



AAMT Submission to the Senate Inquiry into Australia's Innovation System (July 2014)

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Introduction

The Australian Association of Mathematics Teachers (AAMT) takes the strong view that innovation in key productive areas of the Australian economy requires further building the strength of education in science, technology, engineering and mathematics (STEM). Due to the pervasive use of mathematics across the STEM disciplines the subject plays a gatekeeper role in education. Mathematical skills are needed by all successful STEM professionals, and their use of mathematics is increasing (AiGroup, 2013).

As a result, AAMT argues that special and particular attention to education in mathematics is essential to creating the overall educational conditions that will support innovation as a key contributor to Australia's prosperity now and into the future. This submission begins with a discussion of the broad level issues. This is followed by specific reference to the aspect of the Terms of Reference that is directly relevant to school education in mathematics. Suggestions for action are included in this section.

Overview

This current inquiry seeks to identify a response to "(t)he challenges to Australian industries and jobs posed by increasing global competition in innovation, science, engineering, research and education." In the context of driving and supporting innovation to meet these challenges, the strength of STEM education needs to improve in two dimensions.

First is the well-known issue of insufficient numbers of young people taking STEM trajectories in education, training and careers. The key trend noted is the decline in the percentage of students taking the so called 'intermediate' and 'advanced' level mathematics subjects in senior secondary school (AMSI, 2014, p.9). Whilst attention to senior school mathematics where these numbers arise is necessary, it is also necessary to address the 'pipeline' issues in the earlier years of schooling. *Maths? Why not?* report (AAMT, 2007) noted that students' experiences with mathematics in early secondary and primary schooling influenced their decision to opt out of higher level mathematics subjects in their senior secondary years.

The second area for strengthening STEM education is its quality. Local, national and international measures of student achievement give part of the quality picture. In the context of building Australia's capacity to innovate, young peoples' STEM education – at schools and universities – needs to support development of their innovative orientation and capabilities. Mathematics teaching and learning in our schools needs urgent review and substantial revision in order to contribute to this dimension of the quality of STEM education that supports innovation.

AAMT's vision for school mathematics is that it should:

- be engaging and challenging for students;
- connect to them and their current and future needs and aspirations;
- reflect much more strongly the ways in mathematics is practised in contemporary interdisciplinary settings; and
- reflect and respect the subject's historical and cultural connections.

It is clear that school mathematics with these characteristics would do much as a component of STEM education that supports innovation. *Maths? Why not?* and other sources indicate that many students reject pathways that include higher level mathematics because they find the subject 'boring', 'irrelevant' and 'hard'. Re-engineering school mathematics along the lines indicated would therefore help to reverse the declining percentage of students taking higher level mathematics as well.

Comments to the Terms of Reference

(b) **The Australian Government's approach to innovation, especially with respect to the funding of education** and research, the allocation of investment in industries, and the maintenance of capabilities across the economy;

The current Australian Government's policy framework in school education can provide a way forward for innovation in and through school mathematics. The *Student's First* approach (Australian Government, 2014) has four foci:

- Teacher quality
- School autonomy
- Engaging parents in education
- Strengthening the curriculum

Whilst the emphases on *School autonomy* and *Engaging parents in education* can play a role in supporting the re-engineering of school mathematics, the core effort needs to be with *Teacher quality*, where the policy goal is to "lift the quality, professionalisation and status of the teaching profession" and *Strengthening the curriculum*, where the policy goal is for "(a)ll Australian students deserve access to a world-class curriculum...the best possible curriculum", including to "restore the focus on science and mathematics in primary and secondary schools."

Moreover, AAMT believes that an education system that provides the underpinning skills and attitudes for innovation in the workplace and society must include innovative teaching of mathematics throughout schooling – innovative students need innovative teachers. These two policy foci – *Teacher quality* and *Strengthening the curriculum* – have the potential to drive the innovative teaching of mathematics this country needs. That potential will only be realised through bold, innovative and long term thinking and action, as outlined below.

Teacher quality

Professional support for teachers of mathematics is currently provided through a range of avenues that are independent and largely disconnected from each other. This leads to duplication and inefficiencies. In its recent submission to the Teacher Education Ministerial Advisory Group, AAMT argued for a coherent, collaborative approach to teacher support in mathematics to be adopted nationally:

"a well-designed and coherent system of support for quality teaching of mathematics that includes quality pre-service, good mentoring into the profession, early career support, ongoing support, targeted initiatives that address particular issues, mature professionals 'giving back' to the profession."

