Glimpses of ICME-7

Thoughts of an ICME regular

ZALMAN USISKIN

The work of mathematics educators in other countries has been a great influence on my work. Georges Papy from Belgium; Troelstra, Freudenthal, and van Hiele from the Netherlands; the School Mathematics Project and other British thinking; the performance of the students in Japan and other countries of the Orient have all influenced my work. Yet my work is rooted in the United States; it has been motivated by U.S. problems and shaped by the U.S. situation. And so I look towards ICMEs with the expectation of learning quite a bit from other countries but not necessarily being able to give so much in return.

ICMEs are different from most other meetings in mathematics education, and not just because they are international. The amount of paperwork generated in conjunction with these meetings before one embarks for the meeting, the number of handouts, and the length of the meeting are all considerably greater. Files from the six ICMEs I have attended fill the space normally occupied by 50 normal meetings.

At ICME-7 there was a meeting of the "old guard", those who had been at every ICME. I understand that there are fewer than 20 in this group, and I am not among them, but as a person who has been to all but the first ICME, I am certainly a regular. As such, the novelty of international meetings like these has worn off. Yet because these meetings occur only once each four years, and because they involve so many countries of the world, there always is a special anticipation as to what new things one might learn.

The major change between this ICME and previous ones was the extent to which countries have become closer in how they think about their problems and, as a consequence, what they are doing in mathematics education. Information and views have been shared at all ICMEs, but in the past there was not much international collaboration as a result. Within the past few years, however, there have been many multinational enterprises in mathematics education. Consequently, recent movements such as constructivism, authentic assessment, and discourse in the classroom are no longer the province of one country or one region of the world but have become world-wide in scope. This would seem on the surface to give them more credibility, but it may only be that what used to be regional fetishes are now world-wide fads.

The increasing cooperation is in a large way due to the earlier ICMEs themselves, which spawned a number of meetings in between the Olympic years. For instance, related to the working group in which I was one of the organizers, that dealing with mathematical modelling, are the ICTMA (International Conference on the Teaching of Mathematical Modelling and Applications) meetings. There had been *two* ICTMA meetings since the last ICME, one in 1989 and one in 1991. Other working groups were planned by ICME participants who attend the yearly PME (Psychology of Mathematics Education) meetings, or are involved in TIMSS (the third international study of mathematics and science achievement). The regional meetings of ICMI around the world are attracting greater and greater numbers of mathematics educators. And we at Chicago had hosted the 3rd UCSMP International Conference on Mathematical Education in 1991. Thus, although I had not seen most of the participants since ICME-6, There were still a great number whom I had seen in that time, some more than once, and the same was true for many others. All of this gave this meeting a warmer tone to it than previous ICMEs. We are all closer to our colleagues in other countries than we have ever been.

The closeness reflects the changing political scene, in which the countries of the world are no longer split into three camps, East, West, and non-aligned. Thus the dream of cooperation or collaboration with colleagues *everywhere* is a possibility. One tangible manifestation of this dream is that the number of countries signed up for the Third International Mathematics and Science Study is well over two times the number in the second study ten years ago, and may ultimately be over three times that number.

The second recurring theme was the change in the status of technology from that of a bit player to one of a starring role. The continuing increase in the power of computers represents a situation that captivates us all; who cannot be charmed by the startling beauty of the images that Mandelbrot displayed, or impressed by the new geometry drawing tools such as CABRI and the Geometer's Sketchpad. No longer does one hear that all software is lousy: now the big question is when a particular tool will be available in a calculator version. We await inexpensive spreadsheets, symbolic algebras, and drawing tools in this form.

The technology is so new that it has not had a chance to become the province of a particular nation. And so it contributes to a climate of cooperation. Following the trend in an age when Europe is growing closer, when the traditional barriers between West and East have been greatly eased, when FAX machines have transformed long-distance communication, it is natural that the mathematics taught in different countries would move to be more similar. And since mathematics has itself become a world-wide language, we are compelled to ask: Are we moving towards a world-wide mathematics curriculum? Or is it that we are moving towards a Yugoslavia, a situation in which on the surface it seems that we have much in common, but as soon as the time befits itself, there will be an explosion of differences among us? Certainly the details of our curricula, within or between most countries of any size, are quite different. But it is not easy to identify the outliers.

