Using Global Learning to Enhance the Preparation of Elementary Teachers in the Teaching of Mathematics and Science: What We Learned

Kay Gibson, Mara Alagic, Connie Haack
Department of Curriculum and Instruction, Wichita State University, USA
kay.gibson@wichita.edu mara.alagic@wichita.edu connie.haack@wichita.edu

James Watters, Geoffrey A. Rogers
Faculty of Education, Queensland University of Technology, Australia
j.watters@qut.edu.au ga.rogers@qut.edu.au

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James Watters, Geoffrey A. Rogers
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Abstract: Structured reflections and metacognitive thinking of elementary teacher education students provide powerful opportunities for students' self-efficacy growth, and the development of both mathematics and science related pedagogical content knowledge (PCK). Guided student-instructor reflections were already a part of an integrated mathematics and science methods class for preservice elementary teachers. A global learning dimension was added to further develop the reflective practice through cross-cultural discussions between students, as well as faculty, with their counterparts at a collaborating overseas university. The discussions were conducted using e-mail and were guided by a series of questions upon which students were to reflect with their 'e-mate'. The pilot of this project revealed problems with the establishment of dependable communication between the students. It also revealed the need for a more structured communication process, more guidance for students in online etiquette, and reconsideration of how students would be assessed for global learning activities.

Introduction

There is a general lack of self-efficacy among preservice elementary education students in the area of teaching mathematics and science. Students' own learning experiences during elementary school have left them with negative beliefs and attitudes, and created anxieties about learning mathematics and science that hinder their ability to effectively teach these subjects. Structured reflections and metacognitive thinking of elementary teacher education students provide powerful opportunities for students' self-efficacy growth and the development of both mathematics and science related pedagogical content knowledge (PCK) (Abell & Bryan 1997; Clarke 2000; Fenneman & Romberg 1998; Hart 2002; Shulman 1986).

The initial implementation of the project detailed in this paper attempted to extend students' existing reflective, metacognitive environment by pairing them with a student 'e-mate' in a similar teacher preparation program in Australia using e-mail to reflect on the teaching and learning of mathematics and science guided by a series of questions. It was anticipated that this reflective practice would provide a supportive learning environment that encouraged the changing of undesirable dispositions and the development of mathematics and science activities for teaching with understanding (Fenneman and Romberg, 1998). We sought to determine how reflection across cultural contexts might affect students' learning and dispositions. Our research question that focused this part of the project was "What happens when preservice teachers in two countries engage in joint reflections on their experiences in their science and mathematics methods classes?"

This paper describes the global learning project that used cross-cultural e-mail reflections to encourage the development by preservice elementary teachers, of more positive dispositions toward the teaching of mathematics and science. Data and insights are presented from the analysis of faculty/researcher comments recorded in weekly e-mail updates to each other, and in their reflections written at the end of the initial implementation that were related to the use of e-mail communication for the cross-cultural reflections. The faculty data are, in some cases, supplemented with student data that were gathered from a questionnaire administered to students at the end of the semester.

The University Learning Contexts

The faculties at both universities use a constructivist, inquiry oriented, approach to teaching and learning. Both the integrated mathematics and science methods class at WSU and the science methods class at QUT are based on national standards for teachers of mathematics and science (NCTM 2000, NRC 1996) with classroom activities emphasizing an inquiry approach to learning. The Australian teacher education program also uses a problem-based learning approach. In both learning environments, students are provided a number of opportunities for reflective practice. Prior to this project, guided student-instructor reflections using e-mail communication were already a part of an integrated mathematics and science methods class for preservice elementary teachers at Wichita State University (WSU). Through cross-cultural e-mail discussions between students, as well as faculty, with their counterparts at the other university, this global learning project added another dimension to existing reflective practice opportunities.

