From Ethnic to Ethics: Towards a Socially Response-able Mathematics Education in the APEC Region

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APEC is an economic collaboration between different economies representing a huge diversity in economic, cultural and educational systems around the world. Such collaboration necessarily raises questions as to what type of mathematics education meets the needs of the different member economies and what type collaborative research can be developed to achieve high quality and equitable mathematics education. This presentation will argue for an ethical approach to the discipline that supplements an ethnomathematical approach.

Since its inception in 1989, the Asia-Pacific Economic Cooperation (APEC) has identified its primary aim as "facilitating economic growth, cooperation, trade and investment in the Asia-Pacific region". The 21 economies[1] that constitute the forum represent "40.5% of the world's population, approximately 54.2% of world GDP and about 43.7% of world trade" (APEC, Undated). This forum represents members of huge diversity in political, social and economic systems.

In particular, APEC recognises the importance of human resource development, including education, as an important arena for collaboration between its member economies. In 2000, the second Education Ministerial meeting of APEC economies in Singapore declared that "in a knowledge-based economy, intellectual capital, 'grown' through education, will provide economies and companies with the competitive edge to prosper and flourish. In the new borderless world, education has to play a key role in retaining the sense of rootedness to one's culture and history, and developing the 'glue' that binds communities and societies together" (APEC, 2000, p.2). Further, in 2008 the fourth Education Ministerial meeting in Peru recognized the role of education that goes beyond economic development that "unquestionably implies the need to strengthen our education systems, considering that well-educated citizens not only contribute to but also make for the social, economic, and sustainable development of our 21 economies within just societies that value knowledge, promote a culture of peace, understanding and diversity" (APEC 2008, p. 1). The declaration goes on to "recognize the need for our education systems to make special efforts to ensure equity and social inclusion". Thus it combined the agendas of equity with quality under the theme of "Quality Education for All". Hence collaboration between the different member economies must acknowledge the dual role of education for economic development as well as for its social and cultural significance. Of special significance here is the identification of mathematics and science education as the first of four priorities for APEC work over the next

[1] APEC uses the term of 'economies' rather than countries to refer to its members.

few years. The Peru forum declares "Mathematics and Science are essential to navigating the data-driven and technological world of the 21st century, no matter one's occupation" (p. 1).

A primary aim of APEC is to provide a forum for collaboration between its member economies. In particular, education plays an important part of this collaboration. The Singapore declaration goes on to assert that "the APEC framework, with its great diversity of economies and their education systems, holds great potential for the exchange of knowledge, people and expertise" (APEC 2000, p.3). In this presentation, I will focus on collaboration in the area of mathematics education. I assert that such international collaboration necessarily raises important questions to mathematics educators within the different economies. In particular, what type of mathematics education can best be developed to satisfy the needs of such a diverse economies and what type of collaborative research may best be conducted to achieve high quality and equity in mathematics across the region. I will turn to each question in the following sections. First though, since this presentation is delivered with the question of ethnomathematics and ethnoscience, I will commence by addressing the basic assumptions of ethnomathematics and point out two reasons identified in the literature that this approach needs to be supplemented in order to overcome its limitation.

The Ethnomathematics Agenda in Mathematics Education[2]

The current literature in mathematics education has problematised the viewing of mathematics as a universal discipline. The questioning of universality of mathematics knowledge has been brought to the forefront of theorising in mathematics education by the work of constructivists who have demonstrated the individual and social constructions of mathematics knowledge (Ernest, 1994). While constructivism has dealt with individual construction of knowledge, it is research from an anthropological perspective that has questioned the universality of mathematics from a cultural perspective.

Although, the relationship between mathematics and culture has been studied since the start of the last century, the publication the book Mathematical Enculturation: A Cultural Perspective on Mathematics Education (Bishop, 1991) can be considered as a landmark in the popularisation of the area in mathematics education. Perhaps one point which is often forgotten about that particular publication is that it aims at a critique of the current status of mathematics education and the development of a proposal for alternative practice in its teaching and in teacher education. The cultural view of the development of mathematics is adopted towards the achievement of this aim. The first question that the book deals with is what is the nature of mathematical knowledge. Using an anthropological approach, Bishop searches for similarities behind the mathematical practices of different cultural groups. Six fundamental mathematical practices that can be identified in most known cultures include counting, locating, measuring, designing, playing and explaining. Research is cited to show that these are "universals" in the sense that all cultures display practices that fall under each type of activity. Even though different cultures have developed their own mathematics, mathematics is a "pan-cultural" (p. 55) phenomenon in the sense that each culture has developed some forms of mathematical activities based on one or more of the above activities.

