

Integrating Online Discussion: Broadening the Conversation

[Qing Li](#)
University of Calgary

Abstract

This article shares an approach to teaching mathematics teacher education courses incorporating asynchronous online discussions. Specifically, this research is guided by the following research questions: (a) How would online discussions contribute or hinder teachers' learning in mathematics methods courses? and (b) What pedagogical strategies need to be considered when incorporating online threaded discussion? The analysis of data collected provides the basis for conclusions and recommendations for educators who are interested in integrating online discussions into mathematics methods classrooms.

The intent of this study is to provide information that can be useful in implementing changes in the modes of communication in mathematics teacher education. This article shares an approach to teaching mathematics teacher education courses incorporating technology associated with asynchronous online discussions. It also examines the effectiveness of some electronic pedagogy that was adapted over a year as I designed, taught, and revised two mathematics methods courses.

Current consensus holds that "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (National Council of Teachers of Mathematics [NCTM], 2000, p.11). This call to integrate technology into mathematics education challenges not only school mathematics, but also preservice and in-service mathematics education of teachers. In its report, the National Council for Accreditation of Teacher Education (NCATE, 2001) pointed out,

To what degree are higher education institutions meeting their responsibility for preparing tomorrow's classroom teachers? Bluntly, a majority of teacher preparation programs are falling far short of what needs to be done.... colleges and universities are making the same mistake that was made by K-12 schools; they treat "technology" as a special addition to the teacher education curriculum – requiring specially prepared faculty and specially equipped classrooms – but not a topic that needs to be incorporated across the entire teacher education program.... they rarely are required to apply technology in their courses and are denied role models of faculty employing technology in their own work. (p. 5)

This statement underscores the new trend in education that emphasizes the importance of learning with technology instead of learning from technology (Jonassen, Howland, Moore, & Marra, 2003). Consequently, mathematics teacher educators need to help preservice and in-service teachers develop the ability to make use of technology by effectively integrating it into teacher education.

With the belief that technology is best learned in context (Willis, 2001), I taught two mathematics methods courses (three classes) integrating technology. To date, little of the scholarship in mathematics teacher education focuses on the integration of asynchronous online discussions as an example of the use of technology in teacher education. Numerous questions remain to be answered for the successful integration of technology into mathematics teacher education. What role should technology play in teacher education? How do online interactions support or constrain mathematics teacher education? How can online interaction contribute to teachers' understanding of current trends in mathematics teacher education? What pedagogical strategies need to be considered when incorporating asynchronous online discussion? Although both multimedia and the Internet were incorporated into these courses, the focus of this paper was on the online discussions.

This project started with the aim of finding out whether and how the Internet as a vehicle or context could be useful in mathematics teacher education. The use of online discussions could help provide insight about what was going on in the teachers' minds. These insights would help with daily assessments and would affect decisions about how to proceed throughout the courses. During the year, much was discovered about online community building, pedagogy, and mathematics learning. New aspects of common issues faced in teacher education were observed, including teachers' experiences with diversity and the importance of issues such as death. As the initial data and early experiences of the year were collected, they began to influence my thoughts about what was being learned. I narrowed my focus on the examination of effectiveness of the integration of online discussion into the mathematics methods courses. Specifically, this research is guided by the following research questions:

- How would online discussions contribute or hinder teachers' learning in mathematics methods courses?
- What pedagogical strategies need to be considered when incorporating online threaded discussion?

Theoretical Perspective and Structure of the Courses

The two courses for pre- and in-service teachers (hereafter referred to collectively as teachers) were entitled Mathematics for Elementary Schools and Mathematics for Secondary Schools. These courses were grounded in theories and research from cognitive research (Bruer, 1993), constructivism (Vygotsky, 1978; Young, 1997), and the

development of new learning technologies (Scardamalia, Bereiter, & Lamon, 1994). Social constructivism, in particular, underlies my conception of the courses. In this view, “the learning that occurs in context is considered more useful or valuable to the learner than the learning that occurs in isolated situations” (Guy, Li, & Simanton, 2002). In addition, knowledge is constructed and advanced through social interactions (Kanuka & Anderson, 1998). Adherents of such perspectives believe that methods courses provide better authentic contexts for the learning of technology than a stand-alone technology course. Methods courses can provide students with opportunities to observe professors modeling integration of technology in teaching and learning; students can apply technology in their own learning, and they can plan and implement innovative uses of technology in their own teaching (Willis, 2001).

