

Global perspectives of science education: Successes and challenges of a pilot project.

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Abstract:

This paper describes a pilot global learning project, which linked Australian preservice primary students teachers with their counterparts in the US. In the context of globalization and with the rapid development of the world wide web, greater understanding of other cultures and practices has become a priority. To address this issue, the study was conducted with approximately sixty Australian students in the second or third year of their primary Bachelor of Education course studying a Science Curriculum unit. These students were matched with a cohort of third year undergraduate preservice elementary student teachers from a university in the United States studying an integrated mathematics science methods course. Over a six week period the students e-mailed each other weekly and attempted to learn about primary / elementary science education in both countries. The project was monitored over the six-week period and carefully evaluated at the end. A number of valuable insights were obtained from the evaluation data and these are discussed. Important lessons gained from the initial pilot project will be used to enhance and shape the future directions of providing global perspectives for primary preservice student teachers.

Global Learning:

The forces of globalization and the impact of technology are driving an increasing internationalization of knowledge. University graduates, as global citizens, need to be aware of cultural contexts within their disciplines and be able to contribute to the intellectual, social and cultural activities in the international community. This is especially necessary among prospective teachers, who not only are increasingly likely to be employed globally, but also need to develop international perspectives among their own students (e.g. Carnoy & Rhoten, 2002; Merryfield, 2001; 2002; Nordgren, 2002). For many undergraduate and graduate preservice teachers, only limited attention is usually given to national and international perspectives. The underlying assumption seems to be that upon graduation, all students will find employment as teachers in their home state. Hence traditionally the emphasis during their course has been on using almost exclusively curricula materials produced by the state authorities. This might have been valid in the past. However, with the increasing internationalization of education, it would now seem prudent to prepare students to be able to teach anywhere in our global village. In recent years teacher shortages in the UK, US and NZ for example, have seen increasing numbers of teacher education graduates from Australia move overseas to teach.

The term *globalization* has been used to refer to trends in higher education that in turn have cross-national implications. The other term sometimes used synonymously with globalization is the term *internationalization* which is considered to refer to the specific policies and initiatives that deal with global trends (Altbach, 2002). Porter and Vidovich (2002) consider that globalization is about the connection of cultures and the integration of economies that involve international networks. According to Carnoy and Rhoten (2002) the main resources for globalization are increasing knowledge and information. Given that schools and universities are international enterprises (Turner, 2000), Carnoy and Rhoten claim that research has shown that among US tertiary students there is a remarkable lack of familiarity with world issues, geography and cultures. In addition, these authors reported that from a survey of some US academic faculty, only 45% agreed that further steps should be taken to internationalize the curriculum. Is there a similar situation existing in Australia?

Some of the emerging global trends seen in higher education will be reflected in the global learning project to be discussed. Students of today are relatively more mobile, discerning and demanding. They often have part time jobs and are less obvious in their participation in on-campus activities. Opportunities to enroll externally have been taken up by many in increasing numbers. To enable quality learning, new and powerful ways need to be developed to support teaching. Computer mediated conferring opens up potential for students to become independent and self regulated learners (Peters, 2000) and removes national boundaries on the context of learning. To grasp this opportunity, teaching staff need to develop the necessary skills to facilitate the development of on line learning communities (Laurillard, 2002; Salmon, 2000).

Aims and theoretical framework:

The aim of this project was to document a process through which pre-service teachers could engage in electronically mediated collaboration to support their learning to teach science. The study was influenced by Salmon's (2000) model of online teaching and learning which describes a sequence of phases beginning with "access and motivation" and progressing through "on-line socialisation", "information exchange", "knowledge construction" and finally "development". The early phases of this model require substantial scaffolding until eventually students become autonomous and spontaneous in their use of the technology to learn. In this process, students develop the technical competence to engage in on-line discussions; establish identities within the confines of a new literacy; break the ice by sharing neutral information until they are confident and trusting to collaborate around mutually beneficial tasks; and eventually develop autonomy to engage in spontaneous communication.

