Using a Nonrestrictive Web-Based Forum to Promote Reflective Discourse with Preservice Science Teachers

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Teaching has been characterized as a culture of isolation (Schlagel, Trathen, & Blanton, 1996). A practicing teacher does not usually have access to ongoing development and support in a classroom setting which promotes idea sharing or support from peers. Electronic communities for teachers have the potential to break down these teacher isolation barriers and provide a support network for teachers in the classroom (Bull, Harris, Lloyd, & Short, 1989; Casey, 1997). Teachers now have the opportunity to join online discussion groups on the World Wide Web (WWW or Web), post questions to electronic bulletin boards, and communicate thoughts and ideas using an e-mail listserv. Many studies describe how teachers learn about telecommunications technology, the kind of support required for teachers to implement such tools effectively, and the obstacles that teachers must overcome to successfully incorporate them into their daily practice (Bos, Krajcik, & Patrick, 1995; Caggiano, Audet, & Abegg, 1995; Casey, 1994; Casey & Vogt, 1994; Russett, 1994; Russett, 1995; Sunal & Sunal, 1992; Weir, 1992).

Some studies have been conducted on the effects of preservice teachers interacting with an electronic telecommunications network. The Curry School of Education at the University of Virginia created the Teacher-LINK system in 1984 to study the process of establishing a network to support the student teaching process (Bull, Harris, Lloyd, & Short, 1989). This study described that preservice teachers used Teacher-LINK as a communications link to their university instructors during their field practicum experience using electronic mail (e-mail) and an electronic

conferencing system. Merseth's (1991) study on first-year teachers partici-
pating in the Beginning Teacher Computer Network (BTCN) showed that
first year teachers used electronic telecommunications for personal,
emotional, and technical support. Casey's (1994) study on preservice
teachers using TeacherNet at California State University reported the
following benefits of preservice teachers using a telecommunications
network: (a) increased time to reflect on what they were learning; (b)
increased feeling of rapport with and support from their university supervi-
sor; (c) decreased feeling of isolation; (d) increased self-esteem due to
mastering technology; and (e) increased knowledge and use of information
access and retrieval. The preservice teachers in Waugh and Rath's (1995)
study perceived that networks can enhance teacher training and support
their work in the schools by using it to access resources and communicate
with others. Waugh's (1996) study on group interactions and students'
questioning patterns in a university course using an electronic network
showed that students posted questions predominantly concerned with
technical aspects and network strategies more than personal questions. An
exploratory investigation of preservice English teachers using telecommu-
nications during their methods instruction and student teaching (Thomas,
Clift, & Sugimoto, 1996) reported that e-mail was an asset for meeting
course requirements and maintaining contact between students and instruc-
tors. The results of a study by Schlagel, Trathen, and Blanton (1996) at
Appalachian State University pointed to the structure of e-mail use as being
an important factor in eliciting spontaneous exchanges of ideas.

The research studies described involved preservice teachers using asynchro-
nous telecommunications for purposeful reflective discourse during their
student teaching experience. These studies were designed to evaluate the
impact of the use of e-mail and bulletin board systems on preservice
teachers' attitudes dealing with the utility and use of the electronic medium
during student teaching practicum experience. Each of these studies was
conducted within the context of restricted networks of preservice teachers.

Although there are increasing numbers of new teacher communications
networks being established in colleges of education around the country, the
published descriptions of these systems are general and often do not include
specifics about the use and implementation of these systems. Few studies
have been conducted in which student teacher postings to electronic
networks have been analyzed for types of discourse. These studies have
described only broad, general categories of discourse occurring on net-
works of preservice teachers. None of the existing studies have analyzed

whether the discourse is thoughtful and promotes a reflective practice in which a cohort group of preservice teachers engage in discourse that involves asking focused questions, seeking common meanings in teaching practice, or constructing ideas during collaboration with other preservice teachers.

