Global learning technology: Developing pre-service elementary teachers' reflective practice through cross-cultural exchanges

Kay Gibson[1], James Watters[2], Mara Alagic[3], Geoff Rogers[4], Constance Haack[5]
1. Department of Curriculum & Instruction, Wichita State University (WSU), USA. 2. Faculty of Education, Queensland University of Technology (QUT), Australia. 3. Department of Curriculum & Instruction, WSU, USA. 4. Faculty of Education, QUT, Australia. 5. Department of Curriculum & Instruction, WSU, USA.

Email 1. kay.gibson@wichita.edu 2. j.watters@qut.edu.au 3. mara.alagic@wichita.edu & 4. ga.rogers@qut.edu.au 5. constance.haack@wichita.edu

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Abstract: This paper reports on the initial implementation of a global learning project. The primary objective of the project was to develop in students a broader, cultural perspective through co-reflection with an e-mate in sister classes at a collaborating overseas institution. The experience was designed to provide a cross-cultural environment for structured reflection and metacognitive thinking in which preservice elementary education students examined their beliefs about teaching and learning mathematics and science.

Introduction

From experience, we have found that a majority of the preservice elementary education students who enroll in our mathematics and science methods classes, be it in Australia or the USA, have low self-efficacy related to the learning and teaching of these two content areas. The literature contains further documentation of negative attitudes and beliefs, and describes various attempts to change such dispositions held by students (Mulholland&Wallace 2001; Schoon & Boone 1998: Watters & Ginns 1995). Reflection on practice has been shown to positively effect the attitudes of preservice elementary teachers about mathematics and science, and the development of their pedagogical content knowledge, thus developing greater self-efficacy in the students (Abell & Bryan 1997; Fenneman & Romberg 1998; Hart 2002).

The two courses involved in this global learning project already had a number of opportunities for students to reflect and explore their knowledge and dispositions related to mathematics and science. The project extended those opportunities with the addition of co-reflective experience in which students examined their beliefs with an e-mate enrolled in a similar course at a collaborating overseas institution.

Rimmington (2003, p.1) states that global learning "is…the combination of something called *global reach* with *global perspectives* to produce a *global graduate"* who possesses required attributes for (the) field of study and chosen career, plus increased sensitivity to cultural differences related to teaching. The environment of global learning facilitates the development of a global graduate through cross-cultural experiential learning using a social constructivist and project-based learning approach.

In the global learning project described here, it was anticipated that the cross-cultural reflection and communication would positively affect the students' self-efficacy related to the teaching and learning of mathematics and science. This paper reports the data that answered the question, what happens when preservice teachers in two countries engage in co-reflections on their experiences in their science and mathematics methods classes? It presents an analysis of data from student e-mail co-reflections, from faculty discussions and e-mail reflections, and from a student questionnaire administered at the end of the semester. Other aspects of the project are reported elsewhere. (e.g. Gibson, Alagic, Haack, Watters, & Rogers 2003)

Design and Procedure

The participants in the project were 116 preservice teachers in either an elementary teacher preparation program at Wichita State University (WSU) in the United States or at the Queensland University of Technology (QUT) in Australia. The students were in the final year of their teacher education program. WSU students were enrolled in an integrated mathematics and science methods class while their Australian counterparts were taking a science methods class having completed their mathematics methods class in the prior semester (Gibson, et al. 2003). The faculty at both universities uses a constructivist, inquiry-oriented approach to teaching and learning. Both methods classes are based on national standards for teachers of mathematics and science.

In previous offerings of the integrated methods class at WSU, students had participated in a number of reflective activities such as reflective journaling online with their instructor; in-class discussions of instructor-created synopses of the original student reflections that are posted online; and reflections on lesson planning that allows for developmentally appropriate content and strategies, peer teaching assignments, and a 10 day field experience completed across a five week period of time. Both of the mathematics and science method classes in the Australian teacher preparation program have also, previously included activities and assignments to encourage and develop reflective practice in the students. In particular, online reflections were required of the distant learning students concerning their dispositions and pedagogical understandings.