Description of the global learning project:

The global learning project was implemented in second semester last year with a group of approximately 60 students from Queensland University of Technology [QUT] and a similar cohort of US students from Wichita State University (WSU). The preservice primary students from QUT were either 3rd year undergraduates or graduates in their 2nd and final year of their B.Ed course. They were studying a primary science education unit [MDB384] of which there were a total of approximately 500 students [which included

approximately 20% externally enrolled students] in the cohort. Each student from QUT was matched with a student from WSU and weekly asynchronous e-mails were established between the pairs. Students from both universities were provided with either set or suggested tasks and questions to ask. The QUT students were issued with weekly suggestions where as the students from WSU had a much more structured set of questions to seek responses from and to record in their reflective journals. The WSU students were required to send copies of their e-mails to their instructors. Through the use of e-mails, the students were able to form an e-community in which they shared learning experiences and explored each other's assumptions about science teaching. Staff from both QUT and WSU supported this process through regular asynchronous e-mail communications and teleconferencing.

At the beginning of their communications, students were encouraged to introduce themselves and establish rapport with each other. Through this on-line socialisation students came to know more about each other's cultural and social contexts. The next phase focussed on information exchange around their learning experiences. They discussed their own science self-efficacy and beliefs about learning and teaching science. Next they probed aspects of each other's beliefs, knowledge and attitudes about primary / elementary science education. Some of the topics that were explored included the unit objectives; assignments; workshops; tutorials; lectures; student handouts posted on the university open learning site (OLT); constructivist theory for learning science and the implications for teaching. The American students examined the main resources used in MDB384 which included a unit specific Science Education Resource Book, two interactive CD ROMs and the OLT site for the unit. In turn students from QUT learnt about the US Science Standards; US teacher accreditation requirements; Teacher's Investigations of Children's Knowledge and Learning Evolvment [TICKLE] – Piagetian Testing; and features of US University and Elementary School Systems. In addition the students were also encouraged to share useful primary science Uniform Resource Locaters [URLs] that can be added to their own Science Page on their Home Page and / or electronic data base of URLs as part of their own professional electronic portfolios. In this way students were encouraged to engage in personal knowledge construction that delved beyond the surface characteristics of each cohort's specific course details. For example, discussion of social issues including Indigenous/Latino education, and urban schools were addressed as opportunities arose.

Evaluation of global learning project:

A variety of both formative / summative and quantitative / qualitative techniques were employed both at QUT and WSU to evaluate the effectiveness of the project. At WSU analysis of the qualitative data from the e-mail exchanges and in-class whole group discussions was completed using interpretative methods. Transcripts were read, coded and examined for patterns and outcomes using constant comparative strategies (Strauss & Corbin, 1990) to support or refute hypotheses. 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.

Throughout the six-week implementation phase at QUT, the first author constantly monitored the project and changes made whenever deemed appropriate. A reflective journal was kept throughout the duration of the project.

At the end of the six week period, data on the impact of the global learning project on students was collected from random samples of their e-mails; audio taping of a random sample of individual interviews and by the use of two focus group discussions. At the end of the six weeks a questionnaire was administered to all students. In addition all students at the beginning and end of the project completed both the SELS and STEBI instruments to assess levels of science teaching self-efficacy (Enochs & Riggs, 1990). The reason for this was to try and ascertain whether any changes due to the global learning project had occurred in their self-efficacy in learning science. Finally a pretest science skills test / survey developed by collaborators at WSU was also administered to the QUT students at the beginning of the project.

In this paper we would like to focus on two aspects of the evaluation of the global learning project. Firstly we examine QUT student's responses to the questionnaire which was administered to all students at the end of the global learning project. Secondly the first author would like to share some of his reflections from being involved in the GL project. A number of other aspects of this project have been reported elsewhere. [See also Gibson, K., Alagic, M., Haack, C., Watters, J. & Rogers, G. (2003) Gibson, K., Watters, J., Alagic, M., Rogers, G. & Haack, C. (2003) Haack, C., Alagic, M., Gibson, K., Watters, J. & Rogers, G. (2003)]

Analysis of questionnaire concerning global learning project:

The questionnaire was designed to probe four main issues: (1) personal knowledge development about science teaching, (2) disadvantages of engaging in on-line collaborative learning, (3) ways to improve the experience, and (4) relevance for school children. The following discussion analyses the response to questions addressing each of these issues.

Q1 In what ways has the global learning project helped you to get a better understanding of the teaching of primary science?