Global Learning

Global learning is more than merely distance learning, more than just the application of communication technology. It is concerned with learning at a distance plus diverse cultural perspectives, language differences, time zone differences and making the best use of innovative pedagogical strategies along with appropriate enabling communication technologies. The students achieve global awareness for the topic being studied as they move from the number and nature of perspectives encountered on one campus or in one region or country to the global arena. Global learning is defined as "the combination of global reach with global perspectives to produce a global graduate...who possesses expected attributes for (the) field of study and chosen career, plus increased understanding of cultural differences and their impact on teamwork and communication: and how to use modern communication technologies to work directly with other people all over the planet" (Glyn Rimmington, October 10, 2002, personal communication). It also provides an excellent medium for further development of fluency with information technology, an essential life–long learning skill in a global and technology rich society. "Fluency" refers to an understanding of information and communication technology to the point of being able to apply it productively, to recognize when it would assist or impede the achievement of a goal, and to continually adapt to the changes and advancements being made (NRC & NAS 1999, NRC 2000).

Project Design and Procedure

The participants in this project were preservice teachers in elementary education teacher preparation programs at two universities. They included 58 students at Wichita State University in the United States of America and 58 students at Queensland University of Technology in Australia. Students at both of the institutions were seniors with generally limited experience in the classroom. At the U.S. institution, students were enrolled in an integrated mathematics and science methods class during the first semester of their senior year, while at the Australian institution their counterparts were taking a science methods class. Most of the Australian students had already completed their mathematics methods class in the previous semester. The project was an integral part of both courses throughout the semester.

Before implementation of the project with the students, the faculty from each institution communicated by phone conference calls and the discussion forum component of Blackboard. The purpose of these communications was to become acquainted with each other; and to reflect on individual teaching philosophies, the desired outcomes of the project, the data collection instruments to be used, anticipated problems, and changes that might need to be made to the design of each existing class. The process that was to be used in pairing the students with a suitable e-mate was also developed, as well as some questions for guided reflections.

Students in Australia randomly selected from a list one student in the United States to reflect with during the course. Students were directed to contact their e-mate with an e-mail to introduce themselves to each other. In subsequent weeks students reflected on questions posed by the faculty, related to their personal beliefs about teaching and learning mathematics and science. During class time, discussions were held concerned with the ideas generated about the guiding question during the e-mail activity from the previous week. Students at WSU were required to copy each of their e-mails to their instructor.

The instructors recorded reflections about their observations of the project implementation through weekly e-mail up-dates to each other, discussing and problem-solving any issues that had arisen during the week. They also noted evidence of metacognitive thinking and learning in the development of pedagogical content knowledge (PCK) and positive dispositions in the students' e-mail reflections, and in the classroom discussions. It was initially anticipated that faculty discussions about the project would be conducted using BlackBoard discussion forums. However, after attempting several different forms of technology, the weekly e-mails and periodic videoconferences via the Internet were utilized.

Student focus groups were to be used to obtain further data concerned with the affect of cross-cultural reflection on students' learning and dispositions. The groups were to meet approximately halfway through the 9-week interaction period and again at the end of the semester. However, due to time constraints, focus groups were only held at the end of the project and no focus groups could be conducted with the WSU students, although some other sources of information were gathered through informal discussions with students and self-evaluation reporting on the question: What did you learn from your e-pal? Data from the three focus groups are not presented here.

Analysis of the qualitative data from the e-mail exchanges and in-class whole group discussions was completed using the constant comparative method where similar comments are categorized into groups. Inter-rater reliability was used to increase and establish validity by having (three faculty and two graduate research assistants) individually read and categorize the contents of all student e-mails.

Findings and Discussion

Dependable communication between e-mates

The pilot of this global learning project revealed that the establishment of dependable communication between the student e-mates was not as easy as anticipated. Faculty discussions and e-mail updates revealed faculty frustration during the early weeks of the project with difficulties surrounding the process of partnering the e-mates and the lack of student responses to e-mates. For example, student e-mail accounts were not necessarily university-based with a number of WSU students choosing to use Hotmail accounts. These accounts had various filters that caused e-mate communication to bounce back to the sender. Other students, who did not use their e-mail account on a regular basis, had full mailboxes which blocked communication from their e-mate.