Ethnomathematics writers have problematised the international acceptance and status of the mathematics (Bishop, 1991). Some argue that mathematics has received its international status because of Eurocentrism and colonialisation (Powell & Frankenstein, 1997). The following observation narrated by D'Ambrosio (1999) illustrates this relationship between the dominance of Western mathematics and colonialisation.

[2] This section is based in part on Atweh, Clarkson and Nebres (2003).

> It is quite relevant that the first non-religious book printed in the New World was an arithmetic book, by Juan Diez Freyle the Summario Compendioso de las Cuentas ..., printed in Mexico in 1557. This was an Aztec arithmetic, useful for Spaniards to trade with the natives, who were responsible for the production of gold and silver. Less than 100 years later, this book practically disappeared and was substituted by a European arithmetic. This clearly shows that the production was no longer in the hands of the natives. (p. 149)

The seeds of ethnomathematical thinking have been attributed to various writers since the 1920 to the present (Gerdes, 1994). However, the popularisation of the term in the international scene in mathematics education is often attributed to the keynote address given by Ubiratan D'Ambrosio (1985) in the 1984 ICME conference in Adelaide (Barton, 1999). Within a few years, ethnomathematics has been able to spread rapidly around the world. An International Study Group on Ethnomathematics (ISGEm) was established in 1985. In its early years the group convened during the NCTM and ICME meetings. In 1990 the group was affiliated within the NCTM. The group manages a web site[3] containing notices of activities in different regions around the world, a list of resources and publications, as well as an email discussion list. The ISGEm has been able to conduct three international congresses on ethnomathematics. The first was held in Granada, Spain, in 1998 and the second in Ouro Porto, Brazil, in 2002 and the third in Auckland, New Zealand in 2006. Regional meetings have been held in a variety of locations such as Bolivia in 1999. Contributions to ethnomathematics research and theorizing have come from of course Brazil, (D'Ambrosio, 1985), Africa (Gerdes, 1994), New Zealand (Barton, 1995, 1999), and North America (Ascher, 1991; Powell & Frankenstein, 1997) among many other places. Hence, it is not possible to say that ethnomathematics is a perspective on mathematics education characteristic of a single country or culture around the world.

In this context, I shall discuss some of the critiques of ethnomathematics in the mathematics education literature. One of the main contributions of ethnomathematics to the disciplines of mathematics and mathematics education has been its critique of conventional assumptions often made by academics and practitioners. However as researchers both from "within" (Barton, 1999) and from "outside" (Dowling, 1998; Vithal & Skovsmose, 1997) the movement have argued, for ethnomathematics to be faithful to its critical approach it must subject itself to a critical gaze. It is worth mentioning that some of the critique from the "outside" has come from educators that are sympathetic to the critical agenda of ethnomathematics but have raised questions as to whether it has gone far enough in the research topics it posits. We shall discuss here three points raised about ethnomathematics that have particular relevance to the topic of this presentation.

First, there is the question of *voice* represented in the ethnomathematics literature. In his book the Sociology of Mathematics Education, Dowling (1998) discusses how ethnomathematics differs from other projects aiming at the emancipation of groups of disfranchised learners of mathematics. Ethnomathematics highlights the already existing mathematical content in the practices of different cultural groups, including groups less developed culturally and socio-economically, rather than contracting these groups as "deficit" in the dominant mathematics. Yet, Dowling makes the observation that nearly all research and writing in mathematics education comes from researchers from within cultural groups who have identified with the dominant "Western" mathematics tradition. These researchers "external" to the cultures they have studied have looked at the practices of other cultural groups. Commenting on the example of the well-known work of Gerdes - originally a Dutch educator as Dowling points out - on the mathematical practices in Mozambique, the author makes the following comments:

[3] http://www.rpi.edu/~eglash/isgem.htm

> Reflection on the impact of colonialism is not a bad thing in the Mozambican or, indeed, in any other curriculum. The difficulty is that it appears that a European is needed to reveal to the African students the value inherent in their own culture. When he does so, of course, he does it in European terms, even referring to a European mathematician (Pythagoras). The African culture, in other words, is not being allowed to speak for itself. (p. 14)

Second, Dowling goes on to argue that this external *gaze* is problematic because it sees the world from its own perspective. He illustrates how the concepts of "locating", for example, taken to be a universal mathematical phenomenon, in the sense discussed by Bishop (1991), can be an over simplification. Referring to the work of Pam Harris with Australian Aborigines, the use of directions in Indigenous and non Indigenous frames represents quite different epistemologies. From a Western perspective, locations are identified from the point of view of an observer who is "outside" the geographical point of reference, while Aboriginal use of location seems to locate the individual within the world. Hence, referring to both as location is at best an oversimplification (p. 13). Bishop acknowledges that these universals might be context sensitive in the sense of being identified from a particular stance or cultural view. He calls them "culturo-centric universals" (p. 55).

