

Globalisation and Mathematics Education: From Above and Below¹

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In another publication (Atweh & Clarkson, 2001) we noted that the two terms *globalisation* and *internationalisation* are at times used by different authors to mean the same thing and also the same term is used by different authors to mean different things. In that publication we provided definitions in which we were using the two terms. However, in presenting these definitions we were cognisant of the dangers in essentialising 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 globalisation can be attributed to differences in the signification that they place on the term. Woock (2000), in a recent review of an edited comparative education book with the focus on the "problem of how the global affects the local [which] is one of the most important areas of research interest within global studies", commented that "nowhere in the book is there an accepted definition of globalisation or any common analysis of its relationship to education" (pp. 163–164).

For many people globalisation is often associated with evil forces and trends in society. They bring to mind a competitive world dominated by big multi- and trans-national corporations, where certain cultural forms become standard norms around the world; a world where inequality in resources and power is ever increasing between East and West and between North and South. Here, we do not construct globalisation as a singular discourse or suggest that is essentially good or bad. Arguably, certain globalisation processes may be good while others may be less desirable in the least, and disastrous in the extreme. Hence, globalisation processes should be carefully scrutinised and contested. Because of its power and the extent to which it has permeated aspects of our social, cultural and economic worlds, it is important to be able to critically evaluate its effect on individuals and cultures. Further, what is considered a good aspect of globalisation for a particular group of people, may very well be at the expense of other groups.

Similarly, globalisation trends are not necessarily inevitable and out of control. Holton (1997) described globalisation from this view as a juggernaut crushing all in its way. One of the discourses common in discussing globalisation is the death of the nation-state. However, as Henry, Lingard, Rizvi and Taylor (1999) argued, the nation state remains the main source of legislation to regulate the effect of globalisation in all

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its aspects. The authors argued that the market cannot be seen as a reified entity that possesses a life of its own and that does not require political intervention (p. 87). The state, hence, is still "alive and necessary, but hardly well" (p. 88). However, the utopian view of globalisation is also not tenable. For some enthusiasts, globalisation is the direct result of modernisation based on principles of liberal democracy. For some, at the end of globalisation "the world should become a unified ... field of isomorphic democratic institutions that would mediate lasting peace among states as well as social groups, and of self levelling markets that would ensure steady economic growth" (Derluagian & Greer, 2000, p. 3). Such a stand becomes indefensible in the face of an increasing polarisation between the rich and the poor.

Further, for Henry and Taylor (1997), globalisation consists of "contradictory impulses of integration, fragmentation and differentiation" (p. 47). For example, while intense internationalisation may lead to globalisation, these same processes may lead to fragmentation at a local level. By the same token, globalisation is not to be confused with *universalisation*. Nash (2000) suggested that "a global culture is inevitably fragmented and pluralist since it is not a world culture" (p. 71). The author argued that if we perceive "global culture as postmodern" there will be "a greater openness and 'responsibility toward Otherness' as cultural differences are seen as valid rather than suppressed or destroyed" (p. 71).

Finally, Falk (1993 in Taylor, Rizvi, Lingard & Henry, 1997) distinguished two forms of globalisation processes. He called them globalisation "from above and from below". Globalisation 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, globalisation 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)

This paper discusses some issues in globalisation in mathematics education. Using data from interviews conducted in Brazil², we will attempt to achieve three aims. Firstly, we aim to show the complexity of the issues surrounding what has become a meta-paradigm of our late modern times, i.e. that of globalisation. Second, we aim to illustrate some of the differing conceptualisations of globalisation that have differing impacts on the discipline of mathematics education. Third, we aim to give voice to mathematics educators not often heard on the Australian scape. Mathematics education in Australia can be critiqued for being dominated by Anglo-European concerns and theoretical stands.