And we are provincial, not merely by country of origin. The size of the ICMEs has caused many of the working and theme subgroups to be the size of small conferences. As a result, most groups are composed of zealots for that aspect of mathematics education that is being discussed within the group. It is natural that those who like proof would attend the theme group on proof; those who favor applications in the curriculum sign up for the working group on mathematical modelling; those who think assessment is a critical issue

would wind up there. But with the larger size, one is lulled into thinking that almost everyone agrees with the views of that group. Not all issues in mathematics education are of equal importance, and a fundamental question for those in schools and colleges is balancing competing interests and forces. If we spend time on modelling, what happens to time spent on proof? If we have computers to do our algebra for us, do we need to teach less algebra to students and more computer science? Where does the practitioner find the time for all the kinds of assessment that is being recommended? The downside of catering to the interests of attendees is the loss of the big picture.

Still, we cannot help but be impressed by what has happened in our profession in the past couple of decades. Due to technology, there has been a revolution in the ways in which mathematics is done, and though this revolution is not yet reflected in all classrooms, it is reflected in the thinking of virtually all leaders in the field In 1980, I lamented that most of the leading practitioners in the United States were not at the ICME This is no longer the case The increase in the numbers of people attending the ICMEs, including virtually every significant force in the world of mathematics education, is cause for optimism about the future. But let us hope that the new world order does not result in a common worldwide curriculum; our differences provide the best stimuli for curriculum development and improvement.

Encouragements and disturbances

DALE L. BREKKE

The Seventh International Congress on Mathematical Education stimulated a range of emotions. Encouragement came from sessions on research methodology in mathematics education, ethnomathematics, women and mathematics, the psychology of mathematics education and mathematics education of minority students. Disturbing ideas came from a session on the effect of the trend toward technology on the relationship between developing and industrialized countries. Sessions on critical mathematics provided a source for both alarm and optimism. There was an intriguing session on the relationship between reading, writing and mathematics. Finally, an exciting futuristic vision of mathematics education was provided by Seymour Papert.

Encouraging Sessions

In sessions of Working Group 23, on Methodologies of Research in Mathematics Education, mathematics education researchers were grappling with finding the best methods of research in this relatively new field here presenters from various countries discussed methods of research which they had found useful and also described potential problems associated with their methods. One sensed that progress was being made in the development of a methodology perhaps uniquely suited to mathematics education, rather than one which borrows too heavily from research in psychology and on animals.

Frank Lester of Indiana University pointed out weaknesses in research submitted for publication in the *Journal for Research in Mathematics Education*. Many of these weaknesses appeared to be tied to the lack of a well-developed methodology in mathematics education. As he said, "Human behavior is too complex to be studied like fields of corn." He also regretted that we haven't developed an apprenticeship program in mathematics education research as has been developed inmost of the sciences, in which graduate students learn to do research throughout their graduate program.

Paolo Boero of Italy stated that we know that traditional statistical research isn't always best, but we don't know what else to accept. He said that no theory of learning is able to take into account all the relevant phenomena in mathematics education.

David Kirshner of Louisiana State University warned of the move to discourage direct translation of English problems into algebra, giving the following example of a problem which can be directly translated and solved, but which cannot be conceptualized first as students are often encouraged to do when solving problems.

> The sum of the ages of Mike and Ed is 44. Mike is twice as old as Ed was when Mike was half as old as Ed will be when Ed is three times as old as Mike was when Mike was three times as old as Ed. How old are Mike and Ed?

Work in ethnomathematics is enlarging the definition of mathematics and mathematics education to include additional contributions of various cultures and showing how indigenous mathematics is often the most effective in local cultures. Ethnomathematics should have an increasingly positive effect on mathematics in general.