Last I will consider the question of *power* as discussed in the ethnomathematics literature. Undoubtedly, ethnomathematics has raised questions of power as they relate to the dominance of Eurocentrism in mathematics and mathematics education. However, as Vithal and Skovsmose (1997) have argued, ethnomathematics has not always extended this discussion to examining the meaning of culture itself. The authors discuss two meanings of culture. One is anthropological that posits culture as "a given within which peoples' lives are shaped" and the other is more critical which sees "culture as a social and political construct that can be used to interpret, organise and structure society" (p. 139). While ethnomathematics has been able to study the development of mathematics as interactions of power "between" different cultural groups, they have not done the same with power interactions "within" the different cultural groups. Further, the question of power needs to be raised as to the effect of seeing the mathematics in every day practices of different cultural groups. Mathematics, argue Vithal and Skovsmose "not only provides a way of 'looking', it also provides a way of 'doing'" (p. 142). Questions need to be raised as to the effect of seeing the mathematics by outsiders on changing the lived reality of the people from the inside. In particular, how can this ethnomathematics be used by the insiders to challenge their subordination from within and from outside their particular culture? This is not to say that ethnomathematics can or cannot affect the lives of the people inside a culture. However, it does assert that ethnomathematics researchers have a responsibility to demonstrate such implications of their work so the ethnomathematics remains consistent with its critical stance.

To summarise, this section has developed the argument that mathematical knowledge has its roots in culture and that effective teaching and learning can only be achieved through this acknowledgement. However, a shallow interpretation of this assertion might lead into wrong assumptions and practices both in teaching mathematics and in research on mathematics education. In order to supplement the discussion on ethnomathematics in mathematics education, I will now turn to ethics and raise the two questions above about what type of mathematics education and what type of research in mathematics education can be the basis of APEC collaboration from the perspective of ethical responsibility.

From Ethnic to Ethic

Ethics is not a topic that is discussed often in mathematics education. Arguably, this absence of ethics discourse in mathematics education is paralleled by its absence from general discourses in education and humanities in Western culture. With the rise of scientific rationality, ethics has often been associated with questions of morality, dogma, codes of behaviour and legal imperatives and often seen as belonging to the domain of metaphysics rather than philosophy proper. Cohen (2005) explains this avoidance of ethical discussion in philosophy as a fear of moralising, preaching and questions of values by philosophical discourses mainly focused on ontology rather than meaning. Similarly, in Western thinking there is a movement away from essentialist thinking represented in the universality of ethical principles (Christie, 2005) and their foundation on rationality as established by philosophers such as Kant. Going back to the philosophical and ethical discourses of Socrates, who argued for the primacy of the knowledge of the good over the knowledge of the truth, Cohen raises the question "Has the philosopher abdicated responsibilities" by only dealing with questions of knowledge rather than values (p. 39).

However, this avoidance of ethical discourse is slowly dissolving. As Critchley (2002) indicates, it was only in the 1980s that the word ethics came back to intellectual discourse after the "antihumanism of the 1970s" (p. 2). Further, the post-ontological philosophical writings of Levinas (1969, 1997) have been influential in the re-introduction of ethics within philosophy by establishing ethics as the 'first philosophy'. As Christie (2005) argues, when it comes to ethics, it is possible to "work with and work against" (p. 240) the construct at the same time. In other words, we adopt a critical stance on the concept by discussing both its usefulness and limitations.

Ethical Response-ability

The demand for responsibility, or more often in its related term accountability, is an increasing concern in educational discourse, policy and practice. However the term is used with a variety of meanings. Responsibility is often presented as a requirement or duty that restricts (as in, it is the teachers responsibility to cover the curriculum) as well as enables (as in, evaluating students' learning is the teachers' responsibility) or sometimes in the placement of blame (as in, who is responsible for the students' lack of achievement?). It often posits a conflict between self-interest and the interests of the other, or the collective - giving a priority to the latter. Ethical codes are constructed under the assumption that norms and regulations need to be set and agreed upon otherwise our 'natural instincts' would find some teachers lazy or dishonest, and leave students under the threat of marginalisation or exploitation. In other words, while ethical codes may be drafted to guard the students' interest from malpractice, they may not be as useful in a positive sense for promoting fruitful and effective relationships between students and teachers.