Further, knowledge construction is based on social experiences. Technology such as the Internet and multimedia provide “an effective means for implementing constructivist strategies that would be difficult to accomplish in other media” (Driscoll, 1994, p. 376). According to McDuffie and Slavit (2003), online discussions used in elementary mathematics methods classrooms can support teachers’ reflection and challenge their beliefs about mathematics education. Based on this set of research, the courses were designed to help the teachers develop skills and advance knowledge in mathematics education by integrating technology with sustained educational experiences.

The main objectives of the methods courses for these teachers were as follows:

- Formulate a personal sense of what mathematics is and what it means to teach mathematics.
- Become more prepared to teach mathematics using technology as a tool.
- Learn different techniques of teaching mathematics.
- Develop resources of good mathematical problems and ways to assess them.
- Enhance teachers’ understanding of mathematics teaching, learning, and assessment based on the *Principles and Standards for School Mathematics* (NCTM, 2000).

The courses were structured to combine regular face-to-face classroom instruction with participation in asynchronous threaded online discussions. The courses started with reflective inquiry by the teachers on their experiences with mathematics teaching and learning. Then the teachers examined theoretical and practical issues in mathematics teacher education. In a final multimedia project, the teachers developed ways to apply course content to improve their own teaching and learning of mathematics.

Face-to-face interaction was still critical in these courses because of the need for rich hands-on experience with manipulatives. As indicated by Merryfield (2001), online instruction is not especially helpful to hands-on work. Because the university is located in a rural area, many of teachers lived 75 miles away from the campus. Integrating part of the course online provided more chances for the teachers to interact with each other and with me than they would have attained by solely commuting to classes.

The online component of the course was provided through Blackboard™. For privacy and access reasons, the Blackboard site was structured so that only the instructor and the teachers enrolled in the classes had access to them. From the course home page, the teachers followed various links to read useful information, such as the course overview and syllabus, related mathematics educational links, a list of manipulatives, and assignments. The teachers were required to read weekly textbook assignments,

contribute at least one message to the online discussion per week, and read the messages of their peers.

The teachers often posted more messages than required. For example, a teacher posted seven messages one week to discuss and defend his position on cultural issues in mathematics education. The average number of postings per teacher for that week was four. After reading the comments of their peers, the teachers could either respond to messages to continue the discussion or start a new thread on other topics such as their own reflections on designated reading assignments. The convenience of the online discussion forum allowed teachers to communicate with each other and the researcher without time or location constraints.

Methods

There were 60 participants enrolled in the two mathematics methods courses: 48 female and 12 male teachers. Among the teachers, 52 were from two sections of the elementary mathematics methods course offered in 2001 and 2002, respectively. Jointly, there were 11 in-service teachers (special education majors) and 41 preservice teachers (elementary majors). The secondary mathematics methods class was offered in 2001 with eight preservice middle/secondary majors. In total, there were three non-White (Native Americans) teachers. They were all enrolled in elementary mathematics methods. All names used in this paper are pseudonyms.

Several data collection techniques were used to ensure triangulation of the data. The data include the teachers' written assignments and their technology projects, a journal recording the instructor's actions (e.g., lesson plans and self-reflections of each lesson), and the transcripts of the asynchronous online discussions.

The teachers' written assignments, the online discussions, and the instructor's journal were coded and analyzed repeatedly throughout the study. Initially, open coding was used to categorize and label my field notes and student work (e.g., "suggests a limitation of online discussion"; "suggests that her understanding of sensitive issues is enhanced"). In addition, axial coding was used to connect various categories.

Data collected throughout the study were used to drive future online discussions. For example, when one teacher posted a message sharing his enjoyment of the online discussion as well as his skepticism at the beginning, I invited the whole class to share their thoughts. Actual excerpts of the teachers' written work and my perceptions are provided to explain and rationalize the findings.

Results

This project was started with the idea that the infusion of technology into the methods courses would enhance the teachers' understanding of topics in mathematics education. The intent was to use online forums to discuss a variety of topics in mathematics education, such as NCTM's six principles and teaching strategies. However, I discovered that online forums not only extended face-to-face interactions in terms of time, location, and opportunity, but also provided a comfortable environment for teachers to speak frankly and freely, particularly about sensitive issues. Regardless of the original course plans, sensitive issues were always brought up and sparked lively online discussions in the courses.

