Cybermentoring: Evolving High-End Video Conferencing Practices to Support Preservice Teacher Training

Todd E. Johnson, Ph.D.
Gerald H. Maring, Ph.D.
John H. Doty
Michelle Fickle

Washington State University

Abstract

This article is a descriptive study of an evolving cybermentoring videoconferencing practice and tool developed to support preservice teacher training. Cybermentoring projects are synchronous distance learning collaborations using high-end video conferencing to foster interactive learning and tutoring among preservice teachers and K-12 students, all of whom are mentored by classroom teachers and university faculty. Cybermentoring for preservice teachers is situated within the theoretical frameworks of constructivism and "co-teaching." A list of projects and two streaming videos illustrating these projects facilitated by our state's cyberinfrastructure are provided. In addition, a case study of one cybermentoring project is presented in terms of its procedures, participants, and participant reflections. The benefits and challenges of cybermentoring are discussed before five suggestions [technology training, strengthening the assessment skills of the cybermentors, improved assessment of tutee learning, use of focus groups, and recommended use of high quality desktop videoconferencing] for improving cybermentoring projects are offered.

Cybermentoring projects at our university are collaborative ventures between the university and K-12 schools in the state. Through high-end videoconferencing, our preservice teachers are provided distance education opportunities to tutor students in course content, literacy, and communication skills (Boxie & Maring, 2001). Since 1998, the cybermentoring project has evolved in its use of various technologies, paralleling the growing recognition of videoconferencing as an effective way to mentor and provide distance education connectivity for preservice teachers (See Malewski, Phillion, & Lehman, 2005; Phillion, 2003; Selim, 2005; Wright, Wilson, Gordon, & Stallworth, 2002).

Cybermentoring, through high-end videoconferencing, allows for interaction between school sites, even at great distances, with television-like clarity and premium sound quality. These capabilities allow for the creation of partnerships between remote sites while still maintaining many of the facets of face-to-face communication crucial for quality educational experiences. Cybermentoring can be fruitful because it provides opportunities for preservice teachers to tutor K-12 students while being mentored by classroom teachers and faculty.

Many specialists and researchers in the field of education (e.g., Feiman-Nemser, 2001; Goodlad, 1990; McDuffie, Akerson, & Morrison, 2003; Ohana, 2004) have recognized the need for the inclusion of early and more extensive field experiences in preservice teacher education programs. Early field experiences can help familiarize preservice teachers with institutional and relational aspects of the job of teaching (Goodlad, 1990), develop their awareness of diverse student cultures and backgrounds (Sleeter, 2001), acquaint them with barriers to learning faced by some students (Edwards, 1996), and increase their sense of preparedness to teach (Fry & McKinney, 1997). Preservice teachers, on their part, have also identified field experiences as among the most useful elements in their teacher education programs (Winey & Squibb, 1991). However, much research and questions remain to determine what types of early experiences are effective for preservice teachers, what kind and depth of learning results from these experiences, and how to help preservice teachers integrate this experiential learning with the declarative and theoretical knowledge gleaned from their learning experiences.

The purpose of this article is to provide a descriptive study of an evolving cybermentoring videoconferencing practice and tool developed to support preservice teacher training. This descriptive research is presented as a first step towards more rigorous studies of cybermentoring. First, we discuss how theories of constructivism and "co-teaching" are related to cybermentoring experiences. Second, we provide a brief overview of our state's facilitating cyberinfrastructure and then list the more than 35 cybermentoring projects we have completed to date. Thirdly, for the sake of a more in-depth description and analysis, we present details from a grade 1 tutorial [general procedure, participants, tutorial materials, and various results]. Further in-depth results are offered in the form of a professor's reflections which span his 3 years of participation. After discussing general benefits and challenges, we make 5 recommendations for improving future cybermentoring projects. We conclude by discussing the need for additional research to determine the appropriate application of videoconferencing systems as the technology becomes more available for school and university use.

Preservice Teacher Training: Constructivism, "Co-Teaching" and Cybermentoring

Constructivism, a widely used theory of learning in distance education, was founded on the premise learning occurs and is enhanced when we reflect on our experiences and participate in social-dialogical processes (Duffy & Cunningham, 1996; Yuzhu Teng & Allen, 2005). As a model of learning, constructivism maintains that individuals create new knowledge or understanding through involvement with content rather than through repetition or imitation (Cannella & Reiff, 1994; Kroll & LaBoskey, 1996; Richardson, 1997). Learning activities in constructivist settings are characterized by active engagement, problem solving, and collaboration with others. However, many preservice teachers, especially at early stages of their academic programs, have not had experiences or collaboration with practicing classroom teachers to help them construct understandings regarding teaching and learning. Therefore, preservice teachers are left to construct an understanding of curriculum, instruction, and schooling that lacks experiential and cognitive validity. Scaffolding or mediated learning from those more knowledgeable is important in helping these preservice teachers achieve these cognitive understandings (Slavin, 2003) and is an essential component of the cybermentoring learning experience.