If the law or the system does not form a valid foundation of ethical responsibility, what does? Philosophy? As discussed above, Western philosophy has often avoided the consideration of ethics. Further, as Levinas argues, philosophy is mainly concerned with questions of being (ontology) and knowledge (epistemology). The discussions of being and knowledge are achieved by reducing the other to the same (Critchley, 1992) and by dealing with consciousness (Bergo, 1999). For Levinas, ethics is before any philosophy and is the basis of all philosophical exchanges. It precedes ontology "which is a relation to otherness that is reducible to comprehension or understanding" (Critchley, 2002, p.11). This relation to the other that precedes understanding he calls "original relation". Chritchley goes on to point out that the powerful contribution of Levinas is that he "does not posit, a priori, a conception of ethics that then instantiates itself (or does not) in certain concrete experiences. Rather, the

ethical is an adjective that describes, a posteriori, as it were, a certain event of being in a relation to the other irreducible to comprehension. It is the relation which is ethical, not an ethics that is instantiated in relations" (p. 12). Using a phenomenological approach, Levinas argues that to be human is to be in a relationship to the other, or more accurately, in a relation for the other. This relation is even prior to mutual obligation or reciprocity. Roth (2007) argues that this original ethical relationship discussed by Levinas consists of an "unlimited, measureless responsibility toward each other that is in continuous excess over any formalization of responsibility in the law and stated ethical principles". Neyland (uses Keman's specifications on how this 'original relation' can be eroded to specify three conditions "(i) particular procedures are authorised, (ii) actions are routinised, and (iii) people are dehumanised" (2004, p. 817, italics in original).

Below I present a discussion on the type of mathematics curricula and type of research in mathematics education that are based on the primacy of responsibility one to the other – albeit with one minor variation to the was the concept as it is often understood. Puka (2005) suggests that a great contribution to ethics is the feminist[4] distinction between responsibility and "response-ability". Response-ability highlights the ability to respond to the demands of our own well being and the ability to respond to the demands of the other. This is similar to what Roth (2007) points out, that responsibility "etymologically derives from a conjunction of the particles re-, doing again, spondere, to pledge, and –ble, a suffix meaning "to be able to." Responsibility therefore denotes the ability to pledge again, a form of re-engagement with the Other who, in his or her utterances, pledges the production of sense. Each one, on his or her own and together, is responsible for the praxis of sense, which we expose and are exposed to in transacting with others" (p. 5).

We turn now to the question of what type of mathematics education can be consistent with ethics as discussed here and may be suitable for international collaboration within the APEC economies. The following discussion is based on the assertion that the primary function of mathematics education should be the development the response-ability of the student (i.e. their ability to respond) to the demands for active participation in their society and that the primary function of collaborative research to increase the response-ability (ability of the mathematics education systems to respond) to the demands of quality and equity mathematics education within each economy.

Socially Response-able Mathematics Education[5]

Undoubtedly, mathematics is an important subject in the curriculum and in the current and future lives of students. In the minds of many, such importance is given to the subject due to the increasing importance of technology and science, two essential areas in problem solving and raising living standards. Mathematics, like science, is often associated with the economic development of a nation (Kuku, 1995). At the personal level of the student, mathematics is often justified as opening doors to many careers and courses of further study.

However, these assumptions about the value of mathematics education for the student and society should not be accepted uncritically. First, the relationship of mathematics to general economic development is far more complex than is often assumed. For example,

[4] For diverse feminist stances with respect to Levinas see Chanter, T. (Ed.). (2001). Feminist interpretations of Emmanuel Levinas. Pennsylvania: Pennsylvania State University.

[5] Further development of ideas expressed here can be found in Atweh (2009)

Woodrow (2003), citing the example of the development of the Asian economies and the high achievement by their students in international testing, argues that increases in mathematics education standards have occurred after their economic development, and arguably as a result of it, rather than the other way around. Further, Ortiz-Franco and Flores (2001) demonstrate that during the period between 1972 and 1992, the mathematics achievement of Latino students in the USA has increased in comparison with other students, although their socioeconomic status has decreased.