In the forums, the teachers set forth or followed up on controversial issues, challenged different views, and debated freely about potentially politically inappropriate opinions. The integration of online forums also created opportunities to discuss things that in previous classroom structure were difficult to address in class. Because of these particularly interesting results related to reflections on sensitive issues, I narrowed the focus of the paper to consider how online forums facilitate teachers' reflections on sensitive issues. Here, sensitive issue is defined in a broad sense that includes topics like special needs, culture, and death in relation to mathematics teaching and learning.

Three examples of the impact of the use of discussion forums on teaching and learning experiences are described. These examples are explored from different analytical standpoints: using online discussion to initiate debates, foster open dialog, and create a valuable learning experience. The discussion on students with special needs demonstrates how the teachers spontaneously started a debate, which in turn led to further actions. The cultural diversity section concentrates on how the threaded discussion fostered an open dialog among the teachers that helped resolve an impassioned debate. The section on death focuses on the potential for using a discussion forum to explore ways of turning this prickly issue into valuable educational experiences and resources.

Initiating Spontaneous Debate – Context: Students With Special Needs

The topic of students with special needs was not among the foci in the original course design. Because the teachers were not familiar with mathematics education, I thought that introducing this sensitive issue with limited time for discussion might create confusion. Surprisingly, the issue naturally emerged in the online exchanges in every class. One instance was stimulated by a reading assignment when a teacher found a “disturbing” statement in the textbook. She raised a question and asked for others' opinions, as indicated in the following message:

I would like to know if anyone else found the statement [the textbook author] made on pg. 67 disturbing (“unless we have some mental handicap, all of us are curious and capable of learning many things.”) I read that several times, not quite believing that an educator had actually written that, and worse, that it had made it through editing. It seems that she is implying mental handicaps make children unable to learn and that they are not curious. Regardless of her intent, that is the implication that was made. (Sarah)

Other teachers responded immediately and confirmed their negative feelings about the statement and pointed out that we should rethink our school philosophy of mathematics teaching and learning. Others even took a step further and suggested action we could take to improve the matter at hand:

I think maybe this error in statement should be brought to her attention or the editor's attention because maybe it has bothered other people too. Maybe the statement could be changed in the next printing edition—just a thought. (Jen)

Because the issue became a concern, it was revisited the following week in our on-campus class. It was agreed that no matter what the intent of the author might be, actions needed to be taken. Hence, an email message quoting Sarah's comments on behalf of the whole class was sent to the textbook author expressing our unease. The author took the suggestion very seriously and responded:

Thank you so much for bringing to my attention the statement on page 67. I, too, find it disturbing and inappropriate. Yes, it made it through the editing process, which is unfortunate, but I am ultimately responsible. We will make a correction in the next printing.

The group felt satisfied with the result. It was satisfying to see such a rich and rewarding discussion about issues related to equity. It was even more satisfying that the teachers did not just sit passively reading from abstract theories and books about equity. Instead, they were actively taking up the ideas and applying them to their lives, and furthermore, took action to improve the current situation. As such, the discussion forum was used as a “mind tool” with which the teachers were empowered (as in Jonassen, 2000).

Fostering Open Dialogue – Context: Cultural diversity

The second sensitive issue related to cultural diversity. The university is located in a small town that is very remote and ethnically homogeneous. Cultural diversity is a superficial and abstract idea for most of our teachers; indeed it is just another fancy term that needs to be remembered. In one class, the topic was intentionally introduced by conducting a simulated face-to-face debate on whether mathematics teaching is culture free. The original instruction was “Debate the following issue: Mathematics is culture free. We should not be concerned about the nature of problems students solve so long as they are doing significant mathematics” (Cooney, Brown, Dossey, Schrage, & Wittman, 1999, p. 17).

Although it was intended to be a simulation, the debate created some tension. One male teacher (Tim) believed that mathematics teaching was culture free, and no one could convince him otherwise. The teachers were not satisfied when the face-to-face debate ended. That day after the class, they automatically moved the debate online, and messages flew back and forth addressing this issue. The debate continued online for weeks and most of the teachers reached a consensus. But Tim still thought that whether or not math teaching was culture free really depended on how we defined mathematics. Based on this, the teaching plan was changed and a panel of guest speakers comprised of international students at our university was invited to the class. That night on the online forum, Tim expressed his thoughts again: “I would just like to thank the group that came...even students from another country think that mathematics teaching is not culturally biased. That’s a load off my shoulders.”