AAMT Submission to TEMAG, p.5.

Establishing and maintaining such a system would involve universities, employers, schools and professional associations working together on a long-term collaborative effort. The AAMT Submission goes on to say that "AAMT and its Affiliates have much to offer by linking the participation of many of the stakeholders in this enterprise through their personal involvement: mathematics educators and mathematicians in universities, pre-service teachers, graduate teachers in schools, educational leaders, providers of professional learning, curriculum officers in the jurisdictions, students in schools, and to some extent parents and care-givers." This potential is currently significantly underutilised.

This 'system' would be framed and supported by mathematics-specific professional standards and recognition, linked to the generic AITSL national framework of standards for teachers. The program of support for teachers and the teaching of mathematics can and should be oriented to giving them the skills and commitment to teach through and for innovation. For example, the programs would tap the professional resources being collected in the 'portal' planned for dissemination of the results of four of the mathematics projects in the current Australian Science and Mathematics Partnerships Program (ASMPP; see Attachment 1 for an outline of this work).

This inquiry should recommend that the Australian Government broker and contribute to the establishment of a system for career-long support and challenge for teachers of mathematics that is expressly linked to the development of innovation in this country.

Strengthening the curriculum

AAMT has long taken the view that this first iteration of the Australian Curriculum: Mathematics is a proof of concept that will demonstrate the advantages of everyone being 'on the same page' in terms of mathematics curriculum. The process of building the current curriculum through the consensus of stakeholders means that it does not include much that could be described as contemporary content, the sort of content that will better match school mathematics with the mathematics practised in the world.

As a result, in its submission to the current Review of the Australian Curriculum, AAMT recommended that "ACARA should work collaboratively with the jurisdictions and the profession to develop and commence a rigorous process of monitoring, evaluation and review to gather the evidence that will inform a major redevelopment of the Australian Curriculum: Mathematics."

This process of monitoring, evaluation and review should be undertaken in the light of the need to significantly 'modernise' the mathematics curriculum to better reflect the need for students to be prepared to contribute to innovation in contemporary workplaces.

This inquiry should recommend that review and redevelopment of the Australian Curriculum: Mathematics (and potentially those in science and technologies) be framed as part of the 'innovation agenda' directed at securing Australia's future prosperity.

About AAMT

The Australian Association of Mathematics Teachers Inc. was founded in 1966 as a 'federation' of mathematics teacher professional associations in the states and territories. The AAMT is the nation's pre-eminent professional association in school mathematics and numeracy education. It exists to:

- support and enhance the work of teachers;
- promote the learning of mathematics; and
- promote progress in mathematics and numeracy education.

The nature of the organisation has enabled the AAMT to play a significant role of national leadership in mathematics and numeracy education over many years.

The Association's members come from all states and territories and all levels of government and non-government schools. They form an extensive network of committed and enthusiastic mathematics and numeracy education professionals including teachers, academics, policy leaders and administrators. Currently the Association has approximately 4,500 members — 2,400 of these are individual teachers. The rest are Institutional members (schools), this giving the AAMT direct contact with more than 25,000 teachers and others.

AAMT is a not-for-profit organisation with tax exempt status from the ATO as a scientific organisation. The Association is funded through membership fees and its other activities. There is no annual funding from any government. Average annual turnover is more than \$2 million.

Through the work of its many volunteer members and highly skilled staff, the AAMT provides a range of services for teachers and schools that includes:

- Three refereed journals (primary, middle school and senior secondary);
- Annual Activities that promote the learning of mathematics by students and teachers, including the National Mathematics Day, National Mathematics Talent Quest and numeracy activities as part of National Literacy and Numeracy Week;
- An extensive catalogue of teaching materials for sale by 'mail order';
- Professional Development activities including electronic networking of teachers and Biennial National Conferences; and
- Projects to undertake research, and curriculum and professional development.

References

Australian Association of Mathematics Teachers, 2007. *Maths? Why not?* AAMT: Adelaide.

Australian Association of Mathematics Teachers, 2006. *Standards for Excellence in Teaching Mathematics in Australian Schools*. AAMT, Adelaide.

Australian Government Department of Education, 2014. *Students First*. Downloaded from <http://www.studentsfirst.gov.au/> on 14 July 2014.