The purpose of this study is to investigate the purposeful use of asynchronous (time-delayed) telecommunications during the student teaching semester using a nonrestrictive, public web-based forum for facilitating reflective discourse with preservice science teachers using critical incidents in science teaching. In a nonrestrictive, public web-based forum, any person with access to the Web can participate in the discourse. More specifically, the following questions are of interest in this research:

1. Does the discourse of critical incidents in science teaching with preservice science teachers on a nonrestrictive, public web-based forum during the student teaching semester reveal a reflective practice of teaching?

2. Does interacting using a web-based forum during the student teaching semester promote reflection on what the preservice science teachers are learning, including teaching approaches and decision making?

3. What are the students' attitudes toward using a web-based forum with critical incidents in science teaching during their student teaching semester?

METHODOLOGY

Participants

The participants in this study were 32 prospective secondary school science teachers enrolled in the Professional Semester (Methods of Teaching Science—one of three different content-specific methods courses that included either Biology Methods, Physical Science Methods, or Middle School Science Methods; Instructional Materials in Science; Seminar in Science Education; and Student Teaching Practicum Experience) at North Carolina State University during the fall semester of 1998. The age of the

students ranged from 21-26 years with a mean age of 22.3 years and a median age of 22. The students' initial telecommunication expertise and comfort level ranged from those with little experience and comfort using e-mail and the Web to those who felt very comfortable and used telecommunications on a daily basis. Most students (n=23) reported that they were not confident using a web-based forum. Only a few students had some type of previous experience using a Bulletin Board System (BBS), online chat, web-based forum, or other electronic conferencing system.

The participants had completed the majority of their academic requirements for a Bachelor of Science degree in Science Education with 10 students concentrating in biological sciences, 10 in physical science, and 12 in middle school science and math. All high school science preservice teachers (n=20) attended an Instructional Materials in Science course for two hours per day during these five weeks. The 12 middle school science preservice teachers were instructed in a different Instructional Materials in Science course. The high school preservice science teachers also received instructional coursework in different methods of teaching science courses based on their science concentration area with 10 students enrolled in a biological sciences methods course and 10 students enrolled in physical science methods course. Each methods of teaching science course was instructed by different science education faculty members than the Instructional Materials in Science course. Students were on campus daily for course instruction during the first five weeks of the semester. For the following 10 weeks, each student was assigned to a public school in a school district near the university for the student teacher practicum experience.

The Science Teaching (SciTeach) Forum

As part of the required course work in the Instructional Materials in Science course and in the Middle School Methods course, each student was required to post two messages each week to the SciTeach (Science Teaching) Forum (http://www.ncsu.edu/sciteach) for the entire semester. One of the two message postings was required to be posted to a specific forum topic called *Critical Incidents in the Science Classroom*. The SciTeach Forum is placed in the context of a larger public web site called Science Junction. The SciTeach Forum can be accessed by anyone with a connection to the Web. A special e-mail account or password is not a requirement to read forum messages or to post messages on the forum.

The SciTeach Forum has been structured to contain discussion topics relating to teaching science content, incorporating instructional technology into the curriculum, and teaching pedagogy in general. The online forum software enables any user to add a new discussion topic to the forum. Within each topic area, a user can post a new message, reply to a message, or reply to a reply of a message. When users first enter a topic area, they are presented with a list of message and reply titles. Each message and reply title displays the author of the message and the date the message was posted on to the forum. The most recent message is listed at the top of the screen. Each message and reply title is a hypertext link. The user clicks on a message or reply title to view the posted message. The software also enables the user to read an entire thread of successive replies to the original message.