There were many sessions dealing with women and mathematics, with presenters from many countries This indicated to me that this topic is being addressed in various parts of the world, not just in those areas where women are relatively more "liberated."

I was impressed by my introduction to the Psychology of Mathematics Education (PME) organization. The organization has a yearly meeting and members are free to join any working group which deals with a topic of particular interest to them. There appears to be considerable cooperation and exchange among members of each working group, with members from various countries giving a broad perspective to discussion Members cooperatively engage in research in the area of their working group.

Uri Treisman discussed his research on African-American and Chinese-American calculus students at Berkeley, both repeating his best-known finding, that a major difference between the two groups had to do with the formation of small study groups among the Chinese-American students, and also advising mathematics departments that it was through their encouragement and personal involvement with minority students that success would be achieved in increasing the number of minority mathematicians.

A disturbing session

The disturbing ideas came in a session in which we were warned that the trend toward technology and the accompanying shift in curriculum and learning was going to produce a greater division between developing and industrialized countries. Murad Jurdak of Lebanon, in his talk "Mathematical education in the global village: the Wedge and the Filter," described how, in the past, mathematics had provided a

common language for both industrialized and developing countries, but that as industrialized countries make greater use of technology in mathematics education and focus on problem solving by using this technology, countries unable to supply technology to their schools will find themselves unable to speak the mathematics educational language of the industrialized countries and will fall farther behind in mathematics.

An alarming and encouraging topic

I was both disturbed and encouraged by the sessions on critical mathematics education, which deals with the political uses of mathematics. By raising my consciousness, the sessions made me alarmed at the potential misuses of mathematics education and, at the same time, showed me that people are beginning to deal with the problems accompanying the politicization of mathematics education. Some mathematic instructors may be surprised to find that their field is not as "pure" as they had always believed and that educating or not educating people in certain areas of mathematics can have political ramifications. The misuses of statistics, for example, is much more likely in a society uneducated in this branch of mathematics. During World War II we saw how mathematicians helped to break enemy codes and to develop the atomic bomb. Students and instructors of mathematics need to be aware of how what they are learning and teaching is connected to politics.

An intriguing session

Marjorie Siegel presented a paper she wrote with Raffaella Borasi entitled: "Reading, Writing, and Mathematics: Rethinking the "Basics" and their Relationship," in which they recommend an inquiry, rather than the typical transmission model for mathematics teaching curriculum. The inquiry model combines reading, writing and mathematical activities. Reading and writing are used "as generative processes of meaning making, rather than means to decode or communicate some fixed meaning." Students become "makers rather than receivers of mathematical knowledge."

The future of mathematics education?

Seymour Papert discussed the impact of computers on education. He proposed that the development of virtual reality environments may make it unnecessary for children to learn to read at an early age and that learning to add or multiply may one day soon be unnecessary, much in the way that knowing how to find square roots by paper and pencil is now considered unnecessary. He questioned whether we, as mathematics educators, would be ready for the transition to such a world. An audience member pointed out that the seeds for change are present, since problems in ecology and militarism have placed the entire planet in jeopardy.

Summary

ICME-7 provided the opportunity to view the current state of mathematics education in many parts of the world, as well as to think about the future of mathematics education. mathematics instructors whose vision may be limited to their own countries and even to their own institutions were able to see a broader scope, both encouraging and distressing, of what's taking place and what may lie ahead. It's a fascinating time to be working in the field.

A brief note on errors

ANNELI LAX

We arrived at the Université Laval at about 4 pm on Monday, August 17; thus we had missed not only the opening ceremonies, the awarding of honorary degrees to Jean-Pierre Kahane and Henry Pollak, but also the mini-conference on calculators and computers. I heard from participants that the miniconference had been very fruitful.

The next morning I had to decide which of about a dozen working groups of interest to me I should join. I decided to visit WG2 on students' misconceptions and inconsistencies of thought, because the introducers Shlomo Vinner and Dina Tirosh had actually written to me to invite me to join, and I have always been interested in student misconceptions.

