

Some discussion of key recommendations from the *Maths? Why not?* project



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Not all the 16 Recommendations for the report of the *Maths? Why not?* project are equally relevant to the AAMT and our members. This paper discusses the recommendations that will be emphasised in the near future in the AAMT's future work and representations to governments and others (the numbering is the same as for the original set of recommendations).

Mathematics teaching and learning

This is the AAMT's core area of concern and two of the recommendations are directly relevant to our work.

Maths? Why not? Recommendation 1

That educational authorities actively support the teaching of mathematics in the primary and junior secondary years to ensure that it is directed towards maximising the pool of students for whom higher-level mathematics in the senior years at school is a viable and attractive pathway. School systems need to foster a culture of sustainable professional development within schools that enables mathematics teachers to act on the student-related influences identified as the main findings of this report by:

- implementing pedagogical strategies that engage students;
- focusing on conceptual understandings at all levels and at key stages in learning, and
- having access to intervention programs that address students' particular learning needs.

and

Maths? Why not? Recommendation 3

That the Commonwealth and/or other research funding bodies initiate further research into the range of mathematics-specific issues that emerged in the *Maths? Why Not?* Project as possible influences on students' engagement and decision making, namely:

- The conceptual obstacles experienced by students in the middle years of schooling, with a view to developing strategies to overcome them;
- The role of formative and summative assessment in early secondary mathematics and the effects of each on students' self-efficacy;
- The links between student-teacher relationships and performance in mathematics;
- Problematic components of curriculum and teaching that were identified (e.g., lack of rigour, shallow treatment of important ideas, irrelevance of content, lack of opportunities for creativity, subject workload); and
- The extent to which teachers develop for students a 'world view' of mathematics and mathematicians.

Possible actions

Rec 1 — seek responses from the state and territory education authorities about what they are currently doing, and when how they are measuring success for their initiatives.

Rec 2 — discuss research foci in these areas with possible potential research partners and funding agencies.

Discussion

This should be the AAMT's highest priority area. Our positions on *Standards, Mathematics for the 21st century* and *The Practice of Assessing School Mathematics* provide important frames for work in this area.

The emphasis needs to be on students reaching their potential through improvements in curriculum, pedagogy and assessment that enable, encourage and engage students to study higher level mathematics. Professional support for the teachers of mathematics we currently have in our schools (whether they are prepared as teachers of mathematics or teaching 'out of area') through professional development and high quality teaching resources is the key to achieving the sorts of improvements required. Providing this support should be complemented by work to develop a forward-looking national curriculum in mathematics.

Teachers/teaching of mathematics overall need to respond to the findings and find ways to make their students' experiences more engaging and encouraging. Specific effort needs to be given to changes and improvements in:

- the purposes and nature of mathematics in schools — this links to the AAMT's current efforts to develop its position paper on *Mathematics for the 21st century*.
- curriculum — addressing the overcrowding, getting better focus and clearer attention to the 'big ticket' mathematical concepts.
- pedagogy — better engagement for individuals; teaching for connections and understanding in a context in which everyone (teachers, students, parents...) expects there to be understanding mathematics of the mathematics.
- assessment — encourage and support learning, not to judge, sort and assign 'value' to students (see also AAMT Position Paper *The Practice of Assessing Mathematics Learning*).

In the interim it is also important to explore 'second chance' approaches for students in years 9/10 who have opted out of mathematics previously but who now see the sense in taking their mathematics further (because of career requirements). This is needed because the above transitions are quite long term; in the meantime we do have kids coming through who aren't in a position to reach their educational potential through inadequate background in mathematics.

Currently there is an emphasis on developing a national curriculum in mathematics (and other subjects). This is an important component of the solution as indicated above; but it is by no means the only, nor, indeed, the major priority. The key to addressing the issues identified in the *Maths? Why not?* report is to work towards ensuring that the teaching of mathematics is of consistently high quality across the country. In order to achieve internationally recognised standards of excellence in teaching practice and student outcomes, and therefore increase the numbers of students taking higher level mathematics that leads to further study and careers in science, technology, engineering and mathematics (STEM), Australia must make a concerted and sustained effort and commitment of resources to:

- attract and retain well-prepared teachers;
- provide for the ongoing professional learning for all teachers of mathematics in the face of profound changes in the discipline and substantial development in our knowledge of how mathematics is learnt;

- actively and significantly reduce the differential performance of students that is based on factors other than their interest and potential in mathematics (eg city / country, Indigenous / non-Indigenous, high / low socio-economic status);
- develop and provide access to high quality teaching and learning resources and technologies; and
- ensure there is adequate time in the school week for students to learn the mathematics necessary for them as involved and productive people in the 21st century.