The teachers again started a lively online debate about the issue, and one female teacher found a critical point:

I strongly believe that the teaching of mathematics is extremely culturally based — not biased as was first asked to our visitors, but [culturally] based — two very different things! I definitely think that the way in which mathematics is taught and effectively learned has much to do with world-application. Seeing as people are from different parts of the world with different needs and concerns, they do and should for that matter, have math taught to them in different methods. Some of the cultural mathematical differences are simply in the way the mathematics is written. We are not arguing that math itself is different in various places.... I am simply asserting that if math was taught the exact same way in places around the world, with the same life examples and methods of teaching, there would be a great diversity in understanding and mathematical knowledge — and I strongly believe this — students learn much better when the things they are learning apply directly to them — it would be an interesting experiment to conduct, that’s for sure. (June)

June's thoughts and insights inspired another lively discussion that resulted in the whole group's better understanding of the issue. The teachers' understanding of being culture free itself reached a higher level — it moved from an abstract idea to the notion of the absence of other culture (in books, in practice, etc.) and then further to the reflecting and rethinking of the discipline itself. They began to question the way mathematics is defined and structured in schools in terms of curriculum, assessment, and activities in relation to culture. The teachers concluded that they really liked the online forum because "we could each state our opinions again and again, and also argue them back." The online forums thus allowed the teachers to engage in in-depth discussion, reflection, and exploration related to the issue in question. The teachers' understanding of this issue reached a higher level than I could bring it to in previous attempts because the forums provided them with an extended and safe communication environment to argue and disagree without involving excessive conflict (as described in Jonassen, 2000).

It is worth noting that in all three classes, the cultural issue in mathematics teaching and learning had raised and inspired lively discussions both online and in face-to-face classes. I intentionally introduced the issue in one of the classes (as discussed above); however, teachers in the other two classes raised the issue autonomously online. For example, two Native American teachers started a discussion online by asking the class, "It may be easy for us, as mathematics teacher to be, to find jobs anywhere... But, have you ever considered looking for a job in Indian reservations? Please share your thoughts about this." Regardless of the questions introduced and the activities involved, immersion into the online environment fostered and encouraged questioning, debate, and the expression of different views and opinions about this sensitive, yet important issue in mathematics teacher education.

Creating a Valuable Learning Experience or Teaching Resource – Context: Death

Online forums enabled the teachers to socialize in a much broader sense, and most importantly engaged them in critical thinking and allowed the transformation of knowledge and creativity into valuable teaching resources. One incident occurred in the spring semester when the stepmother of a teacher (referred to here as Sandy) died suddenly at the age of 47. Sandy was distraught and had to leave for 3 weeks. The class used the forums not only to console Sandy, but also to explore this prickly topic with regard to mathematics teacher education. Although Sandy was not able to attend classes, she continued to be an active participant through the forums. One of the questions she posed was this:

Death occurs in families all the time, and the families of the deceased, of course, vary in age.... When a child in your classroom loses a parent or sibling, or any other family member that is very close, how do you deal with them? Do you talk to them openly about it when they feel comfortable, or do you let them be on their own? Should death be something discussed in the classroom? (Granted, age does matter when talking about it with your students, so be careful.) I wouldn't know what to do if I was approached by a child who was grieving and felt comfortable enough to talk to me.

All of Sandy's colleagues were very enthusiastic in sharing their thoughts and experiences related to the issue. Different strategies and various situations were explored. Some discussed the pros and cons of talking to children about death. Some suggested that the most important way to help children who have lost their loved ones is to create a warm, friendly, and sympathetic environment:

I do believe that when a child loses a loved one, it is sometimes very difficult for a child to come and talk about, therefore, we as teachers, need to step back, and let the child talk about the situation on his or her own. Pushing a child or asking a child about the death might just make things worse, and the child may not be ready to talk about their loss. ... Providing a child with comfort, warmth, and sympathy is the best thing a teacher can do for a child that is grieving. Asking the child about the death just might upset the child too much, which could make things worse for the child. If and when the child is ready to talk, just be as open as you can to the child. Let him or her tell you what is on their minds. Again, by being open and honest with the child, builds an everlasting relationship between teacher and child (Ann).

