Developments in International Comparative Research in Mathematics Education:
Problematising Cultural Explanations

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1.   Problematising Cultural Affiliation

In the Discussion Paper for this ICMI study, it is stated, "For this study, culture refers essentially to values and beliefs." The ICMI Study is distinguished from other studies "in that it is specifically concerned with comparing practices in different settings and with trying to interpret these different practices in terms of cultural tradition." The Discussion Paper makes it clear that the ICMI study is "limited to only a selection of cultural traditions" and then argues that "Those based in East Asia and the West seem particularly promising for comparison." In invoking a comparison between East-Asian and Western cultural traditions of mathematics education, the ICMI Study does not "merely refer to geographic areas." Instead, a comparison is made between the "Chinese/Confucian tradition on one side, and the Greek/Latin/Christian tradition on the other." By framing the comparison in this way, the ICMI Study is at risk of oversimplifying the situation by appearing to assume that school systems can be aligned with one 'cultural tradition' or the other. This paper draws on an extensive review of international comparative research in mathematics education to problematise cultural explanations of observed differences and similarities.

In his re-analysis of data from the Second International Mathematics Study (SIMS), Bracey (1997) suggested that the differences in mathematics performance found at an international level were replicated in a partitioning of the U. S. sample along cultural or ethnic lines. As a simple illustration of this point: Asian-American students, participating in a school system that has been substantially maligned in the U. S. popular press, perform at a level comparable with their high-performing counterparts in schools in Asian countries. This single illustration suggests that differences on particular measures of mathematical performance are at least as attributable to the cultural affiliation of the students as to the particular school system attended. The significance of such internal cultural variation is lost in the aggregation of performance data for countries as culturally plural as the USA, Australia, or Canada. Such analyses also have implications for societies with a small number of substantial ethnically-distinct communities, such as Malaysia and South Africa.

Berliner reiterated this point in an article in the Washington Post (Sunday, January 28, 2001, p. B3). That is, rather than serving an agenda of international competitive comparison, the results of international achievement testing can be analysed to identify members of a nation who are less well served by the school system than others.

> Which America are we talking about? . . . Average scores mislead completely in a country as heterogeneous as ours . . . The TIMSS-R tells us just what is happening. In science, for the items common to both the TIMSS and the TIMSS-R, the scores of white students in the United States were exceeded by only three other nations. But black American school children were beaten by every single nation, and Hispanic kids were beaten by all but two nations. A similar pattern was true of mathematics scores . . . The true message of the TIMSS-R and other international assessments is that the United States will not improve in international standings until our terrible inequalities are fixed.
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> (Berliner, 2001, B3).

A corollary to this line of reasoning is voiced by Wang (2001) who, in discussing technical concerns with TIMSS, cites Hu (2000, p. 8) as saying, "This study does not break down Americans by race, if they did,

Asian Americans would likely score as high as Asians in their home countries, and Whites would rank near top of the European nations." There are several ways to interpret this observation. Berliner's approach seems the most rational and productive: From several perspectives the comparison of national means of student achievement is problematic. Comparisons between sectors of the community within a given country may be more fruitful, within a given state or school system even more so. Such comparisons may at least highlight community groups who are less equal in the benefits they accrue from a school system intended to benefit all students equally. Educational policy can then be framed to address any inequalities.

But what are the implications from the perspective of cultural traditions. The analyses summarized above suggest that the cultural affiliation of the learner (whatever their geographical location) is at least as important as the cultural alignment of the school or school system and certainly should not be simplistically identified with nationality.

2. Exporting Cultural Traditions: Whose Practice?

The previous section is not intended to challenge the premise that school systems enact cultural values. However, it does challenge the simplistic identification of culture with nationality. Once the confusion of nation with culture has been problematised, then the utility of international comparative research can be considered with greater cultural sensitivity. For example, the identification of international differences and similarities in student mathematical performance has limited utility, except as a form of national report card, unless it is accompanied by data that suggest cultural, societal, or instructional differences that might be used to explain such differences and similarities and then to promote improved mathematical learning and associated performance. But the more complex the structure of the outcomes measured (algebra, proportional reasoning, analogical reasoning, rate), the less clear the associations that can be drawn between those outcomes and the sample characteristics (country, age, years of schooling) by which any variation in outcome might be explained. And the more complex the detailing of the educational environment within which schooling is undertaken (affluence, parental involvement, curricular structure, pedagogical practices) the more difficult the discernment of any patterns of association between such subtle environmental characteristics and the valued outcomes of schooling.

