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## Internationalization and Globalization of Mathematics Education: Toward an Agenda for Research/Action

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Consider the following anecdotes based on real experiences:

- A group of students from a state school in Brisbane uses the Internet to study mathematics within a “community of learners” with other students from Canada.
- A developing country in Latin America thinking about education reform in particular with regard to assessment invites researchers from the United Kingdom to give advice about what they need to do. To keep the advice more comprehensive, they make it a point to invite people from both sides of the debate about national testing and national curriculum.
- At the induction ceremony of a group of PhD students in Colombia, a professor is giving a lecture on the major developments of educational thought during this century. He cites Ausubel, Piaget, Von Glaserfeld, Kuhn, and many other very familiar theorists. He did not make a reference to Orlando Fals Borda of Colombia or Paulo Freire of Brazil.
- A group of 30 educators from Spain, the United States, and Canada volunteered their holiday time to assist students from Universidad Nacional de El Salvador to obtain master’s degrees in mathematics education.

Perhaps similar experiences are quite familiar to many mathematics educators around the world. Numerous other examples could be also given about the divergence of general culture and values. There is little doubt that the world that some have prophesized in terms of a “global village” (McLuhan & Bruce, 1992) is well and truly here. For many, it is an exciting world. Yet, at the same time, it is a worrying world.

It is a world with great potential for many—if they can afford the privilege to actively participate in it.

The UNESCO (1998) World Declaration on Higher Education for the Twenty-first Century claims that “[t]he second half of this century will go down in the history of higher education as the period of its most spectacular expansion. . . . But it is also the period which has seen the gap between industrially developed, the developing countries and in particular the least developed countries with regard to access and resources for higher learning and research, already enormous, becoming even wider” (p. 1–2). The document goes on further to point out that without adequate higher education such a gap can not be bridged.

In particular, mathematics education is becoming a truly international activity. Robitaille and Travers (1992) argued that mathematics education is perhaps the most international subject of higher education. This is reflected in the number of international conferences and journals in the field as well as the divergence of views in curriculum development and research. This chapter examines some emerging issues that are facing mathematics education at the outset of the third millennium. Some of these issues stem from the literature within the mathematics education community itself. However, because these processes have been undertheorized in mathematics education, we have made extensive use of literature from outside the field as well. We have dual aims in this chapter: first, to develop an initial tentative theoretical model to investigate the conglomerate activities and issues related to internationalization and globalization of mathematics education and, second, using this model we hope to identify some needed action and/or research within the mathematics education community toward dealing with the rapidly changing global context.

Perhaps at the outset we need to stress two limitations of the chapter. Because of the limited research base investigating the processes of globalization and internationalization of mathematics education, the ideas here are rather developmental. Second, we are well aware that the views reported here are in the main the product of thinking embedded in developed English-speaking countries. Both chapter authors have experience in developing countries—the first author by birth and initial education and the second by work as educator. We have attempted to reflect some voices from developing countries, but we do not claim to speak from their perspective. One thing that troubled us in reviewing the literature in this area is the scarcity of voices from developing countries about their experiences, aspirations, and wishes.

## CONCEPTUALIZATION OF INTERNATIONALIZATION AND GLOBALIZATION

Although the terms *internationalization* and *globalization* are relatively recent in academic discourse (Waters, 1995), they are playing an increasingly significant role in higher education policy and practice. Waters claimed that, whereas postmodernism was the concept for the 1980s, globalization and internationalization may well be the key concepts “to understand the transition of human society into the third millennium” (p. 1). Moreover, because the terms at times are given different meanings by different

authors and at other times are used interchangeably, we need to conceptualize their usage in this chapter. 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.

In this chapter, we are particularly interested in internationalization of mathematics education. Perhaps it is useful to provide some examples of internationalization activities and processes involving mathematics education. Internationalization of teaching might include international students in undergraduate or postgraduate courses, internationalization of the curriculum, and comparative curricula studies. Internationalization of research might include international research conferences, international publications, and collaborative and/or comparative cross-country research projects. Finally, internationalization of service may be activities such as curriculum development, less formal 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). This is in line with Giddens’ assertion that globalization is not simply the formation of large-scale organizations and systems that determine what happens in each place, but also refers to the day-to-day awareness of global issues. 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 widespread acceptance of some epistemological positions such as constructivism.