This discussion about children losing loved ones led naturally to another discussion about the 9/11 tragedy. A teacher told the following true story:

I heard of a boy in a Kindergarten classroom somewhere around here who was playing with blocks and planes. He built two towers and drove the plane around them and then crashed them into it The teachers stopped him from doing it, and took the planes and other vehicles away from the children that week. ... When it comes to thinking about whether not his teachers did the right thing by stopping his actions and taking the toys away for a while, I am wondering, do you guys agree or disagree with that? (Erica)

Thoughts, insights, suggestions, and more questions flooded the forum as messages flew back and forth. Most teachers believed that the kindergarten teachers were wrong to simply take the toy away from the boy:

As far as the case you described, the teachers didn't really have a right to take away the planes or blocks from the children. Yes, it may have prevented the child from doing this, but how did it help in the classroom?

The teachers also tried to analyze the event in order to understand the situation while some offered possible solutions:

In thinking about the way children deal with emotions and events, I think he was trying to make sense out of something that was very tragic and took the lives of many, many people. Or, he was just imitating what he saw and didn't understand the story behind where his actions came from.

Some questioned other kinds of teacher actions in similar situations:

A lot of teachers shut televisions off in the schools and most left the duty of talking to the children about the events up to their parents. Do you think this is a good way of dealing with this?

Others questioned the role of mass media, especially TV, during and long after the 9/11 tragedy: "This (9/11 tragedy) was and still is plastered all over the television and many parents cannot avoid their children from seeing this. Why are the mass media doing this?"

Various teaching strategies for dealing with tragedy were suggested, ranging from creating a friendly environment for children, to generating discussions with children, to using books about death and then leading children to individually explore this issue:

Someone also mentioned books and school counselors (if available)... reading a book that talks about death and then letting the children ask questions as they like — I like that idea. It doesn't put any child on the spot, and it lets them think about death on their own. And if and when children feel comfortable enough to talk to you as a teacher, they will come forward. I think then you have to be especially careful in what you tell them. Sometimes just listening to them is the thing to do.

The teachers also expressed their appreciation for the opportunities this online discussion provided for idea sharing and in-depth analysis of classroom strategies: "I'm extremely happy to see that we all have an opinion on how to handle death when it's encountered by a child in the classroom. I've never really given it much thought until this discussion."

This open flow of thoughts and experiences broadened the teachers' views of teaching and learning. The discussion was an inspiration to change some of their instructional strategies. In an on-campus class, a mathematics activity was incorporated: the whole class made a paper flower bouquet. Each student traced his/her palm on color papers and cut out the shapes to make flowers. The discussion of various mathematics topics such as measurement and number sense was woven into this flower-making activity. For example, how to measure the area of everyone's palm (measurement of irregular shapes), how many petals in each flower and in each bouquet (number sense). Finally the bouquet was dedicated to Sandy. When the flowers were handed to her, she was brought to tears. Later that night on the threaded discussion, she posted again, expressing her sincerest appreciation for the warmth and sympathy of the whole class, and indicated how moved she was by the activity.

Another teacher, inspired by this event, responded to Sandy's message and further suggested that we generate a series of mathematics/disciplinary activities that could be used in these kinds of situations. Many teachers responded enthusiastically and another forum was created specifically devoted to this activity. The teachers liked the idea and quickly started to add different thoughts and activity suggestions to the forum. Suggestions came from their previous experiences, from their partner teachers, from books, from the Internet, and so on. Sometimes, a vague idea would be followed by group brainstorming, suggestions, revision, and polishing. Because this idea came from the teachers themselves and, therefore, contained more direct significance for them, they were fully engaged and contributed enthusiastically.

In the end, they had generated a rich collection of ready-to-use mathematics activities ranging from creating biographies for kids' loved ones to making pop-up sympathy cards. In the case of the biographies, elementary students measure and record sizes of body images such as arm length, circumference of head, height, and weight of a loved one. From this, they can further develop biographies of their loved one. See the [appendix](#) for part of a sample activity generated by the teachers. These activities formed a bank of valuable teaching resources that all of the teachers highly appreciated. Each activity contains rich mathematics knowledge, is adaptable to different age levels, uses multidisciplinary approaches, and emphasizes a hands-on, minds-on kind of learning. Each is thoughtfully tied to the sensitive issue of death (many could be easily modified to properly tie to other issues) to various mathematics topics.