As shared in the educational literature, learning to teach should be more than a hoped-for outcome of coursework. Coursework alone, lacking opportunities to practice, challenge assumptions, or even apply and see evidence of student improvement through teaching-related experiences provides only half the experience necessary to becoming a teacher (Ball & Cohen, 2000; Hill, Rowan, & Lowenburg-Ball, 2005, Kaufman, 1997). Moving to an approach in which preservice teachers learn to teach in more authentic contexts should help them consider alternative perspectives and attend to relevant knowledge. Exploration of such frameworks is paramount. As Feiman-Nemser & Remillard (1995) note, "we have some evidence that powerful and innovative teacher preparation can affect the way teachers think about teaching and learning, students, and subject matter" (p. 3). Through cybermentoring, preservice teachers are provided this experiential opportunity to practice teaching, and also receive the benefits of receiving mentoring from practicing classroom teachers and faculty while providing a service to K-12 students (see Akmal & Maring, 2004; Boxie, 2004; Maring, Levy, & Schmid 2002).

Cybermentoring projects offer a way in which preservice teachers can be challenged to consider their beliefs and values about teaching. A successful mentoring relationship with a practicing classroom teacher and faculty member, an early form of collaboration, can provide the guidance, support, and opportunities for inquiry and reflective practice necessary to ensure professional growth. Typically, applying mentoring practices in a preservice teacher education program has consisted of the support provided by a university supervisor and the cooperating teacher only during the student teaching practicum. In other words, little to no opportunity for mentoring experiences prior to practicum courses and student teaching has traditionally been available for preservice teachers. By using videoconferencing to tutor K-12 students, preservice teachers can receive mentoring from classroom teachers as well as from faculty in cybermentoring projects which can be considered a form of "co-teaching" (Eick, Ware, & Williams, 2003; Roth & Tobin, 2002; Roth & Tobin, 2005).

Co-teaching experiences that include cybermentoring activities enable preservice teachers to learn through praxis, since they teach, dialog, and reflect collaboratively in a supportive, real environment (Roth & Tobin, 2002; Roth & Tobin, 2005). Thus, cybermentoring, as a "co-teaching" opportunity, provides three benefits. First, it serves as a model that provides support for quicker development of both instructional and subject matter knowledge (Malewski, Phillion, & Lehman, 2005). Second, it enables student teachers to focus on the practice of teaching earlier in their career (Eick, Ware, & Williams, 2003). Third, as found by Yuzhu Teng & Allen (2005), it provides participating preservice teachers the opportunity to integrate and learn about the application of technology early in their preservice teacher curricula. This third "benefit" also provides them the opportunity to enhance their self confidence and willingness to use technology in the future (Yuzhu Teng & Allen, 2005).

Cyberinfrastructure and Cybermentoring

In this section, we describe first the cyberinfrastructure that facilitated our use of high-end videoconferencing**.** We then provide an overview of the three phases of the cybermentoring projects we have completed to date.

Cyberinfrastructure

The Washington Higher Education Telecommunication System (WHETS), the interactive video system initiated in 1981, has grown to one of the largest university compressed video systems in the country based on hours of programmed use (WHETS, 2005). Annually it delivers almost 13,000 hours of programming that includes over 250 courses per year and 1,000 hours of videoconferencing to numerous university classrooms and learning centers within state (WHETS, 2005). Throughout its two-decade history, the system has continued to evolve as new technologies have become available, allowing WHETS to be responsive to the needs of the university and, in particular, its faculty. This evolution has proceeded from analog microwave broadcasting full motion video, to multiplexed analog, to digital microwave using full T-1 compressed video, and, finally, to leased commercial transmission and half-T-1 bandwidth along with IP video and video streaming.

Building on the success of WHETS, the state of Washington embarked on a multi-million dollar investment in telecommunications infrastructure in the mid 1990s that allowed for connectivity and transmission capability between all of the state's four-year institutions, community colleges, and the K-12 system. The four-year institutions and community colleges were added to the system relatively quickly, while K-12 lagged somewhat behind. However, by the end of the decade ISDN and internet capabilities were available to all the schools in the state. Most K-12 schools, though, choose to utilize their limited resources on computer and internet resources rather than videoconferencing. Some schools with particular needs and larger school districts began investing in videoconferencing technology. Despite the typical challenges associated with purchasing and types of equipment, the state's K-20 infrastructure provides numerous opportunities for interaction between all levels of institutions and schools in the state.