Critical Incidents in Science Teaching

As previously mentioned, the participants were required to place one forum posting to the Critical Incidents in the Science Classroom topic each week. The critical incidents that were posted to this forum topic area were descriptions of possible classroom situations that science teachers might encounter. Critical incidents have been used in various university course settings in the areas of nursing (Naidu & Oliver, 1999), journalism (Carter, Kang, & Taggart, 1999), human resource development (Preskill, 1996), and in education (Lunetta & Zalewski, 1974; Brookfield, 1990; Kennedy & Wyrick, 1995; Louiselle, St-Loius, & Dupuy-Walker, 1998; Nott & Wellington, 1996; Clough, 1998). A few of the critical incidents posted to the forum involved nonspecific science pedagogy issues that could apply to any preservice teacher; these included issues such as covering all course objectives for the "end of the course test" (Clough, 1998) and aspects of the student-teacher/cooperating teacher relationship. The following are examples of critical incidents:

> You are demonstrating wave phenomena using a ripple tank. The students are unable to observe refraction clearly and frankly you too find observing the refraction difficult with the apparatus available. What kinds of things would you say and do at this point?

Students are working with microscopes and you want them to observe and draw onion skin cells. They accurately set up the slides and microscopes, focus correctly, and begin observing and drawing. As you walk around the room you see some drawings that reflect the accepted image of onion cells, but approximately 1/3 to 1/2 the students are drawing sketches that look nothing like the accepted image of onion cells. What kinds of things would you say and do at this point? (Clough, 1998 modified from Nott & Wellington, 1995).

Role of the Researcher

The researchers in this study were instructors of a science methods course taken by each participant. They introduced the forum to all participants during the course and were responsible for maintaining the forum and answering any technical questions or problems the students might have during the semester. One of the researchers was responsible for posting a critical incident to the forum each week. Prior to the beginning of the semester, critical incidents were selected from a variety of sources (Clough, 1998; Nott & Wellington, 1995) and others were created by the researchers.

Data Collection and Analysis

This study was conducted using an adaptation of qualitative research methodology of Glasser (1978) and Bogdan and Bilken (1992). The researchers first reviewed the literature of computer-mediated communication use with preservice and inservice teachers to identify data categories of previous research to use initially to code the preservice teachers' message postings. Using Glasser's six-step constant comparative protocol, the discourse on the Critical Incidents in the Science Classroom topic on the SciTeach Forum was analyzed to explore message types and patterns that facilitate collaborative student teacher reflective discourse.

The data from the forum was coded and categorized by evaluating each message based upon the type of information or communication contained in the transcript. Emergent categories were assigned to identify the types of messages and interactions that were taking place. By using the constant

comparative method, the initial coding scheme became modified rather quickly. Another science educator reviewed the coding categories as a measure of coding reliability. The emergent message type categories (or code words) identified in the critical incidents discourse were:

• Classroom practicum experience: Statements referring to an event that occurs in the classroom.

• Science Pedagogy: statements pertaining to science-specific pedagogy and not general pedagogy.

• Nature of Teaching: statements relating to classroom instruction, methods, or classroom management issues; the role of the teacher; and specific teacher-student interactions.

• Support: statements referring to support, including receiving or giving support, and supporting one's ideas.

• Concern for students: statements pertaining to the welfare of classroom students.

• Requests for information: statements or specific questions, which ask for information, advice or ideas.

• Resources: statements in which students share resources including teaching ideas, general information, or instructional strategies.

• Recognition: statements in which a student acknowledges an idea presented on the forum.

Each student message was also coded for evidence of reflective discourse. The reflective discourse codes were:

• Perceptions: insight, intuition; knowledge gained by observing; becoming aware in one's mind.

• Asking focused questions: asking focused questions to build on ideas previously presented in the message thread.

• Peer scaffolding: a statement that builds on a previous posting in the message thread.

Peer scaffolding was further subdivided into the following themes:

• Guidance and feedback: messages that build on a previous response in the thread that offers some type of guidance and feedback on the issue discussed. Can include a response to a stated activity or provide movement of an issue into a new direction.

• General advice: messages that offer general advice or personal views to further develop an idea in the message thread.

• Modeling pedagogical practices: messages that augment an idea by illustrating a pedagogical practice.

