Numeracy and Beyond

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1 Summary

This was the conclusion of a two part workshop called Numeracy and Beyond begun at PIMS, Vancouver, July 8–11, 2003, and intended not as a gathering of experts offering advice, but one of people with insight and experience in mathematics and its promulgation, soberly examining the question of what level of numeracy might be required of average citizens in the future, and how it would relate to the needs of engineers or scientists.

The first priority was to identify key principles, which are simple, widely acceptable, and fundamental, which could guide teaching and learning, and be largely independent of particular contexts. After detailed presentations and discussions, touching on the various subjects involved, such as the decimal system, fractions, statistics, measurement, graphics, geometry, etc., the following four points had emerged.

1. Cultivation of numeracy, though built on K–12 education, should continue through the college curriculum in close cooperation with other disciplines.
2. Elementary mathematics, being the foundation of numeracy and impinging on many other fields, should be taught with great care and learnt thoroughly.
3. Curricula should be sufficiently lean to allow deeper treatment of core topics; their goals should be stated in concise documents with minimal adumbration.
4. Teachers should train to be "at home" in basic mathematics, if necessary at the expense of exploring educational theory not closely related to teaching.

Their implementation was not seen as unproblematic. Given that numbers are indifferent if not repulsive to many (especially Western) cultures, the cooperation mentioned in Item (1) would require considerable effort. Furthermore, Item (3) would go against the almost universal tendency of administrations to issue jargon-laden directives. Straightforward goals such as numerical competence are seldom addressed in today's curricula, which strive instead for "higher" and more nebulous ones. The race toward calculus inhibits the practice of calculation. Overlaps between intended, implemented, and assessed curricula are progressively shrinking (as can be observed even at universities), perhaps mirroring those between the communities of mathematicians, teachers, and policy makers.

The retreat into educational theory, alluded to in Item (4), is as attractive to prospective teachers haunted by "math anxiety" as it harmful to their future performance. However, it is quite legitimately encouraged by Faculties of Education, who naturally see it in a positive light. The resolution of this conflict was seen as a key issue by most participants. Two avenues were described by people with experience in them, and they both involve the cooperation of mathematicians with a sense of what is relevant in schools: ongoing professional development of teachers and joint seminars with teacher trainers. It was also remarked that elementary mathematics could perhaps be presented in such a way that its common sense roots are clearly visible, so that teachers will learn to master it even without external training.

The greatest variety of interpretations was attached to the apparently innocuous word "thoroughly" in Item (2). There is a growing recognition (cf." American Educator" Spring 2004) that for knowledge to become long-lasting, sustained practice "beyond the point of mastery" is necessary. Accordingly, many participants felt that teaching should aim at grade-appropriate mastery, including conceptual grasp as well as numerical fluency. While no one disagreed with the proposition that almost all young children have great learning potential, there was some reluctance to have curricular goals defined by international comparisons, such as the performance of Singapore children at Grade 8 (say, in TIMSS 1985). Underdeveloped (e.g., North American) school systems would need time to catch up.

Older students would present even greater challenges, for starters their lack of interest. Here the most common recommendations involved "real life" or "hands on" scenarios. Not all of them were geared toward demonstrating improved numerical know-how, but one presentation showed what was possible, in terms of producing actual, albeit modest, results by applying elementary arithmetic on spread-sheets to simple (simulated) "real life" tasks in "hopeless" Grade 12 classes. This was a useful reality check for the initial visions of wide-spread numeracy.

Like sports, mathematics could serve to equalize chances rather than accentuating differences. In particular, it can open the door to traditionally underrepresented groups into high-level technical professions. If it can ever be made school proof, it will probably be—as in sports—through a return to its rigorous but inherently attractive sources. These are mental—affected, but not altered, by technology.