Cybermentoring Phases

Three Phases of Cybermentoring. Cybermentoring activities were originally done through Internet Service Delivery Networks (ISDN), but are now being conducted through IP (Internet Protocols using computers) connections. Various integrated technologies are also used. For example, high-end video conferencing equipment [e.g., Polycom View Station FX Codec], desktop and laptop computers [including tablet pc's], document cameras [e.g., Canon RE-450X Projector], VCR's used for research and training purposes, university server for archiving lesson plans, and Whiteboards [e.g., www.smarttech.com]. Each of the evolving transitions was done in tandem with the continued expansion and growth of the states' cyberinfrastructure.

To date, over 35 cybermentoring projects have been completed. The link to the streaming video clip in Figure 1 [using Microsoft® Windows Media® player] illustrates the transition of cybermentoring from desktop to high-end video conferencing and from the use of asynchronous to synchronous distance learning technologies.

Figure 1
Video Clip of Evolving Cybermentoring Projects from 1998 to Present.
http://experience.wsu.edu/cybermentor/cybermentor1.asx

- **Phase I ---- Cybermentoring Collaborations By Means of Webpages and Email Feedback Links:** Cybermentoring projects, using web pages with email links, were used by university and K-12 school students to facilitate collaborative distance learning opportunities for students in rural schools. Grade levels and lessons included some of the following; grade 1 rain forest units, grade 1 classroom newspaper unit, grade 2 science unit, grade 7 science literacy unit, grade 8 short story writing, grade 8 geology unit, grade 10 math and physics unit, alternative high school writing unit, and GED writing unit in Spanish and English.

- **Phase II ---- Cybermentoring Collaborations Using Desktop Video Conferencing** (i.e., iVisit, CU-SeeMe, NetMeeting)**:** Next the project moved from email and web pages to adding desktop video conferencing in selected cybermentoring projects such as grade 1 multicultural literature unit, grade 3 friendly letter writing unit, grade 5 social studies election unit, grade 4-5 literature circles unit, grade 7 earth science unit, and grade 11 chemistry water quality unit.

- **Phase III ---- Cybermentoring Collaborations Using High-end Video Conferencing:** Moving from desktop videoconferencing to utilize high-end video conferencing, evolving in tandem with our state's cyberinfrastructure, we then started to provide tutorial opportunities for grade 1 phonics and reading fluency, grade 3 reading assessment and remediation, grade 3 Accelerated Reader program support, grade 4 science weather unit, grade 6 special education math, grade 9 reading immersion unit, grade 9 earth science curriculum planning, grade 6-8 reading comprehension and fluency, grade 8 remedial math, grade 9 ESL tutoring (Russian), grade 10 math problem solving, and grades 8-11 integrative curriculum materials using engineering education/math applications.

Cybermentoring Project Case Study

In this section we explore cybermentoring in a more in depth fashion by describing aspects of a first grade cybermentoring project that spanned 3 semesters.

METHODS

General Procedure

Cybermentoring projects conducted through regular undergraduate preservice teacher education courses have two primary components. First, preservice teachers read, review, and discuss professional texts and articles to provide a foundation in such areas as learning to read (Armbruster & Osborn, 2001), reading to learn (Vacca & Vacca, 2004), or quantitative literacy (Hiebert & Carpenter, 1992; Fennema, Franke, Carpenter, & Carey, 1993; National Research Council, 1990). Small groups of preservice teachers, teamed through common interests, are then paired with a classroom teacher. Initial planning meetings are used to identify educational and tutorial goals with each of the preservice teachers, with support from the classroom teacher and faculty. Faculty, teachers, and preservice teachers work up an assessment plan to document the K-12 students' overall performance towards achieving the educational goals.

Participants -- Tutors and Tutee

Participants in the following case study included a first grade student in a large urban school (over 300 miles from the university) and two preservice teachers. The project took place over a sixteen-week period in the Spring semester of 2004. The goal was to increase the student's reading fluency as measured by the practicing classroom teacher's use of a words-correct-per-minute (wcpm) rubric.