Australian Industry Group, 2013. *Lifting our Science, Technology, Engineering and Mathematics (STEM) Skills*. AiGroup: Melbourne.

Australian Mathematical Sciences Institute, 2014. *Discipline Profile of the Mathematical Sciences 2014*. AMSI: Melbourne.

Attachment 1



ASMPP and AAMT – the Portal

Background

Projects funded under the Australian Science and Mathematics Partnerships Program (ASMPP) are designed to

- build the theoretical and pedagogical skills of school teachers to deliver maths and science subjects;
- increase the number of school students undertaking maths and science subjects to Year 12;
- improve outcomes for these students; and
- encourage more students to study science, technology, engineering and maths courses at university through innovative partnerships.

(Guidelines p. 4)

At the time submissions were developed (July 2013), AAMT negotiated a role in seven proposed projects. Two of these proposals were unsuccessful, meaning that AAMT is a formal partner in five of the 15 projects that were funded. The projects are:

- University of Tasmania – Towards Educating Mathematics Professionals Encompassing Science and Technology (TEMPEST)
- University of Technology Sydney – Maths Inside: Highlighting the role of mathematics in society as motivation to engage more in mathematical activities.
- RMIT University – Reframing Mathematical Futures: Building a learning and teaching resource to enhance mathematical reasoning in Years 7 to 10
- University of South Australia – Excellence and Equity in Maths: Aboriginal and Torres Strait Islander Student Achievement and Tertiary Aspirations in Mathematics
- University of Canberra – National Mentoring for Science and Mathematics Teachers

These five mathematics projects represent about 46% of the total of the programs (\$15.5 mill.) and are therefore a significant investment in school mathematics.

Rationale

It is AAMT's view that the interests of teachers of mathematics at all levels will be best served if the substantial funding associated with this program results in a coherent resource that can support teachers' ongoing professional growth in a sustainable and ongoing way. For current purposes this resource will be called the Portal of Australian Professional Learning Resources in School Mathematics (Portal). The projects funded under ASMPP will enable the Portal to be established, populated with high quality content, tested and refined.

As an AAMT facility the Portal is a good fit with the purpose of the association to 'support the teaching and learning of mathematics', in this case by providing resources and guidance for high quality professional learning for teachers. Hence the work in the Portal will have a life beyond the project that produces it (i.e. sustainability). It will also have an audience as wide as the reach of AAMT, its Affiliates and their combined extensive networks (i.e. spread).

Once the Portal is in place and has proven itself, there will be a significant incentive for other projects to seek to present their work, findings and professional resources through the Portal.

The Portal

AAMT's partnerships with the first four projects listed above rest on agreement that the materials and processes from those projects will be incorporated in the Portal. The partnership with the

University of Canberra has a very different focus from the other four and is not connected to the Portal notion at this stage.

The Portal will provide access to high quality professional learning resources and programs that address contemporary needs of Australian teachers of mathematics from Foundation to Year 12. It will be built, initially, as the means for providing ongoing availability and delivery of the professional learning that is developed, piloted, evaluated and 'rolled out' through these projects. Hence it will represent a subset of the materials required for comprehensive coverage of teachers' contemporary needs.

The main audience for and users of the Portal will be those with responsibility for leading in mathematics from the system to the school levels. Put simply, the Portal will give these people access to the best that Australia has to offer as they, in turn, lead the professional learning of their colleagues. Over time, it is anticipated that it will become the logical repository for the results of many projects and initiatives that develop professional learning materials and programs.

The Portal will be built, housed and operated by AAMT for the long term benefit of teachers of mathematics. It will take advantage of the increasing affordances of online means for professional support for teachers.

Next steps

AAMT is committed to developing all aspects of the Portal, from high level educational design principles to detailed technical specification – and all the key elements in between – in collaboration with its partners working together. To achieve this there will be initial discussions with each of the projects. After those conversations it will be possible to describe the overall scope of the contents of the materials to be developed for inclusion in the Portal. Importantly, these direct conversations will identify further opportunities for Affiliates within the Portal development, and across the projects generally.

In parallel with this preliminary planning of the Portal, AAMT is currently helping publish materials from one of the completed ASMPP Pilot programs conducted by staff from RMIT University. Whilst this will result in a reasonably primitive product, the process is already bringing to the surface a range of issues that will need to be resolved in the development of the Portal.

Will Morony, CEO
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