Similarly, the assumption that mathematics is needed to increase access of students to jobs as a justification of its place in the curriculum should be regarded with care. The dominance in school mathematics of content needed for careers that are seen as mathematically based – mainly science and engineering, is unwarranted and, perhaps, is a residue of times when few students finished high school and went to university. Notwithstanding the importance of jobs in science and engineering for social technological development, only a few students end up in such careers. Further, with advances in technology, the demand for most calculations and algorithms that still dominate the majority of school teaching are increasingly becoming obsolete. Indeed, Jablonka and Gellert (2007) point out that, in certain areas, mathematics has become mostly invisible due to the wide spread of technology. Arguably, the nature of mathematics used in society has changed more rapidly than school curricula. This leads to our argument that all students need a considerable amount of mathematical knowledge for effective citizenship in the increasingly mathematised world of today – albeit different type of mathematics. Not only is a significant amount of mathematical thinking behind most day-to-day decisions that people make, but also as Skovsmose (1998) asserts, mathematics plays a role in 'formatting' the world. In other words it creates a social and physical world after its own image. This power of mathematics is, of course, double edged. While many great achievements in science and technology were facilitated by mathematics, mathematics is also implicated in technologically caused catastrophes such as wars and mass destruction (D'Ambrosio, 1998). Hence, a utilitarian approach to mathematics falls short of developing a response-able student. As Ernest (2002) argues, a critical approach to mathematics and citizenship is needed. This ethical response-ability discussion applied to mathematics education posits the primary aim of mathematics education to enable the response-ability of students in their current and future lives as citizens.

Developing mathematical knowledge and capacity helps the students to not only, using Freire's (in Gutstein, 2006) terminology, "read the world", i.e. understand it, but it should lay the foundation for their capacity to "write the world", i.e. change it. In the traditional wisdom of school mathematics, reading the world (at least some aspects of it) is the function of the school, whereas writing the world is often constructed as a possible capacity that might arise later when the students enter the workforce and civil society. Borrowing the terminology from Down, Ditchburn and Lee (2007), the role of mathematics education as it relates to citizenship can be at three levels. Mathematics education can contribute to the ability of students to function as effective citizens in the world. The authors call this a conforming ideal. This is consistent with the dominant justification of mathematics as developing skills and knowledge useful for preparation for work. However, mathematics can also be used to enable students to understand how the world works (or does not work) in order to change some aspects of their world. This, the authors refer to as reforming. However, mathematics has an additional capacity. It can be used to create the world in a new way. The authors call this the transforming capacity. This focus on mathematics education is consistent with the critical mathematics movement.

Similarly, an ethical responsibility approach to mathematics education changes the focus of interactions between teachers and students. Increasingly, schools and classrooms are

controlled from outside (Fullan, 2000) by increasing demands of the system. Teachers increasingly feel deprofessionalised when faced with continuous changes imposed from above (Hargreaves, 1994). Perhaps relevant here is the discussion by Habermas of his theory of communicative action in which he makes the distinction between the lifeworld and the system world (Habermas, 1987). While the lifeworld is the taken for granted, pre-interpreted, everyday life existence, communicative action in this world is saturated by tradition and routine. Through the lifeworld, individuals construct their own identities, create social solidarity, participate in, and create culture. On the other hand, the social world consists of social organisations dominated by technical goals and outcomes. The function of the systems level of society is to coordinate and control natural and social forces, as well as the resources and organisations required to administer them through bureaucratic structures. Seidman (1998) explains that whereas in the lifeworld "action is oriented to mutual understanding", the emphasis is on "instrumental control and efficiency" at the systems level (p. 197).

Habermas goes on to argue that these two life spheres are highly differentiated into subsystems and that their interactions are complex. In analysing late modernity, Habermas makes two key observations about this interaction. The first he terms the uncoupling of the system from the lifeworld. This refers to the fact that systems have become increasingly autonomous from the concerns of the lifeworld. Systems seem to have developed a rationality of their own and act according to their own imperatives even at times when they contradict the processes of the lifeworld that sustain them. The second observation that Habermas makes about late modernity relates to the colonisation of the lifeworld by the system imperatives. This is seen, for example, in the dominance of the systems language of efficiency, productivity, goals and roles on the lifeworld on people. For instance, our roles in social systems functioning contribute to our notions of our own personal identity, for example as clients and consumers.

Neyland (2004) argues that in mathematics education the demand for accountability or responsibility as portrayed in the world-wide push towards standards and testing reflects a 'scientific management' rationality that posits institutions and norms as the cause of ethical behaviour. Using Levinas's writings, he goes on to argue that such institutions externalise and mechanise ethical behaviour and thus "sometimes erodes a primordial ethical relation between people" (p. 517). In this context, we argue that a focus on ethical responsibility shifts the focus of interactions between students and teachers to an encounter between two human beings, and although it is not totally free from system demands, it allows for teachers' decision making based on the interest of the student. At the same time, it re-establishes the professional status of teachers and frees the lifeworld of the school from some of the colonization of the system. It implies a collaborative and mutually respectful classroom environment where the participants are constructed as co-learners, an environment to which Vygotsky and Freier aspire.

