Ontario Math Ed Forum
20 October 2007

reports
OAME, OMCA, OCMA

update
Working Groups for the Canadian Mathematics Ed Forum

reminder
Send update of your list of publications for the Ontario math ed researchers file to Margaret Sinclair <msinclair@edu.yorku.ca>

Math Curriculum and Textbooks

morning
Anthony Azzopardi, Ministry of Education, Toronto

afternoon
James Stewart, Professor Emeritus, McMaster University

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Math teaching and learning - key elements

* implementation and stability of high school curriculum (also important for tertiary institutions)
* knowing students (motivation, expectations, etc.)
* adequate resources (textbooks; other written materials, technology, internet, etc.)
* teachers (students' high school math experience very strongly correlated to their perception of quality of their math teachers)

*** absence of vision/bigger picture

US

'Leadership in science and technology at risk'

[Notices of American Math Society, June/July 2005]

'Poor state of mathematics and science education … puts our nation in jeopardy'

[Director, National Science Foundation]

National Academy of Science recommendations

1) Increase America's talent pool by vastly improving K-12 mathematics and science education

2) Develop, recruit, and retain top students, scientists, and engineers from both the US and abroad

...

When European Union heads of state and government met at a summit in Lisbon in 2000, they set the goal of making Europe "the most competitive and dynamic knowledge-based economy in the world." Today, it is worth remembering that the development of a modern "knowledge economy" reflects a larger transition from an economy based on land, labour and capital to one in which the main components of production are information and knowledge. Because of that, the most effective modern economies will be those that produce the most information and knowledge – and make that information and knowledge easily accessible to the greatest number of individuals and enterprises.

[Lisbon Council, OECD report 2006]

"China and India are starting to deliver high skills at low cost at an ever increasing pace"

"There is no way for Europe to stop these rapidly developing countries from producing wave after wave of highly skilled graduates …"

France and Germany (= 35% of EU's economy) are no longer among the world leaders in developing knowledge and skills

If Europe wants to retain its competitive edge … the education system must be made more flexible, more effective and more easily accessible to a wider range of people.

Recommendations include:

1) Create a system of sustainable and high-quality educational institutions with the freedom to respond to demand

2) Develop higher education systems to improve access, quality and equality

…

Some issues

* emphasis on process (construction of knowledge - discovery, group work, technology, communication)
* place and role of 'traditional' teaching

* time needed to learn/study

* most common math problems this year:
  confusing dependent and independent variables, reading information from graphs (e.g. when solving equations)
  x^2 can be smaller than x (ie, multiplication might not increase the value)
  difficulties in working with ln, exp, trig

Communication and understanding

* students are willing to talk, but quality is not there yet
* use of colloquial vs precise/formal language ('square of a chocolate', 'area of a circle')
* use of correct logical reasoning structures ('for every,' 'for some,' implication, etc.)

'If you don't eat your vegetables, you won't get any ice-cream'

* understanding (area, real numbers, irrational numbers)
* what we prove/justify and what we take for granted

'conflicting influences'
'competing forces'

$$\lim_{x \to 0^+} (1+x)^{(1/x)} \qquad \lim_{x \to 0^+} (1+x) \cdot \frac{1}{x}$$

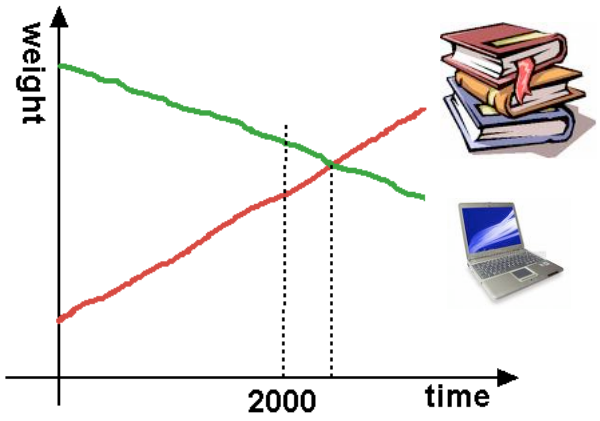
$\frac{0}{0}$ 'meaningless expression, which we cannot evaluate'
'ambiguous expression'

'infinity is a difficult concept that we cannot fully comprehend'

Multiple lives of a textbook

"… textbook represents a message from the larger mathematical community about what student should learn in their school mathematics experience."

Herbel-Eisenmann, B. A. (2007) From Intended Curriculum to Written Curriculum: Examining the "Voice" of a Mathematics Textbook, *Journal for Research in Mathematics Education*, **38**(4), 344-369.



"Textbooks form the backbone as well as the Achilles' heel of the school experience in mathematics. The dominance of the textbook is illustrated by the finding that more than 90% of 12th-grade teachers indicated that the textbook was their most commonly used resource."

McKnight, C. Crosswhite, F. J. and Dossey, J. A., Kifer, E., Swafford, J. O., Travers, K. J., and Cooney, T. J. (1987) *The Underachieving Curriculum*: *Assessing U. S. school mathematics from an international perspective*, Champaign, IL: Stipes.

Textbook-related research …

* relationship between textbook and curriculum (mostly K-12)

* relationship between textbook and learner

Herbel-Eisenmann, B. A. and Wagner, D. (2007) A framework for uncovering the way a textbook may position the mathematics learner*, For the Learning of Mathematics* **27**(2), 8-14.

* global comparisons

Li, Y. (2000) 'A comparison of problems that follow selected content presentations in American and Chinese mathematics textbooks', *Journal for Research in Mathematics Education* **31**, 234-241.

* some content analysis and exploration of the ways in which textbooks are used in classrooms and beyond

McCrory, R. (2006) 'Mathematicians and Mathematics Textbooks for Prospective Elementary Teachers', *Notices of the AMS*, **53**(1), 20-29.

* using functional-structural approach, Richard and Sierpinska (2004) analyze presentation of the same material in two different textbooks on geometry used in French secondary schools in Quebec

Richard, P. and Sierpinska, A. (2004) 'Etude fonctionnelle-structurelle de deux extraits des manuels anciens de géométrie', in: Lemoyne G. (ed.), *Revue des Sciences de l'Éducation* **30** (2), 379-410.

"… unscientific market research is chiefly used to determine *content and approach*. … Commercially published, traditional textbooks dominate mathematics curriculum materials […] and to a great extent determine teaching practices."

Clements, D. H. (2007) 'Curriculum Research: Toward a Framework for Research-based Curricula', *Journal for Research in Mathematics Education* **38**(1), 35-70.