Naively, one might argue that if Asian countries are consistently successful on international measures of mathematics performance, then less-successful non-Asian countries would do well to adapt for their use the instructional practices of Asian classrooms. Such a line of reasoning is grounded in four key assumptions: (i) that the term "Asian" identifies a coherent body of practice; (ii) that the performances valued in international tests constitute an adequate model of mathematics, appropriate to the needs of the less-successful country; (iii) that differences in mathematical performance are attributable to differences in instructional practice (and not to other differences in culture, societal affluence or aspiration, or curriculum); and (iv) that the distinctive instructional practices of more-successful countries (should these exist) can be meaningfully adapted for use by less-successful countries.

Hess and Azuma (1991) assert that formal schooling confronts students with organisational conditions that "are not conducive to learning." They claim that "Teachers deal with these circumstances by encouraging facilitative dispositions in students or by making learning events more appealing" (Hess & Azuma, 1991, p. 2). Most importantly, Hess and Azuma assert that:

> Cultures differ in the emphasis they place on these two strategies. Japanese tend to stress developing adaptive dispositions; Americans try to make the learning context more attractive. National differences in educational achievement may be more completely understood by analysis of cultural differences in student dispositions. The interaction of student characteristics and teacher strategies creates very different classroom climates in the two countries.
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> (Hess & Azuma, 1991, p. 2).

The curriculum is the embodiment of the aspirations of the school system. To a significant extent, the teacher is the agent of the system by whose actions the curriculum is put into effect. Teachers, however, interpret the curriculum in idiosyncratic fashion, within the constraints and affordances of both system and culture. Both the curriculum and the teacher have been the focus of recent international comparative study. Among the studies of curriculum and teaching practice, we can lose sight of the student. Thorsten makes this point beautifully.

> What is absent from nearly all the rhetoric and variables of TIMSS pointing to the future needs of the global economy is indeed this human side: the notion that students themselves are agents. TIMSS makes students from 41 countries into passive objects of 41 bureaucratic gazes, all linked to the seduction of one global economic curriculum.
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> (Thorsten, 2000, p. 71).

As educational research has increasingly drawn our attention to the importance of the social processes whereby competence is constructed and in which competence is constituted (for both teaching and learning). The agency of the student, the nature of learner practice, and the cultural specificity of that agency and that practice must be accommodated within our research designs.

3. Similarity and Difference Through the Lens of Culture

Schmidt, McKnight, Valverde, Houang and Wiley (1997) investigated the mathematics curricula of the "almost 50" countries participating in the Third International Mathematics and Science Study (TIMSS). The documented differences in curricular organisation were extensive. Even within a single country differentiated curricular catered to communities perceived as having different needs. Countries differed in the extent of such differentiation, in the complexity or uniformity of their school systems, and in the distribution of educational decision-making responsibility within those school systems. Given such diversity, the identification of any curricular similarity with regard to mathematics should be seen as significant. And there were significant similarities. There were similarities of topic, if not of curricular location; broad correspondences of grade level and content that became differences if you looked more closely; differences in the range of content addressed at a particular grade level, but which repeated particular developmental sequences where common content was addressed over several grade levels. In another international study of mathematics curricula, the OECD study of thirteen countries' innovative programs in mathematics, science and technology found that, "Virtually everywhere, the curriculum is becoming more practical" (Atkin & Black, 1997, p. 24). Yet, despite this common trend, the same study found significant differences in the reasons that prompted the new curricula (Atkin & Black, 1996). These interwoven similarities and differences are almost the signature of international comparative research.

Schmidt, McKnight, Valverde, Houang, and Wiley (1997) reported that differences in the characterization of mathematical activity were extreme at the Middle School level; from 'representing' situations mathematically, 'generalizing' and 'justifying' to 'recalling mathematical objects and properties' and 'performing routine procedures.' Despite the apparent diversity, it was the latter two expectations that were emphasised in the curricula studied. Given the documented diversity, it is the occurrence of similarity that requires explanation. Some curricular similarities may be the heritage of a colonial past. Others may be the result of more recent cultural imperialism or simply good international marketing.