Socially Response-able Research in Mathematics Education[6]

In this section of the presentation I will address the second question posed above about what type of collaborative research may best be conducted to achieve high quality and equity in mathematics across the region. I will discuss the relevant merits of two types of possible international research: cross country comparative studies and collaborative research.

[6] Further elaboration of ideas discussed here can be found in Atweh, Clarkson and Nebres (2003), Atweh (2004) and Atweh (2007).

Although not necessarily mutually exclusive, here I argue that they do represent different assumptions and may lead into different results.

International Comparative Studies

The publication of results from the recent Third International Study in Mathematics and Science Study (TIMSS) and PISA have ignited the interest in international comparative research that is based on cross-country comparisons in curriculum, teaching and/or student achievement. Arguably, there are only a few issues in mathematics education that attract more public debate from the media, politicians, and even parents than international comparisons. This type of study has generated a considerable amount of controversy within the mathematics education literature. Robitaille and Travers (1992) argue the case for international studies on achievement while others have identified concerns about their validity, usefulness, misuses and abuses (Fensham, 2008).

In addition to the numerous references to these studies and their findings in journal articles and conference presentations, Kaiser, Luna and Huntly (1999) have edited a book that deals with the topic from a wide range of perspectives. The book contains discussion from both sides of the debate as well as illustration of the findings from some of these studies. The book consists of sixteen chapters with contributions from the USA, Australia, UK, Germany, Japan and the Philippines. Part I of the book consists of chapters by people who have contributed to the major international studies in mathematics education during the past twenty years. Part II consists of contributions by academics who examine various issues related to international testing including their assumptions, weaknesses and benefits.

Undoubtedly international studies such as TIMSS and PISA are costly and time consuming. Advocates of international comparisons have argued that such studies offer a better understanding of one's own educational system, identifying its strengths and weaknesses, in their attempts to identify approaches to reform mathematics education. Hence, they can assist policymakers and administrators and help in the design of teacher education programs (Kaiser, 1999b, p. 5). Further, Robitaille and Travers (1992) discuss the slogan-like principle behind international comparisons of "the world as an educational laboratory" (p. 688). Such studies allow the investigation of factors that may be hard to control in a single country, such as class size, single gender classes, and out of class tutoring. In their chapter, these authors argue how results from these studies can challenge the accepted wisdom within certain countries. The authors conclude that even the potential misuse of their widely publicized findings of country ranking, which they deem to be inevitable, should not be down played if it leads to an examination of reasons and factors associated with success.

On the other side of the debate, opponents of international comparisons have raised questions about the benefit of these studies to provide useful findings towards the improvement of education systems in any country. Misley (1995) questions whether national educational policy makers should rely on these international comparative studies as a means of enhancing pedagogy, as these tests can only give certain kinds of information about current conditions and context. Hence, he questions whether these studies could offer insights into sound teaching/learning practices, or just create hype and newsworthiness. This form of testing is publicly seen in terms of an international competition, that is, labelling those better off and those countries not so well off. The political aspects of the studies overshadow any potential educational benefit. Similarly, Kaiser (1999a) summarises some of the major concerns about international comparative studies. He points out that the differences in country achievement "can largely be explained by the emphases in both the curriculum and the lessons" (p. 148). Furthermore, international testing results cannot explain many cultural differences and preferences such as the status and relevance of mathematics in that particular country, and whether it has "the status of folk education in contrast to elite education" (p.

149). These studies have limited pedagogical benefit, since a pedagogy that might work in one country may not work in another context (Kaiser 1999b, p. 13).

In a comprehensive discussion of international studies, Clarke (2003) summarises the potential dangers of the misuse of such activities as follows:

> (i) Through the *imposition* on participating countries of a global curriculum against which their performance will be judged; (ii) Through the *appropriation* of the research agenda by those countries most responsible for the conduct of the study, the design of the instruments, and the dissemination of the findings; and (iii) through the exploitation of the results of such studies to disfranchise communities, school systems, or the teaching profession through the implicit denigration of curricula or teaching practices that were never designed to achieve the goals of the global curriculum in which such studies appear predicated (p. 178).

