Globalized Curriculum or Global Approach to Curriculum Reform in Mathematics Education[1]

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The mathematics education community has shown considerable awareness of the international status of its discipline. Robitaille and Travers (1992) argue that mathematics education is perhaps the most international subject of higher education. Internationalization of mathematics is not a recent phenomenon. The movement of the earliest mathematical knowledge between east and west dates back to early recorded history. However, here we are more interested in mathematics education and, in particular, mathematics education research and curriculum policy and reform. Perhaps the earliest forms of internationalization activities that can be noted in the past century were informal and irregular. Countries, such as the United States, 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. 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 many of these academics to their home countries is a serious loss for many developing countries (UNESCO, 1998).

Other processes of internationalization are more systematic, and perhaps more far reaching. The pattern of overseas studies discussed above is closely related to wider patterns of colonialization of developing countries. At the conclusion of both world wars, many developing countries came under the mandate of the "victorious" countries, which were given the responsibility of preparing these dependent countries for independence and statehood. A number of the colonized countries have modeled their education systems, including their teacher education programs, on that of the mandate countries.

In the post World War II era, other processes evolved in the form of international organizations such as the United Nations, UNESCO and the World Bank – or its regional equivalents. These organizations have been highly influential in the developing of the mathematics education programs in many developing countries Perhaps, of more direct influence of these international organizations on mathematics education was the formation of the International Commission of Mathematics Instruction (ICMI) and its four-yearly International Congress of Mathematics Education. The role of ICMI in the internationalization of mathematics education will be discussed further below. Likewise within the international community of mathematics educators there are other professionally based organizations that provide

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cross regional and international contacts between mathematics educators. International Group of Psychology of Mathematics Education, Comité Interamericano de Educación Matemática (Inter-American Committee on Mathematics Education), The South East Asian Mathematics Society, and African Mathematics Union, and the Mathematics Education Research Group of Australasia, just to name a few, hold regular, if not annual conferences.

Another important phenomenon of internationalization of mathematics education research is the emergence of international publications. Arguably, the most widely distributed research journals are in English. Perhaps the most well known in the English speaking countries are the Journal for Research in Mathematics Education, Educational Studies in Mathematics, and For the Learning of Mathematics. These vary in the type of articles and or research paradigms in which they specialize, as well as in their research criteria for publication. Some are published by professional organizations, while others are published commercially. With the increasing availability of the Internet, some of these journals are already being published electronically while new on-line publications, such as Chreods and the Philosophy of Mathematics Education are emerging. Also worthwhile mentioning are some journals that publish articles in more than one language such as Didactique des Matematiques and the International Newsletter on Proof.

Perhaps less prominent in the mathematics education literature is the topic of globalization. Although the term *globalization* is relatively recent in academic discourse (Waters, 1995), it is playing an increasingly significant role in higher education policy and practice. Waters claimed that while postmodernism was *the* concept for the eighties, globalization may well be the key concept "to understand the transition of human society into the third millennium" (p. 1). A search of the literature for this paper has yielded very few references to globalization in mathematics education. The exceptions are two chapters in a recent international publication on Sociocultural Research on Mathematics Education: An International Perspective (Atweh, Forgasz, & Nebres, 2001).

The aim of this theoretical paper is threefold. Firstly, it presents a construct towards the study of globalization it discusses the issue of similarity of mathematics education curricula around the world and raised questions about their divergence towards a single global curriculum. Thirdly, it identifies some of the problematics in international collaboration in mathematics education.

Conceptualization of Terms

Atweh and Clarkson (2001) noted that the two terms *globalization* and *internationalization* are at times used by different authors to mean the same thing and also different authors have used the same term to mean different things. Hence, it is appropriate to commence by attempting to clarify what we understand by those terms as they will be used in this paper. However, in presenting these clarifications we are cognizant of the dangers in essentializing and oversimplifying of terms used in a wide variety of meanings, none of which capture their essences (Buenfil-Burgos, 2000). Arguably, the strong debate between some promoters and rejecters of globalization can be attributed to differences in the signification that they place on the term. However, in order to make sense of and engage in the discussion below, we need to articulate clearly what we understand by these terms, at the same acknowledging that these are not the only possible interpretations of the constructs used.