Issues in Globalisation in Mathematics Education

Two areas in which questions have been raised about the effects of the processes of globalisation of mathematics education are curriculum development and types of research conducted. A striking feature of the different curriculum documents

² Part of an investigation into globalisation and internationalisation in mathematics education funded by the Australian Research Council

and textbooks in mathematics education around the world is their similarities rather than their differences (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 structure their curricula and pedagogies. 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. These similarities have given rise to the term "global curriculum" in mathematics education. Atweh and Clarkson (in press) discussed some voices in mathematics education calling for a global curriculum and contrasted it with "global collaboration" as means of curricular reform in mathematics education around the world.

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 single 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 contradictory trends in globalisation of integration and fragmentation referred to by Henry and Taylor (1997).

Methodology

The results reported here are part of a two-year study consisting of the conduct of focus groups in Australia, South/Latin America and South East Asia (Morgan, 1997; Vaughn, Schumm, & Sinagub, 1996).³ The local organisers of each of the focus groups are requested to invite leading mathematics educators in their countries with substantive international contacts and experiences to participate in the groups. The focus group discussions last between one and two hours each and comprise between

³ Later stages of the project will involve surveys and case studies.

five and ten educators. One of the authors acts as the focus group facilitator. Prior to the focus group, the participants receive a short summary consisting of some definitions of terms used and some issues that they may wish to address. A major characteristic of focus groups is that they allow participants to raise issues that are important to them rather than address the questions posed by the researchers. From time to time, the researchers ask some clarifying questions and direct the discussion to move on to other topics. The languages of the participants are used in the discussion paper and in the focus groups. Indeed, participants are encouraged to use their first language if that helps them to clarify their argument. All focus groups are audio taped and transcribed, translated into English where applicable, and the translation confirmed by a second native speaker of the language. The transcripts will be sent back to the participants to check their accuracy and to suggest any alterations and additions that they would like to make. The analysis reported here is based on an interview conducted in Brazil with nine mathematics educators involved in international activities. This interview was conducted in three languages, Portuguese, Spanish and English with participants using what ever language they felt comfortable with, at times translating for each others as required.

Analysis and Discussion

The Brazilian Context

Of the 19 republics forming Latin America, Brazil is the only Portuguese speaking country. With the largest population in the region, the country ranks number 4 in the GDP per capita at US\$4,670 (UNESCO, 2001, p. 11). In general, the Latin American economies include some with the most extreme distribution of income in the world: Brazil, Colombia, Guatemala and Paraguay being the most prominent (UNESCO, 2001, p. 13). Poverty among Brazil's population of around 174.2million (IGBE, 2002), is highest in the country's northeast which has a per capita income of one seventh of the richest south-eastern state of Sao Paulo (World Bank, 1999). Arguably, Brazil's two most pressing problems are land distribution and foreign debt.

Business Week (2001) stated that the public debt would reach 56% as a share of the GDP by the end of the 2001, up from 49% at the end of 2000. To slow the slide in the value of the Real, Brazil's central bank has increased the interest rate to 19% from 15.75%. In the current economic climate, Brazil's \$248 billion public debt is a heavy burden on the country. Analysts fear that if these trends persist, Brazil could follow Argentina down the road to insolvency.

Brazil has the second most unequal land distribution in the world (Global Exchange, 2002), and members of Brazil's Landless Worker's Movement (MST) are blaming the World Bank for cooperating with the Brazilian government in land reform projects that will alter the constitution. They claim they would be denied the right to unused land which would be privatised under the World Bank plan. Currently, the government can purchase and redistribute unused land although successive governments have proved unwilling to take advantage of this right. Three percent of the population owns two-thirds of the arable land (Global Exchange, 2002). The MST believes that this plan will do nothing to alleviate poverty as, although landless people could apply to the World Bank for loans under the proposal, the terms are too tough and land inequality will continue.

