

International Cooperation in Mathematics Education

Theoretical Discussion Paper

Mathematics education is perhaps one of the most internationalised subjects both in basic education (primary and lower secondary in many countries) and in post compulsory education (upper secondary and universities). This phenomenon perhaps reflects the common beliefs that mathematics is a universal body of knowledge that is trans-cultural, and that certain forms of mathematics knowledge are essential for the technological development of nations and hence to their economic development. It is important to note, however, that both beliefs are often challenged. Some argue that there are many different forms of mathematical knowledge (eg. ethnomathematics, school mathematics, everyday life mathematics, formal mathematics) that were developed to meet the needs of local cultural and social groups (D'Ambrosio, 1985) and that the relationship between mathematics as taught in schools and economic development is a rather complex one (Woodrow, 2003). There is some evidence that economic development precede high achievement in mathematics rather than the other way around, and while mathematics achievement for some groups have increased during the past few years, their socioeconomic status has actually decreased.

International migration of mathematical knowledge is not a new phenomenon. In this discussion we are more interested in the profession of mathematics education rather than the discipline of mathematics – that is the professional and academic work of educators involved in research and curriculum development in mathematics education. International contacts between mathematics educators commenced with the period of colonialisation but have increased exponentially during the past fifty years. This is reflected in the great increase in international organisations and conferences; journals and books; professional exchanges and international students; and international comparative studies and collaborative research.

We observe that these phenomena have not attracted much direct discussion and research about their benefit or their negative effects within the field of mathematics education.

The International Congress of Mathematics Education is the largest gathering of mathematics educators from around the world. Hence it is an ideal opportunity to commence dialogue and discussion on such international contacts. Therefore, this Discussion Group aims to provide a forum for:

- sharing experiences and learnings by mathematics educators from around the world arising from their international contacts;
- identifying benefits and problems arising from such contacts; and

- developing some guidelines/recommendations for research and action towards making such contacts more socially just and more effective for achieving the interests of all participants.

Towards these aims, this initial working Discussion Paper will attempt to

- raise some initial issues and questions, rather than take a stand on them, towards initiating the discussion and dialogue between mathematics educators, and through that; and
- clarify and limit the focus and scope of the discussion at the international gathering.

Issues for Discussion

What are the goals for international collaborations?

Mathematics education today is undoubtedly affected by the globalisation trends of our new times. Increasingly, public funding to universities is based partially on the amount of money they attract externally and on the number of publications they produce. In many countries, international competitive publications are given higher value than local publications. For many universities around the world international projects, in forms of attracting international students, conducting international development projects, and international publication, are seen as highly lucrative revenue. Further, World Bank lending schemes have imposed similar changes on many developing countries (Jones, 1992). Hence, undoubtedly there are economic benefits to educators engaging in international cooperation.

However, a striking feature of this increasingly globalised world is its inequality. Numerous reports from international organisations have pointed out that the gap between the “haves and have nots” has increased within many countries and between countries. The cost of such inequality for social, political and peace conditions around the world cannot be neglected. Arguably, such inequality in access to resources and funds is paralleled by the dominance by some countries of the agendas and voices in international cooperation in mathematics education.

Traditionally, mathematics education has been isolated from discussion of its contribution to this inequality either as a vehicle to legitimate it, if not increase it, or as a potential contributor to its reduction. Several authors have challenged the prevailing image of mathematics as a neutral/apolitical body of knowledge that is isolated from social and cultural considerations (eg. Bishop, Borba and Skovsmose, D’Ambrosio, Lerman). Jacobson (1996, p. 1253) noted the curtailing of funds from international agencies towards developing countries making it “more difficult to look for governments for improved international cooperation in mathematics education”. He joined Miguel de Guzman, a past President of ICMI, in calling for an increasing role of cooperation between professional mathematics educators and their associations to work to improve mathematics education worldwide. Hence there are social justice dimensions behind international cooperation.

Sub-questions:

- What are/should be the specific motivations and goals of international cooperation in mathematics education?

- Are some of these goals to be seen as contradictory or complementary; and how can they be reconciled?
- What are the economic and sociopolitical benefits of international cooperation in mathematics education and are those benefits equally shared?
- How can international cooperation lead into enriching mathematics education world wide?
- How can the dominance of certain voices and agendas in existing cooperation in mathematics education be minimised?

Should cooperation be regional or global?

In the above discussion we have noted the proliferation of many international publications and conferences around the world. Perhaps the best known conferences with the largest attendance of mathematics educators are the International Congress of Mathematics Education (ICME) and the International Group for Psychology Mathematics Education (PME). Other congresses that commenced as regional conferences, such as International Commission for the Study and Improvement of Mathematics Education (CIEAEM) which commenced as a European professional organisation have achieved international dimensions.