Tutorial Materials

Tutoring materials were parts or adaptations of the *Read Well Program* (Sprick, Howard, & Fidanque, 1998), which had been adopted for classroom use by the school district. Each of the tutorial sessions was thirty minutes long and took place two days a week. During the tutoring sessions, the preservice tutors worked with the student to improve reading fluency through the use of duet reading, solo reading, and timed reading techniques contained in the *Read Well Program*. The preservice tutors also used comprehension strategies that included oral retelling, looking back at the text, and oral re-reading throughout the tutorials. A link to a video clip of the Grade 1 reading fluency preservice teacher tutorial is provided with Figure 2 [using Microsoft® Windows Media® player].

Figure 2
Video Clip of Reading Fluency Cybermentoring Tutorial with a Grade 1 Student and Preservice Teachers *http://experience.wsu.edu/cybermentor/cybermentor2.asx*

RESULTS

Student Impact

For the first grade student, cybermentoring tutorials began in the 17th, 18th, and 19th weeks of the school year, when the student's reading fluency was below grade level, as measured in these weeks at 38, 36, 33 words-correct-per-minute (wcpm), respectively. By the 29th and 30th week, the student's wcpm scores in reading fluency were 74 and 73, respectively. These data indicated that the struggling reader, during the time of the cybermentoring-supported instruction, was able to surpass the first grade criterion-related benchmark set by the state of Washington for read aloud-unpracticed grade-level text by demonstrating a fluency in a range of 50–65+ words correct per minute (OSPI, 2005).

Teacher Reflection

The classroom teacher, in a letter to the director of the cybermentoring project, wrote:

> *"This student entered the first grade knowing virtually no letters or sounds. He advanced through the reading groups quickly and was almost on grade level by the time he left our school. I do believe the Cybermentoring played a big part in his success. He was very excited to interact with the cyber-mentors and this motivated him to want to read well."*

Although the teacher's instruction *and/or* the power of tutoring far more than tutoring via videoconferencing may have caused the student's gains in reading fluency, there is clearly a relationship here between cybermentoring and reading improvement. To determine strict causality, treatment/control comparisons and participant randomization would have to be designed into future investigations. The teacher also shared the following reflection at a different time:

> *"I would even be willing just to have the Polycom in there if you want preservice teachers to observe the teaching and maybe not interact with students or* [just so that] *they could ask questions, like students. I think that would be very valuable*

for them. I know it would have helped me as a preservice teacher to watch some teaching going on."

Reflections of Two Cybermentors

One of the participating preservice teachers wrote the following reflection:

"Based upon my observations of the [taped] reading sessions …I feel [the student] may have bypassed the fluency stage . . . . [for] his level of comprehension seemed to be quite high. When [the student] was reading, it seemed as though his focus was to understand the material . . . rather than to read every single word … in a smooth and flowing manner. [He] had a tendency to skip phrases . . . and substitute contractions ["shouldn't" for "should not"]…which affected his fluency scores, but when confronted, he would immediately identify the phrase he skipped. This showed that he was aware of what he was reading and may have been reading in his head faster than he was reading aloud. . . . [He] also had a tendency to add embellishments . . . when told to read with feeling. But his embellishments fit with the meaning of the text. When [the student] was told to read the passages he made mistakes on again and pay attention to every word, he would read the passages accurately. Upon completion of the passages he read, he would engage the tutor in discussions about the subject matter of the passages and ask questions about unfamiliar concepts and phenomena . . . . perhaps [the student] was further along in his reading development than his wcpm fluency scores would indicate….perhaps our current methods of assessing reading abilities of students in the classroom may need to be re-evaluated."

These insights indicate that this preservice teacher had developed significant insights about the learning to read process [e.g., acceptable vs. unacceptable oral reading word substitutions and omissions].

Another preservice teacher, even though she was just beginning her program of study, also provided insightful comments, in this case related to concepts taught in her teacher preparation program, her preferred style of teaching, specific reading strategies, and her own confidence from using advanced and integrated technologies as a teaching and learning tool.

. . . I learned a lot . . . .

I was able to see first hand how children respond to the Read Well program by observing Miss ____ teach a lesson. From other classes [here on campus], *I knew that kids respond very well and feel better in a structured environment. Because of Read Well's structure, these children were able to thrive. They were especially engaged through music, when they sang various songs about phonics and phonemic awareness…. I learned a lot about myself during the project. I learned how much, despite how organized I am, I like structure and predictability….I learned a lot about reading and reading strategies. I was surprised that the first graders were reading such difficult words!….The project afforded me the opportunity to participate in video conferencing. At first, I was VERY nervous about this----being a very camera-shy person. But after about 5 minutes with the student I was tutoring, my shyness was overtaken by my desire to reach this child and help him learn to read. I found that I was no longer apprehensive about being on video because it helps* [when students] *see your facial expression and body language. I also quickly mastered*

the document camera and began to appreciate it. With the first graders, it was the easiest way to communicate. Without the document camera, I do not know if I would ever have found the page he was on. By using it, and zooming out to see the full page, and zooming in to see an individual word, I was able to show the student exactly where I wanted him to be, and he was able to follow along. . . . All in all, I think this was a good learning experience, and I feel I walked away with more knowledge about how kids learn, and about the Read Well program, than I learned through the course readings. It was very rewarding. I only wish I could have done it more.