Taylor, Rizvi, Lingard and Henry (1997), understood *internationalization* as "relationships and transactions between nations rather than those which transcend

national boundaries" (p. 57). According to this understanding, any activity that involves a cross-country collaboration contributes to the internationalization of the activities of the partners. In this context, we will interpret such transactions in a rather inclusive sense. 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 more extensive international level. Examples of such internationalization activities include: international students in undergraduate or postgraduate courses; internationalization of the curriculum and comparative curricula studies; international research conferences; international publications and collaborative and/or comparative cross-country research projects; professional development programs and international consultancies.

Robertson (1992, cited in Henry & Taylor, 1997) defined *globalization* as a concept which refers both to the compression of the world and the intensification of consciousness of the world as a whole" (p. 46). This is in line with Giddens' (1994, cited in Henry & Taylor, 1997) concept of compression of time-space. Waters (1995) used the term globalization 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). In other words, it is the increasing awareness of the "world as one" or a realization of the "global village" (McLuhan & Bruce, 1992). Some examples of processes that may reflect globalization trends in mathematics education are: the convergence of school mathematics and mathematics education curricula around the world; similarity in research questions and methodologies as well as standards of reporting research; and wide spread acceptance of some epistemological positions such as constructivism and ethnomathematics.

Atweh and Clarkson (2001) argued that even though the two constructs are distinct their operation is intermixed in rather complex ways. Obviously intense internationalization may lead to globalization, however this relationship is not deterministic. Further, they point out the two terms differ on the degree of autonomy that they allow for the individual participating nations. While international collaborations tend to be transparent and enjoy a degree of autonomy in participation, globalization processes are often associated with "forces [that] are impersonal and beyond the control and intentions of any individual or groups of individuals" (Waters, 1995,p. 2).

Issues in Globalization in Mathematics Education

Two areas in which questions have been raised about the effects of the processes of globalization of mathematics education are curriculum development and types of research conducted. A striking feature of the different curriculum documents and textbooks in mathematics education around the world is their similarities rather than their variety (Oldham, 1989 cited in Clements & Ellerton, 1996). Such similarities are quite obvious in the areas of content and sequencing of topics, and, to a certain extent, in the theoretical stances adopted by mathematics educators to study their discipline. Moreover, these similarities have proven to be rather stable across the years; changes in curriculum in one country or certain region (mainly Anglo-European) are often reflected in other countries within a few years. Note for example the wide acceptance of the New Mathematics movement in the 1960s, and the more recent wide spread "assessment driven reforms" (Hargreaves, 1989) based on standards and profiles. In both sets of reforms, the impetus arose from similar reforms

in the United States and United Kingdom and spread to many other countries. Further, the status of mathematics in the curriculum is similar in many countries where it is given a special importance, second only, if not equal, to language education. In many countries mathematics is tied to scientific, technological, and hence to economic development (Kuku, 1995). Perhaps, this widespread importance put on mathematics learning is reflected in the international declaration of the year 2000 as the International Year of Mathematics. Undoubtedly, these similarities have added ammunition to the often-expressed view that mathematics is a "universal language" (Robitaille & Travers, 1992). Such similarities in curriculum reform and emphasis on the role of mathematics are often reflected and perpetuated in higher mathematics education courses and academic writing.

In the area of research in mathematics education, Bishop (1992) argued that similarity is a feature of many research traditions evolving in different countries around the globe. Although research in mathematics education is a relatively recent phenomenon in many countries, research questions, methods, practices and publications are becoming more standardized. Bishop concluded that these similarities have led to difficulties in identifying *a* national perspective of mathematics education research in any country. He rightly added that these similarities should not be taken to mean that there is a universal acceptance of particular research methods or paradigms. Researchers around the world have a greater variety of research paradigms that they can employ in the conduct of their investigations. However, the variety and tensions between different paradigms in research are similar in many countries (Silver & Kilpatrick, 1994). Perhaps this illustrates the tension between globalization and fragmentation referred to by Henry and Taylor (1997).