I liked the informality with which Shlomo Vinner got us started and how he encouraged active participation. When smaller groups were formed, I was assigned to the one of which Vinner was the facilitator. I recall a discussion of two examples of students' inconsistencies of thought. (In retrospect, these concrete examples were particularly refreshing since most of the subsequent discussions and presentations I heard at the ICME lacked specific illustrations; I missed them.) One of these examples was the incorrect conclusion students often reach from the pythagorean identity, namely that

(1) $a^2 + b^2 = c^2 \Rightarrow a + b = c$ or $(a^2 + b^2)^{1/2} = a + b$

(and more generally $(a + b)^n = a^n + b^n$ even when $n \neq 1$)

The other example offered was another special case of the above, namely for n = 2:

(2) $(a + b)^2 = a^2 + b^2$.

From the subsequent discussion I recall the following points (perhaps distorted by my poor memory and lively imagination and bias):

To show students the error of their ways, give them (a) a counterexample (b) a more geometric, almost sensual experience. Thus for (1) try

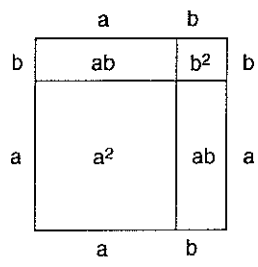
(1a) $3^2 + 4^2 = 9 + 16 = 25 = 5^2$ but $3 + 4 = 7 \neq 5$.

(1b) Let a, b, c be lengths of sides of a triangle and note that the equality a + b = c would lead to a degenerate triangle (having a 180° angle instead of a right angle)

Similarly, for (2) try

(2a) $(3 + 4)^2 = 7^2 = 49$, $3^2 + 4^2 = 25$, $49 \neq 25$

(2b) $(a + b)^2 = a^2 + 2ab + b^2 \neq a^2 + b^2$



Most people found the geometric arguments (b) more convincing than a numerical counterexample. Some wondered if several counterexamples would be more compelling or if students should perhaps be asked to find out under *what conditions* the equations $\sqrt{a^2 + b^2} = a + b$ and $(c + d)^2 = c^2 + d^2$ hold. {This would be in the spirit of I. Niven who has given talks on such inspired uses of common errors.}

Then a number of people commented that the very same students who make errors (1) or (2) do *not* make such errors when these expressions occur in certain contexts. Then the participants made some conjectures concerning the cause of such student errors, coming up with a partial list of the one that can be found in Ed Barbeau's article in the then most recent issue of FLM in which he catches professional mathematicians giving incorrect answers to several well chosen more sophisticated mathematical questions, for example: extending a principle into a domain where it is no longer valid. (I called this article to the participants' attention.)

Two thoughts that occurred to me but which I did not express at the time are:

(i) Would our students make these errors if we placed no time limit on such tasks?

(ii) Instead of conjecturing about the causes of such errors, why don't we ask our students how they were led to their conclusions? If we can't do that in class, let us ask them to write about it. We shall learn a lot about their thinking, and we shall simultaneously make them more reflective.

During the course of this ICME, I often wanted to suggest this direct approach (ii) to replace complicated analyses of data acquired in a less direct way.

Then and now

LEO ROGERS

The first International Congress on Mathematics Education was held in Lyons in 1960. It was quite a homely affair compared with the more recent gatherings. I may be considered a veteran at the game, and I don't wish to indulge in nostalgia, but it seemed to me more difficult to find my way around the programme, and the campus at Université Laval, than ever before. The latter, I suppose, is my own fault, often leaving too little time to get from one place to another, but the programme, while published in an easily accessible form, I found almost too complex.

Why should this be so? The organizers had a mammoth task; 23 working groups, 17 topic groups; over 400 short presentations by posters, software, videotapes, films, exhibitions, and so on. The ICME-1 meeting in Lyons seems quite small now in comparison, probably not much more than 1,000 or so.

Registering over 3,500 participants at ICME-7 must have been a potential nightmare for the organisers, and I would be surprised if there had been no problems, but on the whole, I got the impression that it all went fairly smoothly. However, finding someone you don't know and cannot recognize from another colleague's description, or listening to a presentation given in a language which neither the speaker nor the listener speaks well, are some of the real practical difficulties of such meetings.