In attempting to tease out the patterns of institutional structure and policy evident in international comparative research (particularly in the work of LeTendre, Baker, Akiba, Goesling, and Wiseman, 2001), Anderson-Levitt (2002) noted the "significant national differences in teacher gender, degree of specialization in math, amount of planning time, and duties outside class" (p. 19). But these differences co-exist with similarities in school organization, classroom organization, and curriculum content. Anderson-Levitt (2002,

p. 20) juxtaposed the statement by LeTendre et al. that "Japanese, German and U.S. teachers all appear to be working from a very similar 'cultural script'" (2001, p. 9) with the conclusions of Stigler and Hiebert (1999) that U.S. and Japanese teachers use different cultural scripts for running lessons. The apparent conflict is usefully (if partially) resolved by noting with Anderson, Ryan and Shapiro (1989) that both U. S. and Japanese teachers draw on the same small repertoire of "whole-class, lecture-recitation and seatwork lessons conducted by one teacher with a group of children isolated in a classroom" (Anderson-Levitt, 2002, p.21), but they utilise their options within this repertoire differently.

LeTendre, Baker, Akiba, Goesling and Wiseman (2001) claim that "Policy debates in the U. S. are increasingly informed by use of internationally generated, comparative data" (p.3). LeTendre and his colleagues go on to argue that criticisms of international comparative research on the basis of "culture clash" ignore international isomorphisms at the level of institutions (particularly schools). LeTendre et al. report yet another interweaving of similarity and difference.

> We find some differences in how teachers' work is organised, but similarities in teachers' belief patterns. We find that core teaching practices and teacher beliefs show little national variation, but that other aspects of teachers' work (e.g., non-instructional duties) do show variation.
> (LeTendre, Baker, Akiba, Goesling & Wiseman, 2001, p. 3)

These differences and the similarities are interconnected and interdependent and it is likely that policy is best informed by research that examines the nature of their interconnection rather than simply the frequency of their occurrence.

4.   Mirrors Not Blueprints: Adaptive Potential

Concern with educational globalisation is raised legitimately as one motivation for the ICMI Study. The Discussion Document cites the paradoxical U. S. importation of textbooks from Singapore at the same time that some Asian countries are seeking to mimic some of the problem solving approaches modeled in some U. S. textbooks. Globalisation seeks to minimise international differences (whether by consensus or imposition) whereas internationalisation seeks to celebrate both the similarities and the differences and to learn from them. This difference can be illustrated by comparing the goal of aspiring to standardize instructional practice in mathematics classrooms internationally and the goal of aspiring to optimize local practice through critical reflection stimulated by consideration of best practice elsewhere.

Of all the approaches to international comparative research, it is the video studies that we might expect to have the greatest potential to inform classroom practice. Stigler, Gallimore and Hiebert (2000) offer two arguments to support the utility of classroom video studies. Each of these will be discussed separately.

> Perhaps the most obvious reason to study classrooms across cultures is that the effectiveness of schooling, as measured by academic achievement, differs across cultures . . . If cross-national achievement differences are tied to cultural variations in teaching, we may discover ways of teaching that work better than the ones our society routinely employs. This would allow us to take advantage of the experience of others all over the world who share similar goals.
> (Stigler, Gallimore, & Hiebert, 2000, p. 87)

The crucial phrase here is the last one: "who share similar goals." If the essential criterion by which we evaluate the effectiveness of a country's classroom practices is academic achievement, then the value which we attach to the documented practices will depend on the correspondence between the means by which that achievement is measured and the goals and values of the school system to which we might adapt the documented practices. Also central to the passage above is the proposition that "cross-national achievement differences are tied to cultural variations in teaching." This proposition provides the principle assumption on

which international comparative studies of teaching practice are predicated, yet it is fair to say that this proposition has yet to be validated by research. The implicit identification of culture with nation, already problematised, does not strengthen the proposition. Finally, the connection between specific instructional actions by teachers and national measures of academic achievement is a tenuous one at best. With what confidence can specific teacher practices be linked causally to aggregated measures of national performance? The connection between classroom practice and consequent learning could be made far more convincingly if the data on learning outcomes and on classroom practice were collected in the same setting and in relation to the same individuals.

> There is another more subtle reason for studying teaching across cultures. Teaching is a cultural activity. Because cultural activities vary little within a society, they are often transparent and unnoticed . . . Cross-cultural comparison is a powerful way to unveil unnoticed but ubiquitous practices . . . Comparative research invites reexamination of the things "taken for granted" in our teaching, as well as suggesting new approaches that never evolved in our own society.
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> (Stigler, Gallimore, & Hiebert, 2000, pp. 87-88).