Perhaps it is worthwhile making some comments on these two constructs and their definitions.

- First, even though two distinct constructs have been identified, this does not mean that the two are disjoint or unrelated. Obviously, globalization, in some sense, may be an outcome or result of intense internationalization. However, the relationship is not necessary or deterministic. Hence, even though we cannot necessarily discuss one construct without reference to the other, it is useful to make this differentiation because of the nonsymmetric relationship between them as well as the distinct value criteria that may be applied to each.

- Second, the two constructs can be differentiated on the dimension of autonomy of the partners. McGinn (1995) argued that “efforts at internationalization . . . [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). Similarly, Waters asserted that globalization is often associated with "forces [that] are impersonal and beyond the control and intentions of any individual or groups of individuals" (p. 2).

- Third, internationalization and globalization are not the same as homogenization (Henry & Taylor, 1997). For these authors, globalization consists of "contradictory impulses of integration, fragmentation and differentiation" (p. 47). For example, although intense internationalization may lead to globalization, these same processes may lead to fragmentation at local level. For example, even though issues such as feminisms, indigenous land rights, gay rights, and human rights have gained global status, issues related to local context cannot be overlooked. For instance, the globalization of concerns about status of women raised issues about voices and the right of middle class, heterosexual Anglo-Saxon women to speak on behalf of black women, lesbians, or women from developing countries. This resulted in the impossibility of talking about "a feminist perspective" and gave rise to a multiplicity of feminisms (Gunew, 1990).

- Fourth, surely, as social processes, the two activities are open to value judgments that are open to contestation (e.g., see the debate between McGinn, 1996, and Ilon, 1997). However, in this context, we do not understand the two constructs as necessarily related to a particular moral judgment (Robertson, 1992, cited in Taylor et al., 1997). In other words, aspects of internationalization and globalization processes may be good, whereas others may be less desirable and should be contested. Further, what is considered good aspect of internationalization and globalization for a particular group of people may very well be at the expense of other groups.

- Finally, Falk (1993, cited in Taylor et al., 1997) distinguished two forms of globalization processes. He called them globalization "from above and from below." Globalization from above was understood as "[t]he collaboration between leading states and the main agents of capital formation. This type of globalisation disseminates a consumerist ethos and draws into its domain transnational business and political elites" (p. 75). On the other hand, globalization from below "[c]onsists of an array of transnational social forces animated by environmental concerns, human rights, hostility to patriarchy and a vision of human community based on the unity of diverse cultures seeking an end to poverty, oppression, humiliation and collective violence" (p. 75).

## INTERNATIONALIZATION PROCESSES IN MATHEMATICS 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 reform. Perhaps the first models of internationalization activities that can be noted are informal and erratic.

Countries such as the United States, United Kingdom, France, 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 are receiving increasing numbers of postgraduate students from Latin America and the Asian Pacific region, respectively. Many of those studying overseas return to their home countries to occupy prominent positions in curriculum development and teacher development. Undoubtedly, the priorities and curriculum and research principles influence their views, and hence the underlying values embedded in these, of the host country where they have received their education. Furthermore, 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 previously 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 “winning” countries, which were given the responsibility of preparing these dependent countries for independence and statehood. A number of the colonialism countries have modeled their education systems, including their teacher education programs, on that of the mandate country. Nebres (1995) discussed some of the initial difficulties encountered by Southeast Asian educators in developing regional collaboration until they “realised how deeply imbedded [their] mathematics education systems [were] in the cultural and colonial histories of [their] countries. . . . [R]epresentatives from Singapore, Malaysia and Hong Kong were describing variations within the British system, the Philippines of the American system; the Vietnamese of the French and so on” (p. 32).