More importantly, each has the potential to turn such tragic incidents, in a considerate manner, into memorable learning experiences for kids. The forum used in this class was instrumental in turning a negative situation into several positive outcomes. It not only helped the teachers deal with this difficult issue, but also left them better equipped as teachers.

My Reflections on the Experience

The experience of teaching these mathematics methods courses has convinced me that the appropriate integration of the Internet into teacher education has the potential to achieve, and even exceed, the goals of conventional mathematics teacher education. For instance, I started to incorporate the threaded discussions with the thought that we would discuss topics such as the NCTM six principles and teaching strategies. Although the discussion forums were useful for these topics, the most dramatic function they served was for communication about sensitive issues, which fostered debate, opened dialogue, and created a valuable learning experience.

The Internet proved to be a superlative medium for dialogue on complicated issues that had previously been difficult in face-to-face interactions. In each of the three classes, sensitive issues were brought up and sparked lively discussions online regardless of the actual structure of the forums. The teachers talked frankly about controversial issues, challenged different views, shared uncomfortable personal experiences, and even took the risk of expressing politically inappropriate opinions. Their understanding of various issues, especially sensitive issues, in mathematics teacher education was greatly enhanced through the online discussions.

The online part of the course was really enjoyable – for both its flexibility and its richness of discussion about mathematics education. Initially, I incorporated the Internet into the course for its flexibility, as the process made me rethink my assumptions about pedagogy, the course content and goals, and the technology. It was exciting to see the teachers carrying out investigations concerning curriculum, teaching, learning, assessment, and equity via online discussions. When questions arose, the teachers searched for theories, examined their own experiences, and constructed knowledge on the relationship between theory and experience. Learning about mathematics education by participating in a learning community, the teachers deconstructed stereotypes and recognized connections among mathematics education topics and applied new knowledge to their professional and daily life.

The online discussions also offered a useful assessment tool that provided instant and ongoing feedback. I gained a broader awareness about the teachers' thoughts and beliefs through the online discussions. This was useful information for changing, refining, and enhancing instructional choices. For instance, I did not plan to discuss the equity issue at the outset of a course. Since the issue evolved naturally in online discussions, the original plan was changed. Face-to-face meeting time was used to further the discussions, and research studies in the area were introduced to the teachers. The increased adaptability of my instructional choices made the learning more authentic. The authenticity of the learning experience, in turn, enhanced the teachers' motivation and empowered them in their subsequent learning and teaching. In short, the courses were strengthened by online discussions on mathematics, pedagogy, and controversial issues.

Implications and Suggestions

Although I would be skeptical of mathematics methods courses taught exclusively online, my experience with online discussion in 10 courses during the past 5 years has convinced me that online interaction and face-to-face experiences can complement each other. For example, hands-on approaches such as using mathematics manipulatives may be easily introduced in face-to-face settings but not in an online environment. On the one hand, issues rose in face-to-face classes, particularly those sensitive issues that require extensive discussion and exploration (such as the cultural diversity issue in mathematics teaching and learning), that can be extended and further nurtured in online discussions.

The flexible nature of online discussion allows sustained dialogue without taking too much time and space from limited face-to-face interaction. On the other hand, ideas and concerns generated in online dialogues, when appropriate, can be broached in face-to-face classes. Related activities and experiments can be incorporated to further student understanding of the topics examined. For example, the activity of inviting a panel of international guest speakers to the secondary mathematics methods course enabled the teachers to access experiences, perspectives, and knowledge from cultures and countries that are marginalized in North American education and media.

When unexpected incidents occur causing teachers to be absent from face-to-face classes, online discussions provide another venue through which they can stay in touch with the class and allow them to progress along with others. More importantly, discussion of incidents incorporated appropriately into the mathematics content discussions can further address student needs and boost their interests. In one of the classes, the death issue not only stimulated a discussion about how mathematics teachers can foster positive thinking about such negative experiences, it also inspired the generation of a bank of mathematics resources dealing with such issues. My experience of using online discussion in mathematics methods courses confirms McDuffie and Slavit's (2003) conclusion that "not only did the online discussions provide the foundation for future in-class interactions, they also enabled in-class discussions to continue beyond class time" (p. 6).

