Multiple Platform Videoconferencing to Support Teacher Education and Professional Development in Mathematics

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Introduction

Stigler and Hiebert reflecting on research findings related to the Third International Mathematics and Science Study in *The Teaching Gap* (Stigler and Hiebert 1999) note that there is a direct connection between improving students' learning in mathematics and improving the quality of teaching. One critical area related to the improvement of teaching is through opportunities for teachers to collaborate and communicate in various ways regarding innovations. Videoconferencing offers one avenue to support communication and collaboration among mathematics educators. As identified by both the International Society for Technology Education (ISTE 2000) and the International Federation for Information Processing (IFIP 2002), technology should be used by teachers to enhance their own professional practice as well as support the teaching and learning of mathematics.

The National Council of Teachers of Mathematics in *Principles and Standards for School Mathematics* (NCTM 2000) identifies technology as a guiding principle for the teaching and learning of mathematics and calls for teachers to use technology to support a strong learning environment. The current focus on teacher professional development and the need for stronger mathematical content support provide a basis for using technology to make the connection to support teacher educators. The nature of these problems points to continued professional development along with proper support as a solution. The appropriate use of technology can assist mathematics educators in deepening understanding of mathematical content and delivery, lesson development, and collaboration. This initiative directly impacts students and their mathematical experiences.

Overview of C^3 Project

The C-cubed project, C^3: Content, Collaboration, and Connectivity (2002) has attempted to provide teachers and students an opportunity to enhance teaching and learning in mathematics through exploring new designs and applications of ICT while researching the impact of ICT on teacher education through both professional development and teacher preparation programs. The project is led by a private Texas university's School of Education in collaboration with the university's Mathematics Department and a local school district. It is currently in its second year of research. The content component is mathematics, with a long-range goal of enhancing instruction and improving student achievement in algebra in the school district. It involves establishing and supporting a collaborative relationship between the university's education and mathematics faculties, teacher education students at the university, and school district mathematics teachers and technology staff. The connectivity component has established an extensive video conferencing network creating an ICT-enriched environment through multiple platforms of videoconferencing. This environment includes fixed, mobile, and personal laptop videoconferencing configurations.

The project supports research investigating non-traditional uses of videoconferencing to extend beyond the course delivery model and connects to the specific content area of mathematics. The objectives of the project include designing a three-tier videoconferencing network system, delivering professional development in mathematics, and establishing a collaborative community among the participating teachers and students. Data collection serves to inform the larger ICT community of models applying videoconferencing in an innovative fashion to effect not only teacher education and preparation in mathematics but also student achievement in mathematics.

C^3 GOALS

Content: The C^3 project established a Mathematics Education laboratory at the university to support the professional development of mathematics educators. This laboratory serves as the foundation for the videoconferencing network system and provides facilities and instructional resources for area mathematics teachers and teacher education students. Professional development activities delivered via videoconferencing have been

implemented that include use of virtual manipulatives, addressing standards in mathematics, interacting with nationally known authors, and modeling of instructional materials and strategies for enhancing the understanding of algebra.

Collaboration: Mathematics teachers were identified at 14 schools within the collaborating school district to participate as Math Fellows. This included three elementary sites, seven middle schools, and four secondary schools. Currently there are 60 Math Fellows who have participated in over 30 videoconference sessions. This will be expanded with a second round of recruiting involving three additional elementary schools and increase the number of Math Fellows to approximately 100. The professional development sessions have targeted various aspects of the teaching and learning of mathematics and have involved not only the math fellows but also university teacher education students, and classroom students.

Connectivity: The purpose was to create an "easy access" videoconferencing environment that would support fixed videoconferencing systems, mobile units to be moved from room to room, and personal systems in the form of laptop computers that are used by the Math Fellows in virtually any location within appropriately equipped facilities. This three-tier approach provides a flexible, portable, and more personal approach to support teachers and students in diverse ways not currently available. Videoconferencing activities have supported point-to-point connections as well as interactive multi-point connections using either the fixed or mobile units with up to four sites. Experimentation is on-going involving connecting all 14 sites simultaneously. The personal units support individual interaction between and among Math Fellows, teacher education and mathematics university faculty, and instructional technology staff. This venue provides opportunities to personalize delivery of professional development.

Preliminary Results and Findings

Baseline data has been collected from each Math Fellow related to beliefs, levels of experience, and understanding of mathematics, instruction, and technology. When the project is completed a post-instrument will be administrated to investigate changes. Formative evaluation has been done throughout the project activities in order to inform progress toward goals and make necessary modifications related to both technology and mathematics instruction. Through qualitative evaluation analysis, participating math fellows have identified several advantages to the use of videoconferencing that parallel Motamedi's (2001) conclusions. These include accessibility to instructional training, reduction of travel time, importation of external resources such as guest speakers, virtual experiences in the form of field trips and other learning experiences, and use of diverse multimedia. Quantitative data collection supports the positive use of videoconferencing. Both evaluative means have also informed continued implementation of the project offering support for modifications as needed.

Evaluations and experimentations have also revealed issues and disadvantages such as connectivity problems related to audio and video quality. Lack of participant experience with interaction differences related to videoconferencing has also been problematic, resulting in less extensive discussions and less effective discourse. There have been limitations to the number of participants and number of sites that can effectively interact at any given time. In general for the implementation of the project, it took an inordinately long time to get the equipment in place and working appropriately in the numerous sites.

Overall, participants have found the experience positive for both themselves as mathematics educators and for their students. They note that numerous opportunities have been available to them that they would not otherwise have experienced. More importantly they see the C^3 project as a beginning to what they may be able to do with videoconferencing in the future.

Conclusions

The directors of the project continue to evaluate and make modifications so that at the end of the two year funding cycle recommendations can be made for future uses related to not only mathematics education but expanding to other areas of teacher education. They have found that with the funding given from the grant one major obstacle to videoconferencing was overcome; that is, the high cost of such an endeavor (Motamedi 2001). The issue now remains related to how to sustain the implementation of videoconferencing to support teachers and students in the future. Can a true educational community be established and supported utilizing easy access to videoconferencing technology and can it sustain professional development and collaborative relationships between and among a university and a school district? Zhao and Rop (2001) in a review of literature related to various types of ICT support through computer mediated communication (CMC) found a lack of rigorous research in the use and effectiveness of technology communication networks, which included videoconferencing. Through the establishment of a viable videoconferencing infrastructure and the refinement process of professional development activities, this project has added significantly to ICT research. More importantly it has laid the foundation for future research opportunities to give long-term outcomes.

References

PROJECT (2002): *Math Lab Home Page*. http://www3.baylor.edu/SOE/C-Cubed/ Accessed October 14th, 2002.

INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING. IFIP Homepage http://www.ifip.or.at/. Accessed October 14th, 2002.

INTERNATIONAL SOCIETY FOR TECHNOLOGY EDUCATION (2000): *National Education Technology Standards for Teachers.* Eugene, OR, ISTE.

MOTAMEDI, V. (2001): A Critical look at the use of videoconferencing in United States distance education. *Education* **122**(2): 386–294.

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS (2000): *Principles and Standards for School Mathematics*. Reston, VA, NCTM.

STIGLER, M. and HIEBERT, J. (1999). *The Teaching Gap*. Free Press.

ZHAO, Y. and ROP, S. (2001): A critical review of the literature on electronic networks as reflective discourse communities for inservice teachers. *Education and Information Technologies* **6**(2): 81-94.

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