In the post-world war era, other processes evolved in the form of international organizations such as the United Nations, UNESCO, and the World Bank—or its regional equivalents. Jacobson (1996) discussed the role of the different projects of these organizations during the “decade of decolonisation in the 1960s” (p. 1239) initially for the implementation of policies of universal primary education and later for the elimination of illiteracy. These organizations have been highly influential in the developing of the mathematics education programs in many developing countries (Souviney, 1983). The work of these organizations was tied to assisting developing countries to make use of the benefit of the experience of the more developed countries for improving their educational systems. Not surprisingly, these projects were supported mainly by Anglo-European monies and conducted with expertise predominantly from these countries.

Perhaps, the more direct effect of these organizations on mathematics education was through the formation of the International Commission of Mathematics Instruction (ICMI) in 1908. Since 1952, the commission has been affiliated with the International Mathematics Union, which in turn is a member of the International Council for Scientific Unions. ICMI has been very active during the second half of the 20th century. Perhaps the most widely familiar ICMI activity is the International Congress of Mathematics Education (ICME), held every four years. Thousands of educators from all over the world attend these congresses. Occasionally, the proceedings of some of the working groups of ICME are translated into languages other than English and are made available through UNESCO.

Also widely familiar are the ICMI Studies. Since 1986, there have been about 10 of these studies in areas such as school mathematics in the 1990s, the popularization of mathematics, mathematics and cognition, and research on gender and mathematics. Each study is conducted by a Program Committee, which calls for submissions from the mathematics education community on the topic of the study, collates the information, organizes an international conference by invitation, and produces the final publication. Another ICMI activity is the holding of regional meetings of mathematics educators. Such meetings have been held in East Asia, Australia, Latin America, and Africa. Likewise, ICMI also has four affiliated permanent study groups: the International Study Group for the Relationship Between the History and Pedagogy of Mathematics, the International Organization of Women and Mathematics Education, the International Group for the Psychology of Mathematics Education (PME), and the World Federations of National Mathematics Competitions. Many of these organizations hold their own annual conferences. Perhaps a less-known activity of ICMI is the Solidarity Program in Mathematics Education. The overall aim of the program is to foster commitment and involvement of mathematics educators around the world for the advancement of mathematics education in "less affluent and less free countries" ICMI (undated).

Within the international community of mathematics educators there are other professionally based organizations that provide for international contacts. The Inter-American Committee on Mathematics Education, The South East Asian Mathematics Society, and African Mathematics Union, CLAME, and the Mathematics Education Research Group of Australasia hold regular, if not annual, conferences. With great difficulty in obtaining funds for overseas travel, attendance at these conferences varies depending on the location of the conference and the official language of communication. It is a common practice for many of these gatherings to invite keynote speakers from United States and United Kingdom.

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

## Issues in Internationalization

Arguably the increasing ease in travel and communication as well as the increase in numbers of venues for international contacts have increased the chances for educators from around the world to meet, share their findings; discuss their mutual interests;

challenge each others learning and practices, and generally to increase their knowledge about problems of mathematics around the world and about solutions that have worked in other places. Undoubtedly, the benefits of such means of international dialogues are varied and significant. However, there are some inherent limitations that need to be addressed.

A major concern often raised about the currently available international channels of communication is their dominance by views and voices of educators from the Anglo-European<sup>1</sup> educators (Bishop, 1992; Clements & Ellerton, 1996). Discussing the role of international ICME conferences, Jacobson (1996) noted that the number of people from developing countries attending such conferences “is still depressingly low, accurately reflecting today’s economic realities” (p. 1241). Educational funding, hence funding for international travel, continues to decline in many countries—arguably more so in the developing countries. Further, all major international forums use English as their first official language, with occasionally a second language of the host country. Translation facilities are either nonexistent or at best limited. There are rarely separate strands on the conference program for presentations in other languages. Naturally these limitations reduce the accessibility of conferences for educators from many non-English-speaking and developing countries.

The dominance of Anglo-European views and voices is also reflected in areas of research reporting. We have noted that the most widely circulated journals in mathematics education are exclusively in English. Silver and Kilpatrick (1994) showed that only 22% of the articles published in the *JRME* during the period 1984 to 1993 are from educators affiliated with universities from outside North America. Many of these articles are co-authored with North American researchers. Further, the acceptance rate of manuscripts submitted to that journal from non-North American researchers is half that of their North American counterparts. Naturally one has to keep in mind that the *JRME* is, in the first place, the official research journal of a North American professional body, the National Council for Teachers of Mathematics. However, considering the avowed international status of that publication, concerns about the dominance of certain views and paradigms is a valid concern. Silver and Kilpatrick demonstrated that the patterns of contribution to *ESM* are less dominated by North American researchers. Perhaps it is not necessary to stress the great contribution of researchers from North America to mathematics education research and knowledge; however, it is necessary to raise concerns about wider representation of views, theories, and paradigms of research.