One faculty pointed out that the problems with e-mail communication had caused the reflective component of the class to be less effective than usual. In the past, e-mail reflections were sent to the instructor who was always careful to reply with an appropriate response in a timely manner. However, the e-mates were not always able to communicate and have ready their reflections to compare to others ideas and for class discussion. Another faculty commented that in her class each student seemed to have at least one problem and resolving them was quite time-consuming. These technology problems tended to decrease student motivation to communicate with e-mates, particularly at the commencement of the project. However, once problems were resolved, students became much more positive about reflecting with their e-mates. The end-of-semester student questionnaire revealed that the technical problems did not emerge as a major issue with only four students mentioning it as an area needing improvement for the next implementation.

More guidance in online etiquette

A lack of student knowledge of online etiquette created confusion for the faculty and caused some student e-mails to be of a poor quality and therefore ineffective. Faculty discussions highlighted problems with students understanding of how to write and format an appropriate e-mail message. They noted that misspelling was a common problem. Some students needed to develop a greater ability to use a polite but not too formal tone in their communications while others showed a lack of online etiquette by not responding to messages in a timely manner. With a few students at each university, the lack of online etiquette appeared to be caused by a basic lack of experience with using e-mail.

The faculty found that they needed to remind students to think about how the message would appear to the receiver. This was apparent to the faculty when they received copies from students of e-mails that had no signature. This proved to be especially confusing when the students e-mail address did not contain their name or when they sent e-mails through another person's account. Subsequently faculty and e-mate replies to these e-mails would often not reach the appropriate student. Faculty also commented that they found it necessary to remind students that attachments should always have the student's name on them as the faculty might receive similar attachments from a number of students.

A more effective assessment procedure

Faculty mentioned in the weekly updates as well as discussions that the way in which students would be assessed in the future for the global learning component of their respective classes would need to be further discussed by all faculty involved in the project. In semesters prior to the project, WSU students had been given specific due dates for the reflection activities and earned points toward a final class grade through their participation. QUT faculty made the decision to not include the global learning activities as part of the class assessment. This was due to the fact that only one of the six instructors who teach sections of the class participated in the initial implementation of the project. This discrepancy in the assessment procedure between the two universities caused some student dissatisfaction with the quality and promptness of the e-mail exchanges. This was especially true for some QUT students who saw little benefit from the global learning activities for assessment. In some cases, they had the feeling that their e-mate was only engaged in the communication in a mechanical way to fulfill a requirement rather than to genuinely engage in the exchange of ideas.

Tied in with the need for a more effective and relevant assessment procedure was the faculty's observation that the instructors needed to set up more structured support for the e-mail reflection activity. Faculty need to provide explicit and clear student expectations that emphasize when and how frequently students should reflect with their e-mate, and remind them often of that. One faculty suggested that the global learning assessment procedure and student expectations should eventually become a permanent part of the class syllabus.

Conclusions

The pilot of this global learning project revealed that the establishment of dependable communication between the student e-mates was not as easy as anticipated. It showed the need for the students to have a more structured communication support process and more guidance in online etiquette. It also forced us to reconsider if and how students would be assessed and held accountable for the global learning component of the class.

For those students who established and nurtured online communication with their e-mate, student comments suggest that this was a beneficial and inspirational global learning experience. Some are even planning to maintain e-mail contact with their partner and eventually pair the children in their elementary classrooms for similar cross-cultural experiences.

References

Abell, D.K. & Bryan, L.A. (1997). Reconceptualizing the elementary science methods course using a reflection orientation. *Journal of Science Teacher Education, 8*(3), 153-166.

Clarke, B. (2000). *Supporting teachers in understanding, assessing and developing children's mathematics through sharing children's thinking*. Paper presented at The 9th International Congress of Mathematics Education.

Fennema, E. & Romberg, T.A. (Eds.). (1998) *Mathematics classrooms that promote understanding.* Mahwah, NJ: Erlbaum.

Hart, L.C. (2002). Preservice teachers' beliefs and practices after participating in an integrated content/methods course. *School Science and Mathematics, 102*(1) 4-11.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM, Inc.

National Research Council. (1996). *Inquiry and the national science education standards*. Washington, DC: National Academy Press

National Research Council. (2000). *How people learn: Brain, mind, and school* (Rev. ed.).Washington, DC: Author.

National Research Council, National Academy of Sciences. (1999). *Being fluent with information technology*. Washington, DC: National Academy Press.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.