In the courses, the online forums were also used for the teachers to share their reading reactions. This option helped them to understand everyone's perspectives about the reading. Consequently, this sharing allowed for the examination of diverse perspectives, which further helped teachers, internalize their understanding of the issues discussed.

There are several important issues related to the incorporation of asynchronous online discussions that deserve our consideration based on this experience with using an online forum in mathematics methods courses. These considerations, however, may go beyond mathematics teacher education and be applicable to other content areas.

First, small class size of 6 to 10 students is best for use of this technology. If the class is very small (e.g., less than five members), it is often hard to generate rich discussion among participants. When the class is large (e.g., over 15), it becomes difficult and time consuming for students even to read all the messages, let alone to deal with all the difficulties associated with navigating the system. In cases of more than 15 students, the best approach is to divide the students into small groups. In one class with 25 students, I created three groups. Students also took turns leading a weekly group discussion. To help all teachers benefit from the different perspectives of the different groups, each leader would summarize the discussion in that group for the week. All the teachers were required to read the discussion of their own group plus the summaries of all other groups every week. That way, the teachers were able to participate fully and also to see a broader picture without being overwhelmed or overburdened by the excessive number of messages to be read.

Second, it is important to organize online discussions into theme and topics. In one of the methods courses, the online discussions were conducted without any reorganizing, and teachers just filed different messages in one big folder. All the messages from the whole semester were linearly connected within that big folder. The straight linear organization of the messages created a big problem, making it difficult for teachers to retrieve information as the number of messages increased. In only a few weeks, the teachers had generated about a hundred messages; it was already hard to go back and search for any particular message. Therefore, the teachers were unable to take full

advantage of having a permanent record of the online discussions. This was contrary to my original intention of using this technology for its opportunities to revisit, to further discuss, and to rediscover issues and theories and perhaps even new applications of the theories. To overcome this drawback, later courses were started by asking the teachers to generate their own themes and then the asynchronous online discussions were organized according to these themes. When issues arose, more themes would be added. The teachers liked the idea and it worked out well.

Third, the teachers used the forums to discuss other issues not necessarily related to the course content. This freedom helped the teachers build a true learning community. For instance, after watching a fellow teacher's extraordinary performance in a football game, we used the forum to congratulate him and to show our happiness and excitement. Such events point toward the potential for a high "social presence" in this online environment. Here, "social presence" is defined as "the ability of learners to project themselves socially and emotionally and affective objectives of learning" (Rourke, Anderson, Garrison, & Archer, 2001). The elevated social presence in the online discussions of this course helped reduce social distance among the teachers. It made the group interactions more appealing and engaging, which in turn, resulted in an increase in social and academic integration (as described in Tinto, 1987).

The choices in using technologies such as computers are like those involved with other educational resources and methods. There is a need to consider both the pros and cons of the specific technology in using it to deal with academic knowledge and pedagogy. These experiences suggest that teachers benefit the most if we consider how learning mathematics education in face-to-face and online settings can complement each other. In particular, the Internet may extend our face-to-face classrooms for teachers to further explore sensitive issues. Evaluating online discussions should be an ongoing process in the learning and teaching process. For instructors, the information gleaned from this process should be used not only to assess students' learning, but also to help instructors themselves improve their instructional choices. Another implication of my experience for the educational use of asynchronous online discussions is that for effective use of this technology, it should be tied to the face-to-face interactions. This way, discussions will be more cohesive, which will in turn, will stimulate learners' interests and enhance their understanding.

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Author Note:

Qing Li
University of Calgary
qinli@ucalgary.ca

Appendix

Part of a Sample Activity Generated by the Teachers

Biography of My _____

Created by _____

1. Measure the height of your loved one. Record your measure by filling the blanks in the following sentence:

My _____ is _____ meters tall.

2. Weigh your loved one. Record your measure by filling the blanks in the following sentence:

My _____ weighs _____ kilograms.

3. Predict: Which one is longer: the circumference of your loved one's head or length of his/her arm?

The circumference of my _____'s head is <, =, > (circle one) the length of my _____'s arm.

4. Measure the circumference of your loved one's head.

The circumference of my _____'s head is _____ centimeters.

5. Measure the length of your loved one's arm (from his/her shoulder to the tip of his/her middle finger). Record:

The length of my _____'s arm is _____ centimeters.

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