Towards the Study of the Processes and Effects of Internationalisation in Mathematics Education

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This proposed study is designed to investigate a rapidly expanding area of activity in mathematics education that has not been researched and theorised. Arguably, mathematics education is one of the most internationalised areas of the curriculum. This paper outlines a longitudinal study to investigate issues in the internationalisation and globalisation of mathematics education in 3 regions with ties to Australia. It is a part of a workshop that aims to obtain feedback from peers and trial the instruments to be used.

Robitaille and Travers (1992) claim that mathematics education is one of the most internationalised areas of higher education. This is evidenced in similarity of the curriculum reforms happening around the world and the number of international conferences and research activities that have propagated during the past few decades. Yet, very few research studies have problematised the processes and outcomes of such internationalisation. This proposed study investigates issues related to internationalisation and globalisation of mathematics education with special emphasis on the professional development of educators.

Although the terms internationalisation and globalisation are relatively recent in academic discourse (Waters, 1995), they are playing an increasingly significant role in higher education policy and practice. Waters claims that while postmodernism was *the* concept for the eighties, globalisation may well be *the* concept for the nineties. Several national (Internationalisation of Higher Education in the Asia-Pacific Region, 1996) and international (de Wit, 1995) conferences have been held on issues of internationalisation of education. Back, Davis and Olson (1996) have shown that almost every Australian university has developed policies and strategies to deal with this trend. Research is essential for further developing Australia's interests in this competitive market, as well as enabling it to provide programs that meet the needs of its international clients.

Conceptualisation of internationalisation and globalisation

Since the concepts of *internationalisation* and *globalisation* sometimes are given different meanings by different authors and other times are used interchangeably, we need to conceptualise their usage in this study. A widely used definition of internationalisation is that of Knight in a report commissioned by DEETYA (Back, Davis, & Olsen, 1996, p. 1): "Internationalisation of higher education is the process of integrating an international/inter-cultural dimension into the teaching, research and service of the institution". Waters (1995) defines globalisation as "a social process in which the constraints of geography on social and cultural arrangements recede and in which people become increasingly aware that they are receding" (p. 3). Globalisation is often associated with "forces [that] are impersonal and beyond the control and intentions of any individual or groups of individuals" (p. 2). McGinn (1995) presents a similar view by asserting that "efforts at internationalisation ... [are] seen by ... authors as activities that improve higher education institutions without diminishing their autonomy. ... There is some evidence, however, that the processes of globalisation are compelling rather than invitational, and therefore require careful scrutiny" (p. 78).

In accordance with the definitions presented above, *internationalisation of mathematics education* is taken here to mean the integration of an international dimension

in the curriculum, research and professional development including activities that promote inter-country collaborations. The term *globalisation of mathematics education* is taken here to refer to the phenomenon of knowledge, values, principles and curricula developed in some context gaining a global adherence.

Internationalisation and globalisation issues in mathematics education

Robitaille and Travers (1992) discussed the relative similarity of content and importance of mathematics curricula around the world and concluded that the "language of mathematics is, in many ways, truly international" (p. 687). Silver and Kilpatrick (1994) and Kilpatrick (1992) discussed the increasingly crucial role in the development of mathematics education in different countries of international conferences (e.g., ICME and PME), publications (e.g., JRME, FLM, ESM and MERJ), international studies of achievement in mathematics (e.g., IAEEA and the more recent TIMSS study), and international collaborative groups (e.g., the BACOMENT project). Although these forums allow researchers from around the world to share results of their studies, they have often been criticised in that commonly they have greater representation of American and European researchers and views (Bishop, 1992). Further, they often consist of brief reports of research projects that do not allow the discussion of the complexity of issues affecting mathematics education (Silver & Kilpatrick, 1994). Similarly, international studies on achievement in mathematics have come under scrutiny on their failure to consider the interaction of the different countries' contexts with achievement levels of students (Robitaille & Travers, 1992). The scant literature that considers internationalisation of mathematics education seems to concentrate on research activities. Bishop (1992) has argued how the "growing mutual international influences of ideas, methods, practices, and expectations" (p. 710) has lead to the difficulties in identifying national perspectives of mathematics education in the different countries. Watson and Atweh (1992) have discussed the role of Australian research in the international community and called for an increase in the Asian co-operation on research activities.