Interviews. Six interviews were conducted from a stratified random sample of preservice science teachers. Preservice teachers were stratified based on their science-specific methods courses (Biology Methods, Physical Science Methods, and Middle School Science Methods). Two subjects were interviewed from each of the three different science-specific methods courses. The interviews addressed the participant's experience, attitude and perceptions with using "critical incidents" on the web-based forum during their professional semester. The interviews were conducted during the week following the end of the participants' student teaching practicum experiences. Interviews were conducted using audiotape. Appendix A lists the interview questions.

Questionnaires. A questionnaire consisting of open-ended questions was administered to each participant at the end of their professional semester to assess the overall effectiveness of the forum. Appendix B lists the open-ended questions.

FINDINGS

The findings of this study are presented within the context of emerging themes that resulted from the data analysis of the forum discourse, questionnaire items, and interviews. Examples of forum discourse of participants and excerpts from the interview transcripts are provided in the discussion of these themes.

Allowing a Reflective Practice of Teaching

> Most of the time you may be thinking it, but you can't necessarily get it out. So, sometimes people will spark something that you were thinking. I understand why they may have said that, so you get a new idea if you get to see someone else's reply to the same question.

Throughout the discourse of the critical incidents, there are many examples of preservice teachers engaging in reflective discourse. The critical incidents are structured in such a way "that it gets you to think" by having to respond to a focused question raised about a complex issue that could occur during student teaching in a science classroom. The incidents were authentic problems that the preservice teachers could "relate to." Reflective discourse was evident in the responses to the critical incidents in which students share their perceptions, ultimately resulting in the seeking of common meaning to resolve the critical incident. In many cases, peer scaffolding resulted in the ideas of one preservice teacher serving as a foundation for others. This was illustrated in the participants' message postings as guidance and feedback, general advice, and modeling pedagogical practices.

Guidance and Feedback

In many cases, the preservice teachers responded to messages that responded to a previous response or multiple responses in the thread by offering some type of guidance and feedback to the issue. Often, the participants responded to a stated activity or facilitated movement of an issue into a new direction. For example, much of the discourse in a microscope lab discussion tended to focus on showing students a correct cellular organelle illustration when they noticed that students were drawing incorrect pictures. In response to what was said in the message thread, one student responded by saying:

> Distributing the drawing is a good idea, but I would do it after students have made their own drawings. If 1/3 or so of the students have drawn a cell that looks nothing like an onion cell,

then give them an actual drawing/picture and ask them to compare it to their drawing. After they have had time to do a visual comparison, ask the student to go back to the microscope. . . look closely. . . and redraw the onion cell again.

In this response, the preservice teacher acknowledged that distributing a drawing is a good idea and then offers guidance to direct the students back to their microscope to reexamine the onion cell. This student built her response based on the response of others. Not all students "respond along the same lines" in the message thread:

I don't think that showing them a "correct" drawing is the right answer in either case. It pretty much defeats the purpose of having them look into the microscope. If you wanted to do a similar activity with them later, students might be tempted to wait until you put up the "correct" drawing before attempting to do the work on their own.

This response is very different from all the others in this message thread. This student shows a critical reasoning that no other students had previously shown in the discourse. Not only does this student disagree with the majority of her peers, she provides a good explanation to support her views. She believes that showing the students the "correct answer" might lead students to decrease their motivation to engage in a classroom activity.

General Advice and Modeling Pedagogical Practices

If a teacher does pursue this discussion in class, do so in a discussion forum, or a round-circle discussion. This puts students at ease and each person has visual contact with the other students. This helps develop the listening, thinking, and communicating process.

I think one way to curb the student from saying that the lab is dumb in the first place is by making a statement of objectives at the beginning of the lab.