This 'more subtle' argument is far less problematic than the first. Watanabe (2001) quotes White (1987) as writing "we should hold Japan up as a mirror, not as a blueprint". This powerful and appealing metaphor can serve as a general characterisation of one of the major uses of international comparative studies of classroom practice. Both the White quote and the passage above place the agency for the interpretation and adaptation of any documented practice with the person looking in the mirror. There is no invocation of absolute best practice – the judgement is a relativist one, and an instructional activity with a high degree of efficacy in Hong Kong may retain little effectiveness when employed in a Swedish classroom, where different cultural values inform and frame the actions of all classroom participants. Most importantly, we are encouraged to study Japanese (or South African or German) classrooms not solely for the purposes of mimicking their practices but for their capacity to support us in our reflection on our own practice. The mutuality of the potential benefit provides further motivation for such research.

How are we to inform national policy through international comparative research? The answer seems to be through large-scale comparative case study research with the capacity to identify and explicate not just the similarities and differences in policy and practice, but the relationship between these similarities and differences. In this way, the rationality and cultural-coherence of a country's educational practice can be documented, juxtaposed and contrasted with the practices of other countries, such that the good practices of one country can be assessed for their adaptive potential for the curriculum of another country. This adaptive potential is best assessed from the perspective of the culture of the importing country. Such assessment will be highly culturally-grounded. The idea of mapping international practice onto a universal linear scale of adaptive potential is ludicrous. But this is not to say that judgments of adaptive potential could not be made in specific relation to the resources and aspirations of a single country by the mathematics educators of that country.

5.   Culture as Interpretive Affiliation

Experience in the Learner's Perspective Study (website: www.edfac.unimelb.edu.au/DSME/research/lps) suggests that one way to interpret the ICMI Study would be in relation to the competing claims of cultural affiliation, as these are experienced by teachers and students in countries such as the Australia, Germany, the Philippines, South Africa and the USA. In these countries, students from both East-Asian and Western cultural backgrounds participate in the same school systems. The problematics of a school system serving the needs of students from these different 'cultural traditions' is an important aspect of the ICMI Study that should not be overlooked. The Learner's Perspective Study seeks to compare the practices and meanings constructed in the classrooms in Australia, Germany, the Philippines, and South Africa, where Eastern and

Western cultural affiliations are simultaneously present in classrooms, and in Japan and Hong Kong, where cultural homogeneity is much more the case.

Our research must do more than document occurrence, whether it is of student achievement, curriculum content, teacher action, lesson structure, or teacher and student belief. Our research must address the interrelationship of these things. From the studies that have been done, we have every reason to believe that it is in these interrelationships that the character and function of culture will most clearly emerge: In the teacher practice that mediates between curriculum content and the student, through the actions and the lesson structure that constitute the enactment of that curriculum in the classroom, together with the beliefs and expectations on which the student's participation is predicated, culminating in the learning of which student achievement is simply the most the most evident socially-constructed and culturally-mediated correlate. Culture is not outside these things. It is in the combination of these and other elements that culture itself is constituted. Nor, as has already been stated, is culture a synonym for nationality. As several studies have shown, the culture of the classroom can be constructed differently within a particular country or school system. There are, however, cultural values and beliefs that frame educational endeavour within each country. International comparative research must do more than document cultural differences, it must accommodate them.

6.   Issues of Authorship

In an international comparative study, any evaluative aspect is reflective of the cultural authorship of the study. If we are to make judgements of merit, whether they be about student achievement or classroom practice, we can only do so from the position of the authoring culture. The efficacy of a practice can only be judged to the extent that it achieves a specified goal. The most obvious goal against which to assess the efficacy of a practice is the goal of the individual or school system engaged in the practice. For the purposes of international comparative research, however, it is legitimate for someone outside the system being studied to evaluate a practice relative to their own goals – provided that this distinction is made explicit. For example, a researcher evaluating a particular curriculum structure would draw different conclusions regarding the efficacy of the structure if the evaluating researcher were assessing its potential utility for a school system in which most students only completed tenth grade compared with one for which twelfth-grade completion were the norm. This is only to say that the report of an international comparative study need not be evaluative, but the readership of such a report may engage in evaluation of the report in relation to their own goals, school system and culture.