Anecdotal evidence collected by the instructors from students in these previous classes, suggested that students are particularly motivated to examine their thoughts in relation to those of their classmates. Thus, the idea of using global learning technology to link culturally different students was appealing as another way in which preservice teachers' reflective abilities could be developed and enhanced.

The faculty from the two universities communicated by conference phone calls and later by video conferencing, in order to get to know each other and to organize details for the implementation of the project. Collaboration was needed to agree on the desired outcomes for the project, to create a process for the pairing of students, to establish data collection instruments, and to brainstorm possible problems so that they could be addressed before they arose.

Once students had been paired with their counterpart overseas, they co-reflected via email to become acquainted with each other. Over a period of nine weeks, questions related to their personal beliefs about teaching and learning mathematics and science were posed by the instructors to guide the students in their reflections. It was anticipated that this new facet of reflective practice would help to address undesirable dispositions that the students had about the development of mathematics and science activities for teaching with understanding (Fennema and Romberg, 1998). Additionally, the e-mail exchanges focused on the students' individual learning about the curriculum development process required for assignments and for the field experience. During this same period of time, the instructors reflected on the progress of the project through e-mail up-dates to each other.

Data regarding the project implementation were collected from the WSU student e-mails, in-class whole group discussions of the e-mail reflection activity anecdotally recorded by the instructors at both universities, and a student questionnaire administered to all students at the end of the semester. The data were examined for evidence of meta-cognitive thinking and learning in the development of pedagogical content knowledge and positive dispositions in the students' reflections. Analysis of the qualitative data from the three sources was completed using the constant comparative method. Inter-rater reliability was used to increase reliability and establish validity of the data from the student e-mails. The level of the reflective thought exhibited in the student e-mails was measured using a five level hierarchical reflection framework developed by Garvin (2003) as a combination of Richert's (1992) research framework and the reflection framework of Hatton and Smith (1995). The five levels of reflection include "reporting" which is the basic retelling of actions or events with no reflection; "technical" which is reflection where decision-making based on experience is evident; "descriptive" which analyses and justifies decisions in terms of best practice; "dialogic" where one has a discussion with one's self to analyze experiences and develop alternatives; and "critical" which demonstrates an awareness of multiple perspectives that are historically and culturally influenced. For the most part, teacher education students in undergraduate programs operate at the reporting and technical levels of the reflection framework. Only after several years of classroom experience do teachers utilize reflective practice at all the levels (Hatton & Smith, 1995).

Findings

Not surprisingly, analysis of the student e-mails, by three independent raters using Garvin's (2003) reflection framework, indicated that the large majority of the preservice teachers' reflections were at the "technical" level with most of the remaining reflections assessed as simple "reporting". There were, however, a few students who had at least one e-mail that demonstrated reflection at the "descriptive" level. These students included comments about Piaget's theory of intellectual development, Gardner's theory of multiple intelligences or Bloom's taxonomy.

Examination of the data from the students' in-class discussions show similar trends and patterns to be evident in groups at both universities. Approximately half of the students seemed disappointed or somewhat dissatisfied with the level of correspondence. Problems associated with connectivity and irregular or lack of responses accounted for the majority of this group's comments. However, almost a third of the students reported that the e-mail co-reflections engaged them in productive discussions about their personal dispositions and the class content. Topics being discussed included questioning, inquiry science, science standards, and constructivism.

Faculty discussions and e-mail updates mirrored student data related to the lack of timely responses to some e-mates. They also expressed frustration with the technical difficulties that were experienced in trying to establish dependable communication between the e-mates, and with the process of matching students at the beginning of the project. However, the faculty viewed the guiding questions as highly useful in stimulating the introduction and discussion of topics that might otherwise not have been addressed in the class. Faculty analysis of the e-mails showed that some questions prompted reflective thinking about the subject content and related pedagogical content knowledge. All faculty felt that the reflective practice required by the global learning project resulted in positive benefits for all participating students and faculty, even though one instructor felt that the e-mail reflective component of the class had not be as effective in her class as when she had reflected individually with each student in previous classes.