Faculty Reflections

One participating faculty shared "*cyber-tutorials provide an opportunity for students to develop a deeper understanding of diverse learners in the K-12 classroom.*" In the following summative reflection, another participating faculty provided extensive evaluative judgments, quotes, and recommendations related to this and many other cybermentoring projects that were completed during a 3- year span. His comments, which include some direct quotes, deal with a wide range of significant benefits and challenges accruing to preservice teachers through cybermentoring;

In general, students saw the cyber-tutoring as a rich learning experience where they not only gained knowledge of students with learning needs they (the tutors) had never encountered before, but they could also learn about technology and content reading. As the cyber-tutorials branched out beyond reading classes to encompass science and math, more students became interested in participating. Students who participated in the process were surprised by the diverse learning needs of the students, something that most of them had not encountered except rather superficially through their own schooling or in other "field" experiences. Several students observed how their views of the project had changed from "just an assignment" to a "meaningful experience." Students who did this really felt as if they were helping students who really needed their help—a good feeling. They noted that they "…had not realized how teaching the neediest students could be so rewarding." In fact, two students opted for a student teaching experience in a similar school setting instead of the affluent suburban schools nearest to their homes. Others, when prompted to consider what they learned from the cyber-tutoring, discerned that they "really had no idea of what goes on in urban schools" while others remarked on what a "marvelous way it was" for them to learn about remote rural schools or reservation schools. Places, heretofore, they never knew existed.

Despite overwhelming enjoyment and benefit from the experience, it was not without its challenges. Students were polled regarding problems or situations that arose with which they had to cope—sometimes on their own. The cyber-tutors uniformly noted that when the teachers saw cyber-tutoring as an opportunity to remove a child from their classroom or to turn over supervision to someone else, namely the cyber-tutors, cyber-tutoring was not satisfactory for either party. "We feel like we are sometimes a 'dumping ground' for students the teacher doesn't want to deal with," commented a student. Others agreed with that assessment. However, the cyber-tutors also recognized that teachers were juggling so many responsibilities that sometimes it was impossible for them to find the time to substantively guide the development of the curriculum,

instruction, or assessment. Equally challenging was that sometimes the technology simply failed. This factor, in the early phases of the project, caused some students to give up. "We come in psyched up to meet with the students and then can't make that connection. It's just frustrating," complained a student in one of the sessions. Because students did not have enough training to resolve those "glitches" themselves, their attempts to work the equipment would be fruitless. Later, as technology facilitators were provided, those problems were minimized.

An additional challenge to optimal cyber-tutoring was that some teachers had outmoded ideas of the way the technology should be used. Several students complained that they "got the feeling that the teacher at that end really wanted to feel needed by the students at XXX"—that is, that the teacher really wanted to pull the student aside and say, "Listen, all that stuff you are learning at XXX is fine, but this is the real classroom and I have the information you really need." To some students that was offensive because they did not believe it described their program or their preparation.

Even with the many factors that could cause the program to fail and the cyber-tutoring to be, ultimately, a waste of time, students saw it as highly beneficial to their own understandings of teaching and student needs.

DISCUSSION

General Benefits and Challenges of Cybermentoring

Cybermentoring is built upon the research supporting the benefits of improving students' academically through enhanced study skills, confidence, and classroom grades through tutoring (Bloom, 1984; McArthur, Stasz, & Zmuidzinas, 1990; Hock, Schumaker, & Deshler, 1995; Vadasy, Jenkins, Antil, Wayne, & O'Connor, 1997). However, rather than traditional face-to-face tutorial sessions, cybermentoring makes use of new and emerging technologies. By using these new technologies, interactions between peer groups, mentors and students in remote locations are made possible. These relationships are fruitful because they provide opportunities for preservice teachers to tutor and mentor K-12 students. Preservice teachers are also provided mentoring by participating teachers and can gain valuable practicum experiences while serving the needs of K-12 students. The overall essential ingredient to successful cybermentoring projects has been the importance of communication among the stakeholders. At times this can be challenging, given occasional connection problems. Fortunately, when connections fail, Email, FAX, telephones, and even site visits provide communication solutions that augment cybermentoring until the high-end video is up and running again. Our experience has also revealed that using paired preservice teachers in the tutorial sessions with pairs of tutees has also been beneficial to overcoming occasional scheduling conflicts and missed tutorial sessions by one of the pairs (Johnson & Gardner, 2004). Faculty, as stakeholders, must also take an active role in providing the mentorship and leadership to keep the projects focused and providing timely feedback to the preservice teachers. Through this feedback, the preservice teachers receive valuable insight regarding how to be critically reflective of their tutoring and learning.