Obviously, the multiplicity of natural languages that mathematics educators represent is an ever-present hindrance to communication and sharing of ideas through conferences and publications. There are no simple solutions to these difficulties. However, with awareness of these limitations and collective dedication to tackling them, it is possible to make international collaborations more accessible to non-English-speaking educators and hence more equitable and just. There are recent technological developments—such as the emergence of the first generation of computer programs that are capable of translation between languages—which may be used toward this purpose. Naturally, there is often a gap in time between when these new resources become

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<sup>1</sup>We are aware that the use of the term *Anglo-European* is somewhat problematic in that it hides the at times substantial differences between the many countries that it covers.

first available and the time in which they become powerful enough to satisfy the needs of the educational community and/or become widely accessible to educators from less-developed countries. Similarly, the increase in multilingual publications would make international dialogue more accessible and representative than it is at present.

Similarly, there is an imbalance in the number of conferences that are held in North America and Europe. Naturally, this is partly justifiable by the fact that there are higher concentration of people interested in these conferences in North America and Europe and that these countries have the necessary infrastructure to mount successful large congresses. However, the expenses necessary to participate at these conferences are a burden for all researchers, yet more so for those from developing countries.

There are other economical aspects behind international collaboration that need to be raised in this regard. Perhaps this can best be illustrated through the case study of changes in international students' policy in Australia between 1950 and modern times (Back, Davis, & Olsen, 1996). At the conclusion of World War II, Australia played a key role in the implementation of the Colombo Plan for cooperative development in South and Southeast Asia. This role included the sponsorship by the Australian Government of international students to study at Australian universities. With the increase of international students, both sponsored and private, studying in Australia, the government introduced certain charges for international private students—commencing at a rate of 10% of the cost of the tuition escalating to about 55% by the late 1980s. However, in the mid-1980s there was an increasing emphasis on the role of higher education as an income generator for Australia. Back et al. described this as a shift from "educational aid" to "educational trade" (p. 7). By 1990 the educational subsidies had all but ceased. It was also notable that the benefits of international students to the Australian culture and the role and status of the country internationally have been rarely identified in government reports and academic research. Hence, there was a second shift in policy from "education as an export" to "internationalisation of higher education" (p. 7). This is not to say that economic interests and discourses in international collaboration were abandoned, but there was, and still is, several, often conflicting, discourses of quality, flexibility, equity, economic, humanism, and so on, informing internationalization practice and structures within many universities. In the mid-to late 1990s, Australian funding to universities changed toward increasing the ability of and expectation for public universities to raise parts of their funding from external sources. International students, as discussed previously, constitute a significant part of sources of funds for some universities. Needless to say, such considerations can be in conflict with the quality of education and fairness of access.

Jacobson (1996) discussed 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 cooperation in mathematics education" (p. 1253). He joined Miguel de Guzman, 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. Activities such as the Solidarity Program in Mathematics Education, mentioned previously, 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 that allow educators to conduct research in overseas countries. The staff destination on the majority of such programs is other Anglo-European countries.

A further limitation to communication available within the existing forums is the limited possibility of deep dialogue due to their format. Conference and journal articles are restricted in space and/or time. Concern has been raised as to their ability to provide for deep analysis of the context behind the research (Silver & Kilpatrick, 1994). Some participants find international conferences too busy, large, and hectic to establish meaningful contacts (Johnston, 1992) or keeping sight of big picture on problems of mathematics education (Usiskin, 1992). Last, we raise the question of whether there are cultural differences and norms in forms of establishing contacts and collaboration. Admittedly, empirical research findings are almost nonexistent in this area. However, experience in travels by both authors to a number of different developing countries shows there are differences in patterns of working and communication. For example, in many cultures personal contacts, established over long periods of time and developed in less formal association, are essential conditions of collaboration. Conferences may not be the best venue to develop such associations for some people.