Universal enrolment in basic education has been achieved or nearly achieved. Illiteracy rates are also reducing, with a drop among 15 to 24 year olds from 10.4% in 1990 to 7.8% in 1999 (UN Dept of Economic and Social Affairs, 2001). 5.1% of GNP

was allocated to the education sector in 1997, compared to 4.5% in 1990 (Elimu, 2001). In comparison, Australia spends around 4.3% of its GDP on education reduced 5.2% in 1993 (Australian Council of Deans of Education, 2001, p. 8). However, Brazil has the highest proportion of repeaters among the 17 countries for which data are available (UNESCO, 2001, p. 42). The Brazilian government, with the assistance of the World Bank, is currently tackling the country's high incidence of poverty through an education strategy that aims to have all children completing primary school at an acceptable academic level by 2007 (World Bank, 1999).

Tertiary education in the whole of Latin America has a smaller share of total expenditure than secondary education, except in Bolivia and Brazil, where tertiary education is allocated about one quarter of the total expenditure (UNESCO, 2001, p. 53). Although tertiary education enrolment is increasing it is still only around 1.4% of the population (Elimu, 2001). Austrade (2002) states that the country's 127 universities together with around 775 other institutions are catering for 1.5million students. 55,000 of these students are studying at postgraduate level. There is also a growing number of Brazilian students studying overseas, with Australia alone hosting 1600 students in 2000, not including short-term language course students.

In the area of mathematics education, due to its colonial history, Brazil had borrowed its early curriculum in mathematics education from Portugal. However, during the past century its contribution to the theorisation of education in general and mathematics education has been significant. Perhaps the writing of Freire and the massive critical literacy campaign formed a model to be copied in many developing countries as well as informed global movements within mathematics education such as critical mathematics and ethnomathematics. The latter was brought to the attention of the Western world at the ICMI conference in Adelaide in 1986 by the world-renowned theoretician Ubi D'Ambrosio. It is not surprising then that the discussants in the focus group have talked about ethnomathematics at length to illustrate issues of globalisation in their country. We will have more to say about ethnomathematics in the analysis below.

Differing Discourses of Globalisation

For the discussants in the focus group the term globalisation had two significations. On one hand, the term "globalisation comes with the connotation that has to do with ... the strategy [that] the big economic ... financial world [use] to continue to act in its own interest" (Brazilian focus group, p. 1). On the other hand, globalisation is "the recognition that there is a human race, not the yellows, the blacks, no, there is a human race and ... globalisation is making everything interconnected" (Brazilian focus group, p. 2). Let us discuss each discourse in some detail.

It should be recalled here that Brazil is one country in the world that suffers massive foreign debt. A large portion of the country's budget goes towards paying the many loans that the country has taken in the past 40 years. For some in this group this is the ugly face of globalisation. It was portrayed as a continuation of the process of colonialisation (Brazilian focus group, p. 1) and described as perverse globalisation (Brazilian focus group, p. 3). Similarity has been drawn between paying taxes to the colonial powers of the past and paying taxes to the new financial colonials of our age:

Now ... when the United States revolted against the taxes payed to England ... they were against taxes payed to the [English] crown. [In the same way, the] independence of Latin America was about revolt [against] the taxes payed to the [Spanish] crown. Now we are paying

taxes to another crown that is the international financial system. ... This is the way they just keep getting taxes and they keep getting richer and richer. (Brazilian focus group, p. 1)

Like its predecessor, the new colonialisation is also faced with the potential revolt. This particular discussant pointed to the Seattle and Geneva demonstrations as signs of a revolt against this "formal globalisation" (Brazilian focus group, p. 1).

The structure, function and effect of the World Bank on developing countries have been discussed at length by Jones (1992). The focus group discussants have pointed to one other form of globalisation that they attribute directly to the pressure from the World Bank on their education policy - namely that of the increasing role of testing in mathematics education (Brazilian focus group, p. 5). This discussant relates his experience with international testing programs:

It's a globalisation procedure [referring to SIMS and TIMSS] that is comparing mathematics curriculum all over the world. ... I was ... invited to a meeting [of a division of] the World Bank, ... at that time I was a member of the State Council for Education. So I had some influence with this government and they [World Bank] wanted Brazil to [participate in SIMS and later TIMMS]. ... So all these evaluations are promoted by the World Bank, by IMF, so there is a clear interest of this financial system to have a good mathematics education. And they are against, of course, ethnomathematics. They want good international standards. (Brazilian focus group, p. 5)