Finally, Keitel and Kilpatrick (1999) raise several political questions about such international comparative studies. They argue that the outcomes of these studies are perceived as biased towards the host country; that is, of those who do the data collection, the analysis and the funding. These authors question whether this is to the detriment of other countries and their concerns about improving education systems. Outcomes of such studies are also perceived as necessarily reductionist, as results cannot do justice to the very complex factors involved. The authors claim that the mathematical tasks do not represent the curricula taught in many schools, teachers' questionnaires do not represent the whole range of teaching practices, and the results do not offer valid comparisons between the various countries' curricula with their divergent cultural and social contexts. "No allowance is made for different aims, issues, history and contexts across the mathematics curricula of the systems being studied" (p. 243). They conclude that comparative testing is not really useful as an educational tool, as it does not produce a clear view of what's really happening in the classroom and why.

International Collaborative Research

The other possible international research can be referred to as collaborative research. In another context, I (Atweh, 2004) discussed the merits of collaborative research between teachers and professional researchers as means to reduce the gap between the development of research knowledge and the practice in the classroom. Similarly Atweh and Bland (2009) discussed the possible contribution of such research in the context of poverty and inequality. Here I will focus on the contribution of international collaborative research between researchers from different APEC economies that represent not only a wide diversity in culture and social conditions but also diversity in available resources and experience for conduct of research.

By collaborative research in this context I refer to research that is jointly designed, implemented and its results published. This research collaboration need to assure that the research questions are mutually relevant to the conditions and needs of countries involved. It should negotiate the responsibilities of all parties and their contribution to the research process.

In the area of research in mathematics education, Bishop (1992) argues 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 concludes that these similarities have led to difficulties in identifying a national perspective of mathematics education research in any country. He rightly adds 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).

These trends of globalisation in research in mathematics education are not, however, without their problems for designing and conducting collaborative research. Firstly, they may imply the uncritical appropriation of research questions and methods from countries with expertise and well known traditions of research into countries that are developing such capacity. Research questions chosen in collaborative projects fall into the danger of reflecting the concerns of the more experienced countries. Secondly, there is a danger in international collaborative research to be conducted between economies that have already developed expertise in such research and/or have access to the resources to conduct such collaboration at the exclusion of less capable countries.

In another context (Atweh, 2007) I reported an example of such collaborative research. The Learners Perspective Study (LPS) is an example of a multi-country long term project. The initial idea for the project stemmed from an informal conversation during an international conference between David Clarke, from Australia, and Christine Keitel, from Germany. The discussion centred around some of the limitations of the Third International Mathematics and Science Study (TIMSS) video study. Among their concerns about the TIMSS data collection methods were its lack of ability to capture student-to-student discussions in the classroom and access students' construal of teacher actions and classroom events. The agreed upon aim of the LPS project was to develop a means of collecting data from the three countries involved in the original TIMSS video study – Germany, Japan and the United States - plus Australia. Yoshinori Shimizu was recruited from Japan, and Joanne Lobato from the US to allow for validity of data collection from those countries. Initial project funding was obtained from the four participating countries. As discussions developed about the project, the project's scope expanded to include more countries. For example, Sweden expressed an interest in participating and then, through further individual contact and discussion, the project extended to include Hong Kong, mainland China, Israel and the Philippines.

Perhaps the participation by the Philippines is particularly interesting for our discussion here. Although the Philippines' educators wanted to join the international team, they were concerned about the lack of Filipino funds available to conduct such a study to allow them to participate at the group's international meetings. However, to facilitate such participation, other project participants elected to subsidise the Philippines by sending them equipment previously used in the Australian data collection. In addition, two technicians were sent to train educators to operate the equipment. Further specialised training, in Manila, was provided by the Australian team in conducting the interviews. Finally, Australian funds were used to subsidise the Philippines' participation at the international research team meeting.

This case study illustrates several issues that may arise during collaborations among academics with varied interests, backgrounds, cultures, as well as experiences in research and access to resources. In order for this global collaboration project to include less affluent cultures, sharing of financial burdens was a prerequisite to collaboration. Hence, part of the project can be classified as the *aid* mode. However, the project also contained elements of the *development* mode for researchers from less experienced countries. Arguably, the contributions different researchers made were not equal because the initial model for gathering and analysing the data was driven by the more affluent countries. However, experienced researchers from more affluent countries also experienced professional development as a result of mentoring developing countries. They gained knowledge and appreciation of different research and mathematics teaching traditions. Such collaborations

reflect the *multicultural* mode. Finally, one can also argue that the project reveals certain elements of Critical Collaboration in its dealing with safeguards against possible data "appropriation" by the richer countries. Through the *critical collaboration* lens on this project, one can argue that the research questions posed and procedures followed represent the more affluent countries' interests.