Career awareness programs

Maths? Why not? Recommendation 5

That professional associations involving teachers of mathematics and career professionals work together to develop, trial and implement career awareness programs in the junior secondary and upper primary years of schooling. These learning units should provide information about the potential and value of mathematics-rich careers, and also highlight links between careers and students' evolving understanding of mathematical concepts.

Possible action:

Commence discussions with career counsellors' associations with a view to determining the parameters of a project / approach and presenting this to government.

Discussion

The AAMT has not been terribly active in this area. Working in partnership with school-based career professionals, industry, universities and others in a clearly focused initiative that is actually designed to communicate with today's students would be a 'new' approach. Students would benefit from concerted, collaborative programs that lead to an appreciation of the pervasiveness of mathematics; and an awareness of the options that flow from studying higher-level mathematics. Mathematics teachers and careers professionals, and potential partners including mathematicians, employers, universities, industry, the community need to be convinced this is important and take it on as a long-term focus. Above all, these programs need to be informative, accurate and oriented to the students' worlds.

The secondary-tertiary transition

Maths? Why not? Recommendation 9

That tertiary institutions develop realistic minimum and desirable levels of mathematical background required for the study of tertiary mathematics subjects at university. These levels should be clearly and unambiguously identified in all promotional material as "pre-requisite knowledge," "assumed knowledge" or similar.

Possible action

Write to the Vice Chancellors to seek their views and policies on this matter.

Discussion

The most important aspect of this recommendation for the AAMT is that tertiary institutions need to be clear and realistic about what prior learning in mathematics is needed for success in mathematics-rich subjects at university.

Further research to obtain a more comprehensive picture of influences on students' decisions to take higher-level mathematics courses

***Maths? Why not?* Recommendation 11**

That the Commonwealth and/or other research funding bodies support an evaluation of the Maths? Why Not? methodology for application to a fully representative sample of Australian students and parents/caregivers to identify students' beliefs and perspectives concerning the influences on their subject, course and career choices. The study should contribute to a holistic understanding of 'Generation Y' in relation to these matters, as well as clarify issues for particular subjects (e.g., the uptake into science and mathematics) and particular pedagogical approaches. There should be a broad scope of students studied (e.g., Years 5 – 12 and into the tertiary years) to gain a comprehensive picture of:

- The meaning students attach to terms, such as, 'usefulness,' 'relevance,' 'less demanding subjects' and 'difficulty' when used in the context of choosing mathematics subjects in the senior years;
- The characteristics of earlier learning experiences which contribute to positive achievement and high levels of interest in mathematics, and which have the potential to influence decision-making (e.g., curriculum, pedagogy, teaching, encouragement, feedback, performance); and
- The factors which contribute to developing positive beliefs about mathematics and its application to students' lives and aspirations.

Possible action

Discuss these areas with possible potential research partners and funding agencies.

Discussion

Maths? Why not? was a fairly limited project in its scope and it is appropriate to argue that there be more thorough research in the area. This should be informed by, and build on the work of *Maths? Why not?* This sort of detailed research is not the AAMT's core activity, but given our work to date it would be important to be involved.

Some other matters from the *Maths? Why not?* report: links to other issues in mathematics education

Secondary teachers of mathematics without suitable preparation

These are the so-called 'out of field' teachers (eg a geography teacher with a single assignment in mathematics; typically a junior secondary class). The AAMT has clear guidelines on the minimum preparation for being a teacher of mathematics. This was developed as part of the AAMT's work on professional teaching standards. We have faced a shortage in the supply of adequately prepared teachers of mathematics for some time — more than 10 years; the AAMT first made representations to governments on this matter in 1996.

Recognition of the issue is only part of the picture, however. Some encouragement for tertiary students to study to be a mathematics teacher is provided by the government's halving of the HECS-HELP repayment. We also need high quality professional development opportunities and expectations on all those who are teaching mathematics (whether properly qualified or not). The reality is that we will have poorly qualified people in front of mathematics classes for a number of years to come. We must put in place adequate support for these people to enable them to do the best they can through substantial and effective retraining programs, mentoring and other support structures.

National Curriculum in mathematics

The AAMT is keen to see this get underway. The *Maths? Why not?* report is yet another powerful argument that a rehash of what is currently done is simply not good enough; we

are encouraged by Prof McGaw's public statements about 'curriculum for the 21st century'. It is a real opportunity to deal with the overcrowded mathematics curriculum and to bring a greater focus on connections that lead to deep conceptual understanding. The AAMT takes the view, that curriculum is a part of the solution only — there needs to be a sustained commitment of resources to supporting the quality of the teaching of mathematics in schools through adequate professional development, teaching resources etc. It is only through improving the quality of teaching of mathematics across the board that these issues can be addressed.

Transitions

Part of what we need to address is the smoothness of transitions — primary-secondary and secondary-tertiary. These transitions need to be transparent, realistic and encouraging of further study of mathematics.