Global Curriculum in Mathematics Education?

There is a great unease expressed by many English-speaking researchers about the dominance of Anglo-European thinking about mathematics education for countries around the world. Commenting on the 7th ICME conference in Canada, Usiskin (1992), perhaps summarizing the feeling of many participants, noted "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 went on to 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 globalization of issues is shared by Rogers (1992) who, commenting on the same conference, lamented that "all our theories about learning are founded in a model of the European Rational Man, and that this starting point might well be inappropriate when applied to other cultures" (p. 22). He went further to assert 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 ... will have universal applications is even further from the truth" (p. 23). This unease about the dominance of Western mathematics is quite strongly expressed in a keynote address to the ICME Regional Collaboration conference held in Melbourne, Australia, where Clements (1995), a leading Australian mathematics educator with extensive international experience, outlined his concerns in the following manner.

> *Over the past 20 years I have often had cause to reflect that it is Western educators who were responsible not only for getting their own mathematics*

teacher education equation wrong, but also for passing on their errors to education systems around the world. (p. 3)

However, often these concerns do not match some voices from developing countries. At the same ICME regional conference, the president of the African Mathematical Union (Kuku, 1995) warned against the over-emphasis on culturally oriented curricula for developing countries that act against their ability to progress and compete in an increasingly globalized world. He called for "a global minimum curriculum below which no continent should be allowed to drift, however under-developed" (p. 407). Some of the reasons he presented are very relevant to the discussion here. The phenomenon of dropping out of mathematics is not restricted to developing countries. Hence, he argued, cultural relevance of the mathematics content to the culture of the student is not the only consideration in determining participation and success. Kuku expressed concern that the over-emphasis on ethnomathematics may be at the expense of "actual progress in the mathematics education of the students" (p. 406). Presumably this mathematics education is the mathematics education that is needed for economic and technological progress within their countries. Further, within each third world country there are many different cultural groups. There are no resources for implementing an appropriate ethnomathematics program for every student group. He concluded by citing examples of Asian countries that were able to achieve huge leaps in economic development through their use of "imported curricula" (p. 408).

Also at the same conference, a similar call was given by Sawiran (1995), a mathematics educator from Malaysia. Sawiran based his comments on the belief that "our experience shows that mathematics is an important ingredient of technology and therefore is a key element to 'progress'" (p. 603)(quotes in original). He concluded his address by saying that "[t]he main thrust in enhancing better quality of education is through "globalization" of education. In this respect, it is proper to consider globalization in mathematics education" (p. 608) (quotes in original). He added that the most important step in globalization is through "collaborative efforts" (p. 608).

Global Curriculum vs. Global Collaboration

For many mathematics educators in the West the very term "global curriculum" as it is often understood in western experience, is an abomination. Rightly so, we may hasten to add. The experience of the National Curriculum in the United Kingdom has raised ample concerns about the lack of sensitivity of standardization attempts to differences due to cultural and social background of students (Apple, 1993) and their effect on demoralization and de-professionalization of teachers (Hargreaves, 1994). Yet the voices of mathematics educators expressed above, and perhaps those of other mathematics educators from developing counties cannot, and should not be overlooked. Let us examine issues related to globalized curriculum reform a little further. The aim of such examination is not to argue for an international standardization of mathematics curriculum; rather, we aim to widen the debate about international collaborations to include issues arising from a globalized context of our new times.