Throughout the discourse the preservice teachers offer each other general advice or personal views to develop an idea in the message thread. General advice is often offered after some discussion of a teacher-student interaction. In many cases, students have critically reflected on the situation and bring in discussions of science-specific or general pedagogical knowledge to address the critical incidents. As students experience critical incidents during their teaching practicum, they bring these experiences into the forum dialogue. For example, in response to a critical incident involving an inquiry lab, in which a student says to you, "This is dumb! You could just simply tell us the answer and how to do the lab. We'd learn the material more quickly and get to new things," one preservice teacher responds with her own personal experience:

> This is a tough thing to handle sometimes. This very comment has been said to me in my classroom. I told the student that science is about figuring out how the world works, like an investigation into nature, and that he could not truly learn about science without participating in this investigation. I reminded him that I could tell him anything but only if he saw it for himself, would he actually know for sure.

In her response, she stresses to the student a basic constructivist view, the importance of creating meaning for himself through his own experiences. The discussion of constructivism is further developed in the message thread as the students reflected on various reasons why inquiry labs are more engaging and interesting to students than lectures. Modeling specific science pedagogical theory such as the learning cycle is also presented in the discourse as an example of making science content meaningful and relevant to students. By offering advice and sharing pedagogical practices, common meaning becomes evident in the discourse. "If you just give the answer to the student, they are less likely to retain the information and use it correctly."

Seeking Common Meaning

In this study, the web-based discourse promoted reflection and understanding of common meanings these preservice science teachers seek to understand. They seek to clarify and extend their understanding of their role as a

teacher and understand their students. In many cases, they perceive their role as a teacher to extend beyond facilitating student knowledge of scientific processes and concepts:

> Why have females been lagging behind in the field of science? Have our educators not been sparking their interest? Have they been drawing the females attention away from math and science and gearing it more towards liberal arts areas? Have our teachers been turning to the males for correct responses and been setting higher expectations for the males? Have educators been accepting that females are just "not as good in science" or what? These are a few questions that researchers have been confronted with for years. So how, as a new science teacher, will I deal with the prejudice of a male dominated field?

By asking focused questions, this participant seeks to understand how gender bias originated and how to come to terms with this issue in her new role as a classroom teacher. Her peers respond with a discussion of gender roles in historical and societal contexts, ideas on why women were not given credit in the past for their ideas, and how gender roles are presented by textbooks and perceived by people. The role of the science teacher becomes more than just being a facilitator of knowledge: " It is the job of science teachers today to reach out to females and create confident scientists." The participants seek out limitations in their role as a teacher. In a discussion of teaching AIDS and sex education, a preservice teacher stated:

> I agree with Aliza. It is unfortunate how little can be discussed on this matter. Teachers just are not in a position where they can freely give their opinions about sex. We seem to have little choice but to cut the conversation short. It would be an interesting and informative discussion for students and the teacher but it just cannot happen in today's classroom.

As the student teachers spend more time in the classroom and become exposed to school district policies and the daily nature of teaching, they begin to move away from "idealistic" thoughts of teaching and become more aware of the "realistic" world of teaching.

Throughout the discourse, preservice teachers seek to understand meaning from the perspective of their own students:

> I agree with David and Leslie. A student should know before they begin a lab why they are doing it. That is the whole point of having objectives with a lesson. Joseph and Dalia also make a key point, that if the kid still says its dumb, ask him/her why. We are supposed to be challenging students to think, but we must also think before we pose an activity to a student: Is it on their level? Does it challenge them? Can they relate to it? Just giving a kid an activity is not teaching. It must have real meaning and benefit to the topic and the student. Just because I as the teacher think it is awesome, doesn't mean a kid will. Listen to this type of statement when it comes from a kid, ask them why they feel this way, and if it is a legitimate reason rethink the activity. Adapting plans is part of being a good teacher!!!

In this case, the preservice teacher seeks to understand how a student would view the activity. She critically reflects on the issue by asking focused questions in an attempt to place herself in the students' shoes. In doing so, she seeks to understand the difference in how teachers and students perceive an activity.

Teaching Approaches and Decision Making

The structure of the critical incidents requires the preservice teachers to think about their teaching approaches and decision making in the classroom. A recurring concern that emerges in the discourse is how to create learning environments in which students take ownership for their own learning.