It is clear that a function of increasing size is the complexity of the organisation and the inevitable overlapping of interests, with the consequent problems of choice. But it is not just the case that there are now more people attending; the culture which demands that a paper has to be presented in order to obtain funding, or to gain an institutional position, no doubt contributes to the number of people seeking to get their names "in the official book".

The dilemma of encouraging newcomers to the business of mathematics education while trying to regulate the quality of the ideas offered seems intractable.

In 1969 ATM provided a workshop—with children—as has been the tradition over the years, believing of course, that there is a sense in which a conference on mathematics education without the main object of our attention, the pupils we teach, would be meaningless. We were not disappointed this time, and in spite of the difficulties of the site and the complexity of the programme, a lively atmosphere prevailed in what have become the traditional surroundings of objects, activities, innovative ideas, chance encounters, purposeful discussion and quiet meditation.

Papert's use of English schoolchildren at Exeter in 1972 was a clear demonstration of the epistemological significance and pedagogical power of the combination of the new computer medium, and appropriate man/machine interfacing. I may have been unlucky in my choices, but what I felt was lacking in the special day miniconference on calculators and computers was just that chance to see demonstrated by, and perhaps to talk with, students who had actually experienced some of the software and methodologies being presented. I wonder if next time it would be possible to make more positive provision for students to participate in some of the presentations. Somehow, being in North America, I expected to find more innovative use of the medium, but was disappointed to discover little that I felt was really new. This is not to denigrate the considerable amount of research that has been generated in this area, but much of it seems to be inward-looking and institutionalised, intended for teaching the content of the standard curriculum, and it seems that the potential for taking the next step and really putting mathematics in the hands of the user has been addressed by only a few. Those few, however, do have a vision of the future and have grasped the meaning of what it will be to become truly computer literate.

But where are the rest? What relevance does all this high-tech have for our colleagues and their pupils in large parts of the world (let alone the less privileged areas of our European-dominated culture), where resources are scarce or non-existent and the number of pupils in a class makes most of these ideas impossible to implement?

Two things occurred to me in this respect. The first was the idea that all our theories about learning are founded on a model of the European Rational Man, and that this starting point might well be inappropriate when applied to other cultures; and the second was that it is likely that in the not too distant future, the technological advances will be so great and so cheap that the so-called "Third World" will have easy access to the Eurocentric cultures.

Throughout history, we have seen that in the major organised civilizations in many different parts of the world, mathematics has grown in response to people's needs and has become a vital part of the social structure. Those who held the secrets were very powerful. Will it be possible, in the future, for the less privileged to leap the gap, as it were, and take advantage of the new advanced technology? The secrets will then be secrets no more.

The assumption that mathematics is a universal language, and is therefore universally the same in all cultures cannot be justified. Likewise, the assumption that our solutions to local problems in pupils' learning and in our own teaching of school mathematics will have universal applications is even further from the truth. What is so valuable about a meeting like ICME is that it provides the opportunity for a large number of people from the host country and its immediate neighbours to experience at first hand the real problems of others, and to realise that the universality of solutions is a myth.

This difference shows up clearly in the Working Groups and the Topic Groups where the organisation allows discourse, and dissent. I think attending a conference like this makes one even more aware how insular and parochial some of us can become. We concentrate on our own problems (of course we need to), create our own solutions, and then have the naiveté to assume those solutions will apply to the problems and situations of others.

Who goes to ICME? There is an inevitable division of those who are involved in mathematics education into three broad categories; schoolteachers, mathematics educators, and university lecturers, with a strong probability that the majority of those attending the congress are in the second category. Some professional associations of mathematics educators attempt to cater for the whole range of professionals, but it seems that the culture of mathematics, and the political and social structures which support it lead to a division whereby few teachers (particularly primary school teachers) and university lecturers are either able to attend, or see such a meeting as a priority.