Suggestions for Improving Cybermentoring

Providing technology training. While carrying out cybermentoring using videoconferencing, many challenges have been associated with the need to make sure that all participants are trained in the use of the high-end video conferencing systems. Practice involving the making of two pilot connections prior to the actual tutorial sessions has been found to be invaluable in building confidence and solving problems with regard to the operation of the systems. However, each transition to adopt new technological advances has continued to pose additional challenges with regard to making sure the technology does not become the primary learning objective over either that of the content and skills development or that of the learning objectives of the tutorial sessions. To address this challenge, hands on experience and written materials for those using the technology are essential. When these have been utilized before the tutorials begin, we have found that there is reduced time spent talking and discussing the technology during the tutorial sessions and increased time spent discussing the content and literacy and other skills inherent to the tutorials (Johnson & Gardner, 2004). The number of successful on-line connections, reduced requests for university technology support, and increased frequency of on-time tutoring sessions have also provided indications and documentation related to growth in technology skills on the part of the cybermentors.

Strengthening the assessment skills of the cybermentors. A second suggestion for improvement of cybermentoring is in the area of the learning environment of the preservice teacher's skills in classroom assessment. Quality assessment tools for measuring K-12 student learning need to be developed and include: 1) The identification of the most important student learning outcomes; 2) Assessment tasks and tools matching the knowledge and skills of the students and their teachers; and 3) the provision to teachers of companion assessment guides and tools (Popham, 2001). How can this challenge be met? One solution [currently being explored] would be to recruit preservice teachers who are concurrently enrolled in a course teaching assessment. Preservice teachers who are cybermentoring while taking an assessment course would have opportunities to collaborate with peers, infuse assessment into the instructional materials, and pilot assessment instruments and rubrics. Simultaneously, the practicing classroom teachers and faculty of these courses would also have opportunities to mentor the preservice teachers in modifying and evaluating the assessments, thereby making them more practical and applicable to the tutoring and application of course content.

Improving the assessment of how cybermentoring impacts student learning. A third way of strengthening cybermentoring relates to the assessment of impact on student (K-12) learning. The use of school district readily available assessment tools and measures like the Northwest Educational Association's (NWEA) *Measures of Academic Progress* (NWEA, 2005) could be used to assess the impact on student learning. The NWEA *Measures of Academic Progress* are a series of computerized adaptive tests that measure a student's general knowledge in reading, language usage, and mathematics (NWEA, 2005). Of particular interest and usefulness for measuring the impact on student learning would be the yearly administration of an instrument similar to this in classrooms or schools utilizing cybermentoring tutorials. In addition, these increasingly common yearly academic assessments provide an opportunity for preservice teachers and practicing teachers to reflect, understand, and learn how standardized assessment results relate to teacher-made assessment tools and rubrics in enhancing instructional materials and pedagogy.

Using focus groups. The development of focus group interviews could be used with the cybermentors and K-12 students receiving tutoring in an attempt to garner a more holistic picture of their cybermentoring experiences. These enhancements could further define and clarify the expectations and responsibilities of the cybermentors within a teacher preparation program and could provide the impetus to offering a greater degree of purpose and belonging for the cybermentors.

Using high quality desktop videoconferencing. As noted in the first section of this article, cybermentoring has made a transition away from desktop technologies like iVisit, Netmeeting, and CU-SeeMe and began to use high-end video conferencing systems. Because desk top systems and IP related technologies to support them [e.g., Microsoft Conference XP, Microsoft Live Meeting, Centra, Marratech, Arel] have improved so much and since so many of the high-end video conferencing systems have increased in price, desktop systems may need to be considered in future cybermentoring projects as the bandwidth that they are connecting at is continually being enhanced.