> I've also noticed that I had a tendency if I'm doing some hands-on stuff in a class like a lab, that I'm trying to do the work for them. With responding with people [on the forum], I've learned to stand back and let them [the students] do it. I have a tendency to help them to do it quicker. I know they can't learn like that from me. They have to think through the process. I think its [the forum] just influenced me in making me not react so quickly, thinking about it a little more.

In this statement from the interview, a participant used the discourse on the forum to reflect on her teaching approaches and realized she was not giving

her students the opportunity to think for themselves. By having the opportunity to read the pedagogical ideas of her peers in similar situations, she was able to reflect on her own teaching and realize how she needed to change her pedagogical style in the classroom.

In sharing peer perceptions, the participants are able to engage in scaffolding pedagogical ideas with each other.

> And I think it's really good if you can see how different people deal with a certain situation. So you can integrate everybody's little pieces together, and then you can decide, okay, this is how I'm going to do it and then you can sit back and reflect did that work or not, and do something different next time if need be.

The preservice teachers were able to integrate bits and pieces of different teaching ideas that were presented in the message threads. They integrate the pieces together and decide how they can improve their own teaching from what was previously said by others. This type of peer scaffolding appears to promote reflection on topics the participants are learning in their university course work. In some instances, participants stated openly on the forum that they had a preconceived notion about handling a certain situation and that notion changed after reading the responses of others on the forum.

Being Prepared

The discourse also promotes reflection on the day-to-day activities a teacher deals with in the school environment.

> It made me realize that, even though you're not consciously thinking about it when you are making your lesson plans, you have to start thinking about what am I going to do if this child asks a question and I don't completely understand, and you have to be prepared for stuff like that. 'Cause kids will ask you something out of the blue and you're like, well what would make them think like that. Or, if you're in a lab and it just does not want to work, you have to figure out how am I going to control,

or what can I do to move along. And you have to be ready for it if something does happen. You have to be ready with something else. So, it just makes you be more aware that you have to be prepared and you always have to have a back-up plan. As I have experienced, so far, I have to have back-up plans because last minute assembly, during one of my classes tomorrow. So it makes you think about all this extra curricular stuff the school puts in. So you have to be prepared for that kind of stuff.

This participant realized that the average school day is full of unexpected surprises that the classroom teacher must think about. Interacting with the critical incidents discourse helped this preservice teacher to contemplate these issues.

Preservice Teacher Interactions

Sharing peer experiences of interactions with their students opens doors to different teaching approaches. As one participant notes:

There's a lot of different views. Especially with the middle and high school teachers. And how they would handle it. You know, like different preparation they have, and classes, and how to work with their students. How they handle interactions with their students.

Much of the discourse in the beginning of the participants' professional semester tended to focus on the types of teacher-student interactions they perceive having with their students. These interactions appear to be a concern for the participants at this point in time in their professional semester. By reading the forum discourse of the participants, one also gets a sense that they are very concerned with how they will interact with their students when they are classroom teachers and how this will influence student learning in their classroom.

Broad Views

In responding to critical incidents, some participants extrapolate the discourse to a larger contextual picture.

> I think what you would do has a lot to do with the students in your class. Is this a class where a lot of the students tend to do well on most tasks, but are having difficulty with this one in particular? If so, your method would be much different than it would be in a class which has a lot of students who tend to be off task quite often.

In this participant's response, the preservice teacher focuses on the nature of the students in the classroom instead of the particular situation. In many critical incident responses, some students saw expanding on the discourse as an opportunity to discuss the nature of science in a more general perspective.

> Understanding science means understanding the world around you. It can also be important to learn about the things we do not understand about our world and the way it works. In our science class, you learn how to ask good questions about why things happen. You also learn how to search for the answers to those questions. In short, you learn problem solving skills. You are also becoming scientifically literate, and that can be very important in American society.

This participant built on the discourse by placing emphasis on acquiring science process skills and becoming a scientifically literate citizen. This participant continues her dialogue by providing detailed examples on how these skills will assist an individual in making life-improving decisions.