There appear to be broadly three types of responses. First, 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 students argued that the questions posed by the US counterparts helped them to think more about their own learning, while others saw the exercise as useful information exchange on different systems. This type of response is exemplified by these comments:

GLP has helped my understandings by providing a neutral person who you can bounce ideas with and discuss opinions etc. This is harder to do with someone in your class because they have been given the same perspective as you have.

This project enabled me to gain better understandings about science by talking to someone who is interested in the same topic.

Yet others saw it as an opportunity to share and discuss science 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. For example, one typical response was:

We've talked over constructivist ideas and given each other suggestions about teaching and talked about experiences we've had teaching children.

Second, 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. The response such as the following were typical of this reaction:

Gives understanding of how things are different yet the same in other countries.

Third, approximately one third of the respondents were somewhat cynical and suggested that the e-mails were spasmodic, or came as a burst when assignments needed to be completed. Several described it as a waste of time. Such a response as the following is typical:

My buddy only emailed me once in week 11. Her emailed (sic) consisted of a question that I had to answer. I didn't bother emailing her back because she seemed only interested in getting answers for her assessment.

Q2: 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 e-mailing 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. Some respondents suggested that better groundwork was needed to match students and that the objectives of the exercise should be made clearer and that students should be held more accountable for their participation. A small number of respondents indicated that there were no disadvantages. One sided commitment was apparent in a number of comments, for example:

Partner was committed to discussing their topics only – was not interested in mine.

Surprisingly few mentioned technical problems although earlier feedback during tutorials suggested that this was a major issue. At least some students were saying that email was bouncing or that partners were claiming they had not received email. Access was found to be a technical problem as well and affected probably about 10-15% of students. However, it must be noted that the university does provide extensive laboratory facilities for students to use.

Q3: Please suggest at least three improvements to the design or implementation of the Global Learning Project if it were to be repeated.

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.

Q4: Finally, to what extent do you think children in schools could engage in a similar international virtual community to develop understandings of science?

All respondents saw the application of global learning to primary / 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. Typical responses were:

In theory I think this project was a great idea, and it could easily be adopted into a classroom situation. I think in a classroom, it would be good to set aside time each week (or each day) to correspond.

Children could engage in a similar international virtual community, as most of the interaction would take place during school time. Therefore the communication would happen on a regular basis.

Maybe US and Australian classes could do same experiments and activities and share results. Discuss differences/similarities/outcome.

Instructor’s reflections:

During and after the global learning project had finished a number of important issues were found to emerge. At the outset it needs to be noted that last year when the global learning project was being implemented the instructor was in his first year at QUT and was therefore still very much settling in. The instructor was also the coordinator for the

large primary science education curriculum unit that had nearly 500 internal / external, graduate / undergraduate students. With regard to the issue raised about assessment and the global learning project, at the time there was felt the need to be very conscious of equity for the whole cohort in the unit, and therefore a conscious decision was made not to include the participation in the global learning project as assessable. Arising from the evaluation it would seem that this is an issue which will need to be addressed in the future. The new reconceptualized BEd, which comes on stream next year, has the potential to offer modules in units and this could ideally suit a module on Global Learning which students would choose to include in their science education program.

By far the overwhelming difficulty from the instructor's perspective was the problems caused by receiving and sending e-mails between e-mates. This was a major cause of frustration particularly during the early weeks of the project although for some it continued throughout. A number of student e-mail accounts were not necessarily university-based with a number of students choosing to use their 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. In the early stages it was necessary for us to ask all students to include the term GL project in the subject headings of their e-mails.

Given that both cohorts of students involved in this global learning project were internal, and therefore engaged in face-to-face teaching and learning, it may seem more logical to involve external students in such a project. It is these external students who normally miss out on being involved in collaborative learning communities. I believe that this an option which we will need to further explore in the future.

From the start of the GL project we were very conscious of the need to start with small manageable steps and tasks. For all of the instructors involved it was also a new learning experience. From the lessons learnt and expertise developed, we are now in a better position to more easily further improve and expand the project.