### GLOBALIZATION PROCESSES 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 focus and aims of mathematics. 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 few years. Note, for example, the wide acceptance of the New Maths movement in the 1960s and the more recent widespread "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 emphasis on mathematics education is similar in many countries. Mathematics as a school subject is given special importance second only, if not equal, to language education in most countries around the world. In many countries mathematics is tied to scientific, technological, and hence to economic development. 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.

Because of these similarities in the curriculum, two types of research flourished in the second half of the 20th century: international comparative studies on the curriculum and international studies on mathematics achievement. Silver and Kilpatrick (1994) claimed that the first type of research has escalated because of the relative ease in which such comparisons can be made in isolation to the very specific sociopolitical contexts of the countries involved. Robitaille and Travers (1992) argued the case for international studies on achievement, whereas others identified concerns about their validity, usefulness, misuses, and abuses (see special issues of *Prospects*, Volume 22, Number 3; *Comparative Education*, Volume 31 Number 1; and Keitel & Kilpatrick, 1999).

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 phenomena in many countries, research questions, methods, practices, and publications are becoming more standardized. Bishop concluded that these similarities 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).

## Issues in Globalization of 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 goes on to express his hope "that the new world order does not result in a common worldwide 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 voices from the developing countries. At the same ICME regional conference, the president of the African Mathematical Union (Kuku, 1995) warned against the overemphasis on culturally oriented curricula for developing countries that act against their ability to progress and compete in an increasingly globalized world. He calls 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 argues, 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 overemphasis 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. Furthermore, 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). 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).

The phenomenon of, and arguments for, globalization of mathematics education curriculum in schools around the world is often attributed to the (mistaken) belief about mathematics objectivity and culturally independent truth (Bishop, 1988; Clements & Ellerton, 1996). However, at least according to the voices from the developing countries reported previously, the calls for globalized mathematics curricula stem from other considerations. Mathematics education is often associated with claims of relevance to employment, economic, and scientific development (Harris, 1991). These views are shared by mathematics educators both in developed and developing countries. Kuku's (1995) concern about the emphasis on ethnomathematics does not stem from his concern that it is not "real mathematics." He raised doubt as to whether this mathematics is appropriate to economic development of African countries in a globalized world. Naturally, it would be very presumptuous to say that, because Western mathematics, or what Bishop (1988) called Mathematics with capital "M," has a proven track record in technological development, it should be used as a model for curriculum development worldwide. What this does imply is that investigations on local versions of curricula and ethnomathematics should take into consideration

not only the historical context of the culture, a factor of utmost importance we might add, but also the country's aspirations and its role in a globalized context. Perhaps this area requires further theorization in the ethnomathematics literature (for a critique of ethnomathematics, see Vithal & Skovsmose, 1997).

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 attempts for standardization to differences due to cultural and social background of students and their effect on demoralization and deprofessionalization of teachers (chap. 10, this volume). Yet the call of these and perhaps other mathematics educators from developing countries cannot and should not be dismissed. Let us examine issues related to globalized curriculum reform a little further. Naturally, 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.

## GLOBAL APPROACHES TO REFORM

The first possible concern about globalized approach to reform in mathematics education is that the imposition of curricula from outside the profession, that is, by governments and bureaucrats, cannot be sensitive to real problems that schools and teachers face. Furthermore, many national approaches to reform are often not built on the principles derived from research and thinking within the profession. Such external imposition of curricula is also deprofessionalizing to teachers in schools. If we examine the reform experience of three English-speaking countries with which the authors of this chapter are familiar, we note different approaches to national reform agendas. The reform model of the National Curriculum in the United Kingdom was 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. 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 content and teaching approaches. The statement was never intended to be a national curriculum.<sup>2</sup> Individual state education systems could implement the statement as they saw fit. Different still was the experience of reforms in the United States. At the

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

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 legally binding status. However, it was used as the basis of several reforms at local school and school district levels.<sup>3</sup>

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 bypass the profession itself. Perhaps the U.S. experience has shown that, if the profession takes 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 point 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.