Concluding Remarks. Cybermentoring is an innovation that should continue to be explored in new ways related to assessing its impact on student achievement and for enhancing the effectiveness of synchronous distance learning tutorials. Cybermentoring initiatives are situated within the proof of concept and research and development arenas. We have offered our analyses and recommendations in this article because we feel cybermentoring holds promise as an educational innovation and because we feel that it is worthy of new and improved applications and of further research at all levels, perhaps most importantly at the program evaluation level.

REFERENCES

Akmal, T., & Maring, G. (2004). Bridging the gap: Using cyber partnerships to connect with distant schools. *The Teacher Educator, (40)*2 69-90.

Armbruster, B., & Osborn, J. (2001). *Put reading first: The research building blocks for teaching children to read.* Washington, DC: National Institute for Literacy. Retrieved April 8, 2005, from http://www.nifl.gov/partnershipforreading/publications/reading_first1.html

Ball, D., & Cohen, D. (2000). *Challenges of improving instruction: A view from the classroom.* Washington, DC: Council of Basic Education.

Bloom, B. (1984). The search for methods of group instruction as effective as one-to-one tutoring. *Educational leadership, 41*(8), 4-17.

Boxie, P. (2004, September). Cybermentoring: An Online Literacy Project in Teacher Education. *T.H.E. Journal.* Retrieved April 8, 2005, from http://www.thejournal.com/magazine/vault/A4976.cfm

Boxie, P., & Maring, G. (2001, May). Cybermentoring: The relationship between pre service teachers' use of online literacy strategies and student achievement. *Reading Online, 4*(10). Retrieved April 8, 2005, from http://www.readingonline.org/articles/art_index.asp?HREF=boxie/index.html

Cannella, G., & Reiff, J. (1994). Individual constructivist teacher education: Teachers as empowered learners. *Teacher Education Quarterly 21*(3), 27-38.

Duffy, T., & Cunningham, D. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), *Educational communications and technology* (pp. 170-199). New York: Simon & Schuster Macmillan.

Edwards, T. (1996). Implications of a model for conceptualizing change in mathematics teachers" instructional practices. *Action in Teacher Education, 18*(2), 19–30.

Eick, C., Ware, F., & Williams, P. (2003). Co-teaching in a science methods course: A situated learning model of becoming a teacher. *Journal of Teacher Education, 54*(1), 74-85.

Feiman-Nemser, S. (2001). From Preparation to Practice: Designing a Continuum to Strengthen and Sustain Teaching. *The Teachers College Record 10* (6), 1013-1055.

Feiman-Nemser, S., & Remillard, J. (1995). Perspectives on learning to teach. East Lansing, MI: Michigan State University. Retrieved October 11, 2005, from http://ncrtl.msu.edu/http/ipapers/html/ip953.htm

Fennema, E., Franke, M., Carpenter, T., & Carey, D. (1993). Using Children's Knowledge in Instruction. *American Educational Research Journal, 30*(3), 555–583.

Fry, P., & McKinney, L. (1997). A qualitative study of preservice teachers' early field experiences in an urban, culturally different school. *Urban Education, 32*(2), 184-201.

Goodlad, J. (1990). *Teachers for Our Nation's Schools.* San Francisco: Jossey-Bass.

Hiebert, J., & Carpenter,T. (1992). Learning and Teaching with Understanding. In Douglas A. Grouws (Ed.), *Handbook of Research on Mathematics Teaching and Learning*, New York: Macmillan.

Hill, H., Rowan, B., & Lowenberg Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student. *American Educational Research Journal, 42*(2), 371-406.

Hock, M., Schumaker, J., & Deshler, D. (1995). Training strategic tutors to enhance learner independence. *Journal of Developmental Education, 19*, 18-26.

Johnson, T., & Gardner, S. (2004, April). *Learning technology implementation: Cybermentoring.* Poster session at the annual meeting of the American Educational Research Association, San Diego, CA.

Kaufman, D. (1997) Collaborative approaches in preparing teachers for content-based and language enhanced settings. In M.A Snow and D.M. Brinton (Eds.), *The content-based classroom: Perspectives on integrating language and content (pp175-186).* White Plains, NY: Longman.

Kroll, L., & LaBoskey, V. (1996). Practicing what we preach: Constructivism in a teacher education program. *Action in Teacher Education 18*(2), 63-72.

Malewski, E., Phillion, J., & Lehman, J. (2005). A Freirian framework for technology-based virtual field experiences. *Contemporary Issues in Technology and Teacher Education, 4*(4). Retrieved May 31, 2005, from http://www.citejournal.org/vol4/iss4/general/article1.cfm

Maring, G., Levy, E., & Schmid, J. (2002, November). Variations on a cybermentoring theme: Six literacy projects involving preservice teachers and students across grade levels. *Reading Online, 6*(4). Retrieved April 8, 2005, from http://www.readingonline.org/articles/art_index.asp?HREF=maring2/index.html

McArthur, D., Stasz, S., & Zmuidzinas, M. (1990). Tutoring techniques in algebra. *Cognition and Instruction, 7*, 197-244.