Atweh and Clarkson (2001) identified three different approaches experienced by different countries to curriculum development and standardization. The first reform model is the National Curriculum in the United Kingdom based on the assumed right, some would say duty, of the central government to legislate for

education welfare in the nation. It is a reform that is accompanied by legislation guaranteeing adherence by all local authorities, schools and teachers. The second model is from Australia. Arguably, due to the nature of the Australian nation as a federation of separate states with their individual authority over school education, rather than perhaps due to different philosophical considerations, reform in Australia proceeded in a different way. By mutual agreement between the different state ministers of education and their federal counterpart, a National Statement for School Mathematics was produced, with the assistance of mathematics educators, consisting of principles for mathematics teaching as well as a sequence of topics at various levels outlined in different topic areas. The Statement was never intended to be a national curriculum[2]. Individual state's education systems could implement the statement as they saw fit. Lastly, different still was the experience of reforms in the United States. At the initiation of a professional body, the National Council for Teachers of Mathematics, mathematics educators at all levels collaborated to produce the well-known Standards documents for Curriculum and Assessment. The statement had no legal status for either the states or for the schools. However it has been widely used as the basis of several reforms at local school and school district levels[3].

In noting these three different processes for mathematics education reform followed by the three countries, we do not intend to make judgments on the soundness or otherwise of their content or principles; in reality they have many similarities in their mathematical content and approaches to teaching. What we would like to note, however, is that not all efforts for establishing curriculum guidelines need to by-pass the profession itself. Perhaps the US experience has shown that if the profession takes the initiative in developing guidelines for reform they may steal the agenda from governments and bureaucrats. Reviewing the curricula reforms around many English-speaking countries, Davis and Guppy (1997) demonstrated how these reforms are transforming education by "squeezing power from the middle" (p. 459). They pointed to the paradoxical pressures faced by professional educators stemming from power sharing and claims on curriculum between state officials on one hand and the well-organized community associations on the other hand. In other words, the opposing trends of decentralization and devolution on one hand, and centralization and standardization of curriculum design and testing on the other, have challenged the role of the professional educator. Arguably, the challenge of globalization could be taken as an opportunity by professional mathematics educators around the world for drawing up their new roles and establishing new coalitions for reclaiming their role in the curriculum debate.

Perhaps, the constructs of *official field* and *pedagogic field* as theorized by Bernstein (2000) maybe useful for the theorization of global collaboration between mathematics educators worldwide. Bernstein distinguished between the official field "created and dominated by the state and its selected agents and ministries" and the pedagogic field that "consists of pedagogues in schools and colleges and departments of education, specialized journals, [and] private research foundations" (p. 31). He goes on to argue that in order for the professional educator to have influence in education there has to be a certain degree of autonomy from the official field. However, he noted that the current educational reforms tend to limit the autonomy of

[2] It is worthwhile to point out that the extent of professional involvement in the development of the Statement and the denial of its developers that it forms a national curriculum has been contested by some mathematics educators (see Ellerton & Clements, 1994).

[3] According to some educators, these efforts have also lead to a "backlash" such as the "maths wars" in some educational districts (see Kilpatrick, 1999).

the teachers and university educators. The form of collaboration called for in this paper arguably is the way to promote globalization from below as a means to counteract globalization from above in mathematics education.

Here we argue that such collaboration could be done at international level. International organizations such as ICMI perhaps form an ideal venue for international collaboration for global reform in mathematics education. Jacobsen (1996) discussed the increasing gap between the rich and poor countries and the curtailing of funds from these international agencies that makes it “more difficult to look for governments for improved international cooperation in mathematics education” (p. 1253). He joined Miguel de Guzman, the 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. The ICMI studies as well as Solidarity Program in Mathematics Education, is a step in the right direction. Of course there is room for many other such projects at all levels including personal, professional and official. For example, many Anglo-European universities have study leave, or sabbatical programs which allow educators to conduct research in overseas countries. The staff destination on the majority of such programs is other Anglo-European countries. In the following section of the paper we will problematize the issue of collaboration.