STUDENT ATTITUDES

Preparing to Teach Science

All participants who were interviewed stated that the critical incidents were helpful in preparing them to teach and think about situations that they might encounter during their student-teaching placements. These statements were correlated with responses from open-ended survey questions. "I feel like it prepares you more." "They were problems I could relate to a lot more."

The critical incidents were perceived by these participants as being relevant and meaningful to them not only for their practicum experience but also for their future job placements.

> It's important for us as students to touch on all the fields since we will be generally certified in science. And it may not be important right now, but at least it gives me an idea on how I might handle these issues if say I was to teach in a biology classroom. It might help. A topic like evolution will probably not come up in a chemistry class, but it would in a biology class. At the same time, there are some chemistry examples which may not be used in a biology class. The critical incidents give us the opportunity to react to different situations. It presents a situation where they may not know how to handle it.

This participant acknowledged the fact that it is important to think about all kinds of science topics even though he had a concentration in only one area. The critical incidents compel the participants to think about and respond to certain science teaching problems to which they might not otherwise be exposed.

Touchy Issues

"Evolution is a very touchy issue that can spark serious conflicts among people." "I feel like the ones that are real touchy issues are real important to think about a lot before you get into the classroom." Throughout the forum discourse and in the participants' interviews, the critical incidents were often referred to as "touchy" or controversial issues. Discussing controversial issues was perceived by these participants as getting them "fired up" and very interested in hearing how their peers thought or how they would react to the situation. Some also stated in the interviews that they extended the discussion of these "touchy issues" outside of the forum with other teachers at their school placements.

DISCUSSION

In traditional student teaching practicum experiences, preservice teachers are often disconnected from their peers in other classrooms. Separated by geographical barriers, preservice teachers interact sporadically with university faculty and rely almost exclusively on cooperating teachers for guidance, information, and support. The SciTeach Forum provides a place for preservice teacher reflection even across geographical distances. Interacting in the critical incidents topic of the forum provided preservice science teachers the means and opportunity to develop as reflective practitioners and engage in thoughtful discourse about science teaching practices. In addition, the dialogue prompts used in the presentation of the critical incidents seems to be an important factor in the development of common meaning that appears in the discourse. The discourse in the critical incidents topic of the SciTeach Forum is thoughtful and promotes a reflective practice in which a group of preservice teachers engage in a dialogue that involves asking focused questions, seeking common meanings in teaching practice, and constructing ideas in collaboration with other preservice teachers.

Although the preservice teachers are interested in discussing controversial topics on the forum, it appears that most of them respond by "playing it safe." In general, most preservice responses are conservative in nature and very few present risk-taking ideas in the classroom. Some interviewed participants noted that a possible reason for this is the open, nonrestrictive nature of the forum. Participants realize that anyone with access to the Internet can view their postings so they might take this into consideration before they place a posting on the forum. It appears that the open, public nature of the forum limits how preservice teachers use the forum to communicate their ideas. Perhaps adopting an alias would encourage a wider range of responses.

Nonfacial communication issues are important to this situation. Communication exchange is not guaranteed among all participants since participants can choose selectively, which postings to read or not to read. Most participants stated that they read messages posted on the forum by scanning the content for issues of interest while disregarding or skimming other messages. One participant stated that he normally skims through messages and reads only those posted by peers from his science-specific methods class. Furthermore, the comfort level with the web-based medium itself might be

a factor in how students communicate with each other. Since the forum provides a means to communicate asynchronously, it permits the more timid and reflective learners in a group a chance to participate in the discussion more than they might in a face-to-face conversation. The structure of the forum also enables each participant the opportunity to reflect on what has been said, think critically, and then respond.