This focus on testing is an "epidemic scare" in the country according to one educator. This is very much a global phenomenon. In the mind of this educator at least, this stress on testing and standardisation of achievement, raises some serious questions. "Is mathematics in the best interest of this perverse global system? ... Are we at the service of the big financial systems by doing better ... mathematics and [more] tests? ... Are we serving the interest of the people or are we serving the interest of the big financial markets? And I think this for me it is a political question" (Brazilian focus group, p. 3). The emotion in which this particular educator has lamented this situation is very obvious in the discussion. He adds "there is no disguise for this, we may love our field, we love what we do, but we are at their service!" (Brazilian focus group, p. 6).

Brazil has refused to participate in a number of the international achievement studies. One educator explains that "the point is that to participate in these [testing programs] ... you have to subordinate the use of funds [granted by the international organisations] to [participate in] the big projects. And we got funds, [but] managed our arrangement with the World Bank to do the evaluation internally, and [therefore, we] were not subordinated" (Brazilian focus group, p. 6).

One of the interesting effects of the globalisation of testing and measurement of achievement is the reversal of patterns in international exchanges typical in the past century. One educator referred to the pattern of many United States' schools importing Asian mathematics programs, in particular from Singapore. The superiority of the Asian students on international testings has raised some interest in the trial of their material in US contexts. However, one educator pointed to the sense of irony in this situation. He pointed out that "they send the Japanese [students], ... and [some] Europeans in general send their children to study in the United States. They think that the education is better despite the results [on achievement tests] being worse" (Brazilian focus group, p. 8). He concluded that in evaluating education, test results

are but a single criteria among many that should be used. Yet more importantly, it shows that in the late modern age, globalisation seen as Americanisation of world mathematics education is not a defensible position.

The economic discourse discussed at length by the participants is perhaps an example of globalisation "from above" discussed by Falks. However, this discourse of economic globalisation and its results in mathematics education was not the only discourse identified by this group. There was a strong acknowledgment of the globalisation "from below". In general, the growth of awareness, as a result of globalisation, of the world as one was welcomed by this group. Perhaps this discourse was often illustrated by this group by the concept of ethnomathematics. This group was also quick to point out that the two discourses are often in conflict with each others. One educator adds "and they [i.e. the World Bank and other global financial groups] are against, of course, ethnomathematics. ... You never, nowhere in the world, do you see a government promoting ethnomathematics" (Brazilian focus group, p. 5). Since ethnomathematics has never received the official approval of governments, it remains a grass roots movement with educators and local schools contesting its interpretations and the level of allegiance to its principles. Arguably, a healthy sign of this globalisation from below is that in mathematics education ethnomathematics has its critics as well (see Vithal & Skovsmose, 1997).

This notion of ethnomathematics is important in this context since it refers to an approach to the teaching of mathematics that in some ways is identified with Brazil, particularly in the writings of D'Ambrosio (1986, but also in many later articles). Arguably, there was a sense of ownership over, if not pride about, this particular perspective (and rightly so, we may add) even though the movement became quite international. The group responded favourably to the suggestion that this popularity of the concept around the world may be a form of globalisation as well. It was picked up in many countries such as the United States (Powell, 2002), New Zealand (Barton, 1999), Africa (Gerdes, 1994), just to name few. However, this transplanting of this perspective into other cultures is more of an adaptation rather than copying. In each of these new contexts, ethnomathematics has been differently translated depending on the local traditions and interpretations (D'Ambrosio, personal communication).

