to have all the answers for my students but more that I will be exploring with my students and join them in uncovering the answers. (Prospective Teacher 3, ungraded self-assessment, 12/04)

Assertion 2:
Analyzing their own reflections on the web-based "snapshots of practice" enabled the prospective teachers to build visions of the possible, that is, to articulate ways that they could envision themselves teaching science.

My intent was for the prospective teachers to leave my course with a well-articulated personal framework for science teaching based upon their own observations and reflections. In previous years these had involved direct observations in their placement classrooms, in informal settings they devised themselves such as talking with children about rocks found on the playground during recess, or in their own learning about the moon in my course. I had worried that displacing the context for their observations onto the web-based "snapshots of practice" might make their findings less personal and compelling. This does not seem to be the case. One prospective teacher, for example, wrote:

> I think that the most beneficial part of the course was this final project. In doing this final project I feel it showed me the most important aspects of being a science teacher. This is certainly the most beneficial thing from the semester. All semester we spoke about the different aspects that foster science learning, but never actually saw them concretely on paper. By going back over our WebCT responses it really helped me pinpoint the different things that foster science learning. When planning my science

> lessons next semester I am going to use my list of recommendations. I want to be sure I incorporate these things in my lessons so my students can get the most out of their science experience. (Prospective Teacher 16, ungraded self-assessment, 12/04)

Assertion 3:
Analyzing their own reflections on the web-based "snapshots of practice" enabled the prospective teachers to articulate the importance of open-ended discussions amid inquiry-based instruction.

Most of the personal frameworks that the prospective teachers constructed included some version of encouraging discussion and student questioning. One prospective teacher, for example, summarized her findings across all of her WebCT reflections as follows:

> Through reading about the science classrooms of multiple teachers, I have found that there are several important themes that make their classrooms work. In these classrooms, the teachers have built a community based upon student discussions… The students in the classes were engaged and all of the science topics were based upon the students' questions and interests that allowed them to observe the world around them and use their own observations to help answer their questions... The teachers also provided plentiful resources for the students to come to their own conclusions and showed the students how their questions fit into the big picture and weren't just isolated topics, but incorporated other subjects and areas of life as well… Based upon the snapshots of other teachers, I have been able to build ideas about how my science classroom should be set up. (Prospective Teacher 2, final, 12/04)

The process was not always an easy one, however. One prospective teacher, for example, acknowledged in his self-assessment reservations about the inquiry-based learning and teaching modeled in my course:

> I learned that by observing and watching your students, you can tailor your lessons to what your students need to learn. Also, I learned that you can easily learn what your students know without giving them a traditional test. You can have a conversation where you simply ask broad questions about a pre-determined topic and then monitor the students as they talk amongst themselves. I think the way you teach (and the way you want us to teach) is a little difficult to understand without having done it. I know I was confused at the beginning and did not see the advantages of this type of learning until near the Thanksgiving break. But as I did my assignments and reflections, the benefits unfolded right in front of me. Hopefully, I can use this type of learning in my professional career. (Prospective Teacher 19, ungraded self assessment, 12/04)

My perception is that incorporating the web-based "snapshots of practice" into the course greatly enhanced the prospective teachers' growth in understanding the inquiry-based approaches to learning and teaching advocated by the *National Science Education Standards* (NRC, 1996).

Reflection

The state of Maryland recently mandated technology standards that teacher education programs must meet to prepare prospective teachers to incorporate technology in instruction (see http://www.smcm.edu/msde-pt3/projects.htm). My use of the web-based "snapshots of practice" addressed several of these standards.

Technology Standard 1 refers to accessing, evaluating, processing, and applying information from electronic sources such as the Internet. In exploring the web-based "snapshots of practice," the prospective teachers accessed rich sources of information about science learning and teaching, evaluated these through providing feedback to the authors, processed them by writing reflections on WebCT and analyzing these for common themes, and applied what they had learned by writing recommendations for science teaching in the context of lessons of their own design. This complex process modeled ways that they might incorporate technology in instruction for their own students beyond simply using the Internet as an alternative to encyclopedias as sources of information.

Technology Standard 2 refers to communicating electronically. The move from weekly journals turned in to the instructor to reflections posted on WebCT made possible the sharing of thinking among all members of the class. Some of the prospective teachers read the previous postings on WebCT and chose to respond to their peers' comments and questions in their own postings. There also were some exchanges among the prospective teachers and the websites' authors. Such interactive electronic communication is a process that I hope to foster in the next version of my course.

Technology Standard 3 refers to legal, social, and ethical issues related to technology use; Standard 4 refers to using student and school performance data to improve instruction. Neither of these were addressed explicitly, nor was Standard 6 which concerns issues related to use of assistive technologies for students with special needs.

Technology Standard 5 refers to designing, implementing, and assessing learning experiences that incorporate the use of technology to support understanding, inquiry, problem-solving, communication, and collaboration during instruction. Use of the web-based "snapshots of practice," particularly during the Fall 2004 course, modeled the use of technology as a cognitive tool (Jonassen & Reeves, 1996) to enhance learning. Rather than modeling teaching as a process of knowledge transmission, the technology made possible modeling teaching as a process of knowledge construction.

Technology Standard 7 refers to developing professional practices that support continued learning and professional growth. In future versions of the course, I may ask the prospective teachers to build their own web-based "snapshots of practice" as alternatives to the reports I currently require for their research projects. They could develop these with the free KEEP Toolkit developed by the Knowledge Media Laboratory of the Carnegie Foundation for the Advancement of Teaching (http://www.carnegiefoundation.org/KML/KEEP/index.htm). Creating snapshots of practice at many points in their teaching careers could help them improve their teaching practices, enable them to share successful practices with others, and raise issues that need exploration by themselves, their schools, and the professional community.

A long-standing goal for me has been to foster interaction among prospective and practicing teachers (van Zee, Cole, Hogan, Oropeza & Roberts, 2000; van Zee, Lay & Roberts, 2003). One way I am considering fostering such collaboration in the future is to involve teachers in our Master's program in building snapshots of their action research projects. The prospective teachers in our methods courses could explore the developing websites and provide feedback; the practicing teachers could deepen their own learning as well as share their expertise by responding. This would be a form of cognitive apprenticeship (Collins, Brown & Newman, 1989) with interactions among teachers of varying levels of expertise mediated by the technology. Such snapshots can provide vivid examples of reform approaches to instruction, inspire viewers to consider modifying their own teaching practices, and enhance a sense of community among prospective and practicing teachers attempting to implement reform approaches to instruction.

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