Whether an international study implements an evaluative agenda or documents the detail needed for the constructive juxtaposition of policy or practice, the issue of cultural authorship is equally relevant. The design of international comparative studies must implement collaborative processes through which educational, philosophical and cultural positions are given voice in the interpretation of data and the reporting of the research. The OECD study of innovative programs in mathematics, science and technology education went some way towards addressing this issue: "A nine-member writing team prepared the final cross-national report (Atkin & Black, 1996). Almost all the countries published their own case studies in the home language for internal distribution" (Atkin & Black, 1997, p. 23). International collaborative studies can implement protocols requiring that the interpretations of data to be included in published reports must be validated by the member researchers from the country providing the data (as is the case for the Learner's Perspective Study). This form of "member check" parallels established practice among researchers using high inference qualitative data of seeking confirmation of data interpretations from the respondents in primary research studies. Implementation of the same regime at the level of participating research groups in international comparative studies requires the careful negotiation of a range of methodological and ethical issues such as the minimisation of misrepresentation through misinterpretation and the scrupulous monitoring of the possibility of disadvantage to a participating school system through the publication of a

report. Such negotiated cross-cultural authorship offers substantial advantages in interpretive richness and cultural validity that outweigh any hypothetical restrictions on freedom of publication.

The other aspect of cultural authorship relevant here is the issue of representation and voice. In commenting on the proliferation of OECD-initiated international comparative research projects, Cohen characterised the OECD as "a club of 29 of the world's richest countries" (Cohen, 1998, p. 4). Even when less affluent countries participate in international studies, it is frequently as the objects of investigation rather than as partners in the research. Research is conducted from a 'Western' perspective and evaluates the practices it studies by 'Western' criteria.

> This research remains largely bounded by the Western conception of (teacher-centred) pedagogical practice and by implicit social rules pertaining to authority and social participation.
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> (Fuller & Clarke, 1994, pp. 143-144).

Among the volumes of text prompted by recent international comparative studies such as TIMSS, no country it seems has been as prolific in generating papers as the USA. These papers warrant a separate analysis of their own, for in them one finds the narratives of nationhood (see Thorsten, 2000). We find such narratives in the media reporting of other large-scale international comparative studies such as PISA (the Programme for International Student Assessment; website: www.pisa.oecd.org).

7.   The Way Forward: Learning from Similarity and Difference

International comparative research is open to misuse in at least three ways: (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 disenfranchise 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 on which such studies appear predicated. Each item would be cause for significant concern if it were shown that research agency resided exclusively with either a Western or an East-Asian perspective.

The earlier discussion has already posited "adaptive potential" as a key consideration by which researchers and educators from one school system consider the relevance and utility of the policies and practices of another. Hatano and Inagaki (1998) remind us that the adaptation of pedagogical practice requires consideration of both the practicality of technical implementation and the extent to which the beliefs underlying the adapted practice are in harmony with local cultural values.

If, as I am arguing, the adaptability of a policy or a practice is dependent on the degree of consonance between the settings and the beliefs of the originating and adapting cultures, then it is incumbent upon the researcher to provide details of those settings and beliefs. This detail is also essential if the research is to support our interrogation of our own practice. The level of detail required is considerable, since the researcher cannot anticipate which aspects of the documented setting and its associated practices and beliefs will resonate or jar with the reader's situation.

If a key criterion for the consideration of a practice as valuable is the learning it promotes, then our research designs must afford plausible connection between a particular classroom practice and consequent learning outcomes. Thorough reporting of the means by which those learning outcomes are documented will allow the reader of the research to identify the extent to which the learning outcomes reflect the goals and values of the reader's curriculum, school system and culture. The utility of international comparative testing rests with the reader's endorsement of the test instrument as the legitimate operationalisation of valued (and locally relevant) educational goals.

International comparative research must be undertaken on a basis of mutual benefit to all participants. The fundamental reflexivity that is embodied in the metaphor of the mirror rather than the blueprint should underlie the function of all such studies. We must guard against the cultural imperialism of an implicit global curriculum (whether Western or Eastern in character) and, instead, stress the centrality of local interpretation of all findings. Adoption of such a relativist approach avoids the competitive dichotomisation of Eastern and Western cultural traditions. Research that is predicated on an anticipation of mutual benefit should avoid the pitfalls of appropriation, imposition and exploitation discussed above. The detailed collaborative study of international policy and practice in mathematics education, and of the products of that policy and practice, should be undertaken in anticipation of insights into the novel, interesting and adaptable practices employed in other school systems of whatever cultural persuasion, and of insights into the strange, invisible, and unquestioned routines and rituals of our own school system and our own mathematics classrooms.

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