My own immediate interests were well served; History and Pedagogy, Social Aspects, Theories of Learning, the Philosophy of Mathematics Education and the Cabri computer geometry. Of the rest, I can say little, except that I really enjoyed the variety of interesting poster presentations and I thought that the Program Committee's idea of organizing the Round Tables to generate some discussion of the topics was a brave and imaginative way to provoke interaction among the newer participants. I would be interested to hear whether the feedback was positive; I certainly had an interesting time.

Socially, I shall remember the best tactic at the tent was to get two beers at once, one in each hand, because the rest of the time I was either looking for people or talking; and the best part of the final cultural evening for me was the aerial ballet. My son came for the whales, and was not disappointed, but we had a hard time looking for places which served vegetarian food!

In four years time I wonder if Seville will be near enough and cheap enough to attract colleagues from the African continent, and I wonder if, in the not too distant future, ICME will be held in a less privileged country than has been the custom thus far?

Walled cities

BETTY JOHNSTON

I am not good at conferences. I feel overwhelmed with choice, small and insignificant with nothing to say, outraged by know-it-alls, bored, irritated by my own restlessness, and suddenly out of all that, sometimes intrigued.

> *All day in planes (progressively smaller—do they fly on from here in helicopters?), arriving in a jumble of bags, time zones, time tables, to a warm easy welcome, a still bed.*

This was my first ICME. A few weeks before I had heard a mathematics educator describe maths as"the pinnacle of man's achievement". Even ignoring gender and professional bias this is a complacent view. Why do we maths educators always have to win? Why is maths described as the gateway to success? ... the single most useful subject in the curriculum? ...the best means of training the mind? I came to the conference resisting these claims. I wanted to argue that maths is the gateway, for most, to failure: the single most meaningless subject in the curriculum: and a great way of training the mind to separate thought and practical consequence. I have taught maths in primary and secondary schools, at university, in teacher education courses and in adult basic education programs, and I wanted to ask: why do we teach maths at all? who misses out? and does it matter?

> *Name tags round our necks like lost children at an impersonal airport, we swarm sleepily to breakfast in concrete buildings, hundreds of us, chasing bacon and familiar faces. But why is the coffee so dreadful? I had dreamt of frothing coffee in bowls, echoes of France.*

Thousands in a huge hall and six—or is it seven—people on the stage to welcome us. Three or four men speak. The single woman is silent. The theme of inequality of access is broached by both the main speakers; they suggest that ICME should find ways of supporting the increased participation of colleagues from poorer countries, an issue taken up by several groups that I later attend.

One out of twenty-three working groups, one out of twelve topic groups, one out of three study groups—which ones? Where am I most likely to find people wondering about the usefulness of maths, questioning its function as gatekeeper? I choose to go to *Mathematics education with reduces resources, Ethnomathematics, IOWME (Women and Mathematics Education)* and a selection of lectures.

In the working group there are about twenty of us, from Uruguay, Bolivia, the Dominican Republic, Mexico, Malawi, South Africa, Nigeria, Spain, Canada, Australia, the USA and the UK. I am silent. In the face of class sizes of 100, no materials, no chalk, little training, my reduced resources are wealth. No claims here about the pinnacle of human achievement. A modest belief in the usefulness of

basic maths, and as one group member says, "It's assumed that the "have-nots" have nothing, but in fact the only thing we don't have is resources. We have plenty of good ideas and practices, developed in difficult circumstances." People learning and teaching maths are clearly involved in economic and political issues: health; the destabilisation of the government in Mozambique; work, technology and culture as resources for school maths; deficit or self-determination models of training; development of what somebody calls the Two-Thirds World. Maths is firmly grounded.

Old Quebec—another world—the walled city on the Rock, where the wide St. Lawrence River narrows and turns. Winding streets follow the contours of the hill, the doors of stone houses open straight from the footpath. Louis the 15th and two centuries of battles linger in the squares and alleyways. Cafes spill out into courtyards, windows and doors are flung open in the warm evening. We from gentler climates glimpse in the flowers and open windows the bare, dark months of winter and feel a sense of loss. But here at last is strong foaming coffee served in generous bowls.