However, in spite of attempts to facilitate the participation by educators from developing countries, ICME's activities remain dominated by educators and issues from Anglo-European countries. The holding of the previous conferences in France, UK, Germany, USA, Australia, Hungary, Canada, Spain, and Japan and the planned conference in Denmark in 2004, are perhaps a reminder of this dominance. For many educators from less industrial countries the cost of travel, not to mention the language barriers, prohibits participation.

However, regional congresses are numerous around the world and are perhaps more representative in the participation of educators in those regions. Such conferences include the North American Chapter of PME, ICME regional conferences, the meetings of the Comité Interamericano de Educación Matemática (Inter-American Committee on Mathematics Education), the European Society for Research in Mathematics Education (ERME), the South East Asian Mathematics Society, the African Mathematics Union, and the Mathematics Education Research Group of Australasia, just to name a few. All these bodies hold regular, if not annual conferences. The languages of these regional meetings vary depending on the region. For example, Latin American countries, with the exception of Brazil, share a common language hence Spanish is the language of their regional meetings, while in the European, Asian and African regions the language of these international contacts is usually English. Further the cost of travel to these gatherings is often less prohibitive for many educators from less developed countries.

There are other considerations behind global and regional cooperation. In some cases, regional cooperation is less subject to cultural diversity than global cooperation. This can be both positive and negative. Learning from "similar" is relatively easy; however, arguably learning from "difference" is both more challenging and perhaps more rewarding. Naturally, each region contains significant variations between the countries represented depending on their economic status and/or their colonial past (Atweh, Clarkson and Nebres, 2003).

Sub-questions:

- What are the benefits and problems of regional vs. global collaboration in mathematics education?
- Is the integration between the two possible and beneficial?

What are the barriers to genuine and equitable international cooperation?

Several factors can be identified as barriers to international cooperation in mathematics education:

- *Financial:* In the above discussion we raised the costs of attending international gatherings, or subscribing to international journals as a prohibiting factor for participation by educators from developing countries. Undoubtedly, these factors extend to the conduct of research and theory development in the discipline.
- *Language:* Very few of the international congresses and journals in mathematics education are multilingual. There is an obvious dominance of the English language as a means of international cooperation. Educators from non-English speaking countries often feel isolated from such participation due to language limitations.
- *Cultural norms:* Cross cultural cooperations often experience conflict due to lack of knowledge about appropriate manners of behaviour and speech that extends beyond mere language. Direct disagreements and debates that are normal in some European countries may be interpreted as signs of rudeness by other cultures. Similarly, manners of subtleness that may be the norms of communication in some Asian cultures may be misinterpreted as signs of passivity and consent by other cultures.
- *Lowest Common Denominator:* Cooperation between cultures that are very different may lead the collaborators to compromise to levels that are lower than their individual interests and needs. This implies a possible conflict between quality and extension of international cooperation.
- *Conflicting agendas:* As noted above, international collaboration may be regarded as a source of income for some countries while other countries, because of their limited resources, may not be able to contribute equally to such cooperation.
- *Voice:* Collaboration between educators with varying backgrounds, interests and resources may lead to domination of the voice of the more able and marginalisation of the less powerful. An example of this is the tendency of writers in the international journals from dominating countries to quote research and theoretical constructs from a selected range of journals at the expense of research published in other countries.

Sub-questions:

- What are the effects of such hindrances to international cooperation?

- What measures should be adhered to in order to minimise such hindrances?

What forms could such cooperation take, and how could it be organised and implemented?

International cooperation can take many forms – some have been mentioned above. Here, we will identify three additional forms of international cooperation. First, it can be done on a one-to-one basis between educators from different countries. The literature in mathematics education contains several publications where articles and research projects have been conducted by cross country researchers. Initial contacts could have been made at an international gathering of mathematics educators, or through email. Second, there are other forms of international cooperation that are more systematic. For example, a more recent activity of ICMI is the Solidarity Program in Mathematics Education. The overall aim of the program is to foster the commitment and involvement of mathematics educators around the world for the advancement of mathematics education in “less affluent and less free countries” (ICMI, Undated). The fund was established in 1992 and places particular emphasis on activities that aim at developing self-sustainable infrastructure within less developed countries. Various professional bodies and organisations around the world make donations to the funds. In 1998 for example the Program has given a grant of US\$18,000 for the professional development of mathematics teachers in Burkina Faso and Cameroun. Other academics use sabbatical or study leave to visit and work with educators from different countries.

Lastly, international development projects from developed countries allow for educators from developed and developing countries to work together. The amount of genuine cooperation varies from one project to another. Some of these developing programs deal with curriculum developers directly while others involve mathematics educators from universities and teacher development institutes. Whether such cooperation continues after the termination of the project varies from one case to another.

Sub-questions:

- What other forms of international cooperation in mathematics education exist at the international scene?
- What are the relative strengths and weaknesses of the different forms of international collaboration?
- How can informal contacts be encouraged and established in a sustainable way?
- What additional formal means of cooperation need to be established or developed in mathematics education?

How can a cooperative preparation of researchers in mathematics education contribute to the development of a genuine and equitable cooperation?