The second type of concern against globalized approach to reform is that it challenges the right of the individual nation-states to determine the curricula for their young people in their schools. There are two considerations here. First, many developing nation states do not have the resources to develop their own educational reforms based on their own educational problems and priorities (Jacobson, 1996). There is a real danger in such situations that their attempts to reform mathematics education in schools would be based on copying overseas reforms. This concern about the importation of curriculum reform implies that "local educators have been denied the experience of developing the material themselves" (Clements & Ellerton, 1996, p. 161). Clements and Ellerton called for increased adoption of action research where curriculum developers work collaboratively with local educators to develop culturally sensitive curriculum that is empowering both for the educators and their students. Second, as Taylor, Rizvi, Lingard, and Henry (1997) argued, the function of the nation-state is changing in the face of globalization. They note that the emergence of the nation-state is a relatively recent phenomenon that dates to the 19th and 20th centuries. Such institutions have taken responsibility for welfare, defense, and foreign trade. They also had the role of developing a cohesive sense of identity between the different ethnic groups that constituted the population within their boundaries.

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<sup>3</sup> According to some educators, these efforts have also led to a "backlash" such as the "maths wars" in some educational districts (see Kilpatrick, 1999).

The patterns of globalization have shown that the nation-state is an "unstable entity" (p. 61). Undoubtedly, with increased immigration, the population constitution of almost all nation-states has changed significantly this century. Further demands for diversity of needs stem from the increasing awareness of the needs of the local ethnic and cultural groups for local control over the curriculum and recognition of their cultural values. Hence, a global approach to curriculum reform should be based on variety and difference rather than standardization. As we argued previously, these reforms should best be developed from within the profession. Also, we argue that such reforms would be based on genuine collaboration (Hargreaves & Evans, 1997) between the educators from different countries. This is an example of globalization "from below" discussed by Falk (1993, cited in Taylor, Rizvi, Lingard, & Henry, 1997).

The third type of concern is the argument that globalized approaches to reform are a blueprint for standardization and homogeneity and, hence, fail to take into consideration diversity, equity, and cultural and local concerns.<sup>4</sup> This is a valid concern that can be also raised about many national curricula in existence (Ellerton & Clements, 1994). There are examples of national reform movements that acknowledge issues of diversity and equity. For example, the National Statement on Mathematics in Australian Schools recognizes the importance of mathematics for citizens' daily life, their civic life, work, and culture (Australian Education Council, 1990, p. 7). It also posits the belief that "all but few exceptional students are capable of achieving the mathematical confidence and competence needed for personal and civic activities, the skills needed for vocational purposes, and some appreciation of the social and cultural significance of mathematics. For some students this will take longer than for others" (p. 8). "Understanding ourselves requires that we understand how mathematics is integral to our ways of thinking about the world" (p. 7). Finally, we argue that acknowledgment of these curricula of local and cultural differences is a necessary but not sufficient condition to achieve curricula localization and equity and social justice. Following the ideals and principles of the critical mathematics movement (Frankenstein, 1998; Skovsmose, 1994), educators, including teachers, may ensure that the mathematics curriculum is experienced as an empowering activity for all students depending on their background, immediate needs, and future aspirations. Perhaps this is how we may meet the challenge raised by Nebres (1995). He provided an axiom (paradox?) for globalizations, as: "The more global and multicultural we seek to become, the deeper must be our local and personal cultural roots" (p. 39).

The debate of what is culturally bound and what is culture free in mathematics is an ongoing debate in mathematics education literature. One area that has received considerable debate in this literature is the relationship of mathematics learning to its cultural, language, and social context (Bishop, 1988; D'Ambrosio, 1985; Ellerton & Clarkson, 1996; Lave, 1988). In reviewing the literature on ethnomathematics, Nunes (1992) referred 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

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<sup>4</sup>Brown and Dowling (1989) argued that internationalism does not automatically guarantee the move away from a monocultural view of the mathematics curriculum.

invariant features underneath surface differences. The work of Bishop (1988) also points to aspects of mathematical thinking that are universal. Further theorizing and research is perhaps needed in this area.