Another interesting issue to emerge from the initial implementation of the GL project was related to the basic core goals of what we were trying to achieve. From the point of view of QUT students we wanted them to learn as much as possible about primary science education in Wichita and in the US generally as well as engaging in reflective discourse. We provided suggestions and questions which they could explore in order for them to work towards achieving this outcome. On reflection it could be argued that such an approach could seem to be at a fairly surface [or superficial] level of learning. However, one could argue that it did provide a useful global perspective for them. On the other hand, the students from WSU were asked to explore science / maths related issues and topics using a much more ordered and structured approach. Given these two apparently different sets of expectations we still maintain that for many of both the QUT and WSU students the interactions and dialogues were fruitful and very rewarding. Learning outcomes from research about direct (highly structured) and nondirect (less structured) instruction can vary. In a study conducted by Hancock (2002) it was revealed that highly structured teaching methods maximized the motivation for students with low conceptual

levels, whereas teaching methods that were low in structure enhanced the motivation of high conceptual level students. We were concerned that a longer time frame may be necessary to allow students to engage in deeper levels of reflection and therefore is it realistic to expect this to occur for most students participating in the current short 6 week global learning project? For the QUT students, they all engage in critical self-reflections as part of their micro science teaching episodes in their weekly two hour workshop classes.

Finally, the use of an experienced colleague to act as an evaluator / support person was found to be invaluable. When teaching students it is easy to become so immersed in the task that it is not always easy to be objective and see the complete picture of what is happening. This phenomena has been termed *enculturation* and refers to the unconscious blinkers which researchers can experience when working in schools and classrooms in which they are very familiar (Wolcott, 1975). It was not until after the semester had finished that we were able to analyze the collected data. The use of evaluation feedback from the WSU team members also proved to be invaluable in allowing us to reflect on the experience.

Future directions:

Several key lessons have been learned from this GL project and these will be used to enhance and shape the future directions of providing global perspectives for primary preservice student teachers. First, we were sufficiently encouraged by the experience to work towards extending the global learning project to include all of the enrolled internal [and external] students and the engagement of other international universities. (We are currently negotiating with several Malaysian Colleges of Education). The inclusion of several universities from around the world would be ideal for our QUT students, as it would provide a rich diversity of cultures.

Second, from our evaluations it would seem that perhaps the most pressing change we need to make is to improve our communication medium. We would like to make use of Black Boards this coming semester instead of relying solely on e-mails. The process of matching students and establishing initial rapport needs further refinement. Another area that needs to be enhanced concerns the tasks that we set the students to do. It is quite evident that there is a need to align tasks so that there is some common ground for discussion.

The teaching materials used at both QUT and WSU need to be further exchanged so that students can explore in greater detail the materials used in each other's science units. For example the videos and CD-ROM resources (Diezmann, & Watters, 2001; Watters, & Diezmann, 2001) depicting Australian teachers could form the focus for discussion and comparison of systems and practices of education.

Third, on reflection, our approach to this exercise was driven by a naive expectation that students would want to collaborate and that some intrinsic interest, curiosity or commitment would drive participation. This expectation was clearly false. Although most students did engage in some form of collaborative learning it was not without the intrusion of some external pressure. The expectation of why students should collaborate

was never made explicit. Nordgren (2002) reflected on his experiences in comparing Swedish schooling practices and American schools and from this vantage point advocated how the Swedish experience challenged his entrenched beliefs about the structure and purpose of schooling. As members of the GL team we too have been challenged to re-examine our own beliefs.

Conclusions:

Although there were the expected “teething” problems, overall we felt that the project was successful and we look forward to continuing the global learning again this coming semester. We felt that the involvement of some of our students in this project provided them with the opportunity to be exposed to an array of different and enriching learning experiences that other students in the science education unit did not have. As the instructor and evaluator involved, it was also a stimulating challenge and rewarding learning experience for both of us as well. We have learnt many lessons from the initial experience and intend to make changes to further enhance the global learning for our students. Arising from our involvement in the global learning project, we tend to agree with Graziadei’s (2000) when he wrote in the book review of “Brave new schools: Challenging cultural illiteracy through global learning networks”, that global learning networks can serve as a catalyst for collaborative critical inquiry. Graziadei also made the claim in his book review that access to sophisticated technology is not essential for engaging in intercultural learning networks. We remain strongly committed to the concept of providing global perspectives of primary science education for our students as we believe that ultimately they will be better prepared to teach primary aged children anywhere in our global village.

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