Arguably, in mathematics education, like in other research domains, the preparation of researchers is one area where the dominance of the most powerful countries is most evident. Countries, such as the United States, the United Kingdom, France, China and the former Soviet Union have had a significant number of overseas or international students, mainly at postgraduate levels. More recently, countries such as Spain and Australia, among others, are receiving increasing numbers of postgraduate students from Latin America and the Asian Pacific region respectively. With the formation of the European Economic Union, the movement of graduate students between the different European universities has escalated considerably.

These activities in preparation of researchers have positive and negative effects on international cooperation. On one hand, it can be regarded as an aide towards the development of the less resourced nations. Some of the wealthier countries offer scholarships to high achieving educators from less industrialised countries. However, on the other hand, such programs allow for the increase in dominance by the host countries on the agendas of the less resourced countries. Many of those studying overseas return to their home countries to occupy prominent positions in curriculum development and teacher training. Undoubtedly, their views are influenced by the priorities, curriculum policy and research principles, and hence the underlying values embedded in these, of the host country where they have received their education. Further, the “brain drain” caused by the non-return of most able of these academics to their home countries is a serious loss for many developing countries.

Alternative models for cooperative training of researchers are the ERME summer school for postgraduate European students.

Sub-questions:

- How can genuine and equitable programs be developed for the preparation of researchers in mathematics education?
- How can the balance be achieved between the need for high quality research and supervision and the need for pluralistic and diversity of research in mathematic education?

Is there a danger that international cooperation may lead to excessive homogenisation of mathematics education?

Many authors have noted the similarities in mathematics education curricula (Oldham, 1989, cited in Clements & Ellerton, 1996) and research (Bishop, 1992) in mathematics education around the world. Is international cooperation leading to homogenisation and standardisation of the discipline?

The concepts of internationalisation and globalisation are often used interchangeably by some authors and used to mean different things by different authors. Atweh, Clarkson and Nebres (2003) present conceptualisations of these terms that may assist in the discussion here. In this context, we understand by “internationalisation” any activity that has participants from more than one nation. They can be either official at state-to-state level, or less formal interaction at a professional or even personal level; they may involve two or more countries; and they may be at a regional level (e.g. Latin America or South East Asia) or a more extensive international level. On the other hand, they use “globalisation” to refer to the receding boundaries between countries and the awareness that such boundaries are receding. In

other words, it is the increasing awareness of the “world as one” or the realisation of the “global village”. In the minds of many, globalisation is associated with multinational organisations, removal of barriers in trade and investment, and new forms of colonisation of culture. Some authors (eg. Falk, 1993, in Taylor, Rizvi, Lingard & Henry, 1997) distinguish between “globalisation from above” and “globalisation from below”, where the latter are activities motivated by concerns about environment, human rights, diversity of culture, and seeking an end to poverty, oppression and violence. Recent publications distinguish between globalisation and globalism to parallel the constructs “from above” and “from below”. According to some authors, globalisation from below is associated with diversification and differentiation rather than homogeneity and universality.

Perhaps the example of the ethnomathematics movement in recent years illustrates this distinction between globalisation from above and from below. The popularisation of the term on the international scene in mathematics education is often attributed to the keynote address given by Ubiratan D’Ambrosio (1995) in the 1984 ICME conference in Adelaide (Barton, 1999). Within a few years, ethnomathematics has been able to spread rapidly around the world. An International Study Group on Ethnomathematics (ISGEM) was established in 1985. In its early years the group convened during the NCTM and ICME meetings. In 1990 the group was affiliated within the United States’ National Council for Teachers of Mathematics (NCTM). The group manages a web site¹ containing notices of activities in different regions around the world, a list of resources and publications, as well as an email discussion list. The ISGEM has been able to conduct two international congresses on ethnomathematics. The first was held in Granada, Spain, in 1998 and the second in Ouro Preto, Brazil, in 2002. Contributions to ethnomathematics research and theorizing have come from of course Brazil, Africa, New Zealand and North America among many other places. Since it is not possible to say that ethnomathematics is a perspective on mathematics education characteristic of a single country or culture around the world, it is a globalised movement in mathematics education. However, ethnomathematics rejects the universalisation of mathematics and mathematics education and stresses local knowledge and difference. Further, researchers from different countries have stressed different understandings of the term and its implications to research and curriculum development. Arguably, it is an example of globalisation from below.

Sub-questions:

- What are the benefits from a global perspective on problems in mathematics education; and what are the dangers of such perspectives?
- What are the dangers of international cooperation in mathematics education for the identity of the less industrialised countries?
- Does cooperation necessarily lead to homogenisation; and how can homogenisation and differentiation be reconciled?
- Under what conditions can international cooperation enrich our awareness of difference or lead to increased homogenisation in mathematics education?
- What are the meanings and advantages of globalisation from above and globalisation from below in mathematics education?

¹ <http://www.rpi.edu/~eglash/isgem.htm>