33 On-line communities as a vehicle for developing secondary mathematics educators

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Abstract

The Internet is another powerful resource for providing pre- and in-service training of mathematics teachers. The traditional boundaries of time and distance are gone as teachers communicate in global learning communities to review content, teaching practices, and share new ideas and concepts for teaching secondary mathematics. The ability to use Newsgroups, MOOs, MUDs, and the World-Wide-Web presents great opportunities for mathematics educators as schools enter the new millennium. One example is NetAdventure developed by the Concord Consortium. The design and content of NetAdventure offers a powerful model for adults studying to become secondary mathematics teachers. As the power and impact of the Internet widens, global interaction of teachers will provide a future forum for exciting and effective on-line learning communities to develop the skills and practices of secondary mathematics educators.

Keywords

Distance learning, methodologies, networks, teacher education, telecommunication.

Introduction

The potential uses of on-line communication in the preparation of preservice and inservice secondary mathematics teachers transcend the traditional geographic benefits of distance education. Not only can the technology provide asynchronous instruction over great distances, it may be used to create genuine opportunities for keeping pace with the rapidly emerging content, epistemologies and pedagogical strategies associated with contemporary mathematics. In other words, computational technology is reinventing mathematics while simultaneously increasing opportunities and raising expectations for the learning of mathematics. Mathematics educators will benefit from these technologies via the ability to personally construct mathematics; cope with the rapid pace of mathematical innovation; discuss the pedagogical issues associated with these changes within an expanded community of practice; and learn how technology may be employed to assist more students in a joyful pursuit of mathematical understanding.

On-line telecourses

The increasing availability of Internet access—e.g., e-mail, newsgroups, Multi-user dimensions (MUDs), MUD object oriented software (MOOs), the World-Wide-Web (WWW)—makes low-cost high-output professional development telecourses possible. In 1997 several interesting models already exist and telecourse development is well underway. Tinker and Haavind (1997) suggest the following scenario for the future of on-line professional development for teachers.

“There will be an explosion of network-based courses for teacher professional development. The best of these will offer world-class learning opportunities that will intermix cognitive research, educational philosophy, subject matter content, and just-in-time support for in-class experimentation. Participants can work with local study groups and larger virtual groups that span the world. The faculty leading these will consist of teams that include international experts, experienced teachers, and outstanding researchers. Graduate credit from leading institutions throughout the world will be available for teachers. Part of the teacher evaluation will be based on curriculum and research contributions participating teachers make and post on the network. The result will be a growing teacher-generated literature of immense value to education and increasing appreciation for the role of life-long learning for teachers and teachers who are also researchers making contributions to education, science, and mathematics.” (p 5)

New content, new tools, new ways of knowing

Perhaps no subject of study bears as little resemblance to the discipline it intends to teach as mathematics education. Much has been written about the societal demands for an increasingly mathematically literate population, the blurring boundaries between branches of mathematics and other disciplines, the increasing importance of mathematics in the social and behavioural sciences and the role of technology in the rapid evolution of mathematics.

The *NCTM Standards* (1989) state that “fifty percent of all mathematics has been invented since World War II.” While topics such as number theory, chaos, topology, cellular automata and fractal geometry may appeal to students unsuccessful in traditional mathematics classes, few, if any, of these branches of mathematical inquiry have found a home in the curriculum. These new areas of mathematics tend to be more contextual, visual, playful, experimental and fascinating than the traditional emphasis on paper and pencil based algebra and geometry—and may provide an answer to Papert’s (1980) concern that

‘A dignified mathematics for children cannot be something we permit ourselves to inflict on children, like unpleasant medicine, although we see no reason to take it ourselves.’ (Papert, 1980, quoted in Stager, 1997, p.12)

Technology provides an opportunity for more children to view mathematics as a powerful part of their own learning and to embrace the process of mathematical inquiry.

Secondary mathematics teachers can and should explore these new mathematical domains. Prospective and practising teachers should acquaint themselves with these new 'ways of knowing' by actually using the technology which led to the development of these new mathematical ideas and which will assist their students in the construction of personal meaning. The constructivist principle of learning through the making of connections is apparent when a teacher is using technology to learn about new mathematical knowledge, that is itself the product of this same or similar technology, and at the same time is also thinking about how this technology might be used by students to construct understanding of a particular mathematical concept (Clements, 1991). Ongoing reflective practice and action research can play an important role in telecourses. Emerging technologies for sharing video over the Internet makes it possible for a community of perspective educators to critique each other's teaching and even visit other classrooms.

Tinker and Haavind (1997) include the following in their consideration of the advantages of telecourses:

- Anytime anywhere learning
- Asynchronous interaction
- Group collaboration
- New educational approaches
- Integration of computers

NetAdventure¹: a model of online

We believe that successful on-line learning activities will combine communication, community, compelling content, context, computation, challenging problems and a personal commitment to active learning.

NetAdventure, developed by the Concord Consortium, is a vital example of how the WWW (the 'Web') may be used to support a community of mathematical inquiry. While NetAdventure is targeted at secondary school students, it is rich enough to engage young children and adults alike. The design and content of NetAdventure offers a powerful model of what might be built for adults studying to become secondary mathematics teachers.

Designed around the metaphor of a summer mathematics and science camp, NetAdventure requires participants to join a group of explorers. Each week, a theme such as collecting and interpreting data on the Web, or how to build a model, is used to unify a daily area of exploration. The user is presented the topic of the day along with the opportunity to explore a previous topic. A list of the other learners participating in the adventure appears along with the names of expert guides who lead each 'expedition'. Each daily topic offers background information, an opportunity to share data, hypotheses and questions with fellow investigators and three problems of increasing complexity.

Within a handful of Web pages, NetAdventure creates a community of practice, challenges individuals to construct new mathematical knowledge,

supports communication of mathematical ideas and provides a powerful context for learning through compelling storytelling, history and connections to real-life. One powerful lesson for contemporary mathematics educators is that a learner can hardly keep pace with three problems per day if the problems are authentic and open-ended. This stands in stark contrast to the dozens of more decontextualised problems students face each day in traditional mathematics classes. Another lesson is that the process skills associated with the ability to think mathematically and communicate mathematical ideas should take precedence over the memorisation of algorithms. If you are not fascinated by prime numbers, tomorrow may be bridge building. Mathematics is presented as a lens into a world of beauty, logic and wonder (Smith, 1994).

Conclusion

Existing telecommunications technology makes it possible to develop environments, similar to NetAdventure, designed to meet the specific needs of preservice and inservice mathematics educators. On-line telecourses are cost-effective and create outstanding opportunities to learn in an ever-expanding community of practice. Our efforts to develop such on-line learning communities will reap tremendous benefits for our universities and children enrolled in mathematics classes.

Footnote

- 1 NetAdventure—WWW at: <http://www.concord.org/netadventure>

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