In a recent chapter, Jacobsen (1996) outlined the effect of international organisations such as UNESCO, the World Bank and ICMI in changing mathematics education world-wide. He argued that the increasing gap between the rich and poor countries and the curtailing of funds from these international agencies make it "more difficult to look for governments for improved international co-operation in mathematics education" (p. 1253). He joined Miguel de Guzman, the past President of ICMI, to call for an increasing role of co-operation between professional mathematics educators and their associations to work to improve mathematics education world-wide. This proposed study in an investigation of some conditions under which such collaboration is effective.

Within the context of internationalisation, questions arise as to whether mathematics education, or parts of it, are becoming globalised. Commenting on the 7th ICME conference in Canada, Usiskin (1992) summarised the feeling of many participants by expressing his impression about "the extent to which countries have become close in how they think about their problems and, as a consequence, what they are doing in mathematics education" (p. 19). Yet, he goes on to express his hope "that the new world order does not result in a common world-wide curriculum; our differences provide the best situation for curriculum development and implementation" (p. 20). This concern about uncritical globalisation of issues is shared by Rogers (1992) stating that "the assumptions that mathematics is a universal language, and is therefore universally the same in all cultures cannot be justified. Likewise, the assumptions that our solutions to local problems in pupil's learning and our own teaching of school mathematics will have universal applications is even further from the truth" (p. 23).

One area that has received considerable debate in the mathematics education literature is the relationship of mathematics learning to its cultural, language and social context (Bishop, 1988; Ellerton & Clarkson, 1996; D'Ambrosio, 1985; Lave, 1988). In reviewing the literature on ethnomathematics, Nunes (1992) refers to the debate in the literature between those who assert that different contexts give rise to different types of mathematics and those who argue for some invariant features underneath surface

differences. Clarkson (1992) has noted how curriculum decisions can change depending on which cultural group is dominant within a country, and the political decisions of the ruling group. Nebres (1995) argued that early international collaborations consisted of developing countries modelling the curricula of the developed countries that colonised them while current collaborations are more based on the formations of common interest networks across national boundaries. He argued for what he calls an axiom of collaboration: "The more global and multicultural we seek to become, the deeper must be our local cultural roots" (p. 39). This proposed study is an investigation of how local context can be accounted for within international collaborative activities.

The area of particular interest to this proposal is the professional development both of school teachers and university educators in mathematics education. Countries in the West, in particular the United States, United Kingdom and Australia, are attracting an increasing number of international students and consultancies in Asian and other countries and literature on issues of internationalisation of professional development is almost non existent.

This proposed longitudinal study aims to

1. investigate theoretical issues in globalisation and internationalisation of mathematics education with particular emphasis on cross-country collaboration in professional development;
2. investigate the experiences, perceptions and beliefs of mathematics educators from four regions about internationalisation and globalisation of mathematics education;
3. develop case studies of programs and activities that can be regarded as best practice in cross-country collaboration in professional development in mathematics education; and
4. develop model(s) for inter-country collaboration in professional development; and
5. design, implement and evaluate a collaborative program based on the model(s) developed in three postgraduate courses in Australian universities and in selected overseas universities.

Research Design

Project Reference Group

In this study it is essential that the design of the project reflects its theoretical underpinnings, in particular, that the project be conducted in an international cooperative way. Hence, the international Project Reference Group (PRG) is a crucial component of the design. This reference group will consist of leading representative educators each of the three international regions and will be consulted at each stage in the design and implementation of this study. These people represent leading educators for the region and would provide contact with mathematics educators from the respective regions not only from their specific countries.