## CONCLUSION

In this chapter, we surveyed some of the processes of internationalization and globalization in mathematics education and raised some of the issues that face the profession as a result of these processes. It is obvious that aspects of mathematics education are already being globalized and standardized, and the infrastructure for increased cross-fertilization of ideas is in place. Hence, ignoring these processes by the profession is not possible and even less desirable to do so. We conclude this discussion by identifying some areas of needed action by mathematics educators worldwide for dealing with these processes. It would be far too ambitious for us to attempt to outline a comprehensive agenda for action for the international mathematics education community. Much more debate is needed in the international community before such a plan crystallizes—if indeed such an agenda is possible or desirable. At best what we can do is to identify some possible items for needed action and research by individual educators, professional organizations, official organizations, and the international community as a whole.

We have identified some potentially conflicting discourses behind the processes of internationalization and globalization: for example, economic gain versus concern about equity, local concerns versus global concerns, standardization versus plurality. Perhaps the modernist binary logic of good versus bad is not useful to deal with the complexity of such constructs. For us, such constructs should be used to evaluate particular actions in which mathematics educators are engaged in all their international contacts. We argue that every cross-country activity should be subjected to careful scrutiny as to the motivation behind it, the principles and processes it employs, and the outcomes and benefits it provides to for all participants.

Such careful scrutiny commences at the level of the individual professional. Mathematics educators involved in international activities should examine their motivation behind international collaboration and its effects not only for them personally and for mathematics education in their community but also globally. Such questions should be raised when educators are planning overseas travel to conferences, spending their sabbatical leave, engaging in staff exchange programs, or planning international joint research projects.

Similarly, international programs such as those that cater to international students, professional development, and/or curriculum development, should subject themselves to critical self-reflection as to the roles of the different parties. We suspect that many such activities uncritically make the claim of being collaborative (see chap. 10, this volume). Such programs should be very open about the roles of each of the partners and their contribution to and gains from the project. They should also examine their assumptions about what are global and what are local concerns and values and how they are reflected in the processes and outcomes of the program.

Likewise, professional organizations planning international gatherings as well as editors of international journals should develop policies to encourage more equitable representations of views from developing countries. These may include multiple language presentations, differential fee structure and subsidies, and encouraging alternative research methodologies and styles of reports. It seems to us that as mathematics educators we are more concerned about standardization and uncontested acceptance of what constitutes good research at the expense of whose voices are represented.

At the level of international organization, ICMI has the infrastructure to play a leading role in getting mathematics educators to form international collaborations and communities. Efforts are in place to deal with issues of representations of views. We argue that more effort should be made in this regard. In particular, the ICMI studies could be used to investigate issues related to globalization of mathematics education, with intensive effort to represent the voices of educators from developing countries. Such a study could examine many of the issues raised in this chapter that need a much more solid research base and debate. Also, more awareness and collaboration are needed in the mathematics education community about the functions of international organizations such as the UNESCO and the World Bank.<sup>5</sup>

Particularly, in research the following are some possible areas that may benefit from more systematic research. Needless to say, we encourage programs of research that involve genuine collaboration between researchers from developing countries and developed countries.

Little is known about the perceptions about and problems encountered by developing countries' educators from international contacts such as international conferences, publications, and joint research and development projects.

There is very limited information about the different forms of international collaborative projects and their principles and effects on academics from developing countries in contrast to benefits to developing countries.

Little is known about the processes of curriculum reform in developing countries and the roles of economic considerations in those processes. In particular, more careful scrutiny is needed about processes and outcomes of projects supported by international organizations.

More information is needed about the social and cultural values embedded in learning theories such as constructivism, and the associated pedagogies that they might imply, that have been widely adopted in the developed countries.

Further theorizing may be necessary about the processes of integration and fragmentation of curricula not only between nations but also within every nation.

Finally, the questions of similarities and differences between different "ethnomathematics" should be carried out with specific reference to values, including those about the aspirations of developing countries and economic realities of a globalized world.

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<sup>5</sup>The involvement of the World Bank in educational funding to developing countries has been problematized by a variety of researchers. Due to space limitations these concerns are not discussed here. For a comprehensive analysis see Jones (1992).



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