Questionnaire responses received from 53 students provided comments on four survey items. The first was "In what ways has the Global Learning Project helped you to get a better understanding of the teaching of elementary mathematics and science?" There appear to be broadly three types of responses. A cluster of responses identified a range of positives extending from a metacognitive focus to a very practical reflection on learning content. That is, some argued that the questions helped them to think more about their own learning, while others saw the exercise as useful to exchange information on different systems. Others saw it as an opportunity to share and discuss content whereas one response noted it provided a broader range of topics to discuss. A majority of the respondents stated that it gave them an alternative perspective on the teaching of mathematics and science. Another type of general response classified the e-mail reflections as positive experiences that allowed them to learn about a different society, different education programs, and different approaches to learning. One respondent wrote that she became aware of another country's learning environment and realized that children, no matter where they live, need to learn the same basics. Approximately a third of the respondents were somewhat cynical and suggested that the emails were spasmodic, or came as a burst when assignments needed to be completed. Several described it as a waste of time.

The second question asked students, "What do you consider to be some of the disadvantages of this Global Learning project?" A number of disadvantages were identified that related to issues of time required to engage in emailing people with limited returns, little benefit for assessment, and in some cases little sense of positive engagement by partners. A few commented that the guiding questions for reflection were not specific to elementary and that they felt rushed to reply because they had limited Internet access. Respondents suggested that better groundwork is needed to match students and that the objectives of the exercise should be clearer and students should be held more accountable for their participation. A small number of respondents indicated that there were no disadvantages.

The third questionnaire item was "Please suggest at least three improvements to the design or implementation of the Global Learning Project if it were to be repeated." Many of the suggestions for improving the initiative were focused on three inter-related issues. The issues involved the task structure, the relevance of the experience to the class, and the clarity of assessment expectations. Respondents felt there should be greater flexibility and choice in questions and topics for reflection. Respondents also stressed that expectations for timely responses to e-mates should be explicitly defined in terms of how often e-mates would check their e-mail and how soon they were to respond. Some suggested that the topics of the two classes should be more closely aligned. Almost half of the respondents thought the activity could be made more relevant by exchanging more lesson plans or ideas and by allowing more time for

in-class discussions of what others were learning from their cross-cultural reflections. The respondents sent a strong message that they wanted to see their participation in the initiative acknowledged in some assessable way. One commented that they would have liked to be provided with a more detailed rubric so they had a better understanding of how they were being assessed. Another possibility for improvement that was highlighted by respondents, involved the use of a chat room, discussion forum, or website for the exchange of reflections rather than e-mail. Interestingly, the mode of communication was a minor issue along with participation.

The fourth item on the questionnaire asked, "Finally, to what extent do you think children in schools could engage in a similar international virtual community to develop understandings of mathematics and science?" All respondents saw the application of global learning to elementary classrooms as positive and desirable. Most qualified their answer with comments emphasizing that modifications would have to be made for the experience to be successful.

Conclusions

Initial project implementation results suggested that a global learning environment designed in this manner for preservice teachers, provided an additional opportunity for constructive reflection on personal dispositions and abilities related to the teaching and learning of mathematics and science. Though it is difficult to identify causal factors in the extremely complex context of a classroom, there are indications that the students' self-efficacy with respect to teaching science and mathematics improved. The cross-cultural reflections broadened students' perspectives about teaching approaches in their future classrooms.

For further implementations, focus on alignment of the approaches to the reflective activities and related assessments in the two courses is necessary. Additionally, faculty will need to structure and support reflective exchanges in a manner that will encourage higher levels of reflectivity (Garvin, 2003).

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