The discourse in the critical incidents section provides university instructors with a unique insight into the thoughts and concerns of their preservice teachers. Issues of power, status, and authority between preservice teachers and cooperating teachers appear throughout the dialogue. Often, the participants discuss how they would handle a situation when they would be given their own classroom and discuss the limitations they perceive as having when they are in their cooperating teacher's classroom. The discourse also offers a "lurker" (those who only read posted messages and do not respond) insight into the participants' views of the nature of teaching. This includes how preservice teachers talk about student-teacher interactions and the types of science-specific pedagogy they would implement or actually do implement in their classrooms.

The participants' notion of how they define their cohort varied in this study. Most participants viewed their cohort as being only the students from their science content-specific methods course. However, some participants did view all participants on the forum as part of one big cohort group. This differing view might be due to the nature of their specific methods course and how the student interacted within that cohort.

Having a large number of respondents to a critical incident appears to cause a saturation effect in the discourse. In many of the message threads, after approximately half of the students responded, the responses began to "sound along the same lines." Some students read the postings of others and said basically the same thing with a new twist to the dialogue. In some cases, the students responded to the critical incident without reading the responses of others. Some participants stated in interviews that being educated in a similar fashion might also be a reason why the preservice teachers responded in similar ways. However, this was not the case for all participant postings in the latter stages of the discourse. There were students who often posted toward the end of the message thread with a reflective posting that built on the ideas of others. To reduce this saturation effect, one might want to consider reducing the number of participants responding to a

critical incident, or have a group of students adopt a "devil's advocate" role in their response to the discourse generated in a critical incident thread.

Relevance to the Field

Web-based forums are computer-conferencing tools that can be used to promote reflective thinking regarding critical issues in science teaching to preservice teachers in remote student teaching placements. As an educational tool, implementing discussion of critical incidents in science teaching through computer conferencing provides an effective and efficient means of sharing ideas, generating new meanings in educational practices, and communicating among peers from remote geographical placements. Since asynchronous communication allows for the rules of communication to be changed, web-based forums can be structured to create an environment, which promotes critical reflection on teaching. This study is relevant to anyone who works with preservice teachers and is interested in structuring web-based forums as a virtual discussion area to promote critical reflection in science teaching.

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APPENDIX A
INTERVIEW QUESTIONS

The following is a list of questions used in the interviews:

What specific experiences of this electronic activity was most valuable?

What specific experiences of this electronic activity was least valuable?

How did the "critical incidents" help to prepare you for your student teaching practicum experience?

How has interacting with the "critical incidents" topic influenced your teaching approaches and decision making?

How do you read the conversation threads in the web-based forum?

How is the web-based forum like a community network?

What seems to affect the depth of the dialogue in the web-based forum?

What are the differences between web-based communication and face-to-face communication?

How does the web-based medium promote discussion?

How does the web-based medium inhibit discussion?

APPENDIX B
SCITEACH FORUM OPEN-ENDED QUESTIONNAIRE ITEMS

1. What was the most beneficial aspect of using the SciTeach forum during your student teaching experience?

2. What is the least beneficial aspect of using the SciTeach forum during your student teaching experience?

3. What types of learning assistance and support did you receive on the forum?

4. Did your peers give you much feedback? If so, what was it and how did it help? If not, what could be done to improve it?

5. What types of topics or discussion threads spurred the most discussion?

6. List any instructional techniques or activities that you learned from the SciTeach forum.

7. Were you able to communicate with other student teachers with "face-to-face" interactions at your school placement?

8. Have you ever discussed forum topics with anyone else? If so, with whom?
Which topics did you discuss?

9. How can such a web-based conferencing tool contribute to the professional development of preservice and licensed teachers? Feel free to suggest any idea that comes to mind, even if you think it may sound too expensive or very silly.

10. How is communication on the web-based forum different from face-to-face communication?

11. How does the web-based forum promote or inhibit online discussion?

12. How would communicating with an e-mail list be different from using a web-based forum? Which do you think would provide a better means of communication during your student teaching internship? Why?

13. How do you think the discussion on the SciTeach forum would be different if access was restricted only to NCSU preservice teachers and faculty?

14. What improvements would you suggest for the SciTeach forum?

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