In Atweh (2007) I discussed the 3Ps of international collaborations: pragmatics, problematics and potentials. At a *pragmatics* level, it is safe to say that international contacts will continue to increase in frequency and magnitude for a long time to come. Mathematics education is both a reflection of more general globalisation in our times and a major contributor to it (as reflected in the current debates about international standards and numeracy in many countries). Increasingly, mathematics education is seen as high priority of many governments aiming to develop competitive economies and attaining higher standards of living. For some, it serves the neo-liberal agendas of the new world order. However, by others it serves as a powerful tool for empowerment and democratisation of a world marked by inequality and injustice. What both perspectives agree upon is the need for increasing international collaborations, albeit of different types, to achieve their agendas.

Different, and often conflicting, agendas are often at play in international collaborations. Some countries and universities are increasingly dependent on economies based on the export of knowledge. Academics are under pressure to play the game and contribute to them. However, some make use of these opportunities to promote other more empowering agendas. The challenge for professional mathematics education is to critically examine their own personal agendas behind their own engagements in international contacts and reflect on their own practices and the outcome of their practices in the short and long term implications. Hence in the midst of pragmatics, there is a role as an opportunity for critical reflection.

At a *problematics* level, the magnitude and scope of international collaboration has the potential for drastic effects on the practices and outcomes in all countries in mathematics education. As argued here, not all countries are equally benefiting from such international collaborations. Due o to resource limitations, many academics from less industrialised countries are excluded from participation. Due to marginalisation, many are not contributing to international debates from their own experience. Further solutions that may work in one context may not be transplanted uncritically into another. When resources are limited in less affluent countries, this might lead into colonisation. While aid projects are not sufficient and dangerous, they may be pre-requisite for more meaningful participation.

Secondly, the role of language in international collaborations is quite problematic. Undoubtedly, English has reached an international standard. However, it is not an international language if we understand by that as the only language of communication. The vast majority of academics in mathematics education do not speak English, although perhaps there are few from every country that do. These should not be the only ones that are allowed to participate in international collaborations. International conferences should always aspire to provide translation facilities into other languages. Further, presentations at conferences in more than one language, as available in some European conferences, should become the standard. Hopefully, that will extend to publications as well. I look for a world where more mathematics educators become bilingual. It is worthwhile to note that many educators from non-English speaking countries are, at least, bi-lingual. Very few western English speaking countries are!

Finally, on the *potentialities*, undoubtedly, international collaborations are a great opportunity to develop a more socially just world. In spite of the potential hijacking of the discipline by the economic and global capitalism, our passion and belief that mathematics

education is worthwhile both for personal and national empowerment should not subside. Through critical global collaboration as discussed above, this contribution of mathematics to the solution of world problems is more achievable. If mathematics is not part of the solution then it is part of the problem.

Concluding Remarks

Arguably mathematics education is the most globalised subject in school curricula and area of research in higher education (Atweh, Clarkson & Nebres, 2003). Globalisation, however, is not a unitary construct – it refers to many different – and often contradictory - trends in society. While the increasing trends of international testing and convergence of policy and curriculum may reflect "globalisation from above", academic interactions and collaborations represent "globalisation from below" (Falk, 1993 in Taylor, Rizvi, Lingard & Henry, 1997). Similarly, in the age of globalisation there is evidence of convergence and homogenisation of curricula and research at an international level, at the same time there are signs of diversification and divergence at local levels. In other words, at the same time when our awareness of similarity between mathematics education programs around the world is increasing, we are also becoming more aware of differences in values and practices – not only between countries and cultures, but also between different groups of the population. As Atweh et al argued, globalisation and internationalisation are neither inherently good nor inherently bad, but due to their wide pervasiveness they should be carefully monitored and queried as to the direction of their development and to who benefits from them and who is left behind.

Collaboration between economies represented in APEC provides great opportunities to reflect upon the type of mathematics education that is useful for *all* students with diverse abilities, interests and needs as well as the type of research that may lead into improving practice in different contexts. However, at the same time, such collaboration represents a great threat of uncritically appropriating the mathematics curricula and research traditions of some economies into others with no guarantee of their relevance to the local conditions and values. As Atweh and Keitel (2007). Argued, unexamined, globalisation can lead into *exploitation, marginalisation, powerlessness, cultural imperialism,* and even *violence.*

In this presentation, I attempted to provide some critical reflection upon priorities both for mathematics curricula that enhance the quality of life for the majority of students that will live their life in an increasing globalised world and types of research in mathematics education that enhance the capacity of all educators who work in diverse settings some of which are inhibiting. I present these remarks not as normative or definitive – rather as a contribution to an international debate and discussion between different mathematics educators to maximise our learning and at the same time avoid the damaging effects of globalisation in the discipline.

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