McDuffie, A., Akerson, V., & Morrison, J. (2003). Designing and Implementing Meaningful Field-Based Experiences for Mathematics Methods Courses: A Framework and Program Description. *The Mathematics Educator, 13*(1), 22-32.

National Research Council (NRC). (1990). *Renewing U.S. Mathematics: A Plan for the 1990s.*Washington, D.C.: National Academy Press.

Northwest Educational Association (NWEA). (2005). Measures of Academic Progress (MAP). Retrieved April 8, 2005, from http://www.nwea.org/assessments/

Ohana, C. (2004). Extended Field Experiences and Cohorts with Elementary Science Methods: Some Unintended Consequences. *Journal of Science Teacher Education, 15*(3), 233 – 254.

Office of Superintendent of Instruction (OSPI). (2005). *K–10 grade level expectations: A new level of specificity for reading.* Retrieved April 8, 2005, from http://www.k12.wa.us/CurriculumInstruct/Reading/pubdocs/ReadingEALR-GLE.pdf

Phillion, J. (2003). Can technology offer a means of mentoring preservice teachers about diversity? *Mentoring and Tutoring, 11*(1), 43-52.

Popham, W. (2001). Teaching to the test. *Educational Leadership, 58*(6), 16-20.

Richardson, V. (1997). Constructivist teaching and teacher education: Theory and practice. In V. Richardson (Ed.), *Constructivist teacher education: building new understandings* (pp. 3-14). Washington, DC: Falmer Press.

Roth, W., & Tobin, K. (2002). *At the elbow of another: Learning to teach by Co-teaching*. New York, NY: Peter Lang.

Roth, W., & Tobin, K. (2005). *Teaching together, learning together (Eds.).* New York, NY: Peter Lang.

Selim, H. (2005). Videoconferencing-Mediated Instruction, *International Journal of Distance Education Technologies, 3*(1), 62-80.

Slavin R. (2003) *Educational Psychology: Theory and Practice*. Boston, MA: Allyn & Bacon.

Sleeter, C. (2001). Preparing teachers for culturally diverse schools: Research and the overwhelming presence of Whiteness. *Journal of Teacher Education, 52* (2), 94-106.

Sprick, M., Howard, L., & Fidanque, A. (1998). *Read well.* Longmont, CO: Sopris West.

Tobin, K., & Roth, W. (2005). Teaching to Learn: A View from the Field. SensePublishers, Rotterdam.

Vacca, R., & Vacca, J. (2004). *Content area reading: Literacy and learning across the curriculum* (8th. Ed.). New York: Allyn & Bacon.

Vadasy, P., Jenkins, J., Antil, L., Wayne, S., & O'Connor, R. (1997). The effectiveness of one-to-one tutoring by community tutors for at-risk beginning readers. *Learning Disability Quarterly, 20*, 126-137.

WHETS. (2005). Learn about the Washington Higher Education Telecommunication System (WHETS). Retrieved April 8, 2005, from http://whets.wsu.edu/articles/articles.aspx?id=58

Winey, K. , & Squibb, B. (1991). Effective teacher preparation experiences: Student perspectives. *Journal of Research in Education, 1*(1), 79-86.

Wright, V., Wilson, E., Gordon, W., & Stallworth, J. (2002). Master technology teacher: A partnership between preservice and inservice teachers and Teacher Educators. *Contemporary Issues in Technology and Teacher Education, 2*(3). Retrieved May 30, from http://www.citejournal.org/vol2/iss3/currentpractice/article1.cfm

Yuzhu Teng, J., & Allen, J. (2005) Using Blackboard in an Educational Psychology Course to Increase Preservice Teachers' Skills and Confidence in Technology Integration, *Journal of Interactive Online Learning, 3*(4), Retrieved May 30, 2005, from http://www.ncolr.org/jiol/issues/PDF/3.4.1.pdf

Note:
Funding for this paper was in part by the National Science Foundation (NSF) Bridges for Engineering Education (BEE) Grant No.: EEC-0342056 titled *The CyberMENTOR [Mathematics and Engineering via New Technologies: Outreach and Recruitment] Planning Project: A series of monthly themed technology summits*. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the author(s) and do not necessarily reflect the views of the funding sources.