Study Overview

This study consists of three main phases. This section presents an overview of the phases which are detailed in the following sections. The study phases follow a contingent design where the results obtained from one phase effect the final design of the following phase. The project commences with a ...

1. *theoretical study and a survey study.* This phase, continues with the development of a theoretical model for discussing internationalisation and globalisation of mathematics education. It uses focus groups that aim to identify issues, benefits and concerns by leading mathematics educators about internationalisation and globalisation of mathematics education (Aim 1). The major issues identified will inform the *survey study* to a large group of mathematics educators in the three international regions and in Australia to identify the extent of international contact by lectures in these regions and their perceptions of acceptable practice in international collaborations (Aim 2). Both the focus groups and the survey will be used to identify international programs/activities in existence in the identified regions, especially those that are

widely regarded as cases of best practice. A diverse selection of activities/ program will be identified for further investigation as ...

2. *case studies.* At least 3 international projects/activities will be identified within each region (total 16) and investigated in depth. This phase of the study aims at identifying features of these programs/activities that make them successful in meeting the needs of the various collaborators (Aim 3). Larger activities would be given more emphasis. The successful design and implementation features of these programs will assist in developing model(s) (Aim 4) for international collaboration and will be used to conduct an ...
3. *action research study.* This will involve the design, implementation and evaluation of courses/programs at the three participating Australian universities and at least one co-operating university from each of the three international regions. These will form the basis for the action research component of the study (Aim 5). Activities conducted in the first four phases of the project will provide knowledge that would lead into ...

Phase 1 (theoretical study and survey study)

Sample: Two samples are needed in this year. For the focus groups we will be inviting at least 6 leading mathematics educators from each of the participating regions who are recognised as experts in mathematics education by their leading role in their countries and by their contribution to international conferences selected in conjunction with the PRG. We will be ensuring a broad representation of views on and experiences in international collaboration. The second sample will be selected to undertake the survey. Since the population is not very large, all full time university mathematics education lecturers in the participating countries, identified with assistance from the PRG, will be surveyed.

Instruments: Focus groups: Focus group are efficient and powerful means for raising issues that the participants see as important (Stewart & Shamdasani, 1990). The model used here will proceed as follows: A synopsis paper, developed by the researchers, highlighting the main issues for discussion (e.g., the scope and types of international activities in their countries, the different models used in international co-operation, available funds and sources, how they meet the needs of their country and major hindrances) would be distributed to participants before the commencement of interview;. The group facilitator (one of the researchers) would introduce the general topic for discussion and requesting comments on theoretical issues as well as specific experiences that the participants may have had. Focus groups tend to be self directing, hence there will be no further interaction from the facilitator.

Survey: The survey will seek information from the participants about the extent of the influence of international activities in the development of their knowledge in mathematics education. The survey will seek their attitudes about the relevance of the various activities (e.g. conference attendance, overseas training, reading journals, joint research) to their local context and personal needs. Similarly, the survey will investigate the participants' attitude and beliefs on the theoretical matters stemming from the focus group. Participants will have a chance to nominate best practice activities that they are familiar with and are requested to provide documentary samples of such.

Procedures: The focus groups will be conducted during the second half of the year. Visits to the three international regions for the conduct of the focus groups will be arranged where possible to coincide with an international conference. Focus groups will be audio or video taped. Some of these focus groups will be conducted in languages other than English. The transcripts will be translated into English. The development of the survey will commence in August. The instrument will be developed in consultation with the reference group. The original form will be developed in English. Where needed, it will be translated into other languages using the back translation method (Brislin, 1986). The survey will be administered in early October by electronic mail if available or by post otherwise.

Data Analysis: Both qualitative and quantitative data would be generated from this stage of the research. Closed ended survey items would be analysed as frequencies and

percentages. Responses will be analysed as function of country of origin and level of exposure to international activities of the respondents. Open ended questions would be coded into meaningful codes based on grounded research techniques (Strauss & Corbin, 1990). The codes are simple descriptions attached to discrete occurrences of events or phenomena. The codes will then be categorised to provide more abstract concepts called categories. Some of these categories would arise from the data while others may arise from the literature reviewed. Since it is expected that a large amount of data would be generated from this phase, the computer program NUD*IST would be utilised to generate and manipulate codes.