One participant in the focus group related her experiences in attending a few presentations from different countries around the world from an ethnomathematics perspective. She gave one example of a paper from Japan that made her realise that "ethnomathematics for instance for the Japanese is not what ethnomathematics is for us" (Brazilian focus group, p. 13). For example these particular Japanese colleagues were discussing some school lessons based on mathematical problems set to the context of fishing:

First they didn't talk about the group, the social group. They just talk about, what they do - they fish, so they talk about this. They don't talk about the group ... the culture or the ... social relationship They just talk about the action ... [For us, this is] a kind of mathematical modelling, they try to understand the mathematics that is in the action of the fishing. [This] at least [is] not the Brazil brand of ethnomathematics (Brazilian focus group, p. 14).

Arguably the very nature of ethnomathematics as a globalisation "from below" reveals a contradiction that illustrates all globalisation processes. Perhaps more than any other perspective in mathematics education, ethnomathematics stresses the "local"

aspects of a cultural group. Its relates to different ethnic and cultural groups as well as different social groups involved in different social practices. However, in becoming a global movement, it is an illustration of how the global and the local interact in complex ways. The binary logic positing the local and global as oppositional fields may not be sufficient to understand the complexity of late modernity. The global always interact with the local to form our multiple identities.

Narrative about the Internet

The ever burgeoning development of electronic technologies is often associated with globalisation. Arguably, the Internet is a powerful tool for developing meaningful mathematical contexts and can develop skills that are becoming increasingly important in future life. However, the Internet is also an important factor in globalisation. Many universities around the world are facing strong competition from overseas institutions offering an increasing variety of courses and degrees over the Internet. It is also a tool that mathematics educators around the world, rather in countries that have easy access to it, are using to increase their interaction and sharing of ideas. However, in general, the Internet was not a main topic that these educators addressed - perhaps because of the lack of access to it in many Brazilian classrooms, except in the larger cities. Yet in their discussion we can identify at least two narratives of the Internet and globalisation. It is essential to point out that both narratives relate to the positive side of the use of the Internet - a narrative of liberation and a narrative of connectedness. This does not mean, of course, that this particular group of academics were not aware of the limitations or problems of equity associated with the Internet. These topics did not arise in this discussion.

Narrative of liberation: There seems to be an agreement in this group about the need for schools to be liberated from the imperatives of the discipline "content". One educator pointed out that in mathematics education often "we are trying to convey a content that has nothing to do with the modern world, using the means that have even less to do with the modern world" (Brazilian focus group, p. 27). Mathematics pedagogy has not taken the new child into account. "How can you imagine a child of today, sitting, listening, taking notes, going home, and trying to understand. It is impossible! It's a different time. And this is not [taken] into account when we do mathematics education" (Brazilian focus group, p. 27). In this context one of the potential benefits of the Internet is to change the role of the school in the children's education. Schools might become centres for working on significant problems and not learning content that can be easily accessible from home.

[In Internet based courses,] ... how much [time] the student devotes to mathematics will depend on the convenience of the student. This is a new thinking about school hours. ... my feeling about the future is that the contents will not be the main objective of going to school. Content you do alone at home. Why do you go to school? To socialise, socialise. I mean socialise with content of tough projects and problems about common interests. But this is my dream about the future education. (Brazilian focus group, p. 27).

Narrative of connectedness: Arguments are often made that the Internet have made mathematics educators more connected than ever before. The wide availability of resources on the Internet may make access to resources and people much easier and more affordable to many mathematics educators around the world. However, these arguments don't often take into account the differential access that different countries have to the Internet and the dominance of English as a language for the accessible

information. Further, they don't problematise the human limitation to handle large amounts of information. However, undoubtedly, the Internet has the potential to make the International mathematics education community more connected.

In a slightly different context, one mathematics educator relates the story of one of his children as he realises the utility of the Internet not only as a source of information, but also as a means for developing cross country connectedness.

I was watching something that happens with my son this summer. He was on an Internet game Thunder or something. ... I let him go because he was playing with children from England, with kids from Korea, Mexico and another places in United States. So near 20 kids playing this game on the Internet. Over a period of time watching and they begin to trade words in each other language. The all start to type ki ki ki, which is ha ha ha in Korean, everybody learnt. A little bit later, he was asked to do a report about some issue and he very naturally asked his friends in England, Korea, Mexico this question. There was nothing I had to do. Why do you have to do this, he just did and so then I begin to ask my other colleagues about their children and they notice the same thing. So that might be something that is happening, that people are learning more important things that we are all learnt, are not at school. (Brazilian focus group, p. 27).