Ethnomathematics is "catching on", it seems. But is it anymore than the new problem-solving, the latest fashion, asks someone in the topic group: "ethnomathematics: making Kashmiri baskets" and "problem-solving strategies: working backwards", ticked off in the class program for the week? Yes, it can be more than this. People from Brazil, the USA, Mozambique, New Zealand, Thailand, the UK, Canada talk about "thawing" maths from culture, reclaiming the word mathematics for what we now have to call ethnomathematics (and letting traditional maths be more accurately labelled "archaic"), working with a Landless People Movement, taking popular knowledge as the starting point but transcending it. Fundamental questions about the nature of mathematics arise in contexts like these. We begin to ask: where did it come from, this maths? is it really a timeless truth, the closest thing to God? We can try to trace, as one later lecturer does, what it is in different cultures that might account for the kinds of maths in those cultures. We allow ourselves to see that, like any other subject, maths, "born to this world, practised by members of this world with minds reflecting this world, must capture certain aspects of it." [1]

And do we realise that the fight for ethnomathematics is a political struggle? someone asks. The central issue is power ...And while everyone rattles on an occasional voice calls out for us to slow down, to translate. Certainly a central issue is power... whose language, whose maths?

Other lecturers address the issue of power, implicating mathematics in the destructiveness of Western culture and in the growing differences between the Western and non-Western worlds. Must "maths for all" mean one kind of maths for the rich and another for the poor: "mathematical literacy for the information age" versus "basic numeracy"?

Along by the St. Lawrence River, to the Saguenay (900 feet deep here), to Tadoussac (the names are the names in childhood books), to the whales. White beluga whales, finbacks, seals, every three or four minutes for hours performing for us out here on the river. Or is it we who are performing for them? are they saying, look at the pods of people out here today? do you think those strange noises they make are real communication? The air is fresh and cold and not all of the people on the boat are mathematicians.

Someone is talking about maths as a regulating language—ah, this makes sense to me. It is a woman trying to unravel the complicated relationship between mathematics and gender. But she has only ten minutes to speak. I must see if she has a longer paper...She is not just reporting studies of attitudes and beliefs, she is not just giving, uncritically, results of statistical surveys about differential gender achievement, or descriptions of social roles, as some presenters do. She seems to be questioning who benefits, and how, from the present organisation of the discourse of maths. I must write to her. Another woman speaks passionately about race and gender. People are moved; one woman I talk to afterwards has really seen for the first time that such issues are crucial in teacher education, her field. These small IOWME groups almost allow open discussion, something different from the speaker/questions-to-the-speaker format of most sessions.

It is during the mini-conference of the Criticalmathematics Education Group, however, that I am for the first time in a group whose members, in spite of pressure of time and tentative definitions, are participating as equals, sharing, criticizing, suggesting. It is a relief to be neither disciple nor expert. Lively dissatisfactions, crying out for change, for accountability—not through exams to hierarchies of control, but to students—for a maths that is liberating, critical, really useful knowledge.

But it can be argued [2] that it is no accident that it is maths that is the gatekeeper to success—for the few—mostly white, male and middle class. Art or biology would not work as well. Old Quebec: the only walled city in North America, United Nations Heritage city, its old streets to be kept intact, protected, a living museum. All very well for a city, but do we want the same for mathematics education: that it should be walled against the changing world, its gates open only to a few? Is it possible to reclaim mathematics, to dismantle the "pinnacle of man's achievement", and ground it in the reality that the rest of us know? Or is it essentially, irredeemably, the plaything of potentates?

And again, dinner in La Grande Allée, tables outside under red umbrellas, musicians playing, queues waiting. Inside, quietness and space, delicate garlic rolls, wine, salad, cold tomato soup with basil, snails and aubergine. And friends. Friends—one old, one new. If nothing else, worth it for this. And the questions.

References

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[2] Walkerdine, V. [1988] *The mastery of reason*, London, Routledge