Phase 2 (case study)

Sample: The case studies will represent a purposeful sample of a wide range of activities developed for cross-country professional development in the overseas countries or in Australia. These programs will be identified in conjunction with the PRG and based on the focus group and the survey results. This method of selection will assure that programs undergoing in-depth analysis are regarded by the community as examples of best practice and cover a range of types of activities (e.g. formal degree courses with large number of international students, formal courses designed specifically for international students, international teacher and educators development projects, activities that depend on the use of telecommunication technology, and internationally funded consultancies).

Instruments: Case study: A variety of instruments will be used to develop the case studies in this investigation. The model used in this study is that presented by Stake (1995). Documents outlining the principles behind the design of the program/activity will be examined. Interviews with the key players (e.g. designers, delivers and selected participants) would be sought. Non participant observation of the program activities will be conducted whenever possible. Where appropriate, questionnaires would be sent to participants in these program to seek their attitudes and experiences in the program. Aspects of the activity that deal with internationalisation and globalisation issues and their adaptation to local context will be of special interest in these case studies.

Procedures: The data from the focus groups and survey will be analysed. The results will be used to generate criteria for the selection and conduct of the case studies. Contact would be made with various activity leaders for possible in-depth study of their activity as a case study. The case studies will be conducted in the second half of the year. Visits to the three regions will be conducted. Each case study would involve at lease one week visit by one of the researchers. Work would commence in August on summary of data from the case study leading to development of models of best practice. Plans and preparations will commence in September with participating institutions for collaborative action research in the following year.

Data Analysis: Two types of analysis would he conducted on data generated from this phase of the study. Case study descriptions based on Stake would be developed for each of the cases studied. Member check with each case would be conducted to assure authenticity of the data. Further, grounded research techniques discussed above will be used to identify the features of the activities that make them successful/unsuccessful. These features would be used to generate the model(s) for best practice. Continuous hermeneutic cycles would be followed to assure that the models obtained would identify the factors that are effective toward the success of these programs. Special emphasis will be made on issues arising from the focus groups and the literature review. It is expected that the model will include features in the activity's design, implementation and evaluation outlining the role of the different participants and features that make them appropriate to the local context of the participants.

Phase 3 (action research study)

Sample: The subjects selected for this part of the project depend on the specific projects that emerge from the previous year's negotiation with the collaborating countries. Students enrolled at three M Ed subjects at the three participating Australian universities, many of whom are international students, and staff teaching these subjects would form

the nucleus of the sample used for the action research. Similar courses will be selected from some of the participating countries that are willing to participate and that can guarantee the resources for such participation. Naturally, participants who refuse to participate in this study may still participate in the activity without providing data to this study.

Instruments: A variety of instruments will be used for action research component of this project: Email correspondences, reflective diaries, regular feedback from subjects, final assessment items in the subjects and questionnaires as formal evaluation by the participants.

Procedures: As is the case with action research designs, the form of these activities is contingent on results from the previous phases of the study. The model of Action Research adopted in this study is that of Kemmis and McTaggart (1988). It includes cycles of planning, action and reflection. The design of the subjects would include participants from different countries working together on assessment tasks using electronic telecommunication. Further, all participants would be involved in some common readings and lectures about mathematics education in the different countries. Other features of the subjects would be developed based on the results case studies developed in phase 3 of the project. Regular electronic contact will be maintained between the designers of the activity toward its conduct and evaluation.

Data Analysis: Similar techniques for analysis of data used in the case studies will be employed in this part of the research. In particular, attention will be given to categories related to participants' experiences, language of discourse, and relationships that develop between the participants (Kemmis & McTaggart).

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