Discussion and Conclusions

Mathematics educators have shown a strong awareness of the internationalisation of their discipline. The rapid growth during the past century of a number of regional and international conferences around the world, in addition to a number of high profile journals of research, has increased the exchange of ideas between educators from different regions of the world. It would be naive and in fact irresponsible to suggest that such exchanges have been equitable to all potential participants. The dominance of Anglo-European educators cannot be denied. A few publications contained chapters on international research and curriculum issue (see, Atweh & Clarkson, 2001). However, the topic of globalisation has featured less in mathematics education literature. Here we argue that mathematics plays an important part in the globalisation. First, the subject itself is a product of centuries of cultural exchange between East and West. In the mind of many, it has achieved a status of an international language independent of cultural affiliation and context of development. The similarity of many mathematics education programs around the world is partly a product of this thinking. Second, also mathematics is seen as a ticket for aspiring individuals and countries for technological, and hence economic, development. This image of mathematics promotes the copying of curricula from the economically more successful to the less successful countries. Therefore, mathematics plays a dual role in the globalisation process. It is itself a *product* global exchanges as well as a *contributor* to the intensification of globalisation.

Waters (1995) claimed that while postmodernism was *the* concept for the 1980s, globalisation may well be the key concept "to understand the transition of human society into the third millennium" (p. 1). In this paper we have argued that globalisation is not a simple and singular discourse. While certain of these discourses, such as economic and financial globalisation, are more familiar in our social and cultural lives, others may be less conspicuous yet as important in defining who we are and what makes us unique. The useful categorisation by Falk discussed previously of

globalisation from above and globalisation from below, has proven useful to understand some of the concerns that some mathematics educators, and arguably others too, harbour against globalisation. Whether mathematics educators have been accustomed to thinking about movements such as constructivism and ethnomathematics as exemplars of globalisations is not clear to us. However, with this particular group of academics the concept of globalisation as seeing the world as one has resonated quite strongly. Globalisation from below was not seen as a threat to the independence and identity that they have identified with in relation to ethnomathematics. It is after all a locally grown movement that was transplanted around the world with slight variations. More importantly these variations are not specific to particular cultures. This perhaps is a good example of the conflicting patterns of integration and differentiation also referred to above.

Similarly, this focus group has demonstrated that globalisation is not simple colonisation of the East by the West or the South by the North. In particular it is not Americanisation of culture around the globe (see Atweh & Clarkson, in press). The pattern of exchanges in theories and curricula around the world is not as simple as it was, say, 50 years ago. For example this group has identified the adoption of testing and standards as foreign imports from the North, yet movements such as ethnomathematics is a local export. This transfer is never simply transplanting one idea into another context. Such transplanting always is an interaction of a new idea with local customs, conditions and experiences. Although the some of the principles of ethnomathematics have arisen from Brazil, they have been developed by various educators from around the globe. It is nearly impossible to label almost any research paradigm or theory of learning and teaching as particularly characteristic of a specific country in mathematics education. Perhaps we need to repeat the warning here that this should not be taken that all countries around the world have been able to contribute effectively and independently to this global exchange. Atweh and Clarkson (2002) have argued that a feeling of lack of reciprocity in international contacts is very strong in the minds of many educators from developing countries.

We will conclude by discussing two alternative responses that mathematics education can develop in the face of this globalisation. One is globalised curricula and the other globalised collaboration. Often there is some unease expressed by many English-speaking researchers about the dominance of Anglo-European thinking about mathematics education for countries around the world. 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, these concerns often 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 globalised world. He called for “a global minimum curriculum below which no continent should be allowed to drift, however under-developed” (p. 407).

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. 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 the 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.

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