Problematizing Global Collaboration

While one can argue that international contacts and exchanges in mathematics and mathematics education have existed since the early developments of both disciplines, undoubtedly they have increased in the new age of globalization and will continue to exponentially increase in the future with further developments in technology, ease of travel and population movements. While we do not construct such contacts as necessarily either good or bad, the outcomes of these processes should be carefully scrutinized world wide as to the benefits and losses that might arise from them. This can only be achieved through deliberate and targeted research, reflection and debate. Further, we argue that such actions need to be done in collaboration between mathematics educators from around the world. Arguably, such collaboration is needed more than ever before because of the magnitude of the effects of the internationalization and globalization on the different participants and the rate of their escalation. Further, such collaboration is more possible than ever before because of the increase in ease of contacts between educators around the world due to wide availability of face-to-face contacts as well as electronic communication.

The concept of collaboration, however, needs further problematization. Hargreaves (1994) argued that "one of the emergent and most promising metaparadigms of the post-modern age is that of *collaboration* as an articulating and integrating principle of action, planning, culture, development, organization and research" (p. 245). In the context of school change which Hargreaves was discussing, he pointed out the benefits of collaboration, as well as some of the dangers the term carries and certain conditions under which it can be most effective and ethical. This paper raises three main points about global collaboration in mathematics education.

First, collaboration between mathematics educators from around the world is particularly problematic when it occurs between players with different needs and differing access to resources. Different countries and regions around the world do not have the same financial ability to contribute to genuine collaborations. The limited resources in some countries imply that they are more likely to copy or import ideas

from the more developed regions or countries rather than to critically and empirically reflect on their appropriateness to their local context. Further, the marketization of higher education in many developed countries implies that such collaboration in these countries is often seen as a source of revenue for these countries rather than aid to the less developed. In this context global collaboration might run into the danger of becoming neo-colonialism with further draining of resources from the poor towards the rich. Hence, participants in global collaboration should be aware of the differing economic interests of the different countries in the race for globalization and international markets. While developing countries may aspire to maintain and improve their standing in the race, developing countries are struggling even to reach the starting line! Arguably, the very metaphor of a "race" and the rhetoric of "competitiveness" require careful critique and scrutiny. Not only are they contrary to the metaparadigm of collaboration but also their adoption would lead to further widening of the gap between the rich and the poor making genuine collaboration even more problematic.

Second, in late-modern and globalized times with the lack of certainty and an awareness of the complexity of the issues, it may be neither desirable nor possible to establish a set of guidelines for ethical international contacts that apply to all situations. However, participants in global collaborations need to be aware of the effects and limitations of such contacts both in the near and long term futures for all participants, and in particular for those whose conditions do not allow them to fully participate. At the same time that we are becoming aware of the politics of difference and local interests, internationalization is also making us aware of our similarities and global interests. Perhaps these should not be constructed as either/or constructs in the traditional positivist logic. What is needed is that all international contacts be self reflective and critical of their processes and effects. Not only should they reflect on the benefits and gains in knowledge by the different parties involved but also on how different parties can be actively involved in developing their own voice and taking increased control in managing their own mathematics education to achieve their interests. International collaborations between mathematics educators should be transparent, reflective and accountable in examining their own rationale, aims, processes and outcomes. Questions of voice and power should always be up front. Collaboration should be constructed to empower individual countries to be self-reliant rather than to increase their dependency on ideas from more developed nations.

Third, genuine collaboration must aim to balance the tension between voice and vision. Hargreaves (1994) argues, "[v]oices need to be not only heard, but engaged, reconciled and argued with. It is important to attend not only to the aesthetic of articulating…voices, but also to the ethics of what it is those voices articulate!" (p. 251). International collaboration should aim at developing a shared vision between the different players and realize that the contribution of the different players with differing access to power is problematic. Similarly, these international exchanges should aim to balance the tension between changes in structures and changes in cultures that allow for genuine collaboration. Not only do questions of costs and processes of international exchanges need scrutiny but also the assumptions behind them. Exchanges that are simply based on "helping" developed countries (to become like us?) are often based on paternal colonial assumptions and do not contribute to genuine collaboration. Collaborations should be based on mutual respect and trust in the ability of the different partners to contribute